SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur, Chengalpattu Dt.-603203, Tamil Nadu.

DEPARTMENT OF

COMPUTER SCIENCE AND ENGINEERING

UNDER GRADUATE

CURRICULA AND SYLLABI

(REGULATIONS 2019)

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)

B.E. COMPUTER SCIENCE AND ENGINEERING
CHOICE BASED CREDIT SYSTEM

REGULATIONS – 2019

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To mould students to exhibit top performance in the higher education and research and to become the State-of-the-art technocrat.

PEO2: To impart the necessary background in Computer Science and Engineering by providing solid foundation in Mathematical, Science and Engineering fundamentals.

PEO3: To equip the students with the breadth of Computer Science and Engineering innovate novel solutions for the benefit of common man.

PEO4: To groom the students to be multifaceted entrepreneurs with professional ethical attitude in broader social perspective.
PEO5: To provide an ambience learning environment that is conducive for the growth of successful professional career of students.

2. PROGRAMME OUTCOMES (POs):

After going through the four years of study, our Computer Science and Engineering

Graduates will exhibit ability to:

PO#	Graduate Attribute	Programme Outcome
1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.
2	Problem analysis	Identify, formulate, research literature, and analyse 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):

PSO1: Exhibit proficiency in planning, implementing and evaluating team oriented-software Programming solutions to specific business problems and society needs.

PSO2: Demonstrate professional skills in applying programming skills, competency and decision making capability through hands-on experiences.

PSO3: Apply logical thinking in analyzing complex real world problems, and use professional and ethical behaviors to provide proper solutions to those problems.

PSO4: Demonstrate the ability to work effectively as part of a team in applying technology to business and personal situations.

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- COMPUTER SCIENCE AND ENGINEERING

Year	SEM	SUBJECT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
I	I	Communicative English	3	3	3	2	3	3	3	2	-	-	3	-	1	1	1	1
		Engineering Mathematics - I	3	2	2	1	-	-	-	-	-	-	-	1	-	-	-	-
		Engineering Physics	3	1	1	1	1	1	1	-	-	-	-	1	-	-	1	-
		Engineering Chemistry	3	2	3	1	2	2	2	-	1	1	-	2	1	1	1	2
		Programming in C	3	2	2	2	2	1	1	-	2	-	1	1	3	1	2	3
		Engineering Graphics	2	-	3	-	-	-	-	-	1	3	-	1	2	1	1	1
		Physics and Chemistry Laboratory	3	1	1	1	-	1	2	1	1	-	-	1	2	3	2	1
		C Programming Laboratory	3	2	3	2	2	2	-	3	1	1	2	1	2	2	2	2
I	II	Technical English	3	2	2	2	-	-	-	-	-	3	2	1	1	1	1	2
		Engineering Mathematics - II	3	2	1	1	-	-	-	-	-	-	-	-	1	-	-	-
		Physics for Information Science	3	2	2	-	1	1	1	-	-	-	-	-	-	-	2	-
		Environmental Science and Engineering	1	1	3	-	-	2	3	-	3	-	-	1	1	1	1	1
		Problem Solving and Python Programming	3	2	3	2	2	2	1	-	-	2	2	2	2	2	2	3
		Basic Civil and Mechanical Engineering	3	2	2	1	-	1	1	1	-	-	-	1	2	1	1	2
		Problem Solving and Python Programming Laboratory	3	2	2	1	2	2	-	1	-	-	2	3	2	3	2	3
		Engineering Practice Laboratory	3	2	2	2	2	1	-	-	1	-	1	1	3	2	2	2
		Applied Physics and Environmental Chemistry Laboratory	3	2	2	2	-	2	3	1	1	-	-	2	1	1	1	1
		NSS/NCC/YRC/NSO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Year	SEM	SUBJECT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
II	III	Discrete Mathematics	3	3	2	-	-	-	-	-	1	-	-	1	-	-	-	-
		Programming & Data Structures in C	3	3	2	2	-	-	-	-	-	-	-	-	2	3	3	-
		Object Oriented Programming	2	3	3	2	3	2	2	1	2	2	1	2	2	2	2	-
		Digital Fundamentals and Communication	3	2	2	2	2	1	1	-	-	2	2	3	2	2	3	2
		Software Engineering	2	2	3	3	-	2	-	-	-	2	3	2	2	2	2	1
		Operating Systems	2	2	2	1	2	1	-	-	-	-	-	-	1	1	2	3
		Data Structures in C Laboratory	2	3	3	-	-	-	-	2	3	3	-	3	3	3	3	2
		Object Oriented Programming Laboratory	2	3	3	2	2	1	2	1	2	2	1	2	2	2	2	-
		Operating Systems Laboratory	2	1	2	1	-	-	-	-	1	-	2	-	2	2	1	-
II	IV	Probability and Queuing Theory	3	3	3	-	-	-	-	-	1	1	-	1	-	-	-	-
		Computer Architecture	3	3	3	2	3	-	-	-	-	-	-	-	2	3	3	-
		Database Management System	3	2	2	2	2	1	1	-	2	-	1	-	2	2	2	1
		Design and Analysis of Algorithm	2	3	3	3	2	2	-	-	-	-	2	-	-	2	3	-
		Object Oriented Analysis and Design	1	2	3	3	2	3	3	-	-	2	-	1	1	1	1	-
		Professional Ethics	-	-	-	-	-	3	3	2	-	-	-	-	1	-	1	-
		Database Management System Laboratory	3	2	2	2	2	1	1	2	2	1	2	3	3	3	3	3
		Object Oriented Analysis and Design Laboratory	2	2	1	2	1	2	2	2	1	3	2	2	3	2	3	2
		Communication Skills Laboratory- Project Based	3	3	3	2	2	-	2	-	-	3	-	1	2	-	1	1

YEAR	SEM	SUBJECT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
III	V	Computer Networks	3	2	2	-	3	-	3	-	-	-	2	-	2	3	3	-
		Automata Theory	3	2	3	2	2	2	-	-	-	2	2	2	3	2	3	3
		Web Technology	2	2	3	3	3	3	3	1	1	-	2	1	3	2	2	2
		Data Warehousing and Data Mining	2	-	2	2	-	1	2	-	-	-	-	-	2	1	1	2
		Open Elective -I																
		Web Technology Laboratory	2	2	3	3	3	3	-	1	-	-	2	1	2	2	2	2
		Networks Laboratory	2	3	2	-	3	-	-	-	-	-	3	-	2	2	2	-
III	VI	Mobile Computing	3	3	2	2	2	1	-	2	2	-	2	3	2	2	2	1
		Compiler Design	3	2	3	2	2	2	-	-	-	2	2	2	3	2	3	3
		Software Testing	3	-	3	2	2	2	-	3	1	1	2	1	2	2	2	2
		Grid and Cloud Computing	2	3	3	2	3	-	-	-	-	-	-	-	2	3	3	-
		Professional Elective - I																
		Mobile Application Development Laboratory	3	2	2	2	3	2	-	1	-	2	1	-	2	2	3	1
		Compiler Design Laboratory	2	-	2	2	2	1	2	-	-	2	-	-	2	1	1	2
		Professional Communication	3	2	2	3	2	-	3	-	-	3	-	1	2	2	2	2
		Mini Project	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Internship	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

YEAR	SEM	SUBJECT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
IV	VII	Cryptography and Network Security	2	2	2	2	2	-	1	-	-	1	2	2	2	2	1	1
		Artificial Intelligence	2	1	2	2	3	3	-	-	-	-	-	-	2	2	-	2
		Open Elective - II																
		Professional Elective - II																
		Professional Elective - III																
		Security Laboratory	3	-	3	-	3	2	-	-	-	2	2	-	3	3	3	2
		Artificial Intelligence Laboratory	1	2	2	2	3	3	3	3	-	-	-	-	2	2	2	-
		Project Work -Phase I	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Internship	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
		Professional Elective V																
		Professional Elective VI																
		Project Work - Phase II	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)
Approved by AICTE & Affiliated to Anna University, Chennai, 'A' Grade Accreditation by NAAC, NBA Accredited, ISO 9001:2015 Certified.

REGULATIONS - 2019
B.E. COMPUTER SCIENCE AND ENGINEERING
CHOICE BASED CREDIT SYSTEM
I TO VIII SEMESTERS CURRICULA AND 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
PRACTICAL								
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
PRACTICAL								
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
* Conduction after College Hours			**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.	1904301	Programming & Data Structures in C	PC	3	3	0	0	3
3.	1904302	Object Oriented Programming	PC	3	3	0	0	3
4	1906306	Digital Fundamentals and Communication	PC	3	3	0	0	3
5	1908503	Software Engineering	PC	3	3	0	0	3
6	1904304	Operating Systems	PC	3	3	0	0	3
PRACTICAL								
7	1904305	Data Structures in C Laboratory	PC	4	0	0	4	2
8	1904306	Object Oriented Programming Laboratory	PC	4	0	0	4	2
9	1904307	Operating Systems Laboratory	PC	4	0	0	4	2
			TOTAL	**31**	**18**	**0**	**12**	**25**

SEMESTER – IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1918402	Probability and Queueing Theory	BS	4	3	1	0	4
2.	1908006	Computer Architecture	PC	3	3	0	0	3
3.	1904001	Database Management System	PC	3	3	0	0	3
4.	1904402	Design and Analysis of Algorithm	PC	3	3	0	0	3
5.	1908008	Object Oriented Analysis and Design	PC	3	3	0	0	3
6.	1915001	Professional Ethics	HS	3	3	0	0	3

PRACTICAL								
7.	1904002	Database Management System Laboratory	PC	4	0	0	4	2
8.	1904405	Object Oriented Analysis and Design Laboratory	PC	4	0	0	4	2
9.	1919001	Communication Skills Laboratory- Project Based	EEC	2	0	0	2	-
			TOTAL	**29**	**18**	**1**	**10**	**23**

SEMESTER – V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1904003	Computer Networks	PC	3	3	0	0	3
2.	1904502	Automata Theory	PC	4	3	1	0	4
3.	1908501	Web Technology	PC	3	3	0	0	3
4.	1908507	Data Warehousing and Data Mining	PC	3	3	0	0	3
5.	19xxxxx	Open Elective -I	OE	3	3	0	0	3
PRACTICAL								
6.	1908510	Web Technology Laboratory	PC	4	0	0	4	2
7.	1904512	Networks 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	1904601	Mobile Computing	PC	3	3	0	0	3
2	1904602	Compiler Design	PC	3	3	0	0	3
3	1908014	Software Testing	PC	3	3	0	0	3
4	1904603	Grid and Cloud Computing	PC	3	3	0	0	3
5	19xxxxx	Professional Elective - I	PC	3	3	0	0	3
PRACTICAL								
6	1904610	Mobile Application Development Laboratory	PC	4	0	0	4	2
7	1904611	Compiler Design Laboratory	PC	4	0	0	4	2
8	1919002	Professional Communication	EEC	2	0	0	2	1

9	1904612	Mini Project	EEC	4	0	0	4	2
10	1904613	Internship	EEC	-	-	-	-	-
			TOTAL	**29**	**15**	**0**	**14**	**22**

SEMESTER – VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1904005	Cryptography and Network Security	PC	3	3	0	0	3
2.	1904006	Artificial Intelligence	PC	3	3	0	0	3
3.	19xxxxx	Open Elective - II	OE	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
PRACTICAL								
6.	1904008	Security Laboratory	PC	4	0	0	4	2
7.	1904009	Artificial Intelligence Laboratory	PC	4	0	0	4	2
8.	1904715	Project Work - Phase I	EEC	4	0	0	4	2
9.	1904716	Internship	EEC	-	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 – IV	PE	3	3	0	0	3
2.	19xxxxx	Professional Elective – V	PE	3	3	0	0	3
PRACTICAL								
3.	1904805	Project Work - Phase II	EEC	12	0	0	12	6
			TOTAL	**18**	**6**	**0**	**12**	**12**

SEMESTER VI
PROFESSIONAL ELECTIVE - I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1904004	Natural Language Processing	PE	3	3	0	0	3
2.	1904605	Security Governance Risk and Compliance	PE	3	3	0	0	3
3.	1904606	Intellectual Property Rights	PE	3	3	0	0	3
4.	1904607	Data Science	PE	3	3	0	0	3
5.	1915002	Principles of Management	PE	3	3	0	0	3

SEMESTER VII
PROFESSIONAL ELECTIVE - II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1908702	Software Project Management	PE	3	3	0	0	3
2.	1904011	Big Data Analytics	PE	3	3	0	0	3
3.	1904706	Introduction to Machine Learning and Algorithms	PE	3	3	0	0	3
4.	1904707	Neural Networks & Fuzzy logic	PE	3	3	0	0	3
5.	1904708	Internet of Things	PE	3	3	0	0	3

SEMESTER VII
PROFESSIONAL ELECTIVE - III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1904709	Cyber Security & Forensics	PE	3	3	0	0	3
2.	1904710	Agile Software Development	PE	3	3	0	0	3
3.	1904711	Ethical Hacking	PE	3	3	0	0	3
4.	1908707	Wireless Adhoc & Sensor Networks	PE	3	3	0	0	3
5.	1915003	Total Quality Management	PE	3	3	0	0	3

SEMESTER VIII
PROFESSIONAL ELECTIVE - IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1904801	Deep Learning	PE	3	3	0	0	3
2.	1904802	GPU Architecture & Programming	PE	3	3	0	0	3
3.	1908012	Social Network Analysis	PE	3	3	0	0	3
4.	1908010	Computer Graphics and Multimedia	PE	3	3	0	0	3

SEMESTER - VIII
PROFESSIONAL ELECTIVE - V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1904803	Green Computing	PE	3	3	0	0	3
2.	1904804	Human Computer Interaction	PE	3	3	0	0	3
3.	1908803	Service Oriented Architecture	PE	3	3	0	0	3
4.	1908009	Information Storage and Management	PE	3	3	0	0	3
5.	1908807	Block Chain	PE	3	3	0	0	3

OPEN ELECTIVE – I (V SEMESTER)

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.	1905001	Energy Conservation and Management	EEE	3	3	0	0	3
6.	1905508	Renewable Energy Sources	EEE	3	3	0	0	3
7.	1905509	SCADA System Management	EEE	3	3	0	0	3

8.	1906507	Entertaintronics	ECE	3	3	0	0	3
9.	1906505	Photonic Networks	ECE	3	3	0	0	3
10.	1906506	Telecommunication Network Management	ECE	3	3	0	0	3
11.	1907503	Sensors and Transducers	EIE	3	3	0	0	3
12.	1907504	Instrumentation in Biomedical Engineering	EIE	3	3	0	0	3
13.	1908001	3D Printing and Design	IT	3	3	0	0	3
14.	1908002	Scripting Languages	IT	3	3	0	0	3
15.	1909510	Product Design and Development	MECH	3	3	0	0	3
16.	1909511	Vibration and Noise Control	MECH	3	3	0	0	3
17.	1909512	Industrial Safety Engineering	MECH	3	3	0	0	3
18.	1910504	Principles of Food Preservation	MEDICAL ELECTRONICS	3	3	0	0	3
19.	1920501	Nanotechnology	PHYSICS	3	3	0	0	3
20.	1920502	Microscopy	PHYSICS	3	3	0	0	3
21.	1921501	Advanced Engineering Chemistry	CHEMISTRY	3	3	0	0	3
22.	1921502	Industrial Nanotechnology	CHEMISTRY	3	3	0	0	3

OPEN ELECTIVE – II (VII SEMESTER)

SL. 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.	1905711	Electrical Circuits	EEE	3	3	0	0	3
4.	1905712	Renewable Energy systems	EEE	3	3	0	0	3
5.	1905713	Electric Vehicles and Power Management	EEE	3	3	0	0	3
6.	1906705	Acoustics	ECE	3	3	0	0	3
7.	1906706	Visual Communication	ECE	3	3	0	0	3
8.	1906707	MEMS and NEMS	ECE	3	3	0	0	3

9.	1907001	Transducers Engineering	EIE	3	3	0	0	3
10.	1907003	Process Modeling and Simulation	EIE	3	3	0	0	3
11.	1907708	State Variable Analysis and Design	EIE	3	3	0	0	3
12.	1908003	Software Quality Management	IT	3	3	0	0	3
13.	1908004	C # and .Net Programming	IT	3	3	0	0	3
14.	1908005	Virtual Reality	IT	3	3	0	0	3
15.	1909718	Robotics	MECH	3	3	0	0	3
16.	1909719	Testing of Materials	MECH	3	3	0	0	3
17.	1909720	Design of Electrical Vehicles	MECH	3	3	0	0	3
18.	1910703	Clinical Trials	MEDICAL ELECTRONICS	3	3	0	0	3
19.	1910704	Regulatory Requirements in Pharmaceutical Industries	MEDICAL ELECTRONICS	3	3	0	0	3
20.	1910705	Microbiology	MEDICAL ELECTRONICS	3	3	0	0	3
21.	1920701	Analytical Methods and Instrumentation	PHYSICS	3	3	0	0	3
22.	1920702	Medical Physics	PHYSICS	3	3	0	0	3
23.	1920703	Electronic Materials	PHYSICS	3	3	0	0	3
24.	1921701	Waste Water Treatment	CHEMISTRY	3	3	0	0	3

SUMMARY

SL. NO.	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL	Percentage
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	3	3		3					9	5.17%
2.	BS	12	12	4	4					32	18. 39%
3.	ES	9	10							19	10.92%
4.	PC			21	16	17	19	10		83	47.70%
5.	PCD		1							1	0.57%
6.	PE							6	6	12	6.89%
7.	OE					3		3		6	3.44%
8.	EEC						3	3	6	12	6.89%
	Total	**24**	**26**	**25**	**23**	**20**	**22**	**22**	**12**	**174**	**100%**
9.	**Non-Credit / Mandatory**										

SEMESTER I

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

OBJECTIVES:

- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions seeking clarification.
- 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

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 Black Swan Limited, Hyderabad: 2015.

2. Richards, C. Jack. **Interchange Students'** Book-2 New Delhi: CUP, 2015.

REFERENCES:

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 and PSO MAPPING:

Course Outcomes	PROGRAM OUTCOMES												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	3	3	2	3	3	-	-	-	-	3	-	1	2	2	2	2
CO2	3	2	3	2	2	-	2	-	-	3	-	1	2	2	1	1
CO3	3	3	-	2	-	-	-	-	-	3	-	1	1	1	1	1
CO4	3	3	-	-	-	-	3	-	-	3	-	1	2	2	1	2
CO5	3	3	3	2	3	3	2	-	-	3	-	1	2	2	2	2

1918102 ENGINEERING MATHEMATICS- I L T P C

3 1 0 4

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

OUTCOMES:

- 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, 10thEdition, 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2	1	-	-	-	-	-	-	-	1	-		-	-
CO 2	3	2	2	1	-	-	-		-	-	-	1	-		-	-
CO 3	3	2	2	1	-	-	-		-	-	-	1	-		-	-
CO 4	3	2	2	1	-	-	-		-	-	-	1	-		-	-
CO 5	3	2	2	1	-	-	-		-	-	-	1	-		-	-

1920103 **ENGINEERING PHYSICS** **L T P C**

(Common to all branches of B.E. / B.Tech. Programmes) **3 0 0 3**

COURSE OBJECTIVES:

- To understand the stress, strain and the concept of Hooke's law for the modulus of elasticity values .
- To facilitate the knowledge about basics of laser, optical fiber sources and transmission techniques.
- To enrich the idea of transfer and measurement of heat and uses of heat exchangers.
- To explore the basics of quantum theory and atomic and subatomic particles.
- To enhance the fundamental knowledge crystal Physics and its applications.

UNIT - I : PROPERTIES OF MATTER **9**

Elasticity – Hooke’s law-Stress-strain diagram and its uses –Poisson ratio-factors

affecting elastic modulus and tensile strength – twisting couple - torsion pendulum: theory and experiment (regular body) - bending of beams - bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders.

UNIT – II : LASERS AND FIBER OPTICS 9

Lasers: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Nd-YAG laser-Semiconductor lasers: homojunction and heterojunction – Applications. Fiber optics: principle, numerical aperture and acceptance angle - types of optical fibres (material, refractive index, and mode) – losses associated with optical fibers–Fiber optic communication- fibre optic sensors: pressure and displacement- Endoscope.

UNIT – III : THERMAL PHYSICS 9

Transfer of heat energy – thermal conduction, convection and radiation – Newton's law cooling (qualitative) -heat conductions in solids – thermal conductivity - Forbe's and Lee's disc method: theory and experiment - conduction through compound media (series and parallel) – thermal insulation – applications: heat exchangers, refrigerators, ovens and solar water heaters.

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:

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

- 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.

Shatendra Sharma & Jyotsna Sharma, “Engineering Physics”. Pearson, 2018.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	1	1			1	1	-	-	-	-	1	-	-	2	-
CO 2	3	1	1		1	1	1	-	-	-		1	-	-	2	-
CO 3	3		1			1		-	-	-	-	1	-	-	1	-
CO 4	3	1		1		1	1	-	-	-	-	1	-	-	1	-
CO 5	3	1		1			1	-	-	-		1	-	-	1	-

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 sorel 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).

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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, Nanocluster, Nanorods, Nanotube (CNT: SWNT and MWNT) and Nanowire, Synthesis - precipitation, thermolysis, hydrothermal, electrodeposition, chemical vapour deposition, laser ablation, sol-gel process and applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

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

REFERENCE BOOKS:

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	3	1	1	1	1					2	1	1	2	2
CO 2	3	2	3	1	2	2	3					3	1	1	2	2
CO 3	2	1	3	2	3	2	3					3			1	2
CO 4	2	1	2		3	3	1					2	1		1	2
CO 5	3	3	3	2	3	3	1		1	1		2	1	1	1	2

1901006	PROGRAMMING IN C	L	T	P	C
	Common to all branches of B.E. / B.Tech. Programmes)	3	0	0	3

COURSE OBJECTIVES:

- To develop C Programs using basic programming.
- To develop C programs using arrays
- To develop C programs using strings.
- To develop applications in C using functions
- To develop C program using structures and union

UNIT – I : BASICS OF C PROGRAMMING **9**

Introduction to algorithm: Flowchart-Pseudo code- Introduction to programming paradigms – C programming: Data Types – Keywords – Variables and Constants – **Operators and Expressions:** Expressions – precedence – associativity – Input/Output statements – **Decision making and looping:** Branching statements, Iterative statements – Compilation process

UNIT – II : ARRAYS AND STRINGS **9**

Introduction to Arrays: **One dimensional array:** Assigning an array to another array – Equating an array with another array –**Two dimensional Arrays:** Declaration – usage of two dimensional array – reading, storing and accessing elements in two dimensional array – memory representation – **String operations:** String library functions – list of strings-command line arguments.

UNIT – III : FUNCTIONS **9**

Introduction to functions: Classification of functions – function definition – function call – function with inputs and outputs – recursive function – library functions-scope of variables.

UNIT – IV : STRUCTURES AND UNIONS **9**

Introduction to Structures: Array of structures – Nested structure-functions and Structures **Introduction to union**: Practical applications of union – typedef and structures – enumerated data type.

UNIT – V : STORAGE CLASS AND PREPROCESSOR DIRECTIVE **9**

Introduction to storage classes: Types of storage classes – **C preprocessor Directives**:

Types of preprocessor directives – Pragma Directive-conditional directive.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3		2							1		2		
CO 2	3	3			2		1						3			
CO 3	2	1		2	3										2	
CO 4			2						2		1			1		
CO 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 **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:

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

- 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.

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:

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

Special points applicable to University Examinations on Engineering Graphics:

- There will be five questions, each of either or type covering all units of the syllabus.
- All questions will carry equal marks of 20 each making a total of 100.
- 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.
- The examination will be conducted in appropriate sessions on the same day.

CO – PO and PSO MAPPING:

Course Outcomes	**Programme Outcomes (PO)**												**Program Specific Outcomes(PSO)**			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2		3						1	3		1	2	1	1	1
CO 2	2		3						1	3		1	2	1	1	1
CO 3	2		3						1	3		1	2	1	1	1
CO 4	2		3						1	3		1	2	1	1	1
CO 5	2		3						1	3		1	2	1	1	1

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

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

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of the course, the student should 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.

CO – PO and PSO MAPPING:

Course Outcomes	PROGRAM OUTCOMES												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	1	1	1	-	1	-	1	1	-	-	-	-	-	1	-
CO 2	3	1	1	1	-	1	-	1	1	-	-	-	-	-	1	-
CO 3	3	1	1	1	-	2	-	1	1	-	-	-	-	-	2	-
CO 4	3	1	1	1	-	1	-	1	1	-	-	-	-	-	2	-
CO 5	3	1	1	1	-	1	-	1	1	-	-	-	-	-	1	-

CHEMISTRY LABORATORY: (Any five experiments to be conducted)

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 viscometery.
- 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

- Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.
- Estimation of copper content of the given solution by iodometry.
- Determination of strength of given hydrochloric acid using pH meter.
- Determination of strength of acids in a mixture of acids using conductivity meter.
- Estimation of iron content of the given solution using potentiometer.
- Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
- Pseudo first order kinetics-ester hydrolysis.
- Corrosion experiment-weight loss method.
- Conductometric titration of strong acid vs strong base.

OUTCOMES

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

- 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.G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, "Vogel's Textbook of Quantitative Chemical Analysis", John Wiley & Sons Inc, 2014.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2	1	2			2					1				
CO 2	3	2	2	2			2					1				
CO 3	2	2	1	2		1	2					1	2	3	2	1
CO 4	3	2	3	2		1	2					1	2	3	2	1
CO 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:

- Programs using I/O statements and expressions.
- Programs using decision-making constructs.
- 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)

- Write a program to perform the Calculator operations, namely, addition, subtraction, multiplication, division and square of a number.
- Check whether a given number is Armstrong number or not?
- Check whether a given number is odd or even?
- Write a program to perform factorial of a number.
- Write a C program to find out the average of 4 integers.
- Show how to display array elements using two dimensional array.
- Write a C program to perform swapping using function.
- Display all prime numbers between two intervals using functions.
- Reverse a sentence using recursion.
- Write a program in C to get the largest element of an array using the function.
- Write a C program to concatenate two string.
- Write a C program to find the length of String.
- Find the frequency of a character in a string.
- Write a C program to Store Student Information in Structure and Display it.
- 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:

At the end of the course, the student should 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3										2			
CO 2					2					1					2	
CO 3				2					1							2
CO 4		2				2					2			2		
CO 5								3				1	2			

SEMESTER II

1919201 TECHNICAL ENGLISH L T P C

3 0 0 3

OBJECTIVES:

The Course prepares second semester Engineering and 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.
- Participate in group discussions.
- Strengthen their listening skill which will help them comprehend lectures and talks in their areas of specialization.

UNIT - I: INTRODUCTION 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 – 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 GRAMMER 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/clarifications - seeking orders , thanking for the orders given, Complaint letters - **Vocabulary Development**- verbal analogies **Language Development**- reported speech.

TOTAL : 45 PERIODS

OUTCOMES:

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

- Read technical texts and write area- specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialization 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, Hyderabad: 2016

2. Sudharshana.N.P and Saveetha. C. **English for Technical Communication**. Cambridge University Press: New Delhi, 2016

REFERENCES:

1. Raman, Meenakshi and Sharma, Sangeetha- **Technical Communication**

Principles and Practice. Oxford University Press: New Delhi,2014.

2. Kumar, Suresh. E. **Engineering English**. Orient Blackswan: Hyderabad,2015
3. Booth-L. Diana, **Project Work**, Oxford University Press, Oxford: 2014.
4. Grussendorf, Marion, **English for Presentations**, Oxford University Press, Oxford: 2007
5. Means, L. Thomas and Elaine Langlois**, English & Communication For Colleges.**
6. IELTS - Cambridge University Press
7. BEC - Cambridge University Press.

CO – PO and PSO MAPPING:

Course Outcomes	PROGRAM OUTCOMES												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO1	3	2	-	-	-	-	-	-	-	3	-	1	1	1	1	1
CO2	3	2	2	-	-	-	-	-	-	-	-	2	2	2	1	2
CO3	3	-	-	-	-	-	-	-	3	3	-	1	1	1	1	1
CO4	3	2	2	2	-	-	-	-	-	3	-	1	2	2	1	1
CO5	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, the student should 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2	1	-	-	-	-	-		-	-	1	-		-
CO 2	3	2	1	-	-	-	-		-		-	-	1	-		-
CO 3	3	2	1	-	-	-	-		-		-	-	1	-		-
CO 4	3	2	1	-	-	-	-		-		-	-	1	-		-
CO 5	3	1	2	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 student should be 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2	-	1	1	1	-	-	-	-	-	-	-	1	-
CO 2	3	2	2	-	-	1	1	-	-	-		-	-	-	1	-
CO 3	3	2	2	-	-	1	1	-	-	-	-	-	-	-	2	-
CO 4	3	2	2	-	-	1	1	-	-	-	-	-	-	-	3	-
CO 5	3	2	2	-	1	1	1	-	-	-		-	-	-	3	-

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:

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

- 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1						3	3		3			1	1	1	1	1
CO 2	2	1	3			2	3					1	1			1
CO 3						2	3		2			1	1	1	1	1
CO 4		2	2				3		3			1	1			1
CO 5	1	1	3			3	2					1	1	1	1	1

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

COURSEOUTCOMES:

At the end of the course, the student should 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	3				1					2	2			3
CO 2					2									2	3	
CO 3				2	3									2		
CO 4					2	2				2				2		
CO 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, La-mont, 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:

At the end of the course, the student should 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 diagonize 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	1	2	-	-	3	2	1	-	-	-	1	1	-	1	2
CO 2	3	3	2	1	-	1	-	-	-	-	-	-	2	1	-	2
CO 3	3	1	2	1	-	1	1	-	-	-	-	-	2	1	-	2
CO 4	3	2	2	1	-	1	-	-	-	-	-	1	2	1	1	2
CO 5	3	2	2	1	-	-	-	-	-	-	-	-	1	-	-	1

1901009 **PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY** **L T P C 0 0 4 2**

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

COURSE OBJECTIVES:

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

LIST OF PROGRAMS:

- Compute the GCD of two numbers.
- Find the square root of a number (Newton‘s method)
- Exponentiation (power of a number)
- Find the maximum of a list of numbers
- Linear search and Binary search
- Selection sort, Insertion sort
- How to create, slice, change, delete and index elements using Tuple.
- Find First n prime numbers
- How to create, slice, change, add, delete and index elements using list.
- Write a program to calculate the length of a string.

- Write a program to reverse the string
- How to change, delete, add and remove elements in Dictionary
- Find the most frequent words in a text read from a file
- Simulate elliptical orbits in Pygame
- Simulate bouncing ball using Pygame

TOTAL: 60 PERIODS

PLATFORM NEEDED:

Python 3 interpreter for Windows/Linux

COURSE OUTCOMES:

At the end of the course, the student should 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3							1				3	2	3		
CO 2		2	2			2					2			3		
CO 3				1									2			
CO 4					2										2	
CO 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:

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

Plumbing Works:

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

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

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

d) Hands-on-exercise:

Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.

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

Carpentry works:

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

b) Hands-on-exercise:

Wood work, joints by sawing, planing and cutting.

II MECHANICAL ENGINEERING PRACTICE 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:

At the end of the course, the student should 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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3					1						1	3			
CO 2		1	2		3						1			1	2	
CO 3				3	2							1				3
CO 4		2	3	1	2									2	3	1
CO 5		3	2	2					1					3	2	2

1901209	APPLIED PHYSICS AND ENVIRONMENTAL CHEMISTRY LABORATORY	L	T	P	C
		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)

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

TOTAL: 30 PERIODS

DEMO:

- Crystal growth- Low temperature solution growth.
- Absorption and transmittance measurement of materials – UV visible spectrum.
- 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 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.

CO – PO and PSO MAPPING:

Course Outcomes	PROGRAM OUTCOMES												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	1	2	2	-	1	-	1	1	-	-	-	-	-	1	-
CO 2	3	2	2	2	-	1	-	1	1	-	-	-	-	-	2	-
CO 3	3	2	2	1	-	-	-	1	1	-	-	-	-	-	1	-
CO 4	3	1	2	2	-	1	-	1	1	-	-	-	-	-	1	-
CO 5	3	2	2	2	-	2	-	1	1	-	-	-	-	-	3	-

ENVIRONMENTAL CHEMISTRY LABORATORY

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

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

Demo

- Pollution abatement by adsorption techniques

- Scintillation Process

OUTCOMES

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

- 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 BOOK

1.G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, “Vogel’s Textbook of Quantitative Chemical Analysis”, John Wiley & Sons Inc, 2014.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	3		3	3					1	1	1	1	1
CO 2	3	3	2	3		3	3					3	1	1		1
CO 3	3	3	3	3		2	3					2	1	1	1	
CO 4	2	3	3	2		3	3					2	1	1		1
CO 5	3	3	3	3		3	3					3	1		1	

SEMESTER – III

1918302 DISCRETE MATHEMATICS L T P C

3 1 0 4

COURSE OBJECTIVES :

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

UNIT - I: LOGIC AND PROOFS 9L+3T

Propositional logic – Propositional equivalences – Normal forms - Predicates and quantifiers – Nested quantifiers – Rules of inference.

UNIT - II: COMBINATORICS 9L+3T

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT - III: GRAPHS 9L+3T

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT - IV: ALGEBRAIC STRUCTURES 9L+3T

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism‘s – Normal subgroup and cosets – Lagrange‘s theorem – Definitions and examples of Rings and Fields.

UNIT - V: LATTICES AND BOOLEAN ALGEBRA 9L+3T

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra.

TOTAL: 45L+15T PERIODS

COURSE 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, and exposed to concepts and properties of algebraic structures such as groups, rings and fields.
- Have knowledge of the concepts needed to test the Boolean algebra.

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 BOOK

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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	2									1	1			
CO 2	3	3	3						1			1	1			
CO 3	3	3	2						1			1	1			
CO 4	3	3	2									1	1			
CO 5	3	3	3						1			1	1			

1904301 PROGRAMMING & DATA STRUCTURES IN C L T P C

3 0 0 3

COURSE OBJECTIVES :

- To understand the concepts of list ADTs.
- To Learn linear data structures – stacks and queues.
- To learn the non-linear data structure trees and its types.
- To understand the concepts of graps and its applications.
- To understand sorting, searching and hashing algorithms.

UNIT - I: LINEAR DATA STRUCTURES – LIST 9

Introduction to structure-Abstract Data Types (ADTs) – List ADT – array-based implementation – linked list implementation —singly linked lists- circularly linked lists- doubly-linked lists – applications of lists –Polynomial Manipulation.

UNIT - II: LINEAR DATA STRUCTURES – STACKS, QUEUES 9

Stack ADT – Operations – Applications – Evaluating arithmetic expressions- Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Priority Queue – deQueue – applications of queues.

UNIT - III: NON LINEAR DATA STRUCTURES – TREES 9

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

UNIT - IV: NON LINEAR DATA STRUCTURES – GRAPHS 9

Definition – Representation of Graph – Types of graph – Breadth-first traversal – Depth-first traversal – Topological Sort – Dijkstra's algorithm-mimimum spanning tree-Bi-connectivity

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.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Implement abstract data types for linear data structures list.

- Apply the different linear data structures to the problem solutions.
- Apply the non linear data structures to solve the complex problems.
- Analyze the applications of graphs
- Critically analyze the various searching and sorting algorithms.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Reema Thareja, “Data Structures Using C”, Second Edition , Oxford University Press, 2011
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, Second Edition, Mcgraw Hill, 2002.
3. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983.
4. Stephen G. Kochan, “Programming in C”, 3rd edition, Pearson Education.
5. Ellis Horowitz, SartajSahni, Susan Anderson-Freed, “Fundamentals of Data Structures in C”, Second Edition, University Press, 2008

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3		2									2			
CO 2	3		3											3		
CO 3	3			2											3	
CO 4	3		2										2			
CO 5		3		3										3		

1904302 OBJECT ORIENTED PROGRAMMING L T P C

3 0 0 3

COURSE OBJECTIVES :

- To understand Object Oriented Programming concepts using Java.
- To know the principles of packages, inheritance and interfaces.
- To handle exceptions and use I/O streams.
- To develop a java application with threads.
- To design and build simple Graphical User Interfaces.

UNIT - I: INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 8

Object Oriented Programming - Abstraction – Encapsulation- Inheritance -Polymorphism- Characteristics of Java – The Java Environment **-** Java Source File -Structure – Compilation. Fundamental Programming Structures in Java – Data Types, Variables, Operators, Control Flow, Arrays.

UNIT - II: CLASSES AND CONSTRUCTORS 10

Defining classes in java -inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces.

UNIT - III: STRINGS AND EXCEPTION HANDLING 9

String Operations - Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, packages.

UNIT - IV: I/O AND MULTITHREADING 9

Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files, Multi-threading, thread life cycle, creating threads, synchronizing threads, Inter-thread communication.

UNIT - V: EVENT DRIVEN PROGRAMMING 9

Graphics programming - Frame – Components - working with 2D shapes - Using color and fonts, - Basics of event handling - event handlers - adapter classes - actions - AWT event hierarchy

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Develop Java programs using Object Oriented Programming principles.
- Develop Java programs with the concepts inheritance and interfaces.
- Build Java applications using exceptions and I/O streams.
- Develop Java applications with threads and Files.
- Develop interactive Java programs using graphics.

TEXT BOOKS:

1. Cay S. Horstmann, Gary cornell, “Core Java Volume –I Fundamentals”, 9th Edition, Prentice Hall, 2013.

REFERENCE BOOKS:

1. Herbert Schildt, “Java The complete reference”, 8th Edition, McGraw Hill Education, 2011.
2. Paul Deitel, Harvey Deitel, “Java SE 8 for programmers”, 3rd Edition, Pearson, 2015.
3. Steven Holzner, “Java 2 Black book”, Dreamtech press, 2011.
4. Timothy Budd, “Understanding Object-oriented programming with Java”, Updated Edition, Pearson Education, 2000.

CO – PO and PSO MAPPING:

Course Outcomes	**Programme Outcomes (PO)**												**Program Specific Outcomes(PSO)**			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3						2	1			1	2		2		
CO 2		3	3	2		1							3			
CO 3	2					2			2						2	
CO 4			2	1					2	2				2		
CO 5	1		3	1	3	2			3	3			2			

1906306 DIGITAL FUNDAMENTALS AND COMMUNICATION L T P C

3 0 0 3

COURSE OBJECTIVES :

The student should be made to:

- Learn the various number systems.
- Understand the various logic gates.
- Be familiar with various combinational circuits.
- Be familiar with designing synchronous and asynchronous sequential circuits.
- Analyze Source and Error control coding.

UNIT - I: BOOLEAN ALGEBRA AND LOGIC GATES 9

Review of Number Systems– Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map– Logic Gates – NAND and NOR Implementations.

UNIT - II: COMBINATIONAL LOGIC 9

Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to HDL – HDL Models of Combinational circuits.

UNIT - III: SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL LOGIC 9

Sequential Circuits – Latches and Flip Flops – Analysis and Design Procedures – State Reduction and State Assignment –HDL for Sequential Logic Circuits. Analysis and Design of Asynchronous Sequential Circuits– Hazards.

UNIT - IV: ANALOG MODULATION 9

Amplitude Modulation – AM, DSBSC, SSBSC, VSB – PSD, modulators and demodulators – Angle modulation – PM and FM – PSD, modulators and demodulators – Super heterodyne receivers.

UNIT - V: DIGITAL MODULATION 9

Low pass sampling theorem – Quantization – PAM – Line coding – PCM, DPCM, DM, and ADPCM and ADM, Time Division Multiplexing, Frequency Division Multiplexing. Phase shift keying – BPSK, DPSK, QPSK .

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Simplify Boolean functions using KMap.
- Implement designs using Programmable Logic Devices .
- Write HDL code for combinational Circuits.
- Write HDL code for Sequential Circuits .
- Ability to comprehend and appreciate the significance and role of this course in the present contemporary world .

TEXT BOOKS:

1. Morris Mano M. and Michael D. Ciletti, “Digital Design”, IV Edition, Pearson Education, 2008.
2. H Taub, D L Schilling, G Saha, “Principles of Communication Systems” 3/e, TMH 2007
3. S. Haykin “Digital Communications” John Wiley 2005.

REFERENCE BOOKS:

1. John F. Wakerly, “Digital Design Principles and Practices”, Fourth Edition, Pearson Education, 2007.
2. Charles H. Roth Jr, “Fundamentals of Logic Design”, Fifth Edition – Jaico Publishing House, Mumbai, 2003.
3. Donald D. Givone, “Digital Principles and Design”, Tata Mcgraw Hill, 2003.
4. B.P.Lathi, “Modern Digital and Analog Communication Systems”, 3rd edition, Oxford University Press, 2007
5. H P Hsu, Schaum Outline Series – “Analog and Digital Communications” TMH 2006
6. B.Sklar, Digital Communications Fundamentals and Applications” 2/e Pearson Education 2007.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	1	2	1							3	3		3	
CO 2		3	2	3	2							2				2
CO 3		2	2		2	1	1			2	2	3	2	2	3	
CO 4	3									2	2			2		
CO 5	3									2	2					

1908503 SOFTWARE ENGINEERING L T P C

3 0 0 3

COURSE 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-XPProcess-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

COURSE 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, Mc Graw-Hill International Edition,2010.
2. Ian Sommerville,-SoftwareEngineering,9th Edition, Pearson Education Asia,2011.

REFERENCE BOOKS:

1. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Pvt Limited, 2009.
2. Pankaj Jalote, "Software Engineering, A Precise Approach", Wiley India, 2010.
3. Kelkar S.A., "Software Engineering", Prentice Hall of India Pvt Ltd, 2007.

4. Stephen R.Schach, “Software Engineering”, Tata McGraw-Hill Publishing Company Limited,2007.
5. http://nptel.ac.in/.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2		3	3								2	2			
CO 2	2		3	3		2								2		
CO 3			3	3							3				2	
CO 4		2								2				2		
CO 5		2				3					3				1	

1904304 OPERATING SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES :

- To understand the basic concepts and functions of operating systems.
- To understand Processes and 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 9

Introduction to operating systems - Evolution of Operating System - Operating System-structures – System calls – System programs –Processes: Process concept – Process scheduling – Operations on processes –Inter process communication – Communication in client-server systems.

UNIT - II: PROCESS SCHEDULING AND SYNCHRONIZATION 9

CPU Scheduling: Scheduling criteria – Scheduling algorithms – Multiple-processor scheduling. Process Synchronization: The critical-section problem –Synchronization hardware – Semaphores – Classic problems of synchronization –critical regions – Monitors. Deadlock: System model – Deadlock characterization –Methods for handling deadlocks – Deadlock prevention – Deadlock avoidance –Deadlock detection – Recovery from deadlock.

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.

UNIT - IV: FILE SYSTEMS 9

File-System Interface: File concept – Access methods – Directory structure – File system mounting – Protection. File-System Implementation: Directory implementation – Allocation methods – Free-space management – efficiency and performance – recovery – log-structured file systems.

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.

TOTAL: 45 PERIODS

COURSE 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.
- Understand the functionality I/O management.

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. Ramez Elmasri, A. Gil Carrick, David Levine, “Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
5. Achyut S. Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

6. Daniel P Bovet and Marco Cesati, “Understanding the Linux kernel”, 3rd edition, O‘Reilly, 2005.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
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CO 1	2					1							2			
CO 2		2	2										1	2		
CO 3				2	2									1		
CO 4						2									2	
CO 5			2	1												3

1904305 DATA STRUCTURES IN C LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES :

- To implement linear and non-linear data structures
- To understand the different applications of linear data structure.
- To implement the different operation on search tree.
- To implement graph traversal algorithms
- To get familiarized to sorting and searching algorithms

List of experiments

1. Array implementation of Stack and Queue ADTs
2. Array implementation of List ADT
3. Linked list implementation of List, Stack and Queue ADTs
4. Applications of List and Stack
   i. Polynomial manipulation
   ii. Infix to post fix conversion
   iii. Postfix Evaluation
5. Implementation of Binary Search Trees
6. Implementation of AVL Trees
7. Implementation of Heaps using Priority Queues.
8. Graph representation and Traversal algorithms
9. Implementation of searching methods

10.Implementation of and sorting algorithms

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- Write functions to implement linear and non-linear data structure operations
- Suggest appropriate linear / non-linear data structure operations for solving a given problem
- Appropriately use the linear / non-linear data structure operations for a given problem
- Apply efficient search method to solve the problems.
- Analyze the different sorting algorithms.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2					2	3	3		3	3			
CO 2	2	3	2					2	3	2		3		3		2
CO 3	2	3	3					2	3	3		3		3		2
CO 4	2	3	3						3	2		2			3	2
CO 5	2	3	3					2		3		2			3	2

1904306 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES :

- To apply the concepts of classes.
- To understand and implement packages and interfaces.
- To handle I/O and exception handling.
- To understand file processing operations.
- To develop applications using event handling.

List of experiments

1. Write a java program to illustrate the concept of class and object creation.
2. Write a java program to implement constructors.
3. Write a java program to implement abstract class and abstract method.
4. Write a java program to implement Inheritance.
5. Write a java program to implement I/O, Throwing and Catching exceptions.
6. Write a java program to implement Designing Packages.
7. Write a java program to implement Interfaces in Java.
8. Write a java program to manipulate file operations.
9. Write a java program to create multithreads in Java applications.
10. Write a java program to implement Graphics classes
11. Write a java program to implement Event driven programming.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- Develop and implement Java programs for simple applications that make use of classes.
- Develop and implement packages and interfaces.
- Develop and implement Java programs with files and I/O.
- Develop and implement Java programs using exception handling and multithreading.
- Develop and implement applications using event handling.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3						2	1			1	2		2		
CO 2		3	3	3		1							3			
CO 3	2				2				2						2	
CO 4			2	1					2	2				2		
CO 5	1		3	1	3	2			3	3			2			

1904307 **OPERATING SYSTEMS LABORATORY** **L T P C**

0 0 4 2

COURSE OBJECTIVES :

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

LIST OF EXPERIMENTS:

1. Basics of UNIX commands
2. Write programs using the following system calls of UNIX operating system fork, exec, getpid, exit, wait, close, stat, opendir, readdir
3. Shell Programming
4. Write C programs to implement the various CPU Scheduling Algorithms
5. Implementation of Semaphores
6. Implementation of Shared memory and IPC
7. Bankers Algorithm for Deadlock Avoidance
8. Implementation of Deadlock Detection Algorithm
9. Implementation of the following Memory Allocation Methods for fixed partition
   a) First Fit
   b) Worst Fit
   c) Best Fit
10. Implementation of Paging Technique of Memory Management
11. Implementation of the following Page Replacement Algorithms
    a) FIFO
    b) LRU
    c) LFU
12. Implementation of the following File Allocation Strategies
    a) Sequential
    b) Indexed
    c) Linked

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- Compare the performance of various CPU Scheduling Algorithms.
- Implement Deadlock avoidance and Detection Algorithms.
- Create processes and implement IPC and Semaphores.
- Analyze the performance of the various Page Replacement Algorithms.
- Implement File Allocation Strategies.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	2	1											2			
CO 2			2	1											2	
CO 3									2		1			2		
CO 4	1		2						1		2				1	
CO 5	2			2							1		2			

SEMESTER – IV

1918402 PROBABILITY AND QUEUEING THEORY L T P C

3 1 0 4

COURSE OBJECTIVES :

- To provide necessary basic concepts in probability and random processes for applications such as random signals, linear systems in communication engineering.
- To understand the basic concepts of probability, one and two dimensional random variables and to introduce some standard distributions applicable to engineering which can describe real life phenomenon.
- To understand the basic concepts of random processes which are widely used in IT fields.
- To understand the concept of queuing models and advanced model to apply in engineering.
- To provide the required mathematical support in real life problems and develop probabilistic models which can be used in several areas of science and engineering.

UNIT - I: RANDOM VARIABLES AND PROBABILITY DISTRIBUTIONS 9L+3T

Random Variables - Discrete and continuous random variables – Moments – Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT - II: TWO - DIMENSIONAL RANDOM VARIABLES 9L+3T

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central Limit Theorem.

UNIT - III: RANDOM PROCESSES 9L+3T

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions.

UNIT - IV: QUEUEING MODELS 9L+3T

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little‘s formula - Queues with finite waiting rooms – Queues with impatient customers : Balking and reneging.

UNIT - V: ADVANCED QUEUEING MODELS 9L+3T

M/G/1 queue – Pollaczek Khinchin formula - M/D/1 and $M/E_K/1$ as special cases – Series queues – Open Jackson networks.

TOTAL: 45L+15T PERIODS

COURSE OUTCOMES :

At the end of the course, the student should 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 random processes in engineering disciplines,
- Acquire skills in analyzing queueing models.
- Understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.

TEXT BOOKS:

1. T. Veerarajan, - Probability, Statistics Random Processes with Queueing Theory and Queueing Networks (Third Edition), Tata McGraw-Hill Publishers
2. Gross, D., Shortle, J.F, Thompson, J.M and Harris. C.M., —Fundamentals of Queueing Theory", Wiley Student 4th Edition, 2014.
3. Ibe, O.C., —Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint, 2007.

REFERENCE BOOKS:

1. P.Sivaramakrishna Das, C.Vijayakumari , "Probability and Queueing Theory", Second Edition, Pearson India Education Services Pvt. Ltd.
2. Hwei Hsu, "Schaum‘s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.
3. Trivedi, K.S., "Probability and Statistics with Reliability, Queueing and Computer Science Applications", 2nd Edition, John Wiley and Sons, 2002.
4. Yates, R.D. and Goodman. D. J., "Probability and Stochastic Processes", 2nd Edition, Wiley India Pvt. Ltd., Bangalore, 2012.

CO – PO and PSO MAPPING:

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CO 1	3	3	3						1	1		1	1			
CO 2	3	3	3						1	1		1	1			
CO 3	3	3	3						1	1		1	1			
CO 4	3	3	3						1	1		1	1			
CO 5	3	3	3						1	1		1	1			

1908006 COMPUTER ARCHITECTURE L T P C

3 0 0 3

COURSE OBJECTIVES :

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

UNIT - I: BASIC STRUCTURE OF A COMPUTER SYSTEM 9

Functional Units – Basic Operational Concepts – Performance – Instructions: Language of the Computer – Operations, Operands – Instruction representation – Logical operations – decision making – MIPS Addressing– Bus structure – Bus operation.

UNIT - II: ARITHMETIC FOR COMPUTERS 9

Addition and Subtraction – Multiplication – Division – Floating Point Representation – Floating Point Operations – Subword Parallelism.

UNIT - III: PROCESSOR AND CONTROL UNIT 9

A Basic MIPS implementation – Building a Datapath – Control Implementation Scheme –

Pipelining – Pipelined data path and control – Handling Data Hazards & Control Hazards – Exceptions.

UNIT - IV: MEMORY & I/O SYSTEMS 9

Memory Hierarchy – memory technologies – cache memory – measuring and improving cache performance – virtual memory, TLB‘s - Accessing I/O Devices, programmed I/O, Interrupts – Direct Memory Access– Arbitration.

UNIT - V: PARALLELISIM 9

Instruction-level-parallelism - Parallel processing challenges – Flynn‘s classification – SISD, MIMD, SIMD, SPMD, and Vector Architectures – Multi-core processors and other Shared Memory Multiprocessors.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Understand the basics structure of computers, operations and instructions
- Design arithmetic and logic unit
- Understand pipelined execution and design control unit
- Understand parallel processing architectures
- Understand parallelism, multi-core processors, different memory systems and I/O communication.

TEXT BOOKS:

1. David A. Patterson and John L. Hennessy, Computer Organization and Design: The Hardware/Software Interface, Fifth Edition, Morgan Kaufmann / Elsevier, 2014.

2. Carl Hamacher, ZvonkoVranesic, SafwatZaky and NaraigManjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.

REFERENCE BOOKS:

1. William Stallings, Computer Organization and Architecture – Designing for Performance, Eighth Edition, Pearson Education, 2010.

2. John P. Hayes, Computer Architecture and Organization, Third Edition, Tata McGraw Hill, 2012.

3. John L. Hennessey and David A. Patterson, Computer Architecture – A

Quantitative Approach, Morgan Kaufmann / Elsevier Publishers, Fifth Edition, 2012.

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CO 1	3			2									2			
CO 2	3	3	3											3		
CO 3	2		3												3	
CO 4			3	2									2			
CO 5				3	3										3	

1904001 DATABASE MANAGEMENT SYSTEM L T P C

3 0 0 3

COURSE 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.
- To analyze the different DB storage like XML,ODMG etc. in distributed environment

UNIT - I: INTRODUCTION TO DATABASES 10

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 8

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: IMPLEMENTATION TECHNIQUES 9

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

TOTAL: 45 PERIODS

COURSE 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.
- Compare and contrast various indexing strategies in different database systems
- 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.

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.G.K.Gupta, "Database Management Systems, Tata McGraw Hill, 2011.

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CO 1	3		3		2		1						2			
CO 2	3	3			2						2			3		
CO 3	2	1		2	3									2		
CO 4			2			1			2		1				2	
CO 5		3							2							1

1904402 DESIGN AND ANALYSIS OF ALGORITHM L T P C

3 0 0 3

COURSE OBJECTIVES :

- To understand and apply the algorithm analysis techniques.
- To analyze and understand the solution to a problem.
- To critically analyze the efficiency of alternative algorithmic solutions for the problem
- To understand different algorithm design techniques.
- To understand the limitations of Algorithmic power.

UNIT - I: INTRODUCTION 9

Notion of an Algorithm – Fundamentals of Algorithmic Problem Solving – Important Problem Types – Fundamentals of the Analysis of Algorithmic Efficiency –Asymptotic Notations and their properties. Analysis Framework– Empirical analysis - Mathematical analysis for Recursive and Non-recursive algorithms, Statement of master theorem- Visualization.

UNIT - II: BRUTE FORCE METHOD 9

Brute Force – Computing an– String Matching- Closest-Pair and Convex-Hull Problems - Exhaustive Search - Travelling Salesman Problem- Knapsack Problem - Assignment problem.

UNIT - III: DIVIDE-AND-CONQUER TECHNIQUE 9

Divide and Conquer Methodology – Binary Search – Merge sort – Quick sort – Heap Sort - Multiplication of Large Integers – Closest-Pair and Convex - Hull Problems.

UNIT - IV: DYNAMIC PROGRAMMING AND GREEDY TECHNIQUE 9

Dynamic programming – Principle of optimality - Coin changing problem, Computing a Binomial Coefficient – Floyd‘s algorithm – Multi stage graph - Optimal Binary Search Trees – Knapsack Problem and Memory functions. Greedy Technique – Container loading problem - Prim‘s algorithm and Kruskal's Algorithm – 0/1 Knapsack problem, Optimal Merge pattern - Huffman Trees.

UNIT - V: COPING WITH THE LIMITATIONS OF ALGORITHM POWER 9

Lower - Bound Arguments - P, NP NP- Complete and NP Hard Problems. Backtracking – n-Queen problem - Hamiltonian Circuit Problem – Subset Sum Problem. Branch and Bound – LIFO Search and FIFO search - Assignment problem – Knapsack Problem – Travelling Salesman Problem -Approximation Algorithms for NP-Hard Problems – Travelling Salesman problem – Knapsack problem.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Design algorithms for various computing problems.
- Analyze and understand the solution to a problem
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency.

TEXT BOOKS:

1. Anany Levitin, —Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2012.

REFERENCE BOOKS:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/

C++, Second Edition, Universities Press, 2007.

2. Parag H.Deve, Himanshu B. Dave“ Design and Analysis of Algorithms“, Pearson Education, 2008
3. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, Introduction

   to Algorithms, Third Edition, PHI Learning Private Limited, 2012.
4. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms,

   Pearson Education, Reprint 2006.
5. Harsh Bhasin, - Algorithms Design and Analysis, Oxford university press, 2015.
6. http://nptel.ac.in/

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CO 1	2		3		3	2								2	2	
CO 2	2	3		3	2	2					2			2	3	
CO 3	2	3		3	2	2					2				3	
CO 4	2	3	3	2	2	2								2	3	
CO 5	2				2						2			2	2	

1908008 OBJECT ORIENTED ANALYSIS AND DESIGN L T P C

3 0 0 3

COURSE OBJECTIVES :

- To understand the fundamentals of object modeling and differentiate Unified Process from other approaches.
- To design with static UML diagrams.
- To design with the UML dynamic and implementation diagrams.
- To improve the software design with design patterns.
- To test the software against its requirements specification

UNIT - I: UNIFIED PROCESS AND USE CASE DIAGRAMS 9

Introduction to OOAD with OO Basics - Unified Process – UML diagrams – Use Case –

Case study – the Next Gen POS system, Inception -Use case Modelling – Relating Use cases – include, extend and generalization – When to use Use-cases.

UNIT - II: DESIGN PATTERNS AND METHODOLOGY 9

GRASP: Designing objects with responsibilities – Creator – Information expert – Low Coupling – High Cohesion – Controller Design Patterns – creational – factory method – structural – Bridge – Adapter – behavioural – Strategy – observer –Applying GoF design patterns – Mapping design to code – methodology – Survey – Rumbaugh, Booch, Jacobson Methods.

UNIT - III: STATIC UML DIAGRAMS 9

Class Diagram— Elaboration – Domain Model – Finding conceptual classes and description classes – Associations – Attributes – Domain model refinement – Finding conceptual class Hierarchies – Aggregation and Composition - Relationship between sequence diagrams and use cases – When to use Class Diagrams.

UNIT - IV: DYNAMIC AND IMPLEMENTATION UML DIAGRAMS 9

Dynamic Diagrams – UML interaction diagrams - System sequence diagram – Collaboration diagram – When to use Communication Diagrams - State machine diagram and Modelling – When to use State Diagrams - Activity diagram – When to use activity diagrams Implementation Diagrams - UML package diagram - When to use package diagrams - Component and Deployment Diagrams – When to use Component and Deployment diagrams.

UNIT - V: TESTING 9

Object Oriented Methodologies – Software Quality Assurance – Impact of object orientation on Testing – Develop Test Cases and Test Plans ,CASE STUDY: Health care, Student Marks Analysing system, CASE studies Tools: Star UML/ UML

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Express software design with UML diagrams
- Design software applications using OO concepts.
- Identify various scenarios based on software requirements
- Transform UML based software design into pattern based design using design patterns
- Create code from design

TEXT BOOKS:

1. Craig Larman, —Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development‖, Third Edition, Pearson Education, 2005.

2. Ali Bahrami - Object Oriented Systems Development - McGraw Hill International Edition - 1999.

REFERENCE BOOKS:

1. Erich Gamma, a n d Richard Helm, Ralph Johnson, John Vlissides, —Design patterns: Elements of Reusable Object-Oriented Software, Addison-Wesley, 1995.

2. Martin Fowler, —UML Distilled: A Brief Guide to the Standard Object Modeling Language, Third edition, Addison Wesley, 2003.

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CO 1	2		2	3						3		2	1			
CO 2			3	3								1		2		
CO 3	1		3	3						2					1	
CO 4		2				3	3			2				1		
CO 5					2	3	3			1					1	

1915001 PROFESSIONAL ETHICS L T P C

3 0 0 3

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

COURSE OUTCOMES:

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

- Students should be able to understand and apply ethics in society on ethical issues.
- Students will be able to get understanding on senses of engineering ethics.
- Students will be able to realize Western culture related to ethics.
- Students will understand risk and safety issues related to engineering.
- Student will have an understanding of engineer's responsibility to society and code of ethics

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 Campebell: "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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1						3	3	2					1			
CO 2								3							1	
CO 3						3	3	2							1	
CO 4						2	3						1			
CO 5								1								

1904002 DATABASE MANAGEMENT SYSTEM LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES :

The student should be made to:

- 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 different applications

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)

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

COURSE OUTCOMES :

Upon completion of the course, the students will 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.
- Critically analyze the use of tables and functions.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3		2		1					3		3		
CO 2		3			2						2					3
CO 3		1		2	3			2							3	
CO 4			2						2	1				3		
CO 5		3				1			2	1			3			

1904405 OBJECT ORIENTED ANALYSIS AND DESIGN LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES :

The student should be made to:

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

LIST OF EXPERIMENTS

UML DESIGN

1. To develop a problem statement.

2. Identify Use Cases and develop the Use Case model.

3. Identify the conceptual classes and develop a domain model with UML Class diagram.

4. Using the identified scenarios, find the interaction between objects and represent them using UML Sequence diagrams.

5. Draw relevant state charts and activity diagrams.

6. Identify the User Interface, Domain objects, and Technical services. Draw the partial layered, logical architecture diagram with UML package diagram notation.

7. Develop and test the Technical services layer.

8. Develop and test the Domain objects layer.

9. Develop and test the User interface layer

Suggested domains for Mini-Project (any 3 can done):

1. Passport automation system.
2. Exam Registration
3. Stock maintenance system.
4. Online course reservation system
5. Software personnel management system
6. Recruitment system
7. Conference Management System
8. BPO Management System
9. Library Management System

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- Perform OO analysis and design for a given problem specification.
- Identify and map basic software requirements in UML mapping.
- Use the UML analysis and design diagrams.
- Improve the software quality using design patterns and to explain the rationale behind applying specific design patterns
- Create code from design.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: Rational Rose Or Agro UML

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2							1	3		2	3			
CO 2	3		2		1										3	
CO 3	2		1	2							2				2	
CO 4					1	2								2		2
CO 5							2	2							3	2

1919001 COMMUNICATION SKILLS LABORATORY – PROJECT BASED L T P C

0 0 2 0

COURSE OBJECTIVES :

The Course will enable learners to:

- 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 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 suitable description with a proper title.

TOTAL: 30 PERIODS

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.

COURSE OUTCOMES :

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

- Listen and respond appropriately.
- Make effective presentations.

- Participate confidently and appropriately in conversations both formal and informal Write winning job applications.
- Read and evaluate texts critically.
- 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 Carne 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 Level3. 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 and et al. 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 MamtaBhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	2	3	3	-	-	-	-	3	-	1	2		2	1
CO 2	3	2	3	2	2	-	2	-	-	3	-	1	2		1	1
CO 3	3	2	3	2	2	-	2	-	-	3	-	1	2		1	1
CO 4	3	3	-	-	-	-	3	-	-	2	-	1	1		1	1
CO 5	3	3	-	2	-	-	-	-	-	3	-	1	1		1	1

SEMESTER - V

1904003	COMPUTER NETWORKS	L T P C
		3 0 0 3

COURSE OBJECTIVES :

- To understand the protocol layering and physical level communication
- To understand the various components required to build different networks.
- 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 AND PHYSICAL LAYER 9

Networks – Network Types – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit-switched Networks – Packet Switching.

UNIT - II: 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 - III: 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 - IV: TRANSPORT LAYER 9

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

UNIT - V: APPLICATION LAYER 9

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

TOTAL: 45 PERIODS

COURSE 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.

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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	3	2			3								2	3		
CO 2	2				3									2	3	
CO 3		3			2						3		2			
CO 4			2		3		3							3	2	
CO 5	3		2								2		2		3	

1904502 **AUTOMATA THEORY** **L T P C**

3 1 0 4

COURSE OBJECTIVES :

- To understand and design various Computing models like Finite State Machine, Pushdown Automata, and Turing Machine.
- To understand the various types of grammar and the corresponding languages.
- To make the students understand the use of automata theory in Compliers & System programming.
- To understand Decidability and Undesirability of various problems
- To strengthen the students' ability to carry out formal and higher studies in computer science.

UNIT - I: AUTOMATA FUNDAMENTALS 9L+3T

Introduction - Languages: Alphabets and Strings - Finite Automata - Deterministic Finite Automata - Non-deterministic Finite Automata – Equivalence of NFA and DFA - Finite Automata with Epsilon Transitions.

UNIT - II: REGULAR EXPRESSIONS & LANGUAGES 9L+3T

Regular Expressions - FA and Regular Expressions - Proving Languages not to be regular -Closure Properties of Regular Languages - Equivalence and Minimization of Automata.

UNIT - III: CONTEXT FREE GRAMMAR AND LANGUAGES 9L+3T

CFG - Parse Trees - Ambiguity in Grammars and Languages - Normal Forms for CFG - Definition of the Pushdown Automata – Languages of a Pushdown Automata - Equivalence of Pushdown Automata and CFG - Pumping Lemma for CFL .

UNIT - IV: TURING MACHINES 9L+3T

Turing Machines – Introduction – Formal definition of Turing machines – Instantaneous descriptions – Turing machines as Acceptors – Turing machine as Transducers computable languages and functions - Deterministic TM, Multi-track and Multitape Turing Machine- Programming Techniques for TM.

UNIT - V: COMPUTATIONAL COMPLEXITY 9L+3T

Undecidability- Basic definitions- Decidable and undecidable problems - Properties of Recursive and Recursively enumerable languages –-Post's Correspondence Problem–

complexity classes – introduction to NP-Hardness and NP-Completeness.

TOTAL: 45L+15T PERIODS

COURSE OUTCOMES :

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

- Explain Automata concepts, Automata and complexity and to adopt a suitable process for finite automata
- Important structural representations other than automata
- Analyze the different types of proofs such as deductive, inductive, proof by contradiction and proof by counter examples
- Difference between DFA and NFA and central concepts of automata theory
- Identify the Difference between Finite automata and Regular Expressions

TEXT BOOKS:

1. J.E.Hopcroft, R.Motwani and J.D Ullman, - Introduction to Automata Theory, Languages and Computations, ThirdEdition, Pearson Education, 2008.

REFERENCE BOOKS:

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	3			2		2							3			
CO 2	3	2													3	
CO 3	3		3		2										3	
CO 4	3										2			2		
CO 5	3			3						2		2				3

1908501 **WEB TECHNOLOGY** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

- To understand about client-server communication and protocols used during communication
- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.
- To develop the web applications using web development framework.

UNIT - I: WEB SITE BASICS AND HTML 9

Web Essentials: Clients, Servers, and Communication. The Internet-Basic Internet Protocols -The World Wide Web-HTTP request message-response message-Web Clients Web Servers. Markup Languages: XHTML. An Introduction to HTML History-Versions-Basic XHTML Syntax and Semantics-Some Fundamental HTML Elements-Relative URLs-Lists-tables-Frames-Forms-HTML 5.0.

UNIT - II: CSS AND CLIENT SIDE SCRIPTING 9

Style Sheets: CSS-Introduction to Cascading Style Sheets-Features-Core Syntax-Style Sheets and HTML-Style Rule Cascading and Inheritance-Text Properties-Box Model Normal FlowBox Layout-Beyond the Normal Flow-CSS3.0. Client-Side Programming: The JavaScript Language-History and Versions Introduction JavaScript in Perspective-Syntax-Variables and Data Types-Statements-Operators-Literals-Functions-Objects-Arrays-Built-inObjects-JavaScript Debuggers.

UNIT - III: CLIENT SIDE TECHNOLOGIES 9

Model-View-Controller Paradigm, Representing Web Data: XML-Documents and Vocabularies-Versions and Declaration-Namespaces-DOM based XML processing Event-oriented Parsing: SAX-Transforming XML Documents-Selecting XML Data: XPATH-Template based Transformations: XSLT-Displaying XML Documents in Browsers.

UNIT - IV: SERVER SIDE TECHNOLOGIES 9

Server-Side Programming: Java Servlets-Architecture -Overview-A Servlet-Generating Dynamic Content-Life Cycle-Parameter Data-Sessions-Cookies-URL Rewriting-Other Capabilities-Data Storage Servlets and Concurrency-Databases and Java Servlets.

Separating Programming and Presentation: JSP Technology Introduction-JSP and Servlets-Running JSP Applications Basic JSP-JavaBeans Classes and JSP-Tag Libraries and Files-Support for the Model-View-Controller Paradigm-Databases and JSP.

UNIT - V: APPLICATION DEVELOPMENT ENVIRONMENT 9

Overview of MVC architecture – Java Server Faces: Features – Components – Tags – Struts: Working principle of Struts – Building model components – View components – Controller components – Forms with Struts – Presentation tags – Developing Web applications – Hibernate: Configuration Settings – Mapping persistent classes – Working with persistent objects – Concurrency – Transactions – Caching – Queries for retrieval of objects – Spring: Framework – Controllers – Developing simple applications.

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- Design simple web pages using markup languages like HTML and XHTML.
- Design web pages using CSS
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side webpages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.

TEXT BOOKS:

1. Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, 2006.
2. Deitel, Deitel, Goldberg, “Internet & World Wide Web How to Program”, Third Edition, Pearson Education, 2006.

REFERENCE BOOKS:

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education, 2007
2. Marty Hall and Larry Brown, “Core Web Programming Second Edition”, Volume I and II, Pearson Education, 2001.
3. Bates, “Developing Web Applications”, Wiley, 2006.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3								1				3			
CO 2		2	3			3								2		
CO 3				3				1			2			3	2	
CO 4	3						3					2			3	1
CO 5	1				3							1		1		3

1908507 DATA WAREHOUSING AND DATA MINING L T P C

3 0 0 3

COURSE OBJECTIVES :

- Be familiar with the concepts of data warehouse.
- Be familiar with techniques of data mining.
- Be acquainted with the tools and techniques used for Knowledge Discovery in Databases.
- Be familiar with data mining functionalities.
- To understand the applications of data mining.

UNIT - I: DATA WAREHOUSING 9

Data warehousing Components –Building a Data warehouse –- Mapping the Data Warehouse to a Multiprocessor Architecture – DBMS Schemas for Decision Support – Data Extraction, Cleanup, and Transformation Tools –Metadata.

UNIT - II: BUSINESS ANALYSIS 9

Reporting and Query tools and Applications – Tool Categories – The Need for Applications – Cognos Impromptu – Online Analytical Processing (OLAP) – Need – Multidimensional Data Model – OLAP Guidelines – Multidimensional versus Multirelational OLAP – Categories of Tools – OLAP Tools and the Internet.

UNIT - III: 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.

UNIT - IV: ASSOCIATION RULE MINING AND CLASSIFICATION 9

Mining Frequent Patterns, Associations and Correlations – Mining Methods – Mining various Kinds of Association Rules – Correlation Analysis – Constraint Based Association Mining – Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.

UNIT - V: CLUSTERING AND TRENDS IN DATA MINING 9

Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods - Density-Based Methods –Grid Based Methods – Model-Based Clustering Methods – Clustering High Dimensional Data - Constraint – Based Cluster Analysis – Outlier Analysis – Data Mining Applications.

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- Understand the basic concepts of Data Warehouse.
- Apply the data warehouse concepts in business analysis.
- Apply data mining techniques and methods to large data sets.
- Understand the concepts of Association and Prediction.
- Compare and contrast the various classifiers.

TEXT BOOKS:

1. Alex Berson and Stephen J.Smith, “Data Warehousing, Data Mining and OLAP”, Tata McGraw – Hill Edition, Thirteenth Reprint 2008.
2. Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Third Edition, Elsevier, 2012.

REFERENCE BOOKS:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, “Introduction to Data Mining”, Person Education, 2007.
2. K.P. Soman, ShyamDiwakar and V. Aja, “Insight into Data Mining Theory and Practice”, Eastern Economy Edition, Prentice Hall of India, 2006.
3. G. K. Gupta, “Introduction to Data Mining with Case Studies”, Eastern Economy Edition, Prentice Hall of India, 2006.
4. Daniel T.Larose, “Data Mining Methods and Models”, Wiley-Interscience, 2006.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2						2						2			
CO 2			2			2	2							1		
CO 3			2												1	
CO 4				2		1										2
CO 5				2												

1908510 WEB TECHNOLOGY LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES :

The student should be made:

- To design interactive web pages using HTML.
- To apply CSS style rules for dynamic web pages.
- To design interactive web pages using Scripting languages.
- To learn server side programming using servlets and JSP.
- To develop web pages using XML/XSLT.

LIST OF EXPERIMENTS

1. HTML
   - I. Simple HTML using
     - Heading elements
     - Text Elements
     - Logical Styles
     - Physical Styles
     - Ordered , Unordered and Definition list
   - II. Hyper Links
     - Image Link - Link to page containing Images and Videos
     - File Link - Time table
     - Single Page Link
   - III. Using Frames
     - Navigation Frame
     - Floating Frame
     - Inline Frame
   - IV. Registration Form with Table
2. CSS - Inline Style , Internal Style and External Style Sheets
3. DHTML
   - I. Use user defined function to get array of values and sort them in ascending order
   - II. Demonstrate String and Math Object's predefined methods
   - III. Demonstrate Array Objects and Date Object's predefined methods
   - IV. Exception Handling
   - V. Calendar Creation: Display all month
     - Validation of registration form
     - Open a Window from the current window
     - Change color of background at each click of button or refresh of a page
     - Display calendar for the month and year selected from combo box
     - OnMouseover event
4. JSP
   - I. Create a welcome Cookie (Hit for a page) and display different image and textcontent each time when the user hit the page
   - II. List a table of content and navigate within the pages
   - III. Demonstrate Request and Response object using HTML Form IV. Database Connection to display all the values in the table

5. Java Servlets
   I. Simple Servlets
   II. Servlets with HTML form
   III. Cookie creation and retrieval using servlet
6. XML
   I. Create any catalog
   II. Display the catalog created using CSS or XSL
   III. Programs using XML –Schema –XSLT/XSL.8.Programs using DOM and SAX
   IV. Programs using AJAX

TOTAL: 60 PERIODS

COURSE OUTCOMES :

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

- Design simple web pages using markup languages like HTML and XHTML
- Develop web pages using CSS.
- Create dynamic web pages using DHTML and java script that is easy to navigate and use.
- Program server side web pages that have to process request from client side web pages.
- Represent web data using XML and develop web pages using JSP.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3										3		1	
CO 2		2	3			3							1	2		
CO 3				3				1			2			3	2	
CO 4	3		3		3							2			3	1
CO 5	1		3		3							1		1		3

1904512 **NETWORKS LABORATORY** **L T P C**

0 0 4 2

COURSE OBJECTIVES :

- To learn and use network commands.
- To learn socket programming.
- To implement and analyze various network protocols.
- To learn and use simulation tools.
- To use simulation tools to analyze the performance of various network protocols.

List of experiments

1. Learn to use commands like tcp dump, netstat, ifconfig, nslookup, ping and traceroute.
2. Write a code simulating Socket Programming and Client – Server model
3. Write a code simulating Stop and Wait protocol.
4. Write a code simulating ARP /RARP protocols.
5. Develop a TCP daytime server and client.
6. Applications using TCP sockets like:
   - Echo client and echo server
   - Chat
   - File Transfer
7. Write a HTTP web client program to download a web page using TCP sockets.
8. Simulation of DNS using UDP sockets.
9. Simulation of Distance Vector/ Link State Routing algorithm.
10. Study of TCP/UDP performance using Simulation tool.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- Implement various network commands.
- Develop applications using socket programming.
- Implement applications using TCP and UDP protocols.
- Use simulation tools to analyze the performance of various network protocols.
- Analyze various routing algorithms.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS:

SOFTWARE: C /C++ / Java / Equivalent Compiler, Network simulator likeNS2 /

Equivalent

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2												2		2	
CO 2			2											2		
CO 3		3			2						3			2		
CO 4					3										2	
CO 5					3									2		

SEMESTER VI

1904601 MOBILE COMPUTING L T P C

3 0 0 3

COURSE OBJECTIVES :

The student should be made to:

- Understand the basic concepts of mobile computing.
- Be familiar with the network protocol stack.
- Learn the basics of mobile telecommunication system.
- Be exposed to Ad-Hoc networks.
- Gain knowledge about different mobile platforms and application development.

UNIT - I: INTRODUCTION 9

Basics of Mobile Computing – Mobile Computing Vs wireless Networking – Hand off and Hand over-Hidden Terminal Problem-Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT - II: MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER 9

Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance-Tunneling.

UNIT - III: MOBILE TELECOMMUNICATION SYSTEM 9

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

UNIT - IV: MOBILE AD-HOC NETWORKS 9

Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Distance Vector and Link State Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.

UNIT - V: MOBILE PLATFORMS AND APPLICATIONS 9

Mobile Device Operating Systems – Special Constrains & Requirements – Comparison of Windows and Android OS-Commercial Mobile Operating Systems-Mobile Payment System – Security Issues.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Explain the basics of mobile telecommunication system
- Choose the required functionality at each layer for given application
- Identify solution for each functionality at each layer
- Use simulator tools and design Ad hoc networks
- Develop a mobile application.

TEXT BOOKS:

1. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt. Ltd, New Delhi – 2012.

REFERENCE BOOKS:

1. Jochen H. Schller, “Mobile Communications”, Second Edition, Pearson Education, New Delhi, 2007.
2. Dharma Prakash Agarval, Qing and An Zeng, “Introduction to Wireless and Mobile systems”, Thomson Asia Pvt Ltd, 2005.
3. William.C.Y.Lee, “Mobile Cellular Telecommunications-Analog and Digital Systems”, Second Edition, Tata Mc Graw Hill Edition , 2006.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3									3	2			
CO 2		3			2						2				3	
CO 3				2	3			2						2		
CO 4			2						2		1					1
CO 5		3				1					2				2	

1904602 **COMPILER DESIGN** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

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

UNIT - I: INTRODUCTION TO COMPILERS **9**

Phases of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – NFA to DFA- Minimizing DFA.

UNIT - II: SYNTAX ANALYSIS **9**

Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar – Top Down Parsing - General Strategies Recursive Descent Parser Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0)Item Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer-YACC.

UNIT - III: INTERMEDIATE CODE GENERATION **9**

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking.

UNIT - IV: RUN-TIME ENVIRONMENT AND CODE GENERATION **9**

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of a simple Code Generator.

UNIT - V: CODE OPTIMIZATION **9**

Principal Sources of Optimization – Peep-hole optimization - DAG- Optimization of Basic Blocks- Global Data Flow Analysis - Efficient Data Flow Algorithm.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Understand the different phases of compiler.
- Design a lexical analyzer for a sample language.
- Apply different parsing algorithms to develop the parsers for a given grammar.
- Understand syntax-directed translation and run-time environment.
- Learn to implement code optimization techniques and a simple code generator.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Randy Allen, Ken Kennedy, and Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design, Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, Compiler Design in C, Prentice-Hall Software Series, 1993.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	3			2		2							3			
CO 2	3	2													3	
CO 3	3		3		2										3	
CO 4	3										2			2		
CO 5	3			3						2		2				3

1908014 **SOFTWARE TESTING** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

The student should be made:

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

UNIT - I: INTRODUCTION **9**

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

UNIT - II: TEST CASE DESIGN STRATEGIES **9**

Test case Design Strategies – Using Black Box Approach to Test Case Design – Boundary Value Analysis – Equivalence Class Partitioning – State based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing - Random Testing – Requirements based testing – Using White Box Approach to Test design – Test Adequacy Criteria – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing.

UNIT - III: LEVELS OF TESTING **9**

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

UNIT - IV: TEST MANAGEMENT **9**

People and organizational issues in testing – Organization structures for testing teams –

testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group- The Structure of Testing Group

UNIT - V: TEST AUTOMATION 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Design test cases suitable for a software development for different domains.
- Prepare test planning based on the document.
- Document test plans and test cases designed.
- Use automatic testing tools.
- Develop and validate a test plan.

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, ―Software Testing – Principles and Practices, Pearson Education, 2006.
2. Ron Patton, ―Software Testing‖, Second Edition, Sams Publishing, Pearson Education, 2007.

REFERENCE BOOKS:

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3										2			
CO 2					2					1					2	
CO 3				2					1							2
CO 4						2					2			2		
CO 5								3				1	2			

1904603 GRID AND CLOUD COMPUTING L T P C

3 0 0 3

COURSE 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

Evolution of Distributed computing: Scalable computing over the Internet – Technologies for network based systems – clusters of cooperative computers – Grid computing Infrastructures – Introduction to Grid Architecture and standards – Elements of Grid – Overview of Grid Architecture**.**

UNIT - II: CLOUD ENABLING TECHNOLOGIES 9

Cloud computing –service oriented architecture- Basics of Virtualization – Types of Virtualization – Implementation Levels ofVirtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices –Virtualization Support and Disaster Recovery.

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UNIT - III: CLOUD ARCHITECTURE, SERVICES AND STORAGE 8

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

UNIT - IV: RESOURCE MANAGEMENT AND SECURITY IN CLOUD 10

Inter Cloud Resource Management – Resource Provisioning and Resource Provisioning Methods – Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges – Software-as-a-Service Security – Security Governance – Virtual Machine Security – IAM – Security Standards.

UNIT - V: CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – MapReduce – Virtual Box -- Google App Engine – Programming Environment for Google App Engine —- Open Stack – Federation in the Cloud – Four Levels of Federation – Federated Services and Applications – Future of Federation.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- Apply grid computing techniques to solve large scale scientific problems.
- 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 and able to install and use current cloud technologies.
- Evaluate and choose the appropriate technologies, algorithms and approaches for Implementation and use of cloud.

TEXT BOOKS:

1. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.

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

REFERENCE BOOKS:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing, Tata Mcgraw Hill, 2013.

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

3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly, 2009.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2			2									2			
CO 2		3	3											3		
CO 3	2		3												3	
CO 4			3	2									2			
CO 5				3	3										3	

1904610 MOBILE APPLICATION DEVELOPMENT LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES :

The student should be made to:

- Know the components and structure of mobile application development frameworks for Android and windows OS based mobiles.
- Understand how to work with various mobile application development frameworks.
- Learn the basic and important design concepts and issues of development of mobile applications.
- Understand the capabilities and limitations of mobile devices.
- Using engineering, physics & mathematical concepts critical to mobile application development

List of experiments

1. Develop an android application to work on GUI components.
2. Write an android application to develop dice roller.
3. Write an android application to develop Native Calculator.
4. Write an android application to develop a Reminder App.
5. Develop an android application to implement Multithreading.
6. Write an android application to implement all the UI design (Widgets, Layouts, UI Events and Event Listeners).
7. Develop an android application to make use of Database Concepts.
8. Implement an android application to use 2D graphics.
9. Develop an android application to implement multimedia (Audio playback and Media Player).
10. Develop an android application to make use of Networking Concept.

(i)Making Phone call.

(ii)Sending Emails.

(iii)Sending SMS.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- Design and Implement various mobile applications using emulators.
- Deploy applications to hand-held devices.
- Transfer current knowledge to learning of new technologies.
- Technical skills related to software development, computer programming & graphic design.
- Using appropriate and accessible digital tools for research and learning.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		2		2								2	2		
CO 2		2		2	3									2		
CO 3			3		3	2									3	
CO 4					3			1		2				1		
CO 5											1			2		1

1904611 **COMPILER DESIGN LABORATORY** **L T P C**

0 0 4 2

COURSE OBJECTIVES :

- Deepen the understanding of compiler design.
- To implement Lexical Analyzer usingLex tool &Syntax Analyzer or parser using YACC Tool.
- To implement NFA and DFA from a given regular expression.
- To implement front end of the compiler by means of generating Intermediate codes
- To implement code optimization techniques

List of experiments

1. Implementation of Symbol Table

2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)

3. Implementation of Lexical Analyzer using Lex Tool

4. Generate YACC specification for a few syntactic categories.

a) Program to recognize a valid arithmetic expression that uses operator +, - , * and /.

b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.

c)Implementation of Calculator using LEX and YACC

5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.

6. Implement type checking

7. Implement control flow analysis and Data flow Analysis

8. Implement any one storage allocation strategies (Heap, Stack)

9. Construction of DAG

10. Implementation of Simple Code Optimization Techniques.

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- The students shall acquire the generic skills to design
- Implement a compiler along with analysis of practical aspects
- Design Lexical analyzer for given language using C and LEX tools.
- Design and convert BNF rules into YACC form to generate various parsers.
- Generate machine code from the intermediate code forms.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1					2					2			2			
CO 2	2						2							1		
CO 3			2												1	
CO 4						1										2
CO 5				2												

1919002 PROFESSIONAL COMMUNICATION L T PC

0 0 2 1

COURSE OBJECTIVES :

The course aims to:

- 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 FOR 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.

COURSE 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 Blackswan: Hyderabad, 2016.
3. E. Suresh Kumar et al. Communication for Professional Success. Orient Blackswan: Hyderabad, 2015

4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. 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
7. Goodheart-Willcox, "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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	2	3	3	-	-	-	-	3	-	1	2	2	2	2
CO 2	3	2	2	2	2	-	3	-	-	2	-	1	2	2	2	2
CO 3	3	2	-	3	-	-	-	-	-	3	-	1	1	1	2	2
CO 4	3	3	-	-	-	-	3	-	-	3	-	1	1	1	1	1
CO 5	3	2	3	-	-	-	-	-	-	3	-	1	2	2	2	2

SEMESTER – VII

1904005 CRYPTOGRAPHY AND NETWORK SECURITY L T P C

3 0 0 3

COURSE 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

COURSE OUTCOMES :

At the end of the course, learners will 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2		2								2				2	
CO 2		2	2	1	2							2	2			1
CO 3		2	2	2								2		2		1
CO 4	2			2			1			1	2				1	
CO 5	3		2	2	2					1			2		1	

1904006 **ARTIFICIAL INTELLIGENCE** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

The student should be made to:

- 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

COURSE 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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1		1				3							2			
CO 2			2											3		
CO 3	3			2									1			
CO 4		2			3									2		
CO 5	2		2										3			2

1904008 **SECURITY LABORATORY** **L T P C**

0 0 4 2

COURSE OBJECTIVES :

- To learn different cipher techniques.
- To implement the algorithms DES.
- To implement the RSA Algorithm.
- To implement the MD5, Digital Signature Algorithms.
- To use network security tools and vulnerability assessment tools

LIST OF EXPERIMENTS

1. Perform encryption, decryption using the following substitution techniques

(i) Ceaser cipher, (ii) playfair cipher ,iii) Hill Cipher ,iv) Vigenere cipher

2. Perform encryption and decryption using following transposition techniques

i) Rail fence

ii) row & Column Transformation

3. Apply DES algorithm for practical applications.

4. Apply AES algorithm for practical applications.

5. Implement RSA Algorithm using HTML and JavaScript

6. Implement the Diffie-Hellman Key Exchange algorithm for a given problem.

7. Calculate the message digest of a text using the SHA-1 algorithm.

8. Implement the SIGNATURE SCHEME - Digital Signature Standard.9. Demonstrate intrusion detection system (ids) using any tool eg. Snort or any other s/w.

10. Automated Attack and Penetration Tools

Exploring N-Stalker, a Vulnerability Assessment Tool

11. Defeating Malware

i) Building Trojans

ii) Rootkit Hunter

TOTAL : 60 PERIODS

COURSE OUTCOMES :

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

- Develop code for classical Encryption Techniques to solve the problems.
- Build cryptosystems by applying symmetric and public key encryption algorithms.
- Construct code for authentication algorithms.
- Develop a signature scheme using Digital signature standard.
- Demonstrate the network security system using open source tools

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE: C / C++ / Java or equivalent compiler GnuPG, Snort, N-Stalker or Equivalent

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3		3						2			3	3	
CO 2	3		3		3						2		3		3	2
CO 3	3		3		3						2		3	3		
CO 4	3		3		3						2		3	3		
CO 5	3		3		3	2				2	2		3	3		

1904009 ARTIFICIAL INTELLIGENCE LABORATORY L T P C

0 0 4 2

COURSE 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

COURSE 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.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

SOFTWARE: C / C++ / Java

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	2		2			3								2		
CO 2			2		3		3								3	
CO 3		2			3		3								3	
CO 4	1	2						3					2		2	
CO 5		1		2											2	

PROFESSIONAL ELECTIVE - I

1904004 NATURAL LANGUAGE PROCESSING L T P C

3 0 0 3

COURSE 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 apply the NLP techniques to IR applications.
- Practice individual investigation in chosen topics.

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 Backoff -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 - Coreference Resolution –Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC). Programming in Python **-** NLTK (Natural Language Toolkit)

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To 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, 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 Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.
4. Anveer Siddiqui, U.S. Tiwary, —Natural Language Processing and Information

Retrieval, Oxford University Press, 2008.

5. http://nltk.sourceforge.net/lite/doc/en/programming.html

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	3		3	2							2	2			
CO 2	3		3	3		2								2	2	
CO 3		3		2	2										3	
CO 4		3		2											2	
CO 5			3		2	2						2				1

1904605 SECURITY GOVERNANCE RISK AND COMPLIANCE L T P C

3 0 0 3

COURSE OBJECTIVES :

- To learn about security Governance strategies.
- To learn about security architecture and frame work.
- To learn about risk management and compliance.
- Learn how to apply security metrics.
- To learn about security management strategies.

UNIT - I: INTRODUCTION 9

Information Security Governance and The CIA Triad: Confidentiality Integrity and Availability, Benefits of Good Governance, Security Governance and Regulation, Applying security Governance principles **-**Organizational Processes, security roles and responsibilities, Compliance-Types of Legal System, Understanding legal and regulatory issues-Computer Crime, ISC code of ethics.

UNIT - II: STRATEGIC METRICS & SECURITY ARCHITECTURE 9

Strategic metrics, Strategic Direction, Information Security Strategic Alignment, Risk Management, Business process assurance/convergence, Value delivery, Resource management, Performance measurement, Security architecture, Security Control Framework- COBIT, OCTAVE, ISO 27000/31000.

UNIT - III: RISK MANAGEMENT **9**

Risk management responsibilities, Managing risk appropriately, Current State of Security, SABSA, CMM, Cyber Security Task Force- Governance Framework, Gap Analysis – SABSA, CMM.

UNIT – IV: SECURITY STRATEGY **9**

Strategy – Failure, Attributes, Resources, Constraints, Sample Strategy Development – The Process**,** Implementing Strategy.

UNIT - V: SECURITY METRICS **9**

Security program Development metrics, Information Security management metrics, CISO Decisions, Information Security operational Metrics, Incident Management and Response Metrics.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- State the basic concepts of GRC
- Paraphrase security architecture
- Paraphrase strategic metrics for security architecture
- Demonstrate identification of risk
- Demonstrate and Interpret working with Security metrics

TEXT BOOKS:

1. Krag Brotby, “Information Security Governance: A Practical Development and Implementation Approach”, WILEY, 2009

REFERENCE BOOKS:

1. Alan Calder, Steve G. Watkins, “Information Security Risk Management for ISO27001/ISO27002”, itgp, 2010.
2. http://www.freetechbooks.com/managing-risk-and-information-security-protect-to-enablet 1150.
3. https://www.udemy.com/cissp-domain-1-security-and-risk-management/
4. https://www.coursera.org/learn/cyber-security-domain/lecture/FLyKS/information-

securitygovernance-and-risk-management

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2		3	3								2	2			
CO 2	2		3	3		2								2		
CO 3			3	3							3				2	
CO 4		2		3								2		2		
CO 5	2					3					3				1	

1904606 INTELLECTUAL PROPERTY RIGHTS L T P C

3 0 0 3

COURSE 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.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Skill to understand the concept of intellectual property rights.
- Develops procedural knowledge to Legal System and solving the problem relating to intellectual property rights.
- Skill to pursue the professional programs in Company Secretaryship, 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, Ess Ess 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	1	2									2			2		
CO 2			2				2					2	3			2
CO 3				3	2				2		2			2		
CO 4						2									2	
CO 5		2					2				2			2		

1904607 DATA SCIENCE L T P C

3 0 0 3

COURSE OBJECTIVES :

- Be exposed to basic introduction of big data
- To impart necessary knowledge of the mathematical foundations
- Be familiar with basic concepts on Machine Learning
- Learn the different classification algorithm for appropriate decision making.
- To learn the tools to implement Data science and its application.

UNIT - I: INTRODUCTION TO DATA SCIENCE 9

Introduction to Data Science-Concept of Data Science-Traits of Big data-Web Scraping-Analysis vs Reporting

UNIT - II: MATHEMATICAL FOUNDATIONS 9

Linear Algebra: Vectors, Matrices- Statistics: Describing a Single Set of Data, Correlation, Simpson's Paradox-Correlation and Causation- Probability: Dependence and Independence, Conditional Probability, Bayes's-Theorem, Random Variables-Continuous Distributions- The Normal Distribution-The Central Limit Theorem.

UNIT - III: MACHINE LEARNING 9

Overview of Machine learning concepts –Types of Machine learning - Linear Regression-

model assumptions-Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression- support vector machines (SVM), decision trees, and random forest.

UNIT - IV: PROGRAMMING TOOLS FOR DATA SCIENCE 9

Introduction to Programming Tools for Data Science-Toolkits using Python: Matplotlib, NumPy, Scikit-learn, NLTK-Visualizing Data: Bar Charts, Line Charts and Scatterplots-Working with data: Reading Files, Scraping the Web, Using APIs (Example: Using the Twitter APIs).

UNIT - V: CASE STUDIES OF DATA SCIENCE APPLICATION 9

Weather forecasting-Stock market prediction-Object recognition- Real Time Sentiment Analysis.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Basic foundations of Big data.
- Demonstrate understanding of the mathematical foundations needed for data science.
- Implement models such as k-nearest Neighbors, Naive Bayes, linear and logistic regression, decision trees.
- Build data science applications using Python based toolkits.
- Familiar in Data science applications and implementation.

TEXT BOOKS:

1. Joel Grus, "Data Science from Scratch: First Principles with Python", O'Reilly Media First edition (April 30, 2015)
2. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition,2017, O'Reilly Media.

REFERENCE BOOKS:

1. Stephen Marsland, —Machine learning: An Algorithmic Perspective‖, CRC Press, Second Edition, 2009.
2. G. Strang (2016). Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA.

3. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, First Edition (November 18, 2016)
4. Montgomery, D. C. and G. C. Runger (2011). Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1					2		2									
CO 2	3		3										2			
CO 3				2							2				3	
CO 4	3				3											
CO 5					2	2	2				2					

1915002 PRINCIPLES OF MANAGEMENT LT P C

3 0 0 3

OBJECTIVES:

- To study the principles of management, functions and its application an organization.
- To educate the students on the concept of planning and decision making.
- To understand the dynamics of human relations in organizations.
- To learn about motivation, communication and leadership aspects.
- To study the process controlling and the various techniques involved in controlling

UNIT – I: INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur - types of managers managerial roles and skills –Evolution of Management – Scientific, human relations, system and contingency approaches – Types of Business organization - Sole proprietorship, partnership, company-public and private sector enterprises - Organization culture and Environment –Multinational Corporations - Current trends and issues in Management.

UNIT – II: PLANNING **9**

Nature and purpose of planning – planning process – types of planning – objectives – setting objectives – policies – Planning premises – Strategic Management –types of strategies – Planning Tools and Techniques – Decision making steps and process.

UNIT – III: ORGANISING **9**

Nature and purpose – Formal and informal organization – organization chart – organization structure – types – Line and staff authority – departmentalization – delegation of authority – centralization and decentralization – Job Design - Human Resource Management – HR Planning, Talent Acquisition, Training and Development, Performance Management, Career planning and management.

UNIT – IV: DIRECTING **9**

Motivation – motivation theories – motivational techniques – job satisfaction – job enrichment – leadership – types and theories of leadership – communication – process of communication – barrier in communication – effective communication – communication and IT.

UNIT – V: CONTROLLING **9**

System and process of controlling – budgetary and non-budgetary control techniques – use of computers and IT in Management control – Quality control and Inventory Control - Productivity problems and management – control and performance – direct and preventive control – Maintenance control and purchase control– reporting.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Students will be able to have a clear understanding of managerial functions.
- Students would have knowledge to apply planning techniques and decision making.
- Understand concept of Human Resource Management.
- Students would be able to understand motivation, leadership and communication principles.
- Students would be able to apply control techniques in the organization.

TEXT BOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, 14th Edition, Pearson, 2017
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, 6th Edition, Pearson, 2004.

REFERENCE BOOKS:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” 10th Edition, Pearson Education, 2016.
2. Robert Kreitner & Mamata Mohapatra, “Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata Mc Graw Hill, 2006. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 6th edition 2017

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1		1							1		2			1		
CO 2		2											1			
CO 3									2					1		
CO 4									1	2					1	
CO 5			1		1		1				1			1		

PROFESSIONAL ELECTIVE - II

1908702 SOFTWARE PROJECT MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES :

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

UNIT – I: PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting Objectives– Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT – II: PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models - Rapid Application development – Agile methods – Dynamic System Development Method – Extreme Programming– Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points - COCOMO II - a Parametric Productivity Model.

UNIT – III: ACTIVITY PLANNING AND RISK MANAGEMENT 9

Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Formulating Network Model – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.

UNIT – IV: PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data – Visualizing progress – Cost monitoring – Earned Value Analysis – Prioritizing Monitoring – Project tracking – Change control – Software Configuration Management – Managing contracts – Contract Management.

UNIT - V: STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham – Hackman job characteristic model – Stress – Health and Safety – Ethical and Professional concerns – Working in teams – Decision making – Organizational structures – Dispersed and Virtual teams – Communications genres – Communication plans – Leadership.

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- Understand Project Management principles while developing software.
- Gain extensive knowledge about the basic project management concepts, framework and the process models.
- Obtain adequate knowledge about software process models and software effort estimation techniques.
- Estimate the risks involved in various project activities.
- Define the checkpoints, project reporting structure, project progress and tracking mechanisms using project management principles.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1				3		3					3		3			
CO 2		2	3				3				2			2		
CO 3			3	3							2			2		
CO 4							3			3					2	
CO 5		2				3				2				1		

1904011 BIG DATA ANALYTICS L T P C

3 0 0 3

COURSE 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

COURSE 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3					3				2						2
CO 2					3	3				3				3		
CO 3		3	2			3			2	2					3	
CO 4	3	2				3				2				2		
CO 5	2				3	3				2					3	2

1904706 INTRODUCTION TO MACHINE LEARNING AND ALGORITHMS L T P C

3 0 0 3

COURSE 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 understand the concepts of Reinforcement learning, Genetic algorithms and Instant based learning.

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 LEARNING 9

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Basis Functions – Case Based Learning.

UNIT - V: ADVANCED LEARNING 9

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.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Differentiate between supervised, unsupervised, semi-supervised machine learning approaches
- Discuss the decision tree algorithm and identity 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
- Analyse 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, 2017.

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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3												3			
CO 2	3	3			2								3			
CO 3	3			3		2								2		
CO 4	3		3												3	
CO 5	3	2	2	2											3	2

1904707 NEURAL NETWORKS & FUZZY LOGIC L T P C

3 0 0 3

COURSE OBJECTIVES:

- Survey of attractive applications of artificial neural networks.
- Practical approach for using artificial neural networks in various technical, organizational and economic applications.
- Prospects for use of artificial neural networks in products
- Artificial neural network provides design based on solid mathematical difference
- Enables Neural networks processing of sensorial data such as signal processing, image processing, pattern recognition, robot control, non-linear modeling and prediction

UNIT - I: INTRODUCTION TO NEURAL NETWORKS 9

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT - II: ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS 9

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

UNIT - III: SINGLE LAYER FEED FORWARD & MULTILAYER FEED FORWARD NEURAL NETWORKS 9

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications. Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT - IV: CLASSICAL & FUZZY SETS 9

Introduction to classical sets – properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT - V: FUZZY LOGIC SYSTEM COMPONENTS AND APPLICATIONS 9

Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Neural network applications: Process identification, control, fault diagnosis and load forecasting. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Comprehend the concepts of feed forward neural networks
- Analyze the various feedback networks.
- Understand the concept of fuzziness involved in various systems and fuzzy set theory.
- Comprehend the fuzzy logic control and adaptive fuzzy logic and to design the fuzzy control using genetic algorithm.
- Analyze the application of fuzzy logic control to real time systems.

TEXT BOOKS:

1. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai - PHI Publication.
2. Introduction to Neural Networks using MATLAB 6.0 – S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH, 2006

REFERENCE BOOKS:

1. Jack M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishing Co., Boston, 2002.
2. Klir G.J. &Folger T.A., “Fuzzy sets, Uncertainty and Information”, Prentice –Hall of India Pvt. Ltd., New Delhi, 2008.
3. Zimmerman H.J., “Fuzzy set theory and its Applications”, Kluwer Academic Publishers Dordrecht, 2001.

4. Laurance Fausett, Englewood cliffs, N.J., “Fundamentals of Neural Networks”, Pearson Education, New Delhi, 2008.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2			2					2				2			
CO 2		2			2		3				2			2		
CO 3			3				2	1		2					1	
CO 4				2		2	2		2						2	
CO 5		2										2		2		2

1904708 INTERNET OF THINGS L T P C

3 0 0 3

COURSE OBJECTIVES :

- Basic knowledge about IoT
- To Gain knowledge of hardware and fundamentals of Arduino.
- Evaluate and study suitable development protocols, technologies and tools.
- Evaluate methods of interface.
- Exposure to industrial applications.

UNIT - I: INTRODUCTION 9

Introduction to IoT concept, Objective, IoT History , Introduction to IoT communication, Why IoT, IoT Architecture, Telemetry Vs IoT, IoT Technologies behind smart & Intelligence devices, IoT Application: Home Automation, Health monitoring system, Smart Transportation and Smart Shopping.

UNIT - II: INTRODUCTION IOT HARDWARE/DEVICES 9

Basics Of Microcontroller, Microprocessor Vs Microcontroller, Types of Sensor, actuators and their application, Programming Fundamentals(C Programming), Introduction to

Arduino microcontroller, hands on Arduino, Arduino board layout and LED Blinking temperature sensor application.

UNIT - III: BASICS OF NETWORKING/COMMUNICATION PROTOCOL 9

Types of IoT Network and topology, Communication protocol-MQTT, Introduction to cloud services-Blynk. Introduction to IoT security.

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/INDUSTRIAL APPLICATIONS 9

Cisco IoT system - IBM Watson IoT platform – Manufacturing - Converged Plantwide Ethernet Model (CPwE) – Power Utility Industry – GridBlocks 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 the basics of internet of Things.
- Understand IoT hardware and software components.
- Evaluate methods of interface.
- Evaluate and study suitable development protocols.
- Develop real life IoT based projects.

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.

REFERENCE BOOKS:

1. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti

(Universities Press)

2."The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)

3. “Getting Started With The Internet Of Things: Connecting Sensors and Microcontrollers to the Cloud” By Cuno Pfister (O REILLY).

4. Introduction to Open Source Software & Open Standards (IBM ICE Publication)

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	2	1		2					2				2			
CO 2		2			2									2		
CO 3			3				3				2				1	
CO 4				2		2	2	1		2					2	
CO 5		2					2		2			2		2		2

PROFESSIONAL ELECTIVE - III

1904709 CYBER SECURITY & FORENSICS L T P C

3 0 0 3

COURSE OBJECTIVES :

- Learn the security issues involving information stored in computers
- Learn about the investigations related to the information theft and attacks related to it.
- Learn computer forensics
- Be familiar with forensics tools
- Learn to analyze and validate forensics data

UNIT - I: INTRODUCTION 9

History of 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: INTRODUCTION TO CYBER 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 Methodologies- 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 FORENSIC 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

COURSE OUTCOMES :

Upon completion of the course, the student should be able to:

- Discuss the importance of network information and to maintain its confidentiality.
- Detailed information to deal with the security against attacks in the network layers.
- Explain computer forensics
- Understand the Use forensics tools
- Analyze and validate forensics data.

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Security, Vikas Publishing House, New Delhi, 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. Marjie T.Britz, “Computer Forensics and Cyber Crime”: An Introduction”, 3rd Edition, Prentice Hall, 2013.

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Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2					1		1					3			
CO 2			2						2					3		
CO 3		3		3			2			1					2	
CO 4					3						2					1
CO 5								3				1				

1904710 AGILE SOFTWARE DEVELOPMENT L T P C

3 0 0 3

COURSE OBJECTIVES :

- To learn about fundamentals of agile software's.
- To learn about agile scrum frame work.
- To learn about agile testing techniques.
- To learn about corba and its application.
- To learn about future trends in industries.

UNIT - I: FUNDAMENTALS OF AGILE 9

The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming. Simple Design, User Stories, Agile Testing, Agile Tools.

UNIT - II: AGILE SCRUM FRAMEWORK 9

Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart and Sprint planning. And retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team. Scrum case study, Tools for Agile project management.

UNIT - III: AGILE TESTING 9

The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the
Agile tester.

UNIT - IV: CORBA 9

Agile design practices, Role of design Principles including Single Responsibility

Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control.

UNIT - V: INDUSTRY TRENDS 9

Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Recognize the business value of adopting Agile approaches
- Drive development with unit tests using Test Driven Development
- Apply design principles and refactoring to achieve Agility
- Deploy automated build tools, version control and continuous integration
- Perform testing activities within an Agile project

TEXT BOOKS:

1. Ken Schawber, Mike Beedle, “Agile Software Development with Scrum”, Pearson Publications, 2008.

2. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Prentice Hall Publications, 2002.

REFERENCE BOOKS:

1. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, Addison Wesley Publications, 2008.

2. Alistair Cockburn, “Agile Software Development: The Cooperative Game”, Addison Wesley Publications, 2006.

3. Mike Cohn, “User Stories Applied: For Agile Software”, Addison Wesley Publications, 2004.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2		3	3								2	2			
CO 2	2		3	3		2								2		
CO 3			3	3							3				2	
CO 4		2								2				2		
CO 5		2				3					3				1	

1904711 ETHICAL HACKING L T P C

3 0 0 3

COURSE OBJECTIVES :

To understand the Software Project Planning and Evaluation techniques.

- 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 provide technical foundation of cracking and ethical hacking.
- To re-enforce and apply theory to encourage an analytical and problem based approach to ethical hacking.

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.

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

COURSE OUTCOMES :

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

- Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks.
- Perform penetration & security testing.
- Become a professional ethical hacker.
- Critically evaluate security techniques used to protect system and user data.
- Identify tools and techniques to carry out a penetration 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. Rajat Khare, "Network Seuciryt and Ethical Hacking", Luniver Press, 2006

2. Ramachandran V, BackTrack 5 Wireless Penetration Testing Beginner's Guide (3rd ed.). Packt Publishing, 2011 5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
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CO 1	3	2	3											2		
CO 2					2											2
CO 3				2					1						2	
CO 4						2					2			2		
CO 5												1	2			

1908707 WIRELESS ADHOC & SENSOR NETWORKS L T P C

3 0 0 3

COURSE OBJECTIVES :

To understand the Software Project Planning and Evaluation techniques.

- To learn about the issues and challenges in the design of wireless ad hoc networks.
- To understand the working of MAC and Routing Protocols for ad hoc and sensor networks
- To learn about Transport Layer protocols & their QoS for adhoc and sensor networks.
- To understand various security issues in ad hoc and sensor networks and the corresponding solution
- To know the challenges in wireless sensor networks

UNIT - I: MAC & ROUTING IN AD HOC NETWORKS 9

Introduction – Issues and challenges in ad hoc networks – MAC Layer Protocols for wireless ad hoc networks – Contention-Based MAC protocols – MAC Protocols Using Directional Antennas – Multiple-Channel MAC Protocols – Power-Aware MAC Protocols – Routing in Ad hoc Networks – Design Issues – Proactive, Reactive and Hybrid Routing Protocols.

UNIT - II: TRANSPORT & QOS IN AD HOC NETWORKS 9

TCP"s challenges and Design Issues in Ad Hoc Networks – Transport protocols for ad hoc networks – Issues and Challenges in providing QoS – MAC Layer QoS solutions – Network Layer QoS solutions – QoS Model.

UNIT - III: MAC & ROUTING IN WIRELESS SENSOR NETWORKS 9

Introduction – Applications – Challenges – Sensor network architecture – MAC Protocols for wireless sensor networks – Low duty cycle protocols and wakeup concepts – Contention-Based protocols – Schedule-Based protocols – IEEE 802.15.4 Zigbee – Topology Control – Routing Protocols.

UNIT - IV: TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

Data-Centric and Contention-Based Networking – Transport Layer and QoS in Wireless Sensor Networks – Congestion Control in network processing – Operating systems for wireless sensor networks – Examples.

UNIT - V: SECURITY IN AD HOC AND SENSOR NETWORKS 9

Security Attacks – Key Distribution and Management – Intrusion Detection – Software based Anti-tamper techniques – Water marking techniques – Defense against routing attacks – Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Identify different issues in wireless ad hoc networks
- Understand the challenges and network architecture in wireless sensor networks.

- Analyze protocols developed for ad hoc and sensor networks.
- Identify and understand security issues in ad hoc and sensor networks.
- Know the transport layer and its services for Wireless ad hoc and sensor networks.

TEXT BOOKS:

1. C.Siva Ram Murthy and B.S.Manoj, —Ad Hoc Wireless Networks – Architectures and Protocols, Pearson Education, 2006.
2. Holger Karl, Andreas Willing, —Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc., 2005.

REFERENCE BOOKS:

1. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, —Ad Hoc Mobile Wireless Networks , Auerbach Publications, 2008.
2. Carlos De Morais Cordeiro, Dharma Prakash Agrawal, —Ad Hoc and Sensor Networks: Theory and Applications (2nd Edition), World Scientific Publishing, 2011.
3. Waltenegus Dargie, Christian Poellabauer, —Fundamentals of Wireless Sensor Networks Theory and Practice, John Wiley and Sons, 2010
4. Xiang-Yang Li , “Wireless Ad Hoc and Sensor Networks: Theory and Applications, 7 th edition, Cambridge university Press,2008.

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CO 1	3					3				2						2
CO 2					3	3				3				3		
CO 3		3	2			3			2	2					3	
CO 4	3	2				3				2				2		
CO 5	2				3	3				2					3	2

1915003 TOTAL QUALITY MANAGEMENT L T P C

3 0 0 3

COURSE 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 AND 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 AND 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

COURSE OUTCOMES :

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

- 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 organization.

TEXT BOOKS:

1. Dale H.Besterfiled, 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., 2006.

4. ISO9001-2015 standards.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1											1					
CO 2											1			1		
CO 3					2											
CO 4		1	1													1
CO 5							2				1					

PROFESSIONAL ELECTIVE - IV

1904801 **DEEP LEARNING** **L T P C**

3 0 0 3

COURSE 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 overfitting.
- Implement deep learning algorithms, and learn how to train deep networks.

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-tem memory and other Gated RNNs – Optimization for Long Term Dependencies – Explicit Memory.

UNIT - V: DEEP LEARNING APPLICATION 9

Linear Factor Models – Auto Encoders - Representation Learning – Structured Probabilistic Models for Deep Learning - Monte Carlo Methods.

TOTAL: 45 PERIODS

COURSE 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.
- To understand the theory behind deep learning methods such as Convolutional Neural Networks and auto encoders.
- To have a grasp of the open issues and trends in deep learning research,
- To have a feeling of when to use or avoid deep learning methods

TEXT BOOKS:

1. Ian GoodFellow, Yoshua Bengio , Aaron Courville, “Deep Learning” MIT Press, Cambridge Massachusetts, London England 2017.

REFERENCE BOOKS:

1. www.deeplearningbook.org
2. Adam Gibson and Josh Patterson’s *Deep Learning: A Practitioners Approach*
3. https://github.com/janishar/mit-deep-learning-book-pdf
4. http://deeplearning.net/tutorial/
5. https://www.guru99.com/deep-learning-tutorial.html
6. Francois Chollet, Google AI researcher and creator of the popular Keras deep learning library, published his book, *Deep Learning with Python* in October 2017.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2					2							2			
CO 2		2											2			
CO 3					2						2				2	
CO 4					2											2
CO 5			3			2		2		2				2		

1904802 GPU ARCHITECTURE & PROGRAMMING L T P C

3 0 0 3

COURSE OBJECTIVES :

- To understand the basics of GPU architectures and CUDA programming.
- To analyze about the various programming issues.
- To write programs for massively parallel processors.
- To understand the issues in mapping algorithms for GPUs.
- To introduce different GPU programming models.

UNIT - I: GPU ARCHITECTURE 9

Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

UNIT - II: CUDA PROGRAMMING 9

Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT - III: PROGRAMMING ISSUES 9

Common Problems: CUDA Error Handling, Parallel Programming Issues, Synchronization, Algorithmic Issues, Finding and Avoiding Errors.

UNIT - IV: OPENCL BASICS 9

OpenCL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic OpenCL Examples.

UNIT - V: ALGORITHMS ON GPU 9

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Describe GPU Architecture
- Write programs using CUDA, identify issues and debug them
- Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
- Write simple programs using OpenCL
- Identify efficient parallel programming patterns to solve problems

TEXT BOOKS:

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

REFERENCE BOOKS:

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

5. http://www.openCL.org

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2			2	1								3			
CO 2		1	2	2	3									3	2	
CO 3			3		2										3	
CO 4			2		2							2				2
CO 5		2	2	1	2										2	2

1908012 SOCIAL NETWORK ANALYSIS L T P C

3 0 0 3

COURSE OBJECTIVES :

- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behavior 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 behavior for social communities - User data management - Inference and Distribution - Enabling new human experiences - Reality mining - Context - Awareness - Privacy in online social networks - Trust in online environment - Trust models based on subjective logic - Trust network analysis - Trust transitivity analysis - Combining trust and reputation - Trust derivation based on trust comparisons - Attack spectrum and countermeasures.

UNIT - V: VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS **9**

Graph theory - Centrality - Clustering - Node-Edge Diagrams - Matrix representation - Visualizing online social networks, Visualizing social networks with matrix-based representations - Matrix and Node-Link Diagrams - Hybrid representations - Cover networks - Community welfare - Collaboration networks - Co-Citation networks..

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behavior in social web and related communities.
- Learn Visualize social networks.

- Understand privacy issues in online social networks, the knowledge representation and applications of social networks.

TEXT BOOKS:

1. Peter Mika, - Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

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.
4. John G. Breslin, Alexander Passant and Stefan Decker, - The Social Semantic Web, Springer, 2009.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3										2			
CO 2					2					1					2	
CO 3				2					1							2
CO 4						2					2			2		
CO 5								3				1	2			

1908010 **COMPUTER GRAPHICS AND MULTIMEDIA** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

- To understand the two-dimensional graphics and their transformations.
- To understand the three-dimensional graphics and their transformations.
- To appreciate illumination and color models
- To become familiar with understand clipping techniques
- To become familiar with Blender Graphics.

UNIT - I: OUTPUT PRIMITIVES AND COLOR MODELS **9**

Introduction to computer graphics and applications- Output primitives – points and lines, line drawing algorithms, circle and ellipse generating algorithms, filled are aprimitives. Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection.

UNIT - II: TWO-DIMENSIONAL GRAPHICS **9**

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

UNIT - III: THREE-DIMENSIONAL GRAPHICS **9**

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

UNIT - IV: MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING **9**

Multimedia basics − Multimedia applications − Multimedia system architecture − Evolving

technologies for multimedia − Defining objects for multimedia systems − Multimedia data interface standards − Multimedia databases. Compression and decompression − Data and file format standards − Multimedia I/O technologies − Digital voice and audio − Video image and animation − Full motion video − Storage and retrieval technologies.

UNIT - V: HYPERMEDIA 9

Multimedia authoring and user interface - Hypermedia messaging -Mobile messaging − Hypermedia message component − Creating hypermedia message − Integrated multimedia message standards − Integrated document management − Distributed multimedia systems.

CASE STUDY: BLENDER GRAPHICS Blender Fundamentals – Drawing Basic Shapes – Modelling – Shading & Textures

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Apply Illumination and color models
- Design two dimensional graphics and apply two dimensional transformations
- Design three dimensional graphics and apply three dimensional transformations.
- Apply clipping techniques to graphics
- Understood Different types of Multimedia File Format.

TEXT BOOKS:

1. Donald Hearn and Pauline Baker M, —Computer Graphics", Prentice Hall, New Delhi, 2007 [UNIT - I: – III]
2. Andleigh, P. K and Kiran Thakrar, —Multimedia Systems and Design‖, PHI, 2003. [UNIT IV,V]

REFERENCE BOOKS:

1. Judith Jeffcoate, —Multimedia in practice: Technology and Applications‖, PHI, 1998.
2. Foley, Vandam, Feiner and Hughes, —Computer Graphics: Principles and Practice‖, 2nd Edition, Pearson Education, 2003.
3. Jeffrey McConnell, —Computer Graphics: Theory into Practice‖, Jones and Bartlett Publishers,2006.
4. Hill F S Jr., "Computer Graphics", Maxwell Macmillan , 1990.
5. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, KelvinSung, and AK Peters, —Fundamentals of Computer Graphics‖, CRC Press, 2010.

6. William M. Newman and Robert F.Sproull, —Principles of Interactive Computer Graphicsǁ Mc Graw Hill 1978.
7. https://www.blender.org/support/tutorials/.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2						2					1			2	
CO 2		2		2	2								2			
CO 3			2										2		2	
CO 4			2											2		
CO 5	2			2					2				2			

PROFESSIONAL ELECTIVE - V

1904803 GREEN COMPUTING L T P C

3 0 0 3

COURSE 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

COURSE OUTCOMES :

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

- To gain basic knowledge about fundamentals of green computing.
- To minimize the inclusion of harmful materials.
- To apply changing government policy to encourage recycling.
- To preserve resources which use less energy to produce use and dispose of product.
- To save resources and environment.

TEXT BOOKS:

1. Bhuvan Unhelkar, Green IT Strategies and Applications-Using Environmental Intelligence, CRC Press, June 2011.

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
6. Woody Leonhard, Katherrine Murray, Green Home computing for dummies, August 2009.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3												3			
CO 2	3	3		3		2				3		3			3	
CO 3	3		3	3	3									3		3
CO 4	3						3									
CO 5	3															

1904804 HUMAN COMPUTER INTERACTION L T P C
3 0 0 3

COURSE OBJECTIVES :

- To learn the foundations of Human Computer Interaction.
- To become familiar with the design technologies for individuals and persons with disabilities.
- To be aware of mobile HCI.
- To learn the guidelines for user interface.
- Highlights the effects of different model of interaction.

UNIT - I: FOUNDATIONS OF HCI 9

The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies

UNIT - II: DESIGN & SOFTWARE PROCESS 9

Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

UNIT - III: MODELS AND THEORIES 9

HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.

UNIT - IV: MOBILE HCI 9

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies

UNIT - V: WEB INTERFACE DESIGN 9

Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Design effective dialog for HCI
- Design effective HCI for individuals and persons with disabilities.
- Assess the importance of user feedback.
- Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
- Develop meaningful user interface.

TEXT BOOKS:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction, 3rd Edition, Pearson Education, 2004 (UNIT - I:, II & III)

2. Brian Fling, Mobile Design and Development, First Edition, O‘Reilly Media Inc., 2009 (UNIT – IV)

3. Bill Scott and Theresa Neil, —Designing Web Interfaces, First Edition, O‘Reilly, 2009. (UNIT-V).

REFERENCE BOOKS:

1. Interaction Design: Beyond Human-Computer Interaction, Jenny Preece, Yvonne Rogers, Helen Sharp, 2002.

2. Designing Interactive Systems: A Comprehensive Guide to HCI, UX and Interaction

Design, David Benyon, 2010.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	1					3		1		1		3	3			
CO 2		1		3			2				3			2		
CO 3	3	3		3		3				3		3				2
CO 4		3	1			2						3			2	
CO 5				3		3										

1908803 SERVICE ORIENTED ARCHITECTURE L T P C

3 0 0 3

COURSE OBJECTIVES :

The student should be made to:

- Learn XML fundamentals.
- Be exposed to build applications based on XML.
- Understand the key principles behind SOA.
- Be familiar with the web services technology elements for realizing SOA.
- Learn the various web service standards.

UNIT – I: INTRODUCTION TO XML 9

XML document structure – Well formed and valid documents – Namespaces – DTD – XML Schema – X-Files.

UNIT – II: BUILDING XML- BASED APPLICATIONS 9

Parsing XML – using DOM, SAX – XML Transformation and XSL – XSL Formatting – Modeling Databases in XML

UNIT – III: SERVICE ORIENTED ARCHITECTURE 9

Characteristics of SOA, Comparing SOA with Client-Server and Distributed architectures – Benefits of SOA -- Principles of Service orientation – Service layers.

UNIT – IV: WEB SERVICES **9**

Service descriptions – WSDL – Messaging with SOAP – Service discovery – UDDI – Message Exchange Patterns – Orchestration – Choreography –WS Transactions.

UNIT - V: BUILDING SOA-BASED APPLICATIONS **9**

Service Oriented Analysis and Design – Service Modeling – Design standards and guidelines -- Composition – WS-BPEL – WS-Coordination – WS-Policy – WS-Security – SOA support in J2EE

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- Understand XML technologies and service orientation
- Understand web services and WS standards
- Use web services extensions to develop solutions
- Understand and apply service modeling and service oriented analysis
- Design SOA based application development.

TEXT BOOKS:

1. Ron Schmelzer et al. " XML and Web Services", Pearson Education, 2002
2. Thomas Erl, "Service Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2005.

REFERENCE BOOKS:

1. Frank P.Coyle, "XML, Web Services and the Data Revolution", Pearson Education, 2002.
2. Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", Pearson Education, 2005.
3. Sandeep Chatterjee and James Webber, "Developing Enterprise Web Services: An Architect's Guide", Prentice Hall, 20044.
4. James McGovern,SameerTyagi, Michael E.Stevens, Sunil Mathew, "Java Web Services Architecture", Morgan Kaufmann Publishers, 2003.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1		2				1							2			
CO 2	3		3					2			3					2
CO 3				2					3					1		
CO 4					1					3		2			3	
CO 5							1									

1908009 INFORMATION STORAGE AND MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES :

The student should be made to:

The student should be made:

- 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

COURSE 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.

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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3												3			
CO 2	3	3		3		2				3		3			3	
CO 3	3		3	3	3									3		3
CO 4	3				3		3									
CO 5	3	1														

1908807 **BLOCKCHAIN** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

The student should be made to:

- 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 Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding

Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain, 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 Blockchain: 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, HashcashPoW, Bitcoin 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 Blockchain, Blockchain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Blockchain.

UNIT - V: BLOCKCHAIN APPLICATION DEVELOPMENT9 9

Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- Understand blockchain technology.
- Develop blockchain based solutions and write smart contract using Hyper ledger Fabric and Ethereum frameworks.
- Build and deploy blockchain application for on premise and cloud based architecture.

- Integrate ideas from various domains and implement them using blockchain technology in different perspectives.
- Analyze the incentive structure in a blockchain 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”.

REFERENCE BOOKS:

1. Daniel Drescher, “Blockchain Basics”, Apress; 1stedition, 2017.
2. Anshul Kaushik, “Blockchain and Crypto Currencies”, Khanna Publishing House, Delhi.
3. Imran Bashir, “Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, Packt Publishing.
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contracts for Ethereum and Blockchain”, Packt Publishing.
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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3					3				2						2
CO 2					3	3				3				3		
CO 3		3	2			3			2	2					3	
CO 4	3	2				3				2				2		
CO 5	2				3	3				2					3	2

OPEN ELECTIVE - I

1902512 **ENVIRONMENT AND AGRICULTURE** **L T P C**

3 0 0 3

COURSE 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 : CLIMATECHANGE 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 – Insets 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

COURSE 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.
2. Environment and agriculture: environmental problems affecting agriculture in the Asia and Pacific region; World Food Day Symposium, Bangkok, Thailand. 1989.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2				1	1			1			2	2	1	1
CO 2	2	3	1		2	3			1		1	1	1	1	1	2
CO 3	1	3				1	2					2	2	2	2	1
CO 4	3	3	3	2	3		3	2	1		2	3	3	1	1	
CO 5		3	2	2	3		3	3			2	3	3	2	3	1

1902513 PRODUCTION TECHNOLOGY OF AGRICULTURAL MACHINERY L T P C
3 0 0 3

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:

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

- 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 Amold Publishers Ltd, London.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	2	1	1	3	-	2	-	-	-	2	1	-	2	2
CO 2	2	2	-	-	1	2	-	-	2	-	1	-	2	2	-	3
CO 3	3	2	-	2	2	-	-	2	-	-	-	-	1	-	3	2
CO 4	2	-	2	3	3	-	2	-	2	1	1	2	2	3	-	2
CO 5	-	2	-	2	3	-	2	-	3	1	-	-	-	2	2	3

1903514 AIR POLLUTION AND CONTROL ENGINEERING L T P C

3 0 0 3

COURSE 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 equipment's.
- 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.

TOTAL: 45 PERIODS

COURSE 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 equipment's.
- Ability to control effects of noise pollution and indoor air pollution.

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.
2. Wayne T.Davis, "Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.
3. M.N Rao and HVN Rao, "Air Pollution", Tata Mcgraw Hill Publishing Company limited,2007.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3					3								2		
CO 2																
CO 3		3	1												3	
CO 4																
CO 5			2					2	2							

1903515 PARTICIPATORY WATER RESOURCES MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES :

- To gain an insight on local and global perceptions and approaches on participatory water resource management
- To know the role of farmers in socio economic issues and challenges.
- To bring the knowledge of water conservation.
- To gain knowledge on issues of water management.
- To develop knowledge on global challenges and solutions.

UNIT - I : FUNDAMENTALS: SOCIOLOGY AND PARTICIPATORY APPROACH 9

Sociology – Basic concepts – Perspectives- Social Stratification – Irrigation as a Socio technical Process - Participatory concepts– Needs for participatory -COURSE OBJECTIVES : of participatory approach.

UNIT - II : UNDERSTANDING FARMERS PARTICIPATION 9

Farmers participation - Need and Benefits - Comparisons of cost and benefit -Sustained system performance - Kinds of participation - Context of participation, factors in the environment - WUA - Constraints in organizing FA - Role of Community Organizer – socio economic - Case Studies.

UNIT - III : ISSUES IN WATER MANAGEMENT 9

Multiple use of water – Issues in Inter-sectoral Water Allocation - domestic, irrigation, industrial sectors - Modernization techniques and its challenges – Command Area Development - Water delivery systems – Advantages and disadvantages.

UNIT - IV : PARTICIPATORY WATER CONSERVATION 9

Global Challenges -Social – Economic – Environmental - Solutions –Political - Water Marketing –Water Rights -Consumer education – Success Stories Case Studies.

UNIT - V : PARTICIPATORY WATERSHED DEVELOPMENT 9

Concept and significance of watershed - Basic factors influencing watershed development – Principles of watershed management - Definition of watershed management – Identification of problems - Watershed approach in Government programmes –- People’s participation –

Entry point activities - Evaluation of watershed management measures.

TOTAL: 45 PERIODS

COURSE 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 BOOK:

1. Chambers Robert, “Managing canal irrigation”, Cambridge University Press, 1989.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes (PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3										2	2		2		
CO 2																
CO 3		2				2		2	1	3						2
CO 4																
CO 5			2	3	3								2		3	2

1905001 ENERGY CONSERVATION AND MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES :

- Understand and analyze the energy data of industries.
- Carryout energy accounting and balancing.
- Conduct energy audit and suggest methodologies for energy savings.
- Utilize the available resources in optimal ways
- Understand and analyze 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 : THERMALSYSTEMS 9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: 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

COURSE OUTCOMES :

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

- Can able to analyze 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.energymanager training.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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	1	1		1		3				2				2		
CO 2			2		1				2			1	1		3	
CO 3		1		3		2								1	1	2
CO 4	3					3		2			2				1	
CO 5		2		3	2		1	2				2		2		

1905508 RENEWABLE ENERGY SOURCES L T P C

3 0 0 3

COURSE 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, extra terrestrial and terrestrial solar radiation, solar radiation on titled 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

COURSE 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	1					2	2	1	1			2		2		
CO 2	1				2	1	3	1				1	3		2	
CO 3	1					2	3	1	2			2			1	2
CO 4	2				3	2	3	2			1	2			1	
CO 5	2					1	2	2	1		2	1		2	2	

1905509	SCADA SYSTEM MANAGEMENT	L T P C
		3 0 0 3

COURSE 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 disconnector 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

COURSE OUTCOMES :

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

- 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	1		2		3	2		2	1			3		1		
CO 2	3			2	3	1									2	
CO 3	2			3	3	2	1			3		1			3	3
CO 4		2		3	3	2			1		2				1	
CO 5					3	1						1	2			

1906507 **ENTERTAINTRONICS** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

The student should be made:

- To understand the student 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 understand the 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 phonesmicrowave ovens, washing machines, air conditioners, ATMs and set-top-boxes – Compact Ultrafast Fiber lasers for Consumer electronics – Virtual reality applications, Alexa.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- Understand the basic applications of display devices.
- Understand 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.
- Understand the Applications of Consumer electronics.

TEXT BOOKS:

1. Shoichi Matsumoto, “Electronic display devices”, Wiley.
2. Ajay Sharma, “Audio video and TV Engineering-Consumer Electronics”, Dhanpat Rai and co.
3. R.G. Gupta, Audio and Video systems, Tata Mc Graw Hill Publishing Co.Ltd.

REFERENCE BOOKS:

1. R. Gulati, Monochrome and Color Television, New Age International (P) Ltd, New Delhi.
2. S P Bali, Consumer Electronics, Pearson.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 2	2	2	2	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 3	3	3	2	2	-	-	-	-	-	-	-	-	2	3	-	-
CO 4	2	2	1	1	-	-	-	-	-	-	-	-	1	2	-	-
CO 5	3	3	2	2	-	-	-	-	-	-	-	-	2	3	-	-

1906505 **PHOTONIC NETWORKS** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

The student should be made:

- To enable the students to manifest the components used is 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: PACKET SWITCHING AND ACCESS 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

COURSE 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, and 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. Uyless 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												Program Specific Outcomes(PSO)			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	-	-	2	1	-	1	-	-	-	-	2	-	1	-	-	-
CO 2	2	-	2	-	1	1	-	-	-	-	-	-	-	-	1	-
CO 3	2	2	-	1	-	-	-	-	-	-	-	2	-	1	-	-
CO 4	2	2	-	2	1	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

1906506 TELECOMMUNICATION NETWORK MANAGEMENT L T P C

3 0 0 3

COURSE 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 analyze the concept of examples of network management

UNIT - I: BASIC FOUNDATIONS AND NETWORK MANAGEMENT APPLICATIONS 9

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 ELEMENT 9

CMISE model–service definitions–errors–scooping and filtering features– synchronization–functional units– association services– common management information protocol specification

UNIT - III: INFORMATION MODELING FOR TMN

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–digita1 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

COURSE 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.
- Design and analyze of management information model.
- Design the simple network management protocol.
- Design the 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	1	1	-	-	-	-	-	-	-	2	2	1	-	-
CO 2	3	3	3	1	-	-	2	2	-	-	-	2	1	2	-	-
CO 3	3	3	3	2	-	-	-	-	-	-	-	2	1	1	-	-
CO 4	3	3	2	3	-		2	2		-	-	2	3	2	-	-
CO 5	2	2	1	1	-	2	2	2	2	-	-	2	2	2	-	-

1907503 SENSORS AND TRANSDUCERS L T P C

3 0 0 3

COURSE 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, Inclinometers.

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

COURSE OUTCOMES :

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

- Explain various calibration techniques and signal types for sensors.
- Understand the basic principles of various 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2	2	1											
CO 2																
CO 3						3	2					1				
CO 4						2	2					1				
CO 5	3	2	2	2	2							1				

1907504 INSTRUMENTATION IN BIOMEDICAL ENGINEERING L T P C

3 0 0 3

COURSE 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 TYPES 9

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 ELECTRODECONFIGURATIONS 9

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

COURSE 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. (Units I, II & V)

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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1				1		1										
CO 2				1		1										
CO 3	3	1	2	1	1	1										
CO 4			2	1	1	1										
CO 5			2	1	1	1										

1908001 3D PRINTING AND DESIGN L T P C

3 0 0 3

COURSE OBJECTIVES :

- The course is designed to impart knowledge and skills related to 3D printing technologies.
- Selection of material and equipment and develop a product using this technique.
- To understand Industry 4.0 environment.
- To understand CAD and Additive manufacturing
- To understand Additive Equipment.

UNIT - I: 3D PRINTING AND ADDITIVE MANUFACTURING 9

Introduction, Process, Classification, Advantages, Additive V/s Conventional Manufacturing processes, Applications.

UNIT - II: CAD AND ADDITIVE MANUFACTURING 9

CAD for Additive Manufacturing-CAD Data formats, Data translation, Data loss, STL format. Additive Manufacturing Techniques - Stereo- Lithography, LOM, FDM, SLS, SLM, Binder Jet technology.

UNIT - III: PROCESS **9**

Process, Process parameter, Process Selection for various applications. Additive Manufacturing Application Domains: Aerospace, Electronics, Health Care, Defence, Automotive, Construction, Food Processing, Machine Tools

UNIT - IV: MATERIALS **9**

Polymers, Metals, Non-Metals, Ceramics, Various forms of raw material- Liquid, Solid, Wire, Powder; Powder Preparation and their desired properties, Polymers and their properties. Support Materials.

UNIT - V: ADDITIVE MANUFACTURING EQUIPMENT **9**

Process Equipment- Design and process parameters-Governing Bonding Mechanism-Common faults and troubleshooting - Process Design- Post Processing: Requirement and Techniques- Product Quality.

TOTAL: 45 PERIODS

OUTCOMES:

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

1. Develop CAD models for 3D printing.
2. Import and Export CAD data and generate .stl file.
3. Select a specific material for the given application.
4. Select a 3D printing process for an application.
5. Produce a product using 3D Printing or Additive Manufacturing (AM).

TEXTBOOKS

1. Khanna Editorial, “3D Printing and Design”, Khanna Publishing House, Delhi.
2. CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping- Principles and Applications”, World Scientific, 2017.

REFERENCE BOOKS:

1. Lan Gibson, David W. Rosen and Brent Stucker, “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2. Andreas Gebhardt, “Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing”, Hanser Publisher, 2011.
3. J.D. Majumdar and I. Manna, “Laser-Assisted Fabrication of Materials”, Springer Series in Material Science, 2013.
4. L. Lu, J. Fuh and Y.S. Wong, “Laser-Induced Materials and Processes for Rapid

Prototyping", Kulwer Academic Press, 2001.
5. Zhiqiang Fan And Frank Liou, "Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy", InTech, 2012.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3		3	2			2	3				2	3	
CO 2	3		3		3	2			2	3				2	3	
CO 3	3		3		3	2			2	3				2	3	
CO 4	3		3		3	2			2	3				2	3	
CO 5	3		3		3	2			2	3				2	3	

1908002 SCRIPTING LANGUAGES L T P C

3 0 0 3

COURSE OBJECTIVES :

- The principles of scripting languages.
- Difference between scripting languages and non- scripting languages.
- Types of scripting languages.
- Scripting languages such as PERL, TCL/TK, python and BASH.
- Creation of programs in the Linux environment and usage of scripting languages in IC design flow.

UNIT - I: LINUX BASICS 9

Introduction to Linux , File System of the Linux, General usage of Linux kernel & basic commands, Linux users and group, Permissions for file, directory and users, searching a file & directory, zipping and unzipping concepts.

UNIT - II: LINUX NETWORKING 9

Introduction to Networking in Linux, Network basics & Tools, File Transfer Protocol in Linux, Network file system, Domain Naming Services, Dynamic hosting configuration

Protocol & Network information Services.

UNIT - III: PERL SCRIPTING 9

Introduction to Perl Scripting, working with simple values, Lists and Hashes, Loops and Decisions, Regular Expressions, Files and Data in Perl Scripting, References & Subroutines, Running and Debugging Perl, Modules, Object – Oriented Perl.

UNIT - IV: TCL / TK SCRIPTING 9

Tcl Fundamentals, String and Pattern Matching, Tcl Data Structures, Control Flow Commands, Procedures and Scope, Evel, Working with Unix, Reflection and Debugging, Script Libraries, Tk Fundamentals, Tk by examples, The Pack Geometry Manager, Binding Commands to X Events, Buttons and Menus, Simple Tk Widgets, Entry and List box Widgets Focus, Grabs and Dialogs.

UNIT - V: PYTHON SCRIPTING 9

Introduction to Python, using the Python Interpreter, More Control Flow Tools, Data Structures, Modules, Input and Output, Errors and Exceptions, Classes, Brief Tour of the Standard Library.

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Create and run scripts using PERL in IC design flow.
- Create and run scripts using TCl in IC design flow
- Create and run scripts using Python in IC design flow
- Use Linux environment and write programs for automation of scripts in VLSI tool design flow.
- Usage of scripting languages in IC design flow.

TEXT BOOKS:

1. Python Tutorial by Guido Van Rossum, Fred L. Drake Jr. editor , Release 2.6.4

2. Practical Programming in Tcl and Tk by Brent Welch, Updated for Tcl 7.4 and Tk4.0.

3. Teach Yorself Perl in 21 days by David Till.

4. Red Hat Enterprise Linux 4 : System Administration Guide Copyright, 2005 Red Hat Inc.

REFERENCE BOOKS:

1. Learning Python – 2nd Ed., Mark Lutz and David Ascher, 2003, O'Reilly.

2. Perl in 24 Hours – 3rd Ed., Clinton Pierce, 2005, Sams Publishing.

3. Learning Perl – 4th Ed. Randal Schwartz, Tom Phoenix and Brain d foy. 2005.

4. Jython Essentials – Samuele Pedroni and Noel Pappin.2002. O'Reilly.

5. Programming Perl – Larry Wall, Tom Christiansen and John Orwant, 3rd Edition, O'Reilly, 2000. (ISBN 0596000278)

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	1											1			
CO 2	2	2	1										2			
CO 3	3	2	2	1									2	1		
CO 4	3	2	3	2									2	2		
CO 5	2	3	3	2									3	2		

1909510 PRODUCT DESIGN AND DEVELOPMENT L T P C

3 0 0 3

COURSE 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 PERIODS: 45

COURSE OUTCOMES :

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

- Understand the product design 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 BOOK :

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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	1	1	1				1		1		1				
CO 2	1	1	1	1	1		1	1		1						
CO 3	1				1	1	1	1	1	1		1				
CO 4	1	1	1				1	1		1						
CO 5	2	2					1			1						

1909511 VIBRATION AND NOISE CONTROL L T P C

3 0 0 3

COURSE OBJECTIVE:

- 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.

UNIT - I : BASICS OF VIBRATION 9

Introduction, classification of vibration: free and forced vibration, undamped and

damped vibration, linear and non linear vibration, response of damped and undamped systems under harmonic force, analysis of single degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT - II : BASICS OF NOISE **9**

Introduction, amplitude, frequency, wavelength and sound pressure level, addition, subtraction and averaging decibel levels, noise dose level, legislation, measurement and analysis of noise, measurement environment, equipment, frequency analysis, tracking analysis, sound quality analysis.

UNIT - III AUTOMOTIVE NOISE SOURCES **9**

Noise Characteristics of engines, engine overall noise levels, assessment of combustion noise, assessment of mechanical noise, engine radiated noise, intake and exhaust noise, engine necessary contributed noise, transmission noise, aerodynamic noise, tire noise, brake noise.

UNIT - IV CONTROLTECHNIQUES **9**

Vibration isolation, tuned absorbers, un-tuned viscous dampers, damping treatments, application dynamic forces generated by IC engines, engine isolation, crank shaft damping, modal analysis of the mass elastic model shock absorbers.

UNIT - V SOURCE OF NOISE AND CONTROL **9**

Methods for control of engine noise, combustion noise, mechanical noise, predictive analysis, palliative treatments and enclosures, automotive noise control principles, sound in enclosures, sound energy absorption, sound transmission through barriers.

TOTAL: 45 PERIODS

COURSE 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 BOOK:

1. Singiresu S.Rao, “Mechanical Vibrations”, 6th Edition, Pearson Education, 2016.

REFERENCE BOOKS:

1. Balakumar Balachandran and Edward B. Magrab, “Fundamentals of Vibrations”, 1st Editon, Cengage Learning, 2009

2. Benson H. Tongue, “Principles of Vibrations”, 2nd Edition, Oxford University, 2007.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2	2	2			1					1	2	2		
CO 2	3	2	2	2			1					1	2	2		
CO 3	3	2	2	2			1					1	2	2		
CO 4	3	2	2	2			1					1	2	2		
CO 5	3	2	2	2			1					1	2	2		

1909512 INDUSTRIAL SAFETY ENGINEERING L T P C

3 0 0 3

COURSE 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

COURSE 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 BOOK:

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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	1	2			2	1					1	1	1		
CO 2	2	1	2			2	1					1	1	1		
CO 3	2	1	2			2	1					1	1	1		
CO 4	2	1	2			2	1					1	1	1		
CO 5	2	1	2			2	1					1	1	1		

1910504 PRINCIPLES OF FOOD PRESERVATION L T P C

3 0 0 3

COURSE 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

COURSE 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.
4. Ranganna, S. "Handbook of Canning and Aseptic Packaging". Tata McGraw-Hill, 2000.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	-	-	3	-	1	1	-	-	-	-	-	2	2	-	2
CO 2	2	3	1	2	-	-	-	2	-	-	-	2	2	3	-	3
CO 3	3	2	1	2	-	1	1	-	-	-	-	2	1	3	2	-
CO 4	3	2	1	2	-	1	1	-	-	-	-	2	1	3	-	-
CO 5	3	1	2	-	-	1	1	-	-	-	-	2	-	3	-	1

1920501 NANOTECHNOLOGY L T P C

3 0 0 3

COURSE OBJECTIVES :

- Make the students to understand the fundamentals of nano materials.
- To acquire the knowledge on different classifications in nano materials.
- To educate the different synthesis techniques.

- To provide information on different fabrication and characterization techniques.
- Make the students to understand and apply the techniques to different systems.

UNIT - I : BASICS OF NANOTECHNOLOGY 9

Introduction –Scientific revolutions –Time and length scale in structures –Definition of a nanosystem –Dimensionality and size dependent phenomena –Surface to volume ratio - Fraction of surface atoms-Properties at nanoscale (optical, mechanical, electronic and magnetic).

UNIT - II : DIFFERENT CLASSES OF NANOMATERIALS 9

Classification based on dimensionality-Quantum Dots, Wells and Wires-Carbon-based nano materials (buckyballs, nanotubes, graphene)–Metal based nano materials (nanogold, nanosilver and metal oxides) –Nanocomposites- Nanopolymers –Nanoglasses –Nano ceramics.

UNIT - III : SYNTHESIS OF NANOMATERIALS 9

Classification of synthesis: Top down and bottom up nanofabrication. Chemical Methods: Solvothermal Synthesis-Photochemical Synthesis –Sonochemical Routes-Chemical Vapor Deposition (CVD) –Metal Oxide -Chemical Vapor Deposition (MOCVD). Physical Methods: Ball Milling –Electrodeposition -Spray Pyrolysis -Flame Pyrolysis - DC/RF Magnetron Sputtering -Molecular Beam Epitaxy (MBE).

UNIT - IV : FABRICATION AND CHARACTERIZATION OF NANOSTRUCTURES 9

Nanofabrication: Photolithography and its limitation-Electron-beam lithography (EBL)-Nanoimprint –Softlithography patterning. Characterization: Environmental Scanning Electron Microscopy (ESEM) High Resolution Transmission Electron Microscope (HRTEM) –Scanning Tunneling Microscope (STM)-Surface enhanced Raman spectroscopy (SERS)-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

COURSE 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
4. 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	3	3	3	1	-	-	-	-	-	1	-	-	1	-
CO 2	2	-	3	3	3	-	-	-	-	-	-	1	-	-	1	-
CO 3	2	-	3	3	3	-	-	-	-	-	-	1	-	-	1	-

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

1920502 MICROSCOPY L T P C

3 0 0 3

COURSE 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 micro structural 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

COURSE 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2	2	1	1	1	1	-	-	-	1	1	-	-	1	-
CO 2	2	2	2	1	2	-	1	-	-	-	-	1	-	-	2	-
CO 3	3	3	2	-	3	2	-	-	-	-	-	1	-	-	1	-
CO 4	3	2	3	1	3	2	-	-	-	-	-	1	-	-	1	-
CO 5	3	3	2	2	3	2	-	-	-	-	1	1	-	-	1	-

1921501 ADVANCED ENGINEERING CHEMISTRY L T P C

3 0 0 3

COURSE 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. Bio-degradable 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

COURSE 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	2	2	2		3					2				
CO 2	2	1		2								1				
CO 3	2			2			1					1				
CO 4	1		1				2		1			1				
CO 5	3	2	2	3	1	1	2					2				

1921502 INDUSTRIAL NANOTECHNOLOGY **L T P C**
3 0 0 3

COURSE 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 i9ndustry
- 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**

Nanocatalyts – Smart materials – Heterogenous 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-Nano indentation.

TOTAL: 45 PERIODS

COURSE 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 bio nanotechnology.
- 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	2	2	2		2	1	1		1			1				
CO 2	1	2	3		1	3	1		1			1				
CO 3	2	1	2		1	1	1		1			1				
CO 4	3	2	1		2	1	1		1			1				
CO 5	2	2	1	2	1	1	1		1			1				

OPEN ELECTIVE – II

1903706 GREEN BUILDING DESIGN L T P C

3 0 0 3

COURSE 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 EMBODIED ENERGY OF BUILDINGS 9

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

COURSE 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.

CO – PO and PSO MAPPING:

Course Outcomes	Program Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3							3						2		
CO 2																
CO 3		2														
CO 4																
CO 5			2	1	2				1	2	2					1

1903716 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT L T P C

3 0 0 3

COURSE 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) – COURSE 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

COURSE 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. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.

3. 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	1				1			2						2		
CO 2																
CO 3		2						1								
CO 4																
CO 5					2	3		2	1	2	1					

1905711 **ELECTRICAL CIRCUITS**

L	T	P	C
3	0	0	3

COURSE 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. Theremins' 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, Theremins' 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.

TOTAL : 45 PERIODS

COURSE OUTCOMES :

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

- 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

TEXTBOOKS:

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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	1	3	2	2			1	1				2		2		
CO 2	1	3	2	1				1				1	2			
CO 3	1			2	1	1			2			2		1		3
CO 4	1				2	2	1	2			1	1			1	
CO 5	1	3	2	1		1	2	1			1	1	3			

1905712 RENEWABLE ENERGY SYSTEMS L T P C

3 0 0 3

COURSE 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).

TOTAL : 45 PERIODS

COURSE OUTCOMES :

- 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. Trzynnadlowski, „Introduction to Modern Power Electronics‟, Second edition, wiley India Pvt. Ltd, 2012.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	3	3	1	2	2	1			1					3		
CO 2	3	2	2	1		1			2		3	1	1	2		
CO 3	3	2	1	2	2	2	1		1					1		1
CO 4	3	3	3	2	2	1			2		2	1			2	
CO 5	3	2	1	1	1	2	2		1			2	3			

1905713 ELECTRIC VEHICLES AND POWER MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

To impart knowledge on the following Topics

• 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

COURSE OUTCOMES:

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

- 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.

TEXTBOOKS:

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 Loury, “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, SonjaStudli & 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		1		2	2	2				1	2		1		
CO 2	2		2		1		1		2		2		2	2		
CO 3	3	2	1		2				2					3		1
CO 4	3	2	2		1		2				2				2	
CO 5	3	2	1		1				1		2	2	2			

1906705 **ACOUSTICS** **L T P C**

3 0 0 3

COURSE 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

COURSE 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.
2. Hall D. E.," Musical Acoustics" 3rd edition Pacific Grove, CA: Brooks/Cole.
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.
2. Rossing T. D., ed.," Springer Handbook of Acoustics" 2nd edition Berlin, Heidelberg: SpringerVerlag 2014.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	-	-	-	2	2	-	-	-	-	-	3	-	-	-
CO 2	2	2	-	2	-	2	3	-	-	-	-	-	2	-	-	-
CO 3	2	2	2	-	-	2	3	-	-	-	-	-	2	-	-	-
CO 4	2	3	2	2	-	2	2	-	-	-	-	-	3	3	-	-
CO 5	2	2	1	2	-	2	-	2	-	-	-	-	2	-	-	-

1906706	VISUAL COMMUNICATION	L T P C
		3 0 0 3

COURSE OBJECTIVES:

The student should be made:

- 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, EIements/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 PERIODS: 45

COURSE 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.
- Understand the world of ideation creating.

TEXT BOOKS:

1. Lester, E Visual Communications: Images with Messages. Thomson Learning.
2. Schildgen, T . Pocket Guide to color with digital applications. Thomsom Learning.
3. Palmer, Frederic: Visual Elements of Art and Design, Longman.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	3	2	1	1	1	-	-	-	-	-	-	1	3	-	-	-
CO 2	3	2	3	2	3	-	-	-	-	-	-	1	3	-	2	-
CO 3	3	2	1	2	-	-	-	-	-	-	-	-	3	2	2	-
CO 4	3	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
CO 5	3	-	2	2	3	-	-	-	-	-	-	2	2	2	3	-

1906707	MEMS AND NEMS	L T P C
		3 0 0 3

COURSE OBJECTIVES:

The students should be made:

- To learn the basic concepts and principles of MEMS and NEMS.
- 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 and micro actuators.
- To introduce the concepts of quantum mechanics and nano systems.

UNIT – I: OVERVIEW 9

New trends in Engineering and Science: Micro and Nanoscale systems, Introduction to Design of MEMS and NEMS – Applications, Devices and structures. Materials for MEMS:Silicon, silicon compounds, polymers, metals.

UNIT – II: MEMS FABRICATION TECHNOLOGIES 9

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation. Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wetetching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect- Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials.

UNIT – III: MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Casestudy: 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 (Parallel plate, Torsion bar, Combdrive actuators), Micromechanical Motors and pumps. Case study: Comb drive

actuators.

UNIT – V: NANOSYSTEMS AND QUANTUM MECHANICS 9

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Schrodinger Equation and Wave function Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

TOTAL PERIODS: 45

COURSE OUTCOMES:

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

- Acquire knowledge about micro system design and its various applications.
- Interpret the basics of micro/nano electromechanical systems including their advantages.
- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
- Analyse the key performance aspects of electromechanical transducers including sensors and actuators through case studies.
- Comprehend the theoretical foundations of quantum mechanics and Nano systems.

REFERENCE BOOKS:

1. Marc Madou, —Fundamentals of Microfabrication, CRC press 1997.
2. Stephen D. Senturia, Micro system Design, Kluwer Academic Publishers,2001.
3. Tai Ran Hsu,MEMS and Microsystems Design and Manufacture,Tata Mcraw Hill, 2002.
4. Chang Liu,Foundations of MEMS, Pearson education India limited, 2006.
5. Sergey Edward Lyshevski, —MEMS and NEMS: Systems, Devices, and Structures,CRC Press, 2002.
6. Mohamed Gad – el – hak, The MEMS HAND Book, CRC press 2005.

CO – PO and PSO MAPPING:

Course Outcomes	Program Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	3	3	-	-	-	-	-	3	-	-	3	3	-	-
CO 2	3	-	3	3	-	2	1	-	-	2	-	-	3	3	-	-
CO 3	3	-	3	3	-	-	1	-	-	2	-	-	3	3	-	-
CO 4	3	2	3	3	-	-	-	1	-	2	-	-	3	3	-	-
CO 5	3	2	3	3	-	-	-	1	-	2	-	-	3	3	-	-

1907001 TRANSDUCERS ENGINEERING L T P C

3 0 0 3

COURSE 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

COURSE OUTCOMES :

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

- Apply the mathematical knowledge and science & engineering fundamentals gained to solve problems pertaining to measurement applications.
- Analyze the problems related to sensors & transducers.
- Select the right sensor/transducer for a given application.
- Determine the static and dynamic characteristics of transducers
- 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3															
CO 2		3														
CO 3			1		2	3						1				
CO 4					2	2										
CO 5				1	1	1						1				

1907003 PROCESS MODELING AND SIMULATION L T P C

3 0 0 3

COURSE 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 anddistillation 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

COURSE OUTCOMES :

At the end of the course, the student will 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).

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	3	2	3	2							1				
CO 2	3	3	2	3	2							1				
CO 3	3	3	2	3	3							1				
CO 4	3	3	2	3	3							1				
CO 5	3	3	2	3	3							1				

1907708 STATE VARIABLE ANALYSIS AND DESIGN L T P C

3 0 0 3

COURSE 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

COURSE OUTCOMES :

At the end of the course, the student will 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	2														
CO 2		2		2												
CO 3		2		2												
CO 4		2		2												
CO 5		2		2												

1908003 SOFTWARE QUALITY MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES :

- To have an introduction to software quality
- To understand software quality assurance.
- To understand about quality control and reliability.
- To understand quality management system.
- To understand about Quality Standards.

UNIT - I: INTRODUCTION TO SOFTWARE QUALITY 9

Software Quality – Hierarchical models of Boehm and McCall – Quality measurement – Metrics measurement and analysis – Gilb's approach – GQM Model .

UNIT - II: SOFTWARE QUALITY ASSURANCE 9

Quality tasks – SQA plan – Teams – Characteristics – Implementation – Documentation –Reviews and Audits

UNIT - III: QUALITY CONTROL AND RELIABILITY 9

Tools for Quality – Ishikawa's basic tools – CASE tools – Defect prevention and removal–Reliability models – Rayleigh model – Reliability growth models for quality Assessment.

UN IT IV QUALITY MANAGEMENT SYSTEM 9

Elements of QMS – Rayleigh model framework – Reliability Growth models for QMS – Complexity metrics and models – Customer satisfaction analysis

UNIT - V: QUALITY STANDARDS 9

Need for standards – ISO 9000 Series – ISO 9000-3 for software development – CMM and CMMI – Six Sigma concepts.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

- To understand introduction about quality measurement.
- To understand SQA plan.
- To understand about Quality assessment.
- To understand about Customer satisfaction analysis.
- To understand Six Sigma Concepts.

TEXT BOOKS:

1. Allan C. Gillies, “Software Quality: Theory and Management”, Thomson Learning, 2003. (UI :Ch 1-4 ; UV : Ch 7-8)

2. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education (Singapore) Pte Ltd., 2002. (UI :Ch 3-4; UIII : Ch 5-8 ; UIV : Ch 9-11)

REFERENCE BOOKS:

1. Norman E. Fenton and Shari Lawrence Pfleeger, “Software Metrics” Thomson, 2003
2. Mordechai Ben – Menachem and Garry S.Marliss, “Software Quality”, Thomson Asia Pte Ltd, 2003.
3. Mary Beth Chrissis, Mike Konrad and Sandy Shrum, “CMMI”, Pearson Education (Singapore) Pte Ltd, 2003.
4. ISO 9000-3 “Notes for the application of the ISO 9001 Standard to software development”.

CO – PO and PSO MAPPING:

Course Outcomes	**Programme Outcomes (PO)**												**PSO**			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 2	2					3				2						2
CO 3					3					3				3		
CO 4		3	2						2						3	
CO 5	2	2				3				2				2		

1908004 **C# AND .NET PROGRAMMING** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

- To learn basic programming in C# and the object oriented programming concepts.
- To update and enhance skills in writing Windows applications, ADO.NET and ASP .NET.
- To study the advanced concepts in data connectivity, WPF, WCF and WWF with C# and .NET 4.5.
- To implement mobile applications using .Net compact framework
- To understand the working of base class libraries, their operations and manipulation of data using XML.

UNIT - I: C# LANGUAGE BASICS 9

.Net Architecture – Core C# – Variables – Data Types – Flow control – Objects and Types- Classes and Structs – Inheritance- Generics – Arrays and Tuples – Operators and Casts – Indexers.

UNIT - II: C# ADVANCED FEATURES 9

Delegates – Lambdas – Lambda Expressions – Events – Event Publisher – Event Listener – Strings and Regular Expressions – Generics – Collections – Memory Management and Pointers – Errors and Exceptions – Reflection.

UNIT - III: BASE CLASS LIBRARIES AND DATA MANIPULATION 9

Diagnostics -Tasks, Threads and Synchronization – .Net Security – Localization – Manipulating XML- SAX and DOM – Manipulating files and the Registry- Transactions – ADO.NET- Peer-to-Peer Networking – PNRP – Building P2P Applications – Windows Presentation Foundation (WPF).

UNIT - IV: WINDOW BASED APPLICATIONS, WCF AND WWF 9

Window based applications – Core ASP.NET- ASP.NET Web forms -Windows Communication Foundation (WCF)- Introduction to Web Services – .Net Remoting –

Windows Service – Windows Workflow Foundation (WWF) – Activities – Workflows.

UNIT - V: .NET FRAMEWORK AND COMPACT FRAMEWORK 9

Assemblies – Shared assemblies – Custom Hosting with CLR Objects – Appdomains – Core XAML – Bubbling and Tunneling Events- Reading and Writing XAML – .Net Compact Framework – Compact Edition Data Stores – Errors, Testing and Debugging – Optimizing performance – Packaging and Deployment – Networking and Mobile Devices

TOTAL: 45 PERIODS

COURSE OUTCOMES :

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

- Write various applications using C# Language in the .NET Framework.
- Develop programs using advanced C# concepts on .NET
- Analyse the base class libraries, operations and manipulation of data using XML.
- Develop distributed applications using .NET Framework.
- Create mobile applications using .NET compact Framework.

TEXT BOOKS:

1. Christian Nagel, Bill Evjen, Jay Glynn, Karli Watson, Morgan Skinner . —Professional C# 2012 and .NET 4.5, Wiley, 2012
2. Harsh Bhasin, —Programming in C#, Oxford University Press, 2014.

REFERENCE BOOKS:

1. Ian Gariffiths, Mathew Adams, Jesse Liberty, —Programming C# 4.0‖, OReilly, Fourth Edition, 2010.
2. Andrew Troelsen, Pro C# 5.0 and the .NET 4.5 Framework, Apress publication, 2012.
3. Andy Wigley, Daniel Moth, Peter Foot, —Mobile Development Handbook, Microsoft Press, 2011.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		2										2			
CO 2		2	2	2	3									2		
CO 3		2	2	2								1			3	
CO 4			3								1					3
CO 5											2	1			2	3

1908005 VIRTUAL REALITY L T P C

3 0 0 3

COURSE 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 inbetweening – 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

COURSE 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 modeling
- Develop Virtual environment.
- Apply study about Virtual Hardwares, Softwares and Develop Virtual Reality applications.

TEXT BOOKS:

1. John Vince, “Virtual Reality Systems “, Pearson Education Asia, 2007.

REFERENCE BOOKS:

1. Adams, “Visualizations of Virtual Reality”, Tata McGraw Hill, 2000.
2. Grigore C. Burdea, Philippe Coiffet , “Virtual Reality Technology”, Wiley Interscience, 2nd Edition, 2006.
3. William R. Sherman, Alan B. Craig, “Understanding Virtual Reality: Interface, Application, and Design”, Morgan Kaufmann, 2008.
4. www.vresources.org.

5. www.vrac.iastate.edu.
6. www.w3.org/MarkUp/VRML.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		3	3									1			
CO 2		2	3	3										3		
CO 3				3		3				3					2	
CO 4				2	2	3								2		
CO 5							3			3		2			1	

1909718 **ROBOTICS** **L T P C**

3 0 0 3

COURSE 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 - Coordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

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 Fingered and Three Fingered 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 Serving 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

COURSE 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. Janakiraman P.A., “Robotics and Image Processing”, Tata McGraw Hill, 1995.
6. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company, 2008.

7. Surender Kumar, “Industrial Robots and Computer Integrated Manufacturing”, Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3		1	2									2	2		
CO 2	3		2	2								1	2	2		
CO 3	3	3	2	2								1	2	2		
CO 4	3		2	3								1	2	2		
CO 5	3		3	3								1	1	2		

1909719 TESTING OF MATERIALS L T P C

3 0 0 3

COURSE OBJECTIVE:

- 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

COURSE 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.

3. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7th Edition, Cousens Press, 2007.

REFERENCE BOOKS:

1. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.

2. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA.

3. Brandon D.G., “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA, 1986.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	2	1	1								1	1	1		
CO 2	3	2	1	1								1	1	1		
CO 3	2	2	1	1								1	1	1		
CO 4	3	2	1	1								1	1	1		
CO 5	3	2	1	1								1	1	1		

1909720 DESIGN OF ELECTRICAL VEHICLES L T P C

3 0 0 3

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

COURSE 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.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	-	2	1	1	-	1	-	1	-	-	1	2				
CO 2	2	-	-	1	2	-	-	-	1	-	-	-				
CO 3	1	-	1	-	-	1	-	-	-	-	1	-				
CO 4	-	2	2	1	-	-	2	-	-	-	-	-				
CO 5	2	2	-	1	-	-	-	-	-	-	2	-				

1910703 CLINICAL TRIALS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To highlight the epidemiologic methods, study design, protocol preparation.
- To learn about the crossover and factorial trial designs.
- To gain knowledge in the basic bio-statistical techniques involved in clinical research.
- To describe the principles involved in ethical, legal and regulatory issues in clinical trials.
- To gain knowledge on the reporting of trials.

UNIT – I: ROLE OF CLINICAL TRIALS IN NEW DRUG DEVELOPMENT 9

Drug Discovery, regulatory guidance and governance, pharmaceutical manufacturing, nonclinical research, clinical trials, post-marketing surveillance, ethical conduct during clinical trials.

UNIT – II: FUNDAMENTALS OF TRIAL DESIGN 9

Randomised clinical trials, uncontrolled trials. Protocol development, endpoints, patient selection, source and control of bias, randomization, blinding, sample size and power.

UNIT – III: ALTERNATE TRIAL DESIGNS 9

Crossover design, factorial design, equivalence trials, bioequivalence trials, non-inferiority trials, cluster randomized trials, multi-center trials.

UNIT – IV: BASICS OF STATISTICAL ANALYSIS 9

Types of data and normal distribution, significance tests and confidence intervals, comparison of means, comparison of proportions, analysis of survival data, subgroup analysis, regression analysis, missing data.

UNIT – V: REPORTING OF TRIALS 9

Overview of reporting, trial profile, presenting baseline data, use of tables, figures, critical appraisal of report, meta-analysis.

TOTAL: 45 PERIODS

COURSE 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 trialsto the students.

TEXT BOOKS:

1. Fundamentals of Clinical Trials, Lawrence M. Friedman, Springer Science & Business Media, 2010
2. Textbook of Clinical Trials, David Machin, Simon Day, Sylvan Green, John Wiley & Sons, 2007
3. Clinical Trials: A Practical Approach, Stuart J. Pocock, John Wiley & Sons, 17-Jul-2013.

REFERENCE BOOKS:

1. Clinical trials, A practical guide to design, analysis and reporting. Duolao Wang and AmeetBakhai. Remedica. 2006.
2. Introduction to statistics in pharmaceutical clinical trials. T.A. Durham and J Rick Turner. Pharmaceutical Press.
3. Clinical Trials: Study Design, Endpoints and Biomarkers, Drug Safety, and FDA and ICH Guidelines, Tom Brody, Academic Press, 2016.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	-	-	-	-	-	2	-	-	-	2	-	-	-	-
CO 2	3	2	2	-	-	-	-	2	-	-	-	2	2	3	-	-
CO 3	3	3	2	2	-	-	-	2	-	-	-	2	2	3	-	-
CO 4	3	3	-	-	-	-	2	3	-	-	-	2	2	2	-	-
CO 5	3	-	-	-	-	-	-	3	-	-	-	2	2	2	-	-

1910704 REGULATORY REQUIREMENTS IN PHARAMACEUTICAL INDUSTRIES

L T P C
3 0 0 3

COURSE OBJECTIVES:

- To acquire the knowledge of pharmaceutical industry regulations.
- To learn about the packaging and labeling of drugs.
- To learn about the patent filling process.
- To gain knowledge about the quality guidelines in drug products.
- To gain knowledge on documentation.

UNIT-I: REGULATORY CONCEPTS **9**

Quality assurance – Quality control – Practice of cGMP – Schedule M – USFDA.

UNIT – II: REGULATORY ASPECTS **9**

Pharmaceuticals: Bulk drug manufacture; Personnel, Buildings and Facilities, Process Equipment, Documentation and Records, Materials Management, Production and In-Process Controls, Packaging and Identification Labelling of API‟s and Intermediates, Storage and distribution, – Biotechnology derived products; Principles, Personnel, Premises and equipments, Animal quarters and care, production, labelling, Lot processing records and distribution records, quality assurance and quality control.

UNIT – III: INTELLECTUAL PROPERTY RIGHTS 9

Patent system – Different types of patents – Filing process of application for patent – Infringement of patents – The patent rules 2003 as amended by the patents (amendment) rules 2016.

UNIT – IV: ICH GUIDELINES 9

Quality guidelines – Impurities in new drug substances (Q3A(R2)) – Impurities in new drug products(Q3B(R2)) – Validation of analytical procedures text and methodology (Q2 (R1)).

UNIT – V: QUALITY AUDIT AND SELF INSPECTIONS 9

SOPs – Documentation – Loan license auditing – Common technical documentation (CTD) – Drug master file (DMF).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

- To be familiarise with the pharmaceutical industry manufacturing practices and regulatory aspects of pharmacy products.
- To know the process of patenting activities.
- To acquire knowledge on filling process.
- To know the quality guidelines followed for pharmaceutical products.
- To understand the aspects involved in document preparation for pharmaceutical product registration.

TEXT BOOKS:

1. C.V.SSubbrahmanyam & 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.

REFERENCEBOOKS:

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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	2	-	-	-	-	-	3	3	-	-	-	3	2	-	-	-
CO 2	2	3	-	-	-	2	3	3	-	-	-	2	2	-	-	-
CO 3	2	2	3	2	-	2	3	3	-	-	-	2	2	-	-	-
CO 4	2	-	-	-	-	2	3	3	-	-	-	2	2	-	-	-
CO 5	2	-	-	-	-	2	3	3	-	-	-	2	2	-	-	-

1910705 MICROBIOLOGY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To introduce students to 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 learn 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, ʎ 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) themathematics 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

COURSE OUTCOMES:

- To provide to the students the fundamentals of Microbiology.
- To describe the scope of microbiology
- To solve the problems in microbial infection and their control**.**
- To understand the concept of food preservation.
- To be familiarize with the industrial use of microbes.

TEXT BOOKS:

1. Pelczar, M.J. “Microbiology”, 5th Edition, Tata McGraw-Hill, 1993.
2. Prescot. Harley, Klein. “ Microbiology “: McGraw-Hill Higher Education, 2008.
3. Ananthanarayanan, R. and C.K. Jayaram Paniker, “Textbook of Microbiology”,4th Edition, Orient Longman, 1990.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	-	-	-	-	-	-	-	-	-	2	2	-	-	-
CO 2	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-	-
CO 3	3	2	2	2	-	2	1	2	-	-	-	2	2	2	2	-
CO 4	3	-	-	2	-	1	2	2	-	-	-	2	2	2	-	-
CO 5	3	-	-	-	-	3	2	-	-	-	-	2	2	-	-	-

1920701 ANALYTICAL METHODS AND INSTRUMENTATION L T P C

3 0 0 3

COURSE 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 13C 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

COURSE 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”.CengageLearning , 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” Goel Publishing House, 1972.

2. Haven, Mary C., etal., “Laboratory Instrumentation “. IVth Edition, John Wiley, 1995.

CO – PO and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	-	3	2	2	-	-	3	-	3	2	1	-	-	1	-
CO 2	2	2	3	2	2	-	-	2	2	3	2	1	-	-	1	-
CO 3	2	2	3	3	3	-	2	2	2	3	3	1	-	-	1	-
CO 4	3	2	3	3	3	-	-	3	2	3	3	1	-		1	-
CO 5	3	-	3	2	2	-	-	3	-	3	2	1	-	-	1	

1920702 **MEDICAL PHYSICS** **L T P C**

3 0 0 3

COURSE OBJECTIVES :

- To study the complete non-ionizing radiations including light and its effect in human body.
- To understand the principles of ultrasound radiation and its applications in medicine.
- To learn about radioactive nuclides.
- To know the interactions of radiation with matters and how isotopes are produced.
- To study the harmful effects of radiation and radiation protection regulations.

UNIT - I : NON-IONIZING RADIATION AND ITSMEDICALAPPLICATION 9

Introduction to EM waves - Tissue as a leaky dielectric - Relaxation processes: Debye

model, Cole–Cole model- Overview of non-ionizing radiation effects-Low Frequency Effects- Higher frequency effects. Physics of light-Measurement of light and its unit-limits of vision and color vision an overview - Applications of ultraviolet in medicine, Thermography.

UNIT - II : ULTRASOUND IN MEDICINE 9

Ultrasound fundamentals – Generation of ultrasound (Ultrasound Transducer) - Interaction of Ultrasound with matter: Cavitation, Reflection, Transmission- Scanning systems – Artefacts- Ultrasound- Doppler-Double Doppler shift-Clinical Applications-Ultrasonography.

UNIT - III : PRINCIPLES OF RADIOACTIVE NUCLIDESANDDECAY 9

Introduction to Radioisotopes - Radioactive decay : Spontaneous Fission, Isomeric Transition, Alpha Decay, Beta Decay, Positron Decay, Electron Capture- Radioactive decay equations – Half life- Mean Life- Effective half-life - Natural and Artificial radioactivity, - Production of radionuclide – Cyclotron produced Radionuclide - Reactor produced Radionuclide: fission and electron Capture reaction, Target and Its Processing Equation for Production of Radionuclide - Radionuclide Generator-Technetium generator.

UNIT - IV : INTERACTION OF RADIATIONWITH 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 EFFECTSAND 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

COURSE 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	3	1	1	-	-	2	1	-	-	-	-	3	-	-	1	-
CO 2	3	1	2	2	1	-	1	-	-	-	-	3	-	-	1	-
CO 3	3	1	2	-	-	2	2	-	-	-	-	2	-	-	1	-
CO 4	2	1	1	-	1	1	1	-	-	-	-	1	-		1	-
CO 5	3	2	3	-	2	1	3	-	-	-	-	3	-	-	1	

1920703 ELECTRONIC MATERIALS L T P C

3 0 0 3

COURSE 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 ANDNANO 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

COURSE 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
- With the basis, students will be able to have clear concepts on electronic behaviors of 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
CO 1	1	1	2	1	1	1	1	-	-	-	-	-	-	-	1	-
CO 2	2	2	2	1	2	-	-	-	-	-	-	-	-	-	1	-
CO 3	3	3	3	-	3	2	-	-	-	-	-	-	-	-	1	-
CO 4	2	3	3	1	3	3	-	-	-	-	-	-	-	-	1	-
CO 5	2	3	2	1	3	3	-	-	-	-	-	-	-	-	1	-

1921701 WASTE WATER TREATMENT L T P C

3 0 0 3

COURSE OBJECTIVES :

- To make the student conversant with the water treatment methods including adsorption and oxidation process.
- To provide basic under standings 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

COURSE 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 and PSO MAPPING:

Course Outcomes	Programme Outcomes (PO)												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
CO 1	2	1							2			1	2	1		
CO 2	1	2							1			1	1	2		
CO 3	3	1			3	1						1	3	1		
CO 4	2				1							1	2			
CO 5	3	2			1							1	3	2		