SRM VALLIAMMAI ENGINEERING COLLEGE

(AN AUTONOMOUS INSTITUTION)

SRM Nagar, Kattankulathur-603203.

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

CURRICULA & SYLLABI

B.E-CIVIL ENGINEERING

REGULATION 2019

SRM VALLIAMMAI ENGINEERING COLLEGE

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B.E. CIVIL ENGINEERING

REGULATIONS – 2019

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

1. To produce graduates who can understand their ethical, environmental as well as professional responsibilities so that they appreciate the impact of the engineering solutions which have sustainability over society and the nation.
2. To develop the graduates who will exhibit strong technical ability to create & synthesize data using relevant tools and concepts, for providing sustainable solutions to civil engineering problems and projects.
3. To equip the graduates with suitable skills making them industry ready when they leave the portals of the Institute and to become a competent distinguished Professional Civil Engineer.
4. To produce students who can exhibit attitude, professionalism, ability to communicate with team members and adapt to the latest technology by engaging themselves in life-long learning

2. PROGRAMME OUTCOMES (POs):

After going through the four years of study, our Civil 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 specialization 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	Design solutions for complex engineering problems

	solutions	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):

By the completion of Civil Engineering program the student will have following Program specific outcomes

1. Establish a Civil Engineering career in industry, government or academic field and

achieve professional expertise as appropriate.

2. Execute innovation and excellence in Civil engineering problem solving and design in global and societal contexts.
3. Commit to lifelong learning and professional development in the Civil Engineering field to stay updated in technology, research topics and contemporary issues.
4. Understand the fundamentals of Civil Engineering in commercial contexts and in expediting construction projects.

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	✓				✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	

MAPPING – B.E- CIVIL ENGINEERING

		Courses	PROGRAMME OUTCOMES												PROGRAM SPECIFIC OUTCOMES			
			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
Year I	Semester I	Communicative English	✓	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓
		Engineering Mathematics-I	✓	✓	✓	✓								✓				
		Engineering Physics	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓		
		Engineering Chemistry	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	✓	✓
		Problem Solving and Python Programming	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓
		Basic Electrical and Electronics Engineering	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓		✓
		Physics and Chemistry Laboratory	✓	✓	✓	✓		✓		✓	✓				✓	✓		
			✓	✓	✓	✓		✓	✓					✓	✓	✓	✓	✓
		Problem Solving and Python Programming Laboratory	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
Year I	Semester II	Technical English	✓	✓	✓	✓					✓	✓	✓	✓	✓	✓	✓	✓
		Engineering Mathematics-II	✓	✓	✓	✓								✓				
		Physics for Civil Engineering	✓	✓	✓			✓	✓					✓	✓	✓		✓
		Environmental Science and Engineering	✓	✓	✓			✓	✓		✓			✓	✓	✓	✓	✓
		Programming in C	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
		Engineering Graphics	✓		✓						✓	✓		✓	✓	✓	✓	✓
		C Programming Laboratory	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓

		Engineering Practices Laboratory	✓	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓
		Applied Physics and Environmental Chemistry Laboratory	✓	✓	✓	✓		✓		✓	✓				✓	✓		
			✓	✓	✓	✓		✓	✓					✓	✓	✓	✓	✓
Year II	**Semester III**	Transforms and Partial Differential Equations	✓	✓			✓							✓				
		Applied Mechanics	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓
		Fluid Mechanics	✓	✓	✓	✓		✓	✓		✓			✓	✓	✓	✓	✓
		Surveying	✓	✓	✓	✓				✓					✓	✓		
		Construction Materials	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓	✓
		Applied Geology	✓	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓
		Construction Materials Laboratory	✓	✓		✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
		Surveying Laboratory	✓	✓	✓	✓	✓				✓			✓	✓	✓	✓	✓
		Communication Skills Laboratory- Project Based	✓	✓	✓	✓	✓		✓			✓		✓	✓	✓	✓	✓
Year II	**Semester IV**	Numerical Methods	✓	✓	✓									✓				
		Strength of Materials	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
		Applied Hydraulic Engineering	✓	✓	✓	✓	✓	✓	✓		✓	✓		✓	✓	✓	✓	✓
		Soil Mechanics	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓
		Construction Techniques and Practices	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Strength of Materials Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

		Hydraulic Engineering Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year III	**Semester V**	Design of Reinforced Cement Concrete Elements	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓		✓
		Structural Analysis-I	✓	✓	✓	✓	✓			✓	✓			✓	✓	✓	✓	✓
		Highway Engineering	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓	✓
		Foundation Engineering	✓	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
		Soil Mechanics Laboratory	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
		Highway Engineering Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		*Survey Camp	✓	✓	✓	✓					✓			✓	✓	✓	✓	✓
		Professional Communication	✓	✓	✓	✓	✓		✓			✓		✓	✓	✓	✓	✓
Year III	**Semester VI**	Design of Steel structural elements	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
		Structural Analysis II	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
		Railways, Airports, Docks and Harbour Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
		Water Supply and Waste water Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Water and Waste water Analysis Laboratory	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Mini Project	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year IV	**Semester VII**	Estimation, Costing and valuation Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Irrigation Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

		Structural Dynamics	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Project Work - Phase I	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Computer Aided Design and Drafting Laboratory	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Internship	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year IV	**Semester VIII**	Project Work - Phase II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PROFESSIONAL ELECTIVE-I																			
Year II	**Semester IV**	Digital Cadastre	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓
		Advanced Surveying	✓	✓	✓	✓	✓	✓			✓			✓	✓	✓	✓	✓	✓
		Remote sensing and Geographic Information System	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
		Geomatics Applications for Civil Engineers	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
		Total Station and GPS Surveying	✓	✓	✓	✓	✓	✓	✓		✓			✓	✓	✓	✓	✓	✓
PROFESSIONAL ELECTIVE-II																			
Year III	**Semester V**	Ground Improvement Techniques	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Introduction to Soil Dynamics and Machine Foundations	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Rock Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Urban Planning and Development	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

		Air Pollution and Control Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Municipal Solid Waste Management	✓	✓	✓	✓	✓		✓	✓	✓	✓			✓	✓	✓	✓
PROFESSIONAL ELECTIVE-III																		
Year III	**Semester VI**	Pavement Engineering	✓	✓	✓	✓	✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
		Traffic Engineering and Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Transport and Environment	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
		Environmental and Social Impact Assessment	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
		Construction Planning and Scheduling	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Intellectual Property Rights	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
		Total Quality Management	✓	✓	✓		✓		✓				✓	✓		✓	✓	
		Disaster management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Professional Ethics						✓	✓	✓					✓	✓		
PROFESSIONAL ELECTIVE-IV																		
Year IV	**Semester VII**	Coastal Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Participatory Water Resources Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

		Green Building Design	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Groundwater Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Water Resources Systems Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓
		Geo Environmental Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Hydrology and Water Resources Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PROFESSIONAL ELECTIVE-V & VI																		
Year IV	**Semester VIII**	Computer Aided Design of Structures	✓	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓		✓
		Maintenance, Repair and Rehabilitation of Structures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Prefabricated Structures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Bridge Engineering	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Integrated Water Resources Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Design of Prestressed Concrete Structures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
		Industrial Structures	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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B.E. CIVIL ENGINEERING
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM
CURRICULA & SYLLABI (I – VIII SEMESTERS)

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.	1901005	Problem Solving and Python Programming	ES	3	3	0	0	3
6.	1901106	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
PRACTICALS								
7.	1901108	Physics and Chemistry Laboratory	BS	4	0	0	4	2
8.	1901009	Problem Solving and Python Programming Laboratory	ES	4	0	0	4	2
			TOTAL	**27**	**18**	**1**	**8**	**23**

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.	1920201	Physics for Civil Engineering	BS	3	3	0	0	3
4.	1921203	Environmental Science and Engineering	BS	3	3	0	0	3
5.	1901006	Programming in C	ES	3	3	0	0	3
6.	1901007	Engineering Graphics	ES	6	2	0	4	4
PRACTICALS								
7.	1901010	C 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.	xxxxxxx	NSS/NCC/YRC/NSO	PCD	1*	0	0	0	1
			TOTAL	**34**	**17**	**1**	**16**	**27**

** conducted after college hours*

SEMESTER III

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1918301	Transforms and Partial Differential Equations	BS	4	3	1	0	4
2.	1903301	Applied Mechanics	PC	3	3	0	0	3
3.	1903302	Fluid Mechanics	PC	3	3	0	0	3
4.	1903303	Surveying	PC	3	3	0	0	3
5.	1903304	Construction Materials	PC	3	3	0	0	3
6.	1903305	Applied Geology	ES	3	3	0	0	3
PRACTICALS								
7.	1903306	Construction Materials Laboratory	PC	4	0	0	4	2
8.	1903307	Surveying Laboratory	PC	4	0	0	4	2
9.	1919001	Communication Skills Laboratory- Project Based	EEC	2	0	0	2	0
			TOTAL	**29**	**18**	**1**	**10**	**23**

SEMESTER IV

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1918401	Numerical Methods	BS	4	3	1	0	4
2.	1903401	Strength of Materials	PC	3	3	0	0	3
3.	1903402	Applied Hydraulic Engineering	PC	3	3	0	0	3
4.	1903403	Soil Mechanics	PC	3	3	0	0	3
5.	1903404	Construction Techniques and Practices	PC	3	3	0	0	3
6.	1903xxx	Professional Elective-I	PE	3	3	0	0	3
PRACTICALS								
7.	1903410	Strength of Materials Laboratory	PC	4	0	0	4	2
8.	1903411	Hydraulic Engineering Laboratory	PC	4	0	0	4	2
			TOTAL	**27**	**18**	**1**	**8**	**23**

SEMESTER V

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1903501	Design of Reinforced Cement Concrete Elements	PC	4	3	1	0	4
2.	1903502	Structural Analysis-I	PC	3	3	0	0	3
3.	1903503	Highway Engineering	PC	3	3	0	0	3
4.	1903504	Foundation Engineering	PC	3	3	0	0	3
5.	1903xxx	Professional Elective-II	PE	3	3	0	0	3
6.	19xxxxx	Open Elective-I	OE	3	3	0	0	3
PRACTICALS								
7.	1903511	Soil Mechanics Laboratory	PC	4	0	0	4	2
8.	1903512	Highway Engineering Laboratory	PC	4	0	0	4	2
9.	1903513	#Survey Camp	EEC	0	0	0	0	2
10.	1919002	Professional Communication	EEC	2	0	0	2	1
			TOTAL	**29**	**18**	**1**	**10**	**26**

#Survey Camp to be conducted for a period of 2 weeks during 4th Semester Summer Vacation

SEMESTER VI

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1903601	Design of Steel structural elements	PC	4	3	1	0	4
2.	1903602	Structural Analysis II	PC	3	3	0	0	3
3.	1903603	Railways, Airports, Docks and Harbour Engineering	PC	3	3	0	0	3
4.	1903604	Water Supply and Waste water Engineering	PC	3	3	0	0	3
5.	19xxxxx	Professional Elective-III	PE	3	3	0	0	3
PRACTICALS								
6.	1903610	Water and Waste water Analysis Laboratory	PC	4	0	0	4	2
7.	1903611	Mini Project	EEC	4	0	0	4	2
			TOTAL	**24**	**15**	**1**	**8**	**20**

SEMESTER VII

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1903701	Estimation, Costing and valuation Engineering	PC	3	3	0	0	3
2.	1903702	Irrigation Engineering	PC	3	3	0	0	3
3.	1903703	Structural Dynamics	PC	3	3	0	0	3
4.	1903xxx	Professional Elective-IV	PE	3	3	0	0	3
5.	19xxxxx	Open Elective-IV	OE	3	3	0	0	3
PRACTICALS								
6.	1903711	Project Work – Phase I	EEC	4	0	0	4	2
7.	1903712	Computer Aided Design and Drafting Laboratory	PC	4	0	0	4	2
8.	1903713	Internship	EEC	0	0	0	0	1
			TOTAL	**23**	**15**	**0**	**8**	**20**

SEMESTER VIII

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	1903xxx	Professional Elective-V	PE	3	3	0	0	3
2.	1903xxx	Professional Elective-VI	PE	3	3	0	0	3
PRACTICALS								
3.	1903809	Project Work –Phase II	EEC	12	0	0	12	6
			TOTAL	**18**	**6**	**0**	**12**	**12**

TOTAL NO OF CREDITS: 174

PROFESSIONAL ELECTIVE- I (SEMESTER IV)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1903405	Digital Cadastre	PE	3	3	0	0	3
2.	1903406	Advanced Surveying	PE	3	3	0	0	3
3.	1903407	Remote Sensing and Geographic Information System	PE	3	3	0	0	3

4.	1903408	Geomatics Applications for Civil Engineers	PE	3	3	0	0	3
5.	1903409	Total Station and GPS Surveying	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE- II (SEMESTER V)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1903505	Ground Improvement Techniques	PE	3	3	0	0	3
2.	1903506	Introduction to Soil Dynamics and Machine Foundations	PE	3	3	0	0	3
3.	1903507	Rock Engineering	PE	3	3	0	0	3
4.	1903508	Urban Planning and Development	PE	3	3	0	0	3
5.	1903509	Air Pollution and Control Engineering	PE	3	3	0	0	3
6.	1903510	Municipal Solid Waste Management	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE- III (SEMESTER VI)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1903605	Pavement Engineering	PE	3	3	0	0	3
2.	1903606	Traffic Engineering and Management	PE	3	3	0	0	3
3.	1903607	Transport and Environment	PE	3	3	0	0	3
4.	1903608	Environmental and Social Impact Assessment	PE	3	3	0	0	3
5.	1903609	Construction Planning and Scheduling	PE	3	3	0	0	3
6.	1904606	Intellectual Property Rights	PE	3	3	0	0	3
7.	1915003	Total Quality Management	PE	3	3	0	0	3
8.	1903612	Disaster management	PE	3	3	0	0	3
9.	1915001	Professional Ethics	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE- IV (SEMESTER VII)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1903704	Coastal Engineering	PE	3	3	0	0	3
2.	1903705	Participatory Water Resources Management	PE	3	3	0	0	3
3.	1903706	Green Building Design	PE	3	3	0	0	3
4.	1903707	Groundwater Engineering	PE	3	3	0	0	3
5.	1903708	Water Resources Systems Engineering	PE	3	3	0	0	3
6.	1903709	Geo-Environmental Engineering	PE	3	3	0	0	3
7.	1903710	Hydrology and Water Resources Engineering	PE	3	3	0	0	3

PROFESSIONAL ELECTIVE- V & VI (SEMESTER VIII)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1903801	Computer Aided Design of Structures	PE	3	3	0	0	3
2.	1903802	Maintenance, Repair and Rehabilitation of Structures	PE	3	3	0	0	3
3.	1903803	Prefabricated Structures	PE	3	3	0	0	3
4.	1903804	Bridge Engineering	PE	3	3	0	0	3
5.	1903805	Integrated Water Resources Management	PE	3	3	0	0	3
6.	1903806	Design of Prestressed Concrete Structures	PE	3	3	0	0	3
7.	1903807	Industrial Structures	PE	3	3	0	0	3

OPEN ELECTIVE- I (SEMESTER V)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	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.	1921501	Advanced Engineering Chemistry	CHEM	3	3	0	0	3
4.	1921502	Industrial Nanotechnology	CHEM	3	3	0	0	3
5.	1904007	Data Structures	CSE	3	3	0	0	3
6.	1904504	Geographic Information System	CSE	3	3	0	0	3
7.	1904508	Database Management System	CSE	3	3	0	0	3
8.	1904509	Cloud Computing	CSE	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.	1906507	Entertaintronics	ECE	3	3	0	0	3
12.	1905001	Energy Conservation And Management	EEE	3	3	0	0	3
13.	1905508	Renewable Energy Sources	EEE	3	3	0	0	3
14.	1905509	SCADA System Management	EEE	3	3	0	0	3
15.	1907503	Sensors and Transducers	EIE	3	3	0	0	3
16.	1907504	Instrumentation in Biomedical Engineering	EIE	3	3	0	0	3
17.	1908001	3D Printing and Design	IT	3	3	0	0	3
18.	1908002	Scripting Languages	IT	3	3	0	0	3
19.	1910504	Principles of Food Preservation	M.ELE	3	3	0	0	3
20.	1909510	Product Design and Development	MECH	3	3	0	0	3
21.	1909511	Vibration and Noise Control	MECH	3	3	0	0	3
22.	1909512	Industrial Safety Engineering	MECH	3	3	0	0	3

23.	1920501	Nanotechnology	PHY	3	3	0	0	3
24.	1920502	Microscopy	PHY	3	3	0	0	3

OPEN ELECTIVE- II (SEMESTER VII)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1921701	Waste water Treatment	CHEM	3	3	0	0	3
2.	1904703	Tamil Computing	CSE	3	3	0	0	3
3.	1904010	Object Oriented Programming	CSE	3	3	0	0	3
4.	1904712	Software Engineering	CSE	3	3	0	0	3
5.	1906705	Acoustics	ECE	3	3	0	0	3
6.	1906706	Visual Communication	ECE	3	3	0	0	3
7.	1906707	MEMS and NEMS	ECE	3	3	0	0	3
8.	1905711	Electrical Circuits	EEE	3	3	0	0	3
9.	1905712	Renewable Energy Systems	EEE	3	3	0	0	3
10.	1905713	Electric Vehicles & Power Management	EEE	3	3	0	0	3
11.	1907001	Transducers Engineering	EIE	3	3	0	0	3
12.	1907003	Process Modeling and Simulation	EIE	3	3	0	0	3
13.	1907708	State Variable Analysis and Design	EIE	3	3	0	0	3
14.	1908003	Software Quality Management	IT	3	3	0	0	3
15.	1908004	C# and. Net Programming	IT	3	3	0	0	3
16.	1908005	Virtual Reality	IT	3	3	0	0	3
17.	1910703	Clinical Trials	M.ELECT	3	3	0	0	3
18.	1910704	Regulatory Requirements in Pharmaceutical Industries	M.ELECT	3	3	0	0	3
19.	1910705	Microbiology	M.ELECT	3	3	0	0	3
20.	1909718	Robotics	MECH	3	3	0	0	3
21.	1909719	Testing of Materials	MECH	3	3	0	0	3
22.	1909720	Design of Electric Vehicles	MECH	3	3	0	0	3
23.	1920701	Analytical Methods and Instrumentation	PHY	3	3	0	0	3
24.	1920702	Medical Physics	PHY	3	3	0	0	3
25.	1920703	Electronic Materials	PHY	3	3	0	0	3

HUMANITIES AND SOCIAL SCIENCES (HS)

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

BASIC SCIENCES (BS)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1918102	Engineering Mathematics - I	BS	4	3	1	0	4
2.	1920103	Engineering Physics	BS	3	3	0	0	3
3.	1921104	Engineering Chemistry	BS	3	3	0	0	3
4.	1901108	Physics and Chemistry Laboratory	BS	4	0	0	4	2
5.	1918202	Engineering Mathematics - II	BS	4	3	1	0	4
6.	1920201	Physics for Civil Engineering	BS	3	3	0	0	3
7.	1921203	Environmental Science and Engineering	BS	3	3	0	0	3
8.	1901209	Applied Physics and Environmental Chemistry Laboratory	BS	4	0	0	4	2
9.	1918301	Transforms and Partial Differential Equations	BS	4	3	1	0	4
10.	1918401	Numerical Methods	BS	4	3	1	0	4

ENGINEERING SCIENCES (ES)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1901005	Problem Solving and Python Programming	ES	3	3	0	0	3
2.	1901106	Basic Electrical and Electronics Engineering	ES	3	3	0	0	3
3.	1901009	Problem solving and Python Programming Laboratory	ES	4	0	0	4	2
4.	1901006	Programming in C	ES	3	3	0	0	3
5.	1901007	Engineering Graphics	ES	6	2	0	4	4
6.	1901010	C Programming Laboratory	ES	4	0	0	4	2
7.	1901208	Engineering Practices Laboratory	BS	4	0	0	4	2
8.	1903305	Applied Geology	ES	3	3	0	0	3

PROFESSIONAL CORE (PC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1903301	Applied Mechanics	PC	3	3	0	0	3
2.	1903302	Fluid Mechanics	PC	3	3	0	0	3
3.	1903303	Surveying	PC	3	3	0	0	3
4.	1903304	Construction Materials	PC	3	3	0	0	3
5.	1903306	Construction Materials Laboratory	PC	4	0	0	4	2
6.	1903307	Surveying Laboratory	PC	4	0	0	4	2
7.	1903401	Strength of Materials	PC	3	3	0	0	3
8.	1903402	Applied Hydraulic Engineering	PC	3	3	0	0	3
9.	1903403	Soil Mechanics	PC	3	3	0	0	3
10.	1903404	Construction Techniques and Practices	PC	3	3	0	0	3
11.	1903410	Strength of Materials Laboratory	PC	4	0	0	4	2
12.	1903411	Hydraulic Engineering Laboratory	PC	4	0	0	4	2
13.	1903501	Design of Reinforced Cement Concrete Elements	PC	4	3	1	0	4
14.	1903502	Structural Analysis-I	PC	3	3	0	0	3
15.	1903503	Highway Engineering	PC	3	3	0	0	3
16.	1903504	Foundation Engineering	PC	3	3	0	0	3
17.	1903511	Soil Mechanics Laboratory	PC	4	0	0	4	2
18.	1903512	Highway Engineering Laboratory	PC	4	0	0	4	2
19.	1903601	Design of Steel Structural Elements	PC	4	3	1	0	4
20.	1903602	Structural Analysis II	PC	3	3	0	0	3
21.	1903603	Railways, Airports, Docks and Harbour Engineering	PC	3	3	0	0	3
22.	1903604	Water Supply and Waste water Engineering	PC	3	3	0	0	3
23.	1903610	Water and Waste water Analysis Laboratory	PC	4	0	0	4	2
24.	1903701	Estimation, Costing and Valuation Engineering	PC	3	3	0	0	3
25.	1903702	Irrigation Engineering	PC	3	3	0	0	3
26.	1903703	Structural Dynamics	PC	3	3	0	0	3
27.	1903712	Computer Aided Design and Drafting Laboratory	PC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

SL NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	1919001	Communication Skills Laboratory- Project Based	EEC	2	0	0	2	0
2.	1903513	Survey Camp	EEC	0	0	0	0	2
3.	1919002	Professional Communication	EEC	2	0	0	2	1
4.	1903611	Mini Project	EEC	4	0	0	4	2
5.	1903711	Project Work - Phase I	EEC	4	0	0	4	2
6.	1903713	Internship	EEC	0	0	0	0	1
7.	1903809	Project Work - Phase II	EEC	12	0	0	12	6

PERSONALITY AND CHARACTER DEVELOPMENT (PCD)

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

SUMMARY

DEPARTMENT OF CIVIL ENGINEERING

S.No	Subject Area	Credits as per Semester								Credits Total	%
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	3	3							**6**	**3.4**
2	**BS**	12	12	4	4					**32**	**18.40**
3	**ES**	8	11	3						**22**	**12.64**
4	**PC**			16	16	17	15	11		**75**	**43.1**
5	**PE**				3	3	3	3	6	**18**	**10.3**
6	**OE**					3		3		**6**	**3.4**
7	**EEC**					3	2	3	6	**14**	**8.0**
8	**PCD**		1							**1**	**0.6**
	Total	**23**	**27**	**23**	**23**	**26**	**20**	**20**	**12**	**174**	**100**
	NON Credit / Mandatory	**-**	**-**	✓	**-**	**-**	**-**	**-**	**-**	**-**	

TOTAL CREDITS: 174

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 clarifications.
- Comprehend content - asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills

UNIT-I: SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS 9

Reading– short comprehension passages, practice in skimming-scanning and predicting- **Writing**– Blog/film review/quora/Twitter/Facebook– developing hints. **Listening**– short texts- short formal and informal conversations. **Speaking-** introducing oneself – exchanging personal information- **Language development**– Wh-Questions- asking and answering-yes or no questions- parts of speech. **Vocabulary development-**– prefixes- suffixes – word formation: making sentences of your own.

UNIT-II: GENERAL READING AND FREE WRITING 9

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

UNIT-III: GRAMMAR AND LANGUAGE DEVELOPMENT 9

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

UNIT-IV: READING AND LANGUAGE DEVELOPMENT **9**

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

UNIT-V: EXTENDED WRITING **9**

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

TOTAL: 45 PERIODS

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 Undergraduate Engineers and Technologists**.** Orient Black Swan Limited, Hyderabad: 2015

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

REFERENCE BOOKS:

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

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

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

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Kreyszig Erwin, **"Advanced Engineering Mathematics"**, John Wiley and Sons, 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												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	2	1	-	-	-	-	-	-	-	1	-	-	-	-
2	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-
3	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-
4	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-
5	3	2	2	1	-	-	-		-	-	-	1	-	-	-	-

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

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

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

OUTCOMES:

Upon completion of this course,

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

TEXT BOOKS:

1. Bhattacharya, D.K. & Poonam, T. “Engineering Physics”. Oxford University Press, 2015.
2. Gaur, R.K. & Gupta, S.L. “Engineering Physics”. Dhanpat Rai Publishers, 2012.
3. Pandey, B.K. &Chaturvedi, S. “Engineering Physics”. Cengage Learning India, 2012.
4. Brijlal and Subramanyam, “Properties of Matter”, S .Chand publishing, 2002.

REFERENCE BOOKS:

1. Halliday, D., Resnick, R. & Walker, J. “Principles of Physics”. Wiley, 2015.
2. Serway, R.A. & Jewett, J.W. “Physics for Scientists and Engineers”. Cengage Learning, 2010.

3. Tipler, P.A. & Mosca, G. “Physics for Scientists and Engineers with Modern Physics’. W.H.Freeman, 2007.
4. Shatendra Sharma & Jyotsna Sharma, “Engineering Physics”. Pearson, 2018.

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

1921104 ENGINEERING CHEMISTRY L T P C

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

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).

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

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												PSO			
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2	2	1	3		1	1	1					2	1	1	1	1
3	2		1			1						1	3	3	3	2
4	1	1	2	1	1		1					2	2	3	3	1
5	2		1		1	1						1	2	3	3	2

1901005 PROBLEM SOLVING AND PYTHON PROGRAMING L T P C

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

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

OUTCOMES:

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

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

TEXT BOOKS:

1. Reema Thareja, **"Python Programming using Problem solving Approach"** ,Oxford Higher Education,2017
2. Allen B. Downey, **"Think Python: How to Think Like a Computer Scientist"**, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/)
3. Guido van Rossum and Fred L. Drake Jr, **"An Introduction to Python**" – Revised and updated for Python 3.2, Network Theory Ltd., 2011.

REFERENCE BOOKS:

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

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

1901106 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C

(Common to CIVIL & MECH) **3 0 0 3**

OBJECTIVES:

- To explain the basic concepts in Electrical circuits & Measuring instruments.
- To explain the different components and function of electrical machines.
- To explain the fundamentals of semiconductor devices and applications.
- To explain the principles of digital electronics.
- To impart knowledge of communication.

UNIT-I: ELECTRICAL CIRCUITS & MEASURMENTS 9

Fundamental laws of electric circuits – Steady State Solution of DC Circuits – Introduction to AC Circuits – Sinusoidal steady state analysis – Power and Power factor – Single Phase and Three Phase Balanced Circuits. Classification of instruments – Operating Principles of indicating Instruments.

UNIT-II: ELECTRICAL MACHINES **9**

Construction - Principle of Operation - Basic Equations and Applications of DC Generators - DC Motors - Single & Three Phase Transformer - Single & Three Phase induction Motor – Synchronous Motor.

UNIT-III: SEMICONDUCTOR DEVICES AND APPLICATIONS **9**

Introduction - Characteristics of PN Junction Diode – Zener Effect – Zener Diode and its Characteristics – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor – CB, CE, CC Configurations and Characteristics.

UNIT-IV: DIGITAL ELECTRONICS **9**

Binary Number System – Logic Gates - Boolean Algebra theorems – Digital circuits - Introduction to sequential Circuits – Flip-Flops – Registers and Counters – A/D and D/A Conversion.

UNIT-V: FUNDAMENTALS OF COMMUNICATION ENGINEERING **9**

Introduction – Elements of Communication Systems – Modulation and Demodulation: Principles of Amplitude and Frequency Modulations. Digital Communication - Communication Systems: Radio, Antenna, TV, Fax, ISDN, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to identify and explain about electrical circuits and measuring instruments.
- Ability to identify and explain the construction and working of electrical machines.
- Ability to identify electronic components and explain its characteristics.
- Ability to acquire knowledge on digital electronics.

- Ability to acquire knowledge on fundamentals of communication systems.

TEXT BOOKS:

1. D.P. Kothari and I.J. Nagarath, **"Basic Electrical and Electronics Engineering"**, McGraw Hill Education (India) Private Limited, Third Reprint, 2016.
2. S.K. Bhattacharya, **"Basic Electrical and Electronics Engineering"**, Pearson India, 2011.
3. Sedha R.S., **"Applied Electronics"**, S. Chand & Co., 2008.

REFERENCE BOOKS:

1. A.E. Fitzgerald, David E Higginbotham and Arvin Grabel, **"Basic Electrical Engineering"**, McGraw Hill Education (India) Private Limited, 2009.
2. Del Toro, **"Electrical Engineering Fundamentals"**, Pearson Education, New Delhi, 2007.
3. Leonard S Bobrow, **"Foundations of Electrical Engineering"**, Oxford University Press, 2013.
4. Mahmood Nahvi and Joseph A. Edminister, **"Electric Circuits"**, Schaum's Outline Series, McGraw Hill, 2010.
5. Mehta V K, **"Principles of Electronics"**, S.Chand. & Company Ltd, 2008.
6. Nagsarkar T K and Sukhija M S, **"Basics of Electrical Engineering"**, Oxford press 2007.

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

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

PHYSICS LABORATORY

OBJECTIVES:

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

LIST OF EXPERIMENTS: (Any 5 Experiments)

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

TOTAL: 30 PERIODS

OUTCOMES:

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

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

REFERENCE BOOKS:

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

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

CHEMISTRY LABORATORY

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.5
- To make the student familiar with the properties and nature of alloys experimentally

LIST OF EXPERIMENTS: (Any 5 Experiments)

1. Estimation of HCl using Na_2CO_3 as primary standard and determination of alkalinity in water sample.
2. Estimation of copper content of the given solution by iodometry.

3. Determination of strength of given hydrochloric acid using pH meter.
4. Determination of strength of acids in a mixture of acids using conductivity meter.
5. Estimation of iron content of the given solution using potentiometer.
6. Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.
7. Pseudo first order kinetics-ester hydrolysis.
8. Corrosion experiment-weight loss method.
9. Conductometric titration of strong acid Vs strong base.

TOTAL: 30 PERIODS

OUTCOMES:

- Obtain the hands-on knowledge in the quantitative chemical analysis of water quality related parameters.
- Understand the experimental concepts in the mixture of acids and bases.
- Appreciate the need of iodometry in the estimation of metals.
- Explore the drawbacks of corrosion by weight loss method.
- Design and carry out the scientific experiments related to boiler troubles.

TEXTBOOKS:

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

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

1901009 PROBLEM SOLVING PYTHON PROGRAMMING LABORATORY

L T P C

0 0 4 2

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

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton‘s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. How to create, slice, change, delete and index elements using Tuple.
8. Find First n prime numbers
9. How to create, slice, change, add, delete and index elements using list.
10. Write a program to calculate the length of a string.
11. Write a program to reverse the string
12. How to change, delete, add and remove elements in Dictionary
13. Find the most frequent words in a text read from a file
14. Simulate elliptical orbits in Pygame
15. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

TOTAL: 60 PERIODS

OUTCOMES:

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

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

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

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

REFERENCE BOOKS:

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

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

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

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

OUTCOMES:

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

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

TEXT BOOKS:

1. Grewal. B.S, **"Higher Engineering Mathematics",** Khanna Publishers, New Delhi, 43rd Edition, 2014.

2. Veerarajan. T, **"Engineering Mathematics"**, McGraw Hill Education (India) Private Limited, 2019.

REFERENCE BOOKS:

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

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

1920201 PHYSICS FOR CIVIL ENGINEERING (For B.E. Civil Engineering)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concept of Thermal performance in buildings .
- To facilitate the knowledge about acoustical measurements in buildings..
- To enrich the idea of lighting designs in buildings.
- To explore the basics New engineering materials.
- To enhance the idea about Natural Hazards which threatens the Human beings.

UNIT- I: THERMAL PERFORMANCE OF BUILDINGS **9**

Heat transfer through fenestrations, thermal insulation and its benefits - heat gain and

heat loss estimation - factors affecting the thermal performance of buildings, thermal measurements, thermal comfort, indices of thermal comfort, climate and design of solar radiation, shading devices. Principles of natural ventilation - ventilation measurements, design for natural ventilation - chilled water plant -fan coil systems - water piping - cooling load - Air conditioning (AC) systems - Window type air conditioner - Protection against fire to be caused by AC Systems.

UNIT- II: ACOUSTICS 9

Classification of sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Methods of sound absorptions - absorbing materials - noise and its measurements, impact of noise in multi-storeyed buildings, sound insulation and its measurements.

UNIT- III: LIGHTING DESIGNS 9

Radiation quantities – spectral quantities – relationship between luminescence and radiant quantities – photometry: cosines law, inverse square law. Vision – photobic, mesophic, scotopic visions. Colour – luminous efficiency function - Visual field glare - day light calculations - day light design of windows and use of models and artificial skies, principles of artificial lighting, supplementary artificial lighting.

UNIT- IV: NEW ENGINEERING MATERIALS 9

Composites - Classification - Fibre reinforced plastics (FRP) and fiber reinforced metals (FRM) - Metallic glasses – Preparation, Properties and applications - Shape memory alloys - Ceramics - Classification - Manufacturing methods - Slip casting - Isostatic pressing - Gas pressure bonding - Properties (thermal, mechanical, electrical and chemical) - ferroelectric and ferromagnetic ceramics - High Aluminium ceramics.

UNIT- V: HAZARDS 9

Seismology and Seismic waves - Earth quake ground motion - Basic concepts and estimation techniques - site effects - Probabilistic and deterministic Seismic hazard analysis - Cyclone -Flood hazards - Fire hazards, fire-proofing of materials, fire safety regulations and firefighting equipment - Prevention and safety measures.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students will able to

- Have knowledge on the thermal performance of buildings.
- Acquire knowledge on the acoustic properties of buildings.
- Gain knowledge on various lighting designs for buildings.
- Get knowledge on the properties and performance of engineering materials, and
- The students will know about the natural hazards and its preventive measures.

TEXT BOOKS:

1. Alexander, D. **"Natural disaster"**, Springer, 1993.
2. Budinski, K.G. & Budinski, M.K. **"Engineering Materials Properties and Selection"**, Prentice Hall, 2009.
3. Severns, W.H. & Fellows, J.R. **"Air conditioning and Refrigeration"**, John Wiley and Sons, London, 1988.
4. Stevens, W.R., **"Building Physics: Lighting: Seeing in the Artificial Environment**", Pergaman Press, 2013.

REFERENCE BOOKS:

1. Gaur R.K. and Gupta S.L., **"Engineering Physics"**. Dhanpat Rai publishers, 2012.
2. Reiter, L. **"Earthquake hazard analysis - Issues and insights"**, Columbia University Press, 1991.
3. Shearer, P.M. **"Introduction to Seismology"**, Cambridge University Press, 1999.

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

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.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

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

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, Hydrabad, 2015.
3. Rajagopalan, R, **"Environmental Studies - From Crisis to Cure"**, Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, **"Environmental Science"**, Cengage Learning India PVT, LTD, Delhi, 2014.

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

1901006 **PROGRAMMING IN C** **L T P C**

3 0 0 3

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 statement, Iterative statement - 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

OUTCOMES:

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

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Paul Deitel and Harvey Deitel, —C How to Program, Seventh edition, Pearson Publication.

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

1901007 ENGINEERING GRAPHICS L T P C

(Common to all branches of B.E. / B.Tech. Programmes) **2 0 4 4**

OBJECTIVES:

The main learning objective of this course is to impart knowledge

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

CONCEPTS AND CONVENTIONS (Not for Examination) 1

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

UNIT-I: PLANE CURVES AND SPECIAL CURVES 10

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

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

Orthographic projection- Principles-Principal planes - First angle projection-projection of points at First Quadrant only. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) which inclined to both the principal planes by rotating object method.

UNIT-III: PROJECTION OF SOLIDS AND ISOMETRIC PROJECTION 16

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

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

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT-V: FREE HAND SKETCHING AND PERSPECTIVE PROJECTIONS 16

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

TOTAL: 75 PERIODS

OUTCOMES:

Upon Completion of this course, the students will 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:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.

4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

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

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

1901010 C PROGRAMMING LABORATORY L T P C

0 0 4 2

OBJECTIVES:

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

LIST OF PROGRAMS:

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

(a) Total marks obtained by each student.

(b) The highest marks in each subject and the marks of the student who secured it.

(c) The student who obtained the highest total marks.

TOTAL : 60 PERIODS

OUTCOMES:

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

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

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

1901208 ENGINEERING PRACTICES LABORATORY L T P C

(Common to all branches of B.E. / B.Tech. Programmes) **0 0 4 2**

OBJECTIVES:

- To provide exposure to the students with hands on experience on various basic 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

OUTCOMES:

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

- Fabricate carpentry components and pipe connections including plumbing works.
- Use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metalwork's
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, 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												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1	3					1						1	3			
2		1	2		3						1			1	2	
3				3	2							1				3
4		2	3	1	2									2	3	1
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

OBJECTIVES:

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

LIST OF EXPERIMENTS: (Any 5 Experiments)

1. Determination of band gap of a semiconductor.

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

TOTAL: 30 PERIODS

DEMO:

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

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

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: (Any 5 Experiments)

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

TOTAL: 30 PERIODS

DEMO:

1. Pollution abatement by adsorption techniques

2. Scintillation Process

OUTCOMES:

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

TEXTBOOKS:

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

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1918301 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS L T P C

3 1 0 4

OBJECTIVES:

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations.
- Apply PDE in solving one dimensional Wave and Heat flow equations.
- To model several physical problems to develop Z transform techniques for discrete time systems.

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

Formation of partial differential equations - Solutions Lagrange's linear equation — Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT-II: FOURIER SERIES 9L+3T

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.

UNIT-III: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9L+3T

Classification of PDE – Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction in infinite plates(excluding insulated edges).

UNIT-IV: FOURIER TRANSFORMS 9L+3T

Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT-V: Z – TRANSFORMS AND DIFFERENCE EQUATIONS 9L+3T

Z- transforms – Elementary properties – Inverse Z – transform (using partial fraction and residues) – Convolution theorem – Solution of difference equations using Z – transform.

TOTAL:45L +15T PERIODS

OUTCOMES:

- Understand the fundamental concept of the concepts of Partial differential Equations.
- Understand the basic concepts of mathematical principles on Fourier & Z-transforms.
- Apply the concept of PDE and Solve Wave equation, and Heat flow equations.
- Understand the concept Fourier series and apply the concept in solving PDE.
- Understand the fundamental concept of the concepts of Solution of difference equations

TEXT BOOKS:

1. Veerarajan. T., “Transforms and Partial Differential Equations”, Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., “Higher Engineering Mathematics”, 42nd Edition, Khanna Publishers,Delhi, 2012.
3. Narayanan.S.,ManicavachagomPillay.T.K and Ramanaiah.G “Advanced Mathematicsfor Engineering Students” Vol. II & III, S.Viswanathan Publishers Pvt. Ltd.1998.

REFERENCE BOOKS:

1. Bali.N.P and Manish Goyal, “A Textbook of Engineering Mathematics”, 7th Edition, Laxmi Publications Pvt Ltd, 2007.
2. Ramana.B.V., “Higher Engineering Mathematics”, Tata McGraw Hill Publishing Company Limited, NewDelhi, 2008.
3. Glyn James, “Advanced Modern Engineering Mathematics”, 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig,“Advanced Engineering Mathematics”, 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, “Advanced Engineering Mathematics” Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.

1. P.Sivaramakrishna Das, C.Vijayakumari, Transforms and Partial Differential Equations, Pearson India Education Services Pvt. Ltd, 2019.

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1903301 APPLIED MECHANICS L T P C

3 0 0 3

OBJECTIVES:

- To learn the fundamental concepts of Stress, Strain and deformation of solids.
- To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
- To analyze and determine the deflection of beams.
- To understand the effect of torsion on shafts and springs.
- To analyze plane and space trusses.

UNIT-I: STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Simple Stresses and strains – Elastic constants (Problem) - Relationship between elastic constants – Stress Strain Diagram (Mild steel and concrete) – Ultimate Stress – Yield Stress – Deformation of axially loaded member -Composite Bars - Thermal Stresses - Hydrostatic stresses

UNIT-II: TRANSFER OF LOADS AND STRESSES IN BEAMS 9

Types of loads, supports, beams – concept of shearing force and bending moment Relationship between intensity of load, Shear Force and Bending moment - Shear Force and Bending Moment Diagrams for Cantilever, simply supported and

overhanging beams with concentrated load, uniformly distributed load, uniformly varying load and concentrated moment. Theory of Simple Bending – Stress Distribution due to bending moment and shearing force Flitched Beams

UNIT-III: SLOPE AND DEFLECTION **9**

Elastic curve – Governing differential equation - Double integration method - Macaulay's method -Area moment method - conjugate beam method for computation of slope and deflection of Determinant beams

.**UNIT-IV: TORSION AND SPRINGS** **9**

Theory of Torsion – Stresses and Deformations in Solid and Hollow Circular Shafts – combined bending moment and torsion of shafts - Power transmitted to shaft – Shaft in series and parallel –Closed and Open Coiled helical springs – springs in series and parallel – Design of buffer springs.

UNIT-V: STATE OF STRESS AND TRUSSES **9**

State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes **-** Mohr's circle method -Analysis of pin jointed plane determinate trusses by method of joints, method of sections and tension coefficient – Space trusses -Tension coefficient method.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understand the concepts of stress and strain.
- Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
- Calculate the deflection of beams by different methods and selection of method for determining slope or deflection.
- Apply basic equation of torsion in design of circular shafts and helical springs, .
- Analyze the pin jointed plane and space trusses

TEXT BOOKS :

1. Rajput. R. K."Strength of Materials", S. Chand and Co, New Delhi,2015.

2. Punmia. B. C., Ashok Kumar Jain and Arun Kumar Jain, "SMTS –I Strength of materials", Laxmi publications. New Delhi, 2015
3. Rattan . S. S, "Strength of Materials", Tata McGraw Hill Education Private Limited, New Delhi, 2012
4. Bansal. R.K. "Strength of Materials", Laxmi Publications Pvt. Ltd., New Delhi,2010

REFERENCE BOOKS :

1. Timoshenko.S.B. and Gere.J.M, "Mechanics of Materials", Van Nos Reinbhold, New Delhi 1999.
2. Vazirani.V.N and Ratwani.M.M, "Analysis of Structures", Vol I Khanna Publishers, New Delhi,1995.
3. Junnarkar.S.B. and Shah.H.J, "Mechanics of Structures", Vol I, Charotar Publishing House, New Delhi 2016.
4. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.

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1903302 FLUID MECHANICS L T P C

3 0 0 3

OBJECTIVES:

- To understand the basic properties of the fluid, fluid kinematics, fluid dynamics.
- To analyze and appreciate the complexities involved in solving the fluid flow problems.
- To understand the concepts involved in boundary layer.

- Application of the conservation laws to flow measurements and flow through pipes and forces on pipe bend.

- To Understand the dimensional analysis and to derive a rational equation

UNIT-I: FLUID PROPERTIES AND FLUID STATICS **9**

Fluid – definition, distinction between solid and fluid - Units and dimensions - Properties of fluids- density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapour pressure, capillarity and surface tension - Fluid statics: concept of fluid static pressure, absolute and gauge pressures - pressure measurements by manometers-forces on planes – centre of pressure – buoyancy and floatation.

UNIT-II: FLUID KINEMATICS AND DYNAMICS **10**

Fluid Kinematics – Classification and types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms)- stream line-streak line-path line- stream function - velocity potential function - flow net -Concept of velocity potential function and stream function with problems. Fluid dynamics - equations of motion -Euler's equation along a streamline - Bernoulli's equation – applications - venturi meter, orifice meter and Pitot tube linear momentum equation and its application to pipe bend-Forces acting on fluid flow

UNIT-III: DIMENSIONAL ANALYSIS AND MODEL STUDIES **8**

Fundamental dimensions - dimensional homogeneity - Rayleigh‘s method and Buckingham Pi-Theorem - Dimensionless parameters - Similitude and model studies - Distorted.

UNIT-IV: FLOW THROUGH PIPES **9**

Reynold‘s experiment - laminar flow through circular pipe (Hagen poiseulle's) - hydraulic and energy gradient – Flow through syphon pipe -flow through pipes - Darcy - Weisbach's equation pipe roughness -friction factor- Moody's diagram- major and minor losses of flow in pipes - pipes in series and in parallel

UNIT-V: BOUNDARY LAYER **9**

Boundary layer – definition-Development of boundary layer thickness and its application boundary layer on a flat plate – laminar and turbulent boundary layer- displacement, energy and momentum thickness – Momentum integral equation-Boundary layer separation and control – drag on flat plate.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to understand

- Basic knowledge of fluids in static, kinematic and dynamic equilibrium.
- The problems related to equation of motion.
- Gain knowledge about dimensional and model analysis.
- Types of flow and losses of flow in pipes.
- The boundary layer problems.

TEXT BOOKS:

1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
2. Jain.A. K.., "Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
3. Subramanya. K "Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.
4. Rajput.R.K. "Fluid Mechanics", S.Chand and Co, New Delhi,2008.

REFERENCE BOOKS:

1. Streeter, V.L., and Wylie, E.B., "Fluid Mechanics", McGraw Hill, 2000.
2. Fox W.R. and McDonald A.T., "Introduction to Fluid Mechanics", John-Wiley and Sons, Singapore, 2013.
3. White, F.M., "Fluid Mechanics", Tata McGraw Hill, 5th Edition, New Delhi, 2017.
4. Mohd. Kaleem Khan, "Fluid Mechanics and Machinery", Oxford University Press, New Delhi, 2015.
5. Bansal.R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications Pvt. Ltd., New Delhi, 2013.

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1903303 SURVEYING L T P C

3 0 0 3

OBJECTIVES:

- To introduce the rudiments of plane surveying and geodetic principles to Civil Engineers.
- To learn the various methods of plane and geodetic surveying to solve the real world Civil Engineering problems.
- To introduce the concepts of Control Surveying
- To introduce the basics of Astronomical Surveying
- To introduce the concepts of Modern Surveying

UNIT-I: FUNDAMENTALS OF CONVENTIONAL SURVEYING AND LEVELLING 9

Classifications and basic principles of surveying -Equipment and accessories for ranging and chaining -Methods of ranging - Compass -Types of Compass - Basic Principles- Bearing – Types - True Bearing - Magnetic Bearing-Traversing - Levelling- Principles and theory of Levelling –Datum- Bench Marks – Temporary and Permanent Adjustments- Methods of Levelling-Booking –Reduction - Sources of errors in Levelling.

UNIT-II: THEODOLITE AND TACHEOMETRIC 9

Horizontal and vertical angle measurements -Temporary and permanent adjustments - Heights and distances - Tacheometer - Stadia Constants - Analytic Lens -Tangential and Stadia Tacheometric surveying - Contour – Contouring – Characteristics of contours – Methods of contouring – Tacheometric contouring - Contour gradient – Uses of contour plan and map.

UNIT-III: CONTROL SURVEYING AND ADJUSTMENT **9**

Horizontal and vertical control – Methods – specifications – triangulation- baseline – satellite station – reduction to centre- trigonometrical levelling – single and reciprocal observations Curvature and refraction. –traversing – Gale‘s table. - Errors Sources- precautions and corrections – classification of errors –true and most probable values - weighed observations – method of equal shifts – principle of least squares - normal equation – correlates- level nets adjustment of simple triangulation networks.

UNIT-IV: ADVANCED TOPICS IN SURVEYING **9**

Hydrographic Surveying – Tides – MSL – Sounding methods – Three point problem – Strength of fix – Astronomical Surveying – Field observations and determination of Azimuth by altitude and hour angle methods –.Astronomical terms and definitions - Motion of sun and stars Celestial coordinate systems - different time systems - Nautical Almanac - Apparent altitude and corrections -Field observations and determination of time, longitude, latitude and azimuth by altitude and hour angle method.

UNIT-V: MODERN SURVEYING **9**

Total Station : Advantages - Fundamental quantities measured - Parts and accessories -working principle - On board calculations - Field procedure -Errors and Good practices in using Total Station GPS Surveying : Different segments - space, control and user segments -satellite configuration signal structure - Orbit determination and representation -Anti Spoofing and Selective Availability -Task of control segment - Hand Held and Geodetic receivers - data processing - Trilateration vs. Triangulation – GPS Receivers Working.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to understand

- The uses of various surveying instruments and mapping
- Measuring Horizontal angle and vertical angle using different instruments
- Methods of Leveling and setting Levels with different instruments
- Concepts of astronomical surveying and methods to determine time, longitude, latitude and azimuth
- Concept and principle of modern surveying.

TEXT BOOKS:

1. Kanetkar.T.P and Kulkarni.S.V, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008
2. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
3. James M. Anderson and Edward M. Mikhail, "Surveying, Theory and Practice", 7th Edition, Mc Graw Hill, 2001.
4. Bannister and S. Raymond, "Surveying", 7th Edition, Longman 2004.
5. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993
6. Venkatramaiah, Text book of Surveying, University press, New Delhi, 2014

REFERENCE BOOKS:

1. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004.
2. Guocheng Xu, "GPS Theory , Algorithms and Applications", Springer Berlin, 2003.
3. Satheesh Gopi, Rasathishkumar, N. Madhu, "Advanced Surveying, Total Station GPS and Remote Sensing", Pearson education, 2007
4. Roy S.K., "Fundamentals of Surveying", 2nd Edition, Prentice Hall of India, 2004.
5. Arora K.R.,"Surveying", Vol I & II", Standard Book house, 10th Edition 2008.

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

1903304 CONSTRUCTION MATERIALS L T P C

3 0 0 3

OBJECTIVES:

- To introduce students to various materials commonly used in civil engineering construction and their properties.
- To get the basic knowledge about stones, bricks, concrete blocks and the criteria's that has to be checked for using these materials in construction.
- Students gain knowledge about the important construction material concrete, its manufacturing , its performance and its types
- To impart knowledge to the students on the properties of materials for concrete by suitable tests.
- To gain knowledge in mix design for concrete and special concretes.

UNIT-I: STONES – BRICKS – CONCRETE BLOCKS 9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Concrete blocks – Lightweight concrete blocks.

UNIT-II: LIME – CEMENT – AGGREGATES – MORTAR 9

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration– Tensile strength – Fineness–Soundness and consistency – Setting time – fine aggregates – river sand – crushed stone sand– properties – coarse Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading.

UNIT-III: CONCRETE 9

Concrete – Ingredients – Manufacturing Process – Batching plants –mixing – transporting – placing – compaction of concrete –curing and finishing – Ready mix Concrete – Mix specification. Physical properties of materials required for Mix Design - Design Mix and Nominal Mix - BIS Method of Mix Design - Mix Design Examples.

UNIT-IV: TIMBER AND OTHER MATERIALS 9

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates –Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel –Uses – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

UNIT-V: MODERN MATERIALS **9**

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products – Refractories – Composite materials – Types – Applications of laminar composites – Fibre textiles– Geo-membranes and Geo-textiles for earth reinforcement.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course the students will be able to

- Understand the typical and potential applications of lime, cement and aggregates
- Know the production of concrete and also the method of placing and making of concrete elements.
- The concept and procedure of mix design as per IS method
- The properties of concrete at fresh and hardened state
- The importance and application of special concretes

TEXT BOOKS:

1. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2015.
2. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
3. Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004
4. Duggal.S.K., "Building Materials", 4th Edition, New Age International, 2008.
5. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, 2003
6. Bhavikatti.S.S, "Concrete Technology", I. K. International Publishing House Pvt. Ltd.,New Delhi, 2015.
7. Santhakumar. A.R.,"Concrete Technology", Oxford University Press India,2006.

REFERENCE BOOKS:

1. Gambhir. M.L., & Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.

2. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, 1995
3. Gambhir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, 2007
4. IS456 - 2000: Indian Standard specification for plain and reinforced concrete, 2011
5. IS4926 - 2003: Indian Standard specification for ready–mixed concrete, 2012
6. IS383 - 1970: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete, 2011
7. IS1542-1992: Indian standard specification for sand for plaster, 2009
8. IS 10262-2009: Indian Standard Concrete Mix Proportioning –Guidelines, 2009

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1903305 APPLIED GEOLOGY L T P C

3 0 0 3

OBJECTIVES:

- At the end of this course the students will be able to geological conditions of earth.
- Will be able to understand the importance of the action of various geological agencies.
- To understand the importance of geological knowledge about minerals
- To understand the importance of geological knowledge about rocks, earthquake and volcanism.
- To understand the methods of study on geological structure.
- To apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor.

UNIT-I: PHYSICAL GEOLOGY **9**

Geology in civil engineering – branches of geology – structure of earth and its composition weathering of rocks - Scope of Geology in Engineering– scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.

UNIT-II: MINEROLOGY **9**

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT-III: PETROLOGY **9**

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

UNIT-IV: STRUCTURAL GEOLOGY AND GEOPHYSICAL METHODS **9**

Geological maps – attitude of beds, study of structures – folds, faults and joints – relevance to civil engineering. Geophysical methods – Seismic and electrical methods for subsurface investigations.

UNIT-V: APPLICATION OF GEOLOGICAL INVESTIGATIONS **9**

Geological Investigations-Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings - Hydrogeological investigations and mining - Coastal protection structures. Investigation of Landslides, causes and mitigation.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing this course

- Will be able to understand the importance of geological knowledge such as earth, earthquake, volcanism and the action of various geological agencies.

- Will get basic knowledge on properties of minerals.
- Gain knowledge about types of rocks, their distribution and uses.
- Will understand the methods of study on geological structure.
- Will understand the application of geological investigation in projects such as dams, tunnels, bridges, roads, airport and harbor

TEXTBOOKS:

1. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
2. Venkat Reddy. D. Engineering Geology, Vikas Publishing House Pvt. Lt, 2010.
3. Gokhale KVGK, "Principles of Engineering Geology", B.S. Publications, Hyderabad 2011.
4. Chenna Kesavulu N. "Textbook of Engineering Geology", Macmillan India Ltd., 2009.
5. Parbin Singh. A "Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2009.

REFERENCE BOOKS:

1. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
2. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
3. Dobrin, M.B "An introduction to geophysical prospecting", McGraw Hill, New Delhi, 1988.

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1903306	CONSTRUCTION MATERIALS LABORATORY	L	T	P	C
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OBJECTIVES:

- To facilitate the understanding of the behavior of construction materials.
- To know about the various test procedures on Fine aggregates
- To know about the various test procedures on Coarse aggregates
- To know about the various test procedures on Bricks and Blocks.
- To understand the properties of fresh concrete

I. TEST ON FINE AGGREGATES **15**

1. Grading of fine aggregates
2. Test for specific gravity
3. Compacted and loose bulk density of fine aggregate

II. TEST ON COARSE AGGREGATE **15**

1. Determination of impact value of coarse aggregate
2. Determination of elongation index
3. Determination of flakiness index
4. Determination of aggregate crushing value of coarse aggregate

III. TEST ON CONCRETE **15**

1. Test for Slump
2. Test for Compaction factor
3. Test for Compressive strength - Cube & Cylinder

IV. TEST ON BRICKS AND BLOCKS **15**

1. Test for compressive strength of bricks and blocks
2. Test for Water absorption of bricks and blocks
3. Determination of Efflorescence of bricks
4. Test on tiles

V. MIX DESIGN (DEMONSTRATION)

Different grades of Concrete

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Compression testing machine	1
2.	Sieve set (IS sieves 4.75 mm, 2.36 mm, 1.1.8 mm, 600 micron, 300 micron, 150 micron and 75 micron)	1
3.	Weighing Balance	1
4.	Pycnometer	1
5.	Aggregate Crushing Value Apparatus	1
6.	Aggregate Impact testing machine	1
7.	IS sieves 12.5 mm, 10 mm and 2.36 mm	1
8.	Vibrator	1
9.	Length gauge	1
10.	Thickness gauge	1
11.	IS Sieves 40 mm,31.5 mm, 25 mm, 20mm, 16mm, 12.5 mm, 10mm, 6.3 mm	1
12.	Slump cone apparatus	3
13.	Compaction factor apparatus	1
14.	Concrete Cube moulds	6
15.	Concrete Cylinder moulds	3
16.	Concrete mixing machine	1
17.	Trowels and Planers	1

OUTCOMES:

- The students will have the required knowledge in the area of testing of construction materials.
- Will be able to analyse components of construction elements experimentally.

- Will be understand the quality of the construction materials experimentally.
- Will be able to understand the properties of fresh concrete.
- Will be able to understand the properties of hardened concrete.

REFERENCE BOOKS:

1. Construction Materials Laboratory Manual, Anna University, Chennai-600 025.
2. IS 4031 (Part 1) – 1996 – Indian Standard Method for determination of fineness by dry sieving.
3. IS 2386 (Part 1 to Part 6) – 1963 – Indian Standard methods for test for aggregate for
4. concrete
5. IS 383 – 1970 Indian Standard specification for coarse and fine aggregates from natural sources for concrete.

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	0	2	2	2	3	-	3	-	3	3	3	3	3	3
2	3	2	0	2	2	2	3	-	3	-	3	3	3	3	3	3
3	3	2	0	2	2	2	3	-	3	-	3	3	3	3	3	3
4	3	2	2	2	2	2	3	-	3	-	3	3	3	3	3	3
5	3	2	2	2	2	2	3	-	3	-	3	3	3	3	3	3

1903307 SURVEYING LABORATORY L T P C

0 0 4 2

OBJECTIVES :

- Acquire practical knowledge on handling survey instruments like Theodolite – to measure horizontal, vertical angles, calculation of area and elevation of ground surface.
- Acquire adequate knowledge to carryout Triangulation, understand the importance of Triangulation and their applications in surveying
- Tacheometery - to identify the elevation and horizontal distance between instrument and object

- Acquire practical knowledge on handling survey instruments like Total station including general field marking for various engineering projects
- At the end of the course the student will possess knowledge about Survey field techniques

LIST OF EXPERIMENTS:

CHAIN SURVEY

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room

TRAVERSING

1. Compass Traversing – Measuring Bearings & arriving included angles
2. Plane table Traversing

LEVELLING - STUDY OF LEVELS AND LEVELLING STAFF

1. Fly levelling using Dumpy level &Tilting level
2. Check levelling

THEODOLITE - STUDY OF THEODOLITE

1. Measurements of horizontal angles by reiteration and repetition and vertical angles
2. Determination of elevation of an object using single plane method when base is accessible/inaccessible
3. Determination of elevation of an object using double plane method

TACHEOMETRY – TANGENTIAL SYSTEM – STADIA SYSTEM

1. Determination of Tacheometric Constants
2. Heights and distances by stadia Tacheometry
3. Heights and distances by Tangential Tacheometry

TOTAL STATION

1. Study of Total Station, Measuring Horizontal and vertical angles
2. Traverse using Total station and Area of Traverse
3. Determination of distance and difference in elevation between two inaccessible points using Total station.

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Total Station	3 Nos
2.	Theodolites	At least 1 for every 5 students
3.	Dumpy level / Filling level	At least 1 for every 5 students
4.	Ranging rods	1 for a set of 5 students
5.	Levelling staff	
6.	Cross staff	
7.	Chains	
8.	Tapes	
9.	Arrows	
10.	Prismatic Compass	10 nos
11.	Surveyor Compass	2 nos
12.	Survey grade or Hand held GPS	3 nos

OUTCOMES:

- Students completing this course would have acquired practical knowledge on handling basic survey instruments including Theodolite, Tacheometry.
- Have knowledge on handling survey instruments Total Station and GPS etc.,
- Have adequate knowledge to carryout Triangulation
- Have basic knowledge on astronomical surveying.
- General field marking for various engineering projects and Location of site etc.

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

1919001 COMMUNICATION SKILLS LABORATORY – PROJECT BASED **L T P C**

0 0 2 0

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: **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: **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: **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: **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: **6**

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

TOTAL PERIODS: 30

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.

OUTCOMES:

At the end of the course Learners will be able to:

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

REFERENCE BOOKS:

1. Gramer F.Margot and Colin S.Ward 'Reading and Writing' (Level 3) Oxford University Press: Oxford, 2011.
2. Debra Daise, CharlNorloff, and Paul 'Reading and Writing' (Level 4) Oxford University Press: Oxford, 2011
3. Brooks, Margret. 'Skills for Success. Listening and Speaking.' (Level 4)Oxford University Press, Oxford: 2011.
4. Richards,C. Jack. & David Bholke. 'Speak Now'(Level 3.) Oxford University Press, Oxford: 2010
5. Davis,Jason and Rhonda LIss. 'Effective Academic Writing' (Level 3) Oxford University Press: Oxford, 2006
6. E.Suresh Kumar. 'Enriching Speaking and Writing Skills. Second Edition. Orient Black swan: Hyderabad, 2012
7. Petelin, Roslyn and Marsh Durham. 'The Professional Writing Guide: Knowing Well and Knowing Why'. Business & Professional Publishing: Australia, 2004.
8. Bhatnagar, Nitin and Mamta Bhatnagar. 'Communicative English for Engineers and Professionals'. Pearson: New Delhi, 2010.
9. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
10. Vargo, Mari. Speak Now (Level 4). Oxford University Press: Oxford, 2013.

11. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006.
12. Ladousse, Gillian Porter. Role Play. Oxford University Press: Oxford, 2014
13. IELTS, TOFEL testing series
14. Jack c. Richards. Tactics for Listening: Developing. Oxford University Press: Oxford,.2004
15. New Oxford Dictionary for writers and editors: The essential A-Z Guide to the Written Word 2005.

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

1918401 NUMERICAL METHODS L T P C

3 1 0 4

OBJECTIVES:

- To introduce the basic concepts of solving algebraic and transcendental equations.
- To introduce the numerical techniques of interpolation in various intervals in real life.
- To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering
- To understand the knowledge of various techniques and methods of solving various types of ordinary differential equations.
- To give knowledge about numerical solving one dimensional wave and heat equations.

UNIT-I: SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9L+3T

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method , Inverse of a matrix by Jordan Method – Iterative method of Gauss Seidel –Dominant Eigenvalue of a matrix by Power method.

UNIT-II: INTERPOLATION AND APPROXIMATION 9L+3T

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Difference operators and relations - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT-III: NUMERICAL DIFFERENTIATION AND INTEGRATION 9L+3T

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT-IV: INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9L+3T

Single step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT-V: BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9L+3T

Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 45L+15T PERIODS

OUTCOMES:

- Understand the basic concepts and techniques of solving algebraic and transcendental equations and numerical techniques of interpolation and error

approximations.

- Apply the numerical techniques of differentiation and integration for engineering problems.
- Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
- Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.
- Understand the basic concepts of solving Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain.

TEXT BOOKS:

1.Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.

2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

REFERENCE BOOKS:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt.Ltd, 3rd Edition, New Delhi, 2007.

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

1903401 STRENGTH OF MATERIALS L T P C

3 0 0 3

OBJECTIVES:

- To know the method of calculating deflection by energy principles.
- To understand the method of finding the unknowns in indeterminate beams.
- To estimate the load carrying capacity and failure modes of columns and cylinders.
- To estimate the various states of stresses and study about the failure theories.
- To estimate the stresses due to unsymmetrical bending and in curved beams

UNIT- I: ENERGY PRINCIPLES – DEFLECTION 9

Strain energy and strain energy density – strain energy due to axial load , shear, flexure and torsion – Castigliano‘s theorems – Maxwell‘s reciprocal equation - Principle of virtual work – unit load method - Application of energy theorems for computing deflections in determinate beams , plane frames and plane trusses - Williot Mohr's Diagram

.

UNIT- II: INDETERMINATE BEAMS 9

Propped cantilever and fixed beams - fixed end moments and reactions – sinking and rotation of supports - Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams

UNIT-III: COLUMNS AND CYLINDERS 9

Euler‘s column theory – critical load for prismatic columns with different end conditions – Effective length – limitations - Rankine-Gordon formula - Eccentrically loaded columns – middle third rule – middle fourth rule - core of a section – Thin cylindrical and spherical shells -Thick cylinders – Compound cylinders

UNIT-IV: STATE OF STRESS 9

Stress tensor – Stress invariants - - Volumetric strain. Theories of failure: Maximum Principal stress theory – Maximum Principal Strain theory – Maximum shear stress

theory – Total Strain energy theory – Maximum distortion energy theory – Application problems.

UNIT- V: ADVANCED TOPICS **9**

Unsymmetrical bending of beams of symmetrical and unsymmetrical sections – Shear Centre curved beams – Winkler Bach formula – stresses in hooks

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.
- Analyze propped cantilever, fixed beams and continuous beams using theorem of three moment equation for external loadings and support settlements.
- Find the load carrying capacity of columns and stresses induced in columns and cylinders
- Determine principal stresses and planes for an element in three dimensional state of stress and study various theories of failure.
- Understand the knowledge on unsymmetrical sections and curved beams

TEXT BOOKS:

1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand & company Ltd., New Delhi, 2015.
2. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain,"Theory of Structures" (SMTS) Vol
   - II, Laxmi Publishing Pvt Ltd, New Delhi 2017.
4. Basavarajiah and Mahadevapa, Strength of Materials, University press, Hyderabad, 2016

REFERENCE BOOKS:

1. Kazimi S.M.A, —Solid Mechanicsǁ, Tata McGraw-Hill Publishing Co., New Delhi, 2003

2. William A .Nash, —Theory and Problems of Strength of Materials‖, Schaum‘s Outline Series, Tata McGraw Hill Publishing company, 2007.
3. Singh. D.K., —Strength of Materials‖, Ane Books Pvt. Ltd., New Delhi, 2016
4. Egor P Popov, —Engineering Mechanics of Solids‖, 2nd edition, PHI Learning Pvt. Ltd., New Delhi, 2012

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

1903402 APPLIED HYDRAULIC ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.
- Application of the law of energy principle applicable to gradually varied flow.
- Application of the law of conservation of laws to momentum applicable to rapidly varied flow.
- To understand the concepts regarding turbines
- To understand the concepts regarding pumps.

UNIT-I: UNIFORM FLOW 9

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Velocity distribution in open channel - Steady uniform flow: Chezy equation, Manning equation - Best hydraulic sections for uniform flow – Wide open channel - Specific energy and specific force – Critical flow – Non erodible channels.

UNIT- II: GRADUALLY VARIED FLOW 9

Dynamic equations of gradually varied flows – Types of flow profiles - Classifications: Computation by Direct step method and Standard step method – Control section – Break in Grade – Computation.

UNIT- III: RAPIDLY VARIED FLOW **9**

Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Celerity – Rapidly varied unsteady flows (positive and negative surges)

UNIT-IV: TURBINES **9**

Application of momentum principles - Impact of Jet on flat, curved plates, Stationary and Moving –Classification of Turbines – Pelton wheel – Francis turbine – Kaplan turbine - Specific speed – Characteristic Curves of Turbines- Draft tube and cavitation – efficiency of turbines.

UNIT- V: PUMPS **9**

Classification of Pumps - Centrifugal pumps – Work done - Minimum speed to start the pump NPSH - Multistage pumps – Characteristics curve - Reciprocating pumps - Negative slip -Indicator diagrams and its variations.

TOTAL : 45 PERIODS

OUTCOMES:

On completion of this course the students will be able to

- Apply their knowledge of fluid mechanics in addressing problems in open channels.
- Able to identify a effective section for flow in different cross sections.
- To solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
- Understand the principles, working and application of turbines.
- Understand the principles, working and application of pumps.

TEXT BOOKS:

1. Subramanya.K ,"Flow in open channels", Tata McGraw Hill, New Delhi, 2000.
2. Modi P.N and Seth.S.M "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House New Delhi, 2009.
3. Chandramouli P.N.,‖Applied Hydraulic Engineering‖, Yes Dee Publishing Pvt. Ltd., 2017.

REFERENCE BOOKS:

1. Ven Te Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
2. Hanif Chaudhry.M., "Open Channel Flow", Second Edition, Springer, 2007.
3. Rajesh Srivastava, "Flow through open channels", Oxford University Press, New Delhi, 2008.
4. Jain.A.K., " Fluid Mechanics" (Including Hydraulic Machines), Khanna Publishers, Twelfth Edition, 2016.
5. Subramanya.K., " Fluid Mechanics and Hydraulic Machines", Tata McGraw Hill Education Private Limited, New Delhi, 2010.

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

1903403 SOIL MECHANICS L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification.
- Students will be able to identify the permeability of soil and sketch flow net for various hydraulic structures to calculate the seepage quantity.
- To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils.
- Students will be able to determine engineering properties through standard tests and empirical correction with index properties.
- To impart knowledge of design of both finite and infinite slopes.

UNIT- I: SOIL CLASSIFICATION 9

History – formation and types of soil – composition - Index properties - clay mineralogy structural arrangement of grains – description – Classification – BIS – US – phase relationship.

UNIT- II: EFFECTIVE STRESS AND PERMEABILITY **9**

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability – Darcy‘s law – Determination of Permeability – Laboratory Determination (Constant head and falling head methods) and field measurement of permeability – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace‘s equation – Introduction to flow nets – Simple problems Sheet pile and wier.

UNIT- III: COMPACTION AND CONSOLIDATION **9**

Compaction – theory – laboratory and field technology – field Compaction method – factors influencing compaction–Components of settlement –— Immediate and consolidation settlement – Factors influencing settlement – Terzaghi‘s one dimensional consolidation theory – Computation of rate of settlement. –- √t and log t methods. e-log p relationship consolidation settlement N-C clays – O.C clays – Computation.

UNIT- IV: STRESS DISTRIBUTION AND SHEAR STRENGTH **9**

Stress distribution in homogeneous and isotropic medium – Boussines of theory – (Point load, Line load and udl) Use of Newmarks influence chart - Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests.

UNIT- V: SLOPE STABILITY **9**

Infinite slopes and finite slopes –— Friction circle method – Use of stability number – Guidelines for location of critical slope surface in cohesive and c - Φ soil – Slope protection measures.

TOTAL: 45 PERIODS

OUTCOMES:

- Students will be able to classify the soil and assess the engineering properties, based on index properties.
- Understand the stress concepts in soils
- Understand and identify the settlement in soils.
- Determine the shear strength of soil.
- Analyze both finite and infinite slopes.

TEXT BOOKS:

1. Murthy, V.N.S., "Text book of Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2014
2. Arora, K.R., "Soil Mechanics and Foundation Engineering", Standard Publishersand Distributors, New Delhi, 7th Edition,2017(Reprint).
3. Gopal Ranjan, A S R Rao, "Basic and Applied Soil Mechanics", New Age International Publication, 3rd Edition,2016.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi,16th Edition,2017.

REFERENCE BOOKS:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations: Basic Geotechnics". Prentice-Hall, 2006.
2. Coduto, D.P., "GeotechnicalEngineering – Principles and Practices", Prentice Hall of India Pvt. Ltd. New Delhi, 2010.
3. Braja M Das, "Principles of Geotechnical Engineering", Cengage Learning India Private Limited, 8th Edition,2014.
4. Palanikumar.M., "SoilMechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited Delhi, 2013.
5. Craig.R.F., "Soil Mechanics", E & FN Spon, London and New York, 2012.
6. Purushothama Raj. P., "Soil Mechanics and Foundations Engineering",2nd Edition, Pearson Education, 2013.
7. Venkatramaiah.C., "Geotechnical Engineering", New Age International Pvt. Ltd., NewD elhi, 2017

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

1903404 CONSTRUCTION TECHNIQUES AND PRACTICES L T P C

3 0 0 3

OBJECTIVES:

The main objective of this course is to make the student aware of

- The various construction techniques used in the construction field.
- The latest construction practices used in the construction.
- The various construction methods for the sub-structure used in the construction sites.
- The knowledge about the various construction procedures for super-structure such as bridge deck, offshore structures, domes etc.
- The various equipment needed for construction of various types of structures to handle the materials.

UNIT- I: CONSTRUCTION TECHNIQUES 9

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism – floor system - Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact of materials – responsible sourcing - Eco Building (Green Building) - Material used - Construction methods - Natural Buildings - Passive buildings - Intelligent(Smart) buildings - Meaning - Building automation - Energy efficient buildings for various zones.

UNIT- II: CONSTRUCTION PRACTICES 9

Specifications, details and sequence of activities and construction co-ordination – Site Clearance – Marking – Earthwork - masonry – stone masonry – Bond in masonry - concrete hollow block masonry – flooring – damp proof courses – construction joints – movement and expansion joints – pre cast pavements – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de-shuttering forms – Fabrication and erection of steel trusses – frames – braced domes – laying brick –– weather and water proof – roof finishes – acoustic and fire protection.

UNIT-III: SUB STRUCTURE CONSTRUCTION 9

Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunneling techniques – Piling techniques - well and caisson - sinking

cofferdam cable anchoring and grouting - driving diaphragm walls, sheet piles - shoring for deep cutting well points -Dewatering and stand by Plant equipment for underground open excavation.

UNIT- IV: SUPER STRUCTURE CONSTRUCTION **9**

Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors Erection of articulated structures, braced domes and space decks.

UNIT- V: CONSTRUCTION EQUIPMENT **9**

Selection of equipment for earth work - earth moving operations - types of earthwork equipment - tractors, motor graders, scrapers, front end waders, earth movers – Equipment for foundation and pile driving. Equipment for compaction, batching, mixing and concreting - Equipment for material handling and erection of structures – types of cranes - Equipment for dredging – Safety Measures.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Know the different construction techniques and structural systems
- Understand various techniques and practices on masonry construction, flooring, and roofing.
- Plan the requirements for substructure construction.
- Know the methods and techniques involved in the construction of various types of super structures
- Select, maintain and operate hand and power tools and equipment used in the building construction sites.

TEXT BOOKS :

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", 5th Edition, McGraw Hill, Singapore, 1995.
2. Arora S.P. and Bindra S.P., "Building Construction, Planning Techniques and Method of Construction", Dhanpat Rai and Sons, 1997.

3. Varghese, P.C. "Building construction", Prentice Hall of India Pvt. Ltd, New Delhi, 2007.

REFERENCE BOOKS :

1. Jha J and Sinha S.K., "Construction and Foundation Engineering", Khanna Publishers, 1999.
2. Sharma S.C. —Construction Equipment and Management‖, Khanna Publishers New Delhi, 2002.
3. Deodhar, S.V. —Construction Equipment and Job Planning‖, Khanna Publishers, New Delhi, 2012.
4. Mahesh Varma, —Construction Equipment and its Planning and Application‖, Metropolitan Book Company, New Delhi, 1983.

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

1903410 STRENGTH OF MATERIALS LABORATORY

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OBJECTIVES:

- To conduct the various tests on cement.
- To evaluate on the properties of helical spring .
- To gain knowledge on the shear, compressive and tensile properties of materials.
- To understand gain knowledge on the impact and hardness properties of materials.
- To determine the deflection of metal beam.

LIST OF EXPERIMENTS

1. Tension test on steel rod

2. Compression test on wood
3. Double shear test on metal rod
4. Torsion test on mild steel rod
5. Impact test on metal specimen (Izod and Charpy)
6. Hardness test on metals (Rockwell and Brinell Hardness Tests)
7. Deflection test on metal beam
8. Compression test on helical spring
9. Tests on Cement.

TOTAL: 60 PERIODS

OUTCOMES:

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

- Conduct the various tests on cement experimentally.
- Evaluate on the properties of helical spring experimentally.
- Conduct the tests to calculate the shear, compressive and tensile properties of materials.
- Investigate the impact and hardness properties of materials experimentally.
- Determine the deflection of beam experimentally.

REFERENCE BOOKS:

1. Strength of Materials Laboratory Manual, Anna University, Chennai - 600 025.
2. M.S. Shetty, ―Concrete Technology-Theory and Practice‖, S. Chand & Company Ltd., New Delhi, 2008.
3. IS1786-2008 (Fourth Revision, Reaffirmed 2013), ―High strength deformed bars and wires for concrete reinforcement – Specification‘, 2008.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Sl. No.	Description of Equipment	Quantity
1.	UTM of minimum 400 kN capacity	1
2.	Torsion testing machine	1
3.	Izod impact testing machine	1

4.	Hardness testing machine Rockwell , Brinnel and Vicker‘s *(any 2)*	1 each
5.	Beam deflection test apparatus	1
6.	Extensometer	1
7.	Compressometer	1
8.	Dial gauge	1
9.	Le Chatelier‘s apparatus	2
10.	Vicat‘s apparatus	2
11.	Mortar cube moulds	10

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

1903411 HYDRAULIC ENGINEERING LABORATORY L T P C

0 0 4 2

OBJECTIVES:

- Students should be able to verify the principles studied in theory by performing the experiments in lab.
- Reinforcing the fundamentals of fluid mechanics and machinery by hands on experiment.
- hands on experiments in calibration of flow meters
- Performance characteristics of pumps
- Performance characteristics of turbines

LIST OF EXPERIMENTS:

A. FLOW MEASUREMENT

1. Calibration of Rotameter
2. Calibration of Venturimeter / Orificemeter
3. Bernoulli‘s Experiment

B. LOSSES IN PIPES

4. Determination of friction factor in pipes
5. Determination of min or losses

C. PUMPS

6. Characteristics of Centrifugal pumps
7. Characteristics of Gear pump
8. Characteristics of Submersible pump
9. Characteristics of Multistage Centrifugal pumps
10. Characteristics of Reciprocating pump

D. TURBINES

11. Characteristics of Pelton wheel turbine
12. Characteristics of Francis turbine/Kaplan turbine

E. DETERMINATION OF METACENTRIC HEIGHT

13. Determination of Metacentric height of floating bodies

TOTAL: 60 PERIODS

OUTCOMES:

- The students will be able to measure flow in pipes and
- The students will be able to determine frictional losses.
- The students will be able to develop characteristics of pumps
- The students will be able to develop characteristics of turbines.
- The students will have through knowledge on floating bodies.

REFERENCE BOOKS:

1. Sarbjit Singh."Experiments in Fluid Mechanics", Prentice Hall of India Pvt. Ltd, Learning Private Limited, Delhi, 2009.
2. "Hydraulic Laboratory Manual", Centre for Water Resources, Anna University, 2004.

3. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2000.
4. Subramanya K. "Flow in open channels", Tata McGraw Hill Publishing.Company, 2001.

LIST OF EQUIPMENTS:

1. One set up of Rotometer
2. One set up of Venturimeter/Orifice meter
3. One Bernoulli‘s Experiment set up
4. One set up of Sigle stage and Multistage Centrifugal Pump
5. One set up of Gear Pump
6. One set up of Submersible pump
7. One set up of Reciprocating Pump
8. One set up of Pelton Wheel turbine
9. One set up of Francis turbines/one set of kaplon turbine
10. One set up of equipment for determination of Metacentric height of floating bodies
11. One set up for determination of friction factor in pipes
12. One set up for determination of minor losses.

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1	2	2	1	3	1	2	2	1	2	1	1	2	3	3	2	3
2	3	2	1	3	1	2	2	1	2	1	1	2	3	2	3	2
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5	3	3	2	3	1	2	2	1	3	1	1	2	2	2	2	3

1903501 DESIGN OF REINFORCED CEMENT CONCRETE ELEMENTS L T P C

3 1 0 4

OBJECTIVES:

- To introduce the different types of philosophies related to structural elements such as slab, beam, column and footing.
- Design of any structural system with reference to Indian standard code of practice.
- To understand about working stress method and limit state method.
- Understand the behavior of reinforced concrete elements.
- To Know the various types of Staircases.

UNIT- I: METHODS OF DESIGN OF CONCRETE STRUCTURES 9+3

Objective of structural design-Steps in RCC Structural Design Process- Type of Loads on Structures and Load combinations- Code of practices and Specifications - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC –Properties of Concrete and Reinforcing Steel - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods- Analysis and Design of Singly reinforced Rectangular beams by working stress method.

UNIT- II: LIMIT STATE DESIGN OF BEAMS 9+3

Analysis and design of singly and doubly reinforced rectangular and flanged beams– Use of IS codes and design aids for Flexure - Behaviour of rectangular RC beams in bond, anchorage, shear and torsion - Design of RC members for combined Bending, Shear and Torsion.

UNIT- III: LIMIT STATE DESIGN OF SLABS AND STAIRCASE 9+3

Analysis and design of cantilever, one way simply supported and continuous slabs and supporting beams-Two way slab- Design of simply supported and continuous slabs using IS code coefficients- Types of Staircases – Design of dog-legged Staircase.

UNIT- IV: LIMIT STATE DESIGN OF COLUMNS 9+3

Types of columns –Axially Loaded columns – Design of short Rectangular Square and circular columns –Design of Slender columns- Design for Uniaxial and Biaxial bending using Column Curves

UNIT- V: LIMIT STATE DESIGN OF FOOTINGS 9+3

Concepts of Proportioning footings and foundations based on soil properties-Design of wall footing – Design of axially and eccentrically loaded Square, Rectangular pad and sloped footings– Design of Combined Rectangular footing for two columns only.

TOTAL: 60 PERIODS

OUTCOMES:

Students will be able to

- Understand the various design methodologies for the design of RC elements.
- Know the analysis and design of beams by limit state method and design of beams for bending, shear and torsion.
- Design the various types of slabs and staircase by limit state method.
- Design columns for axial, uniaxial and biaxial eccentric loadings.
- Design of footing by limit state method.

TEXT BOOKS:

1. Varghese, P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, Pvt. Ltd., New Delhi, 2002.
2. Gambhir. M.L., “Fundamentals of Reinforced Concrete Design", Prentice Hall of India Private Limited, New Delhi, 2006.
3. Subramanian,N., “Design of Reinforced Concrete Structures”, Oxford University Press, New Delhi, 2013.
4. Krishnaraju.N, “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
5. Ramachandra, “Limit state Design of Concrete Structures” Standard Book House, New Delhi
6. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of Reinforced Concrete”, Laxmi Publication Pvt. Ltd., New Delhi, 2007.

REFERENCE BOOKS:

1. IS 456:2000, “Code of practice for Plain and Reinforced Concrete”, Bureau of Indian Standards, New Delhi, 2000
2. SP16, IS 456:1978, “Design Aids for Reinforced Concrete to Bureau of Indian Standards”, New Delhi, 1999
3. Jain, A.K., “Limit State Design of RC Structures”, Nemchand Publications, Roorkee, 1998

4. Sinha, S.N., “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd. New Delhi, 2002
5. Shah V L Karve S R., “Limit State Theory and Design of Reinforced Concrete”, Structures Publications, Pune, 2013.
6. Unnikrishna Pillai, S., Devadas Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Company Ltd., 2009
7. Bandyopadhyay. J.N., “Design of Concrete Structures”, Prentice Hall of India Pvt. Ltd., New Delhi, 2008.

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

1903502 STRUCTURAL ANALYSIS I L T P C

3 0 0 3

OBJECTIVES:

- To ensure the reliability and durability of structures.
- To understand the complex analysis of indeterminate structures with different end conditions through various classical methods of analysis of indeterminate structures.
- To learn the concept of force method and displacement method of analysis using matrix approach.
- To apply the equation of equilibrium to structures and compute the reaction.
- To Derive the shear and bending moment equations for indeterminate structures and draw the shearing force and bending moment diagrams.

UNIT- I: INDETERMINATE FRAMES 9

Degree of Static and Kinematic Indeterminacies – Analysis of continuous beams, plane frames and indeterminate plane trusses by strain energy method (up to two degree of redundancy)

UNIT- II: SLOPE DEFLECTION METHOD 9

Slope deflection equations – Sign conventions -Equilibrium conditions - Analysis of continuous beams and rigid frames– Rigid frames with inclined members - Support settlements- symmetric frames with Symmetric and Skew-symmetric loadings.

UNIT- III: MOMENT DISTRIBUTION METHOD **9**

Stiffness and carry over factors – Distribution and carryover of moments - Analysis of continuous Beams- Plane rigid frames with and without sway – Support settlement - symmetric frames with symmetric and skew-symmetric loadings.

UNIT- IV: FLEXIBILITY METHOD **9**

Equilibrium Vs Compatibility -Primary structures - Compatibility conditions – Formation flexibility matrices - Analysis of Indeterminate pin- jointed plane frames, continuous beams and rigid jointed plane frames by direct flexibility approach.

UNIT-V: STIFFNESS METHOD **9**

Restrained structure –Formation of stiffness matrices – Rotation matrix – Transformation of Stiffness matrices -Analysis of Continuous Beams, Pin-jointed plane frames and rigid frames by direct stiffness method.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Analyze continuous beams, pin-jointed indeterminate plane frames and rigid plane frames by strain energy method
- Analyse the continuous beams and rigid frames by slope defection method.
- Understand the concept of moment distribution and analysis of continuous beams and rigid frames with and without sway.
- Analyse the indeterminate pin jointed plane frames continuous beams and rigid frames using matrix flexibility method.
- Understand the concept of matrix stiffness method and analysis of continuous beams, pin jointed trusses and rigid plane frames.

TEXT BOOKS:

1. Bhavikatti, S.S “Structural Analysis”, Vol.1,& 2, Vikas Publishing House Pvt.Ltd., NewDelhi-4, 2014.
2. Bhavikatti, S.S, “Matrix Method of Structural Analysis”, I. K. International Publishing House Pvt.Ltd., New Delhi-4, 2014.
3. Vazrani.V.N and Ratwani, M.M, “Analysis of Structures”, Vol.II, Khanna Publishers, 2015.

4. Pandit G.S. and Gupta S.P., ”Structural Analysis – A Matrix Approach”, Tata McGraw Hill Publishing Company Ltd.,2006

REFERENCE BOOKS:

1. Punmia. B.C, Ashok Kumar Jain & Arun Kumar Jain, “Theory of structures”, Laxmi Publications , New Delhi, 2004.
2. William Weaver, Jrand James M.Gere, “Matrix analysis of framed structures”, CBS Publishers & Distributors, Delhi,1995
3. Hibbeler, R.C.,”Structural Analysis”, VII Edition, Prentice Hall, 2012.
4. Reddy.C.S, “Basic Structural Analysis” ,Tata McGraw Hill Publishing Company,2005.
5. Rajasekaran.S,&G.Sankarasubramanian., “Computational Structural Mechanics”, PHI Learning Pvt. Ltd, 2015

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1	3	-	2	3	-	-	-	1	2	-	-	2	1	2	1	-
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3	2	2	-	-	2	-	-	1	2	-	-	2	1	2	3	-
4	3	3	2	-	-	-	-	1	2	-	-	2	-	2	1	-
5	2	-	-	-	3	-	-	1	2	-	-	2	-	2	3	1

1903503 HIGHWAY ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To give an overview about the highway engineering with respect to planning.
- To gain the knowledge of flexible and rigid pavements design.
- At the end of the course the students have knowledge of construction and maintenance of highways as per IRC standards.
- To design road geometry to ensure stability of vehicles when negotiating curves and grades and to provide adequate sight distances for undertaking passing maneuvers along curves on two-lane, two-way roads.
- To learn the basic characteristics of transportation planning and the models.

UNIT- I: HIGHWAY PLANNING AND ALIGNMENT 9

Significance of highway planning – Modal limitations towards sustainability - History of road development in India – factors influencing highway alignment – Soil suitability analysis - Road ecology - Engineering surveys for alignment, objectives, conventional and modern methods Classification of highways – Locations and functions – Typical cross sections of Urban and Rural roads – Highway pricing

UNIT- II: GEOMETRIC DESIGN OF HIGHWAYS **9**

Cross sectional elements - Sight distances – Horizontal curves, Super elevation, transition curves, widening at curves – Vertical curves - Gradients, Special consideration for hill roads Hairpin bends – Lateral and vertical clearance at underpasses.

UNIT- III: DESIGN OF FLEXIBLE AND RIGID PAVEMENTS **9**

Pavement components and their role - Design principles -Design practice for flexible and rigid pavements (IRC methods only) – Embankments- Problems in Flexible pavement design.

UNIT- IV: HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE **9**

Highway construction materials, properties, testing methods – CBR Test for subgrade - tests on aggregate & bitumen – Test on Bituminous mixes-Construction practice including modern materials and methods, Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials – Glass, Fiber, Plastic, Geo-Textiles, Geo-Membrane (problem not included) – Quality control measures - Highway drainage –– Construction machineries.

UNIT- V: EVALUATION AND MAINTENANCE OF PAVEMENTS **9**

Pavement distress in flexible and rigid pavements – Types of maintenance – Pavement management Systems - Pavement evaluation, roughness, present serviceability index, skid resistance, structural evaluation, evaluation by deflection measurements (Benkelman beam deflection test) – Strengthening of pavements –Overlay design - Highway Project formulation.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Get knowledge on planning and aligning of highway.
- Geometric design of highways and design of flexible and rigid pavements.
- Gain knowledge on Highway construction materials, properties and testing methods.

- Understand the concept of pavement management system and evaluation of distress
- Get knowledge of maintenance of pavements.

TEXT BOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. “Highway Engineering”, Nemchand Publishers, 2014.
2. Subramanian K.P., “Highways, Railways, Airport and Harbour Engineering”, Scitech Publications (India), Chennai, 2010
3. Kadiyali.L.R. “Principles and Practice of Highway Engineering”, Khanna Technical Publications, 8th edition Delhi, 2013.

REFERENCE BOOKS:

1. Indian Road Congress (IRC), “Guidelines for the Design of Flexible Pavements”, (Third Revision), IRC: 37-2012
2. Indian Road Congress (IRC), “Guidelines for the Design of Plain Jointed Rigid Pavements for Highways”, (Third Revision), IRC: 58-2012
3. Yang H. Huang, “Pavement Analysis and Design", Pearson Education Inc, Nineth Impression, South Asia, 2012
4. Ian D. Walsh, "ICE manual of highway design and management", ICE Publishers, Ist Edition, USA, 2011
5. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, “Principles of Highway Engineering and Traffic Analysis”, Wiley India Pvt. Ltd., New Delhi, 2011
6. Garber and Hoel, “Principles of Traffic and Highway Engineering”, CENGAGE Learning, New Delhi, 2010
7. O‘Flaherty.C.A “Highways”, Butterworth – Heinemann, Oxford, 2006.

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

1903504 FOUNDATION ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge to plan and execute a detail site investigation programme.
- To select geotechnical design parameters and type of foundations.
- Also to familiarize the students for the geotechnical design of different type of foundations and retaining walls.
- To know the settlement of foundations on shallow and deep foundations.
- To learn the contact pressure and settlement of foundations for various footings and rafts.

UNIT- I: SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Scope and objectives – Methods of exploration – Auguring and boring – Wash boring and rotary drilling – Geophysical methods - Depth and spacing of bore holes – Soil samples – Representative and undisturbed – Sampling methods – Split spoon sampler, Thin wall sampler, Stationary piston sampler – Penetration tests (SPT and SCPT) – Data interpretation - Strength parameters - Bore log report- Selection of foundation based on soil condition.

UNIT- II: SHALLOW FOUNDATION 9

Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi‘s Bearing Capacity Theory and BIS formula - problems – Factors affecting bearing capacity – Bearing capacity from in-situ tests (SPT, SCPT and plate load) – Allowable bearing pressure – Seismic considerations in bearing capacity evaluation. Determination of Settlement of foundations on granular and clay deposits – Total and differential settlement – Allowable settlements – Codal provision – Methods of minimizing total and differential settlements.

UNIT- III: FOOTINGS AND RAFTS 9

Types of Isolated footing, Combined footing, Mat foundation – Contact pressure and settlement distribution – Proportioning of foundations for conventional rigid behaviour – Minimum thickness for rigid behaviour – Applications – Compensated foundation – Codal provision

UNIT- IV: DEEP FOUNDATION 9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Design methodology for piles - Static formula – Dynamic formulae (Engineering news and Hileys) – Capacity from insitu tests (SPT and SCPT) –Negative skin friction – Uplift capacity Group capacity by different methods (Feld‘s rule, Converse – Labarra formula and block failure criterion) – Settlement of pile groups – Interpretation of pile load test (routine test only), Under reamed piles – Capacity under compression and uplift – Cohesive – expansive – non expansive – Cohesionless soils – Codal provisions.

UNIT- V: RETAINING WALLS **9**

Introduction- Plastic equilibrium in soils – Active and passive states – Rankine‘s theory – Cohesionless and cohesive soil – Coulomb‘s wedge theory – Condition for critical failure plane – Earth pressure on retaining walls of simple configurations – Culmann‘s Graphical method – Pressure on the wall due to line load.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Understand the site investigation, methods and sampling.
- Get knowledge on bearing capacity and testing methods.
- To design various types of shallow footings.
- Determine the load carrying capacity, settlement of pile foundation.
- Determine the earth pressure on retaining walls and analysis for stability.

TEXT BOOKS:

1. Murthy, V.N.S., Text book of “Soil Mechanics and Foundation Engineering”, CBS Publishers Distribution Ltd., New Delhi. 2014.
2. Arora, K.R., “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 7th Edition, 2017 (Reprint).
3. Punmia, B.C., “Soil Mechanics and Foundations”, Laxmi Publications Pvt. Ltd. New Delhi, 16th Edition 2017.

REFERENCE BOOKS:

1. Braja M Das, “Principles of Foundation Engineering” (8th Edition), Cengage Learning 2014.
2. Kaniraj, S.R. “Design aids in Soil Mechanics and Foundation Engineering”, Tata McGraw Hill publishing company Ltd., New Delhi, 2014.

3. Joseph E bowles, “Foundation Analysis and design”, McGraw Hill Education, 5th Edition, 2015.
4. IS Code 6403:1981 (Reaffirmed 1997) “Bearing capacity of shallow foundation”, Bureau of Indian Standards, New Delhi.
5. IS Code 8009 (Part 1):1976 (Reaffirmed 1998) “Shallow foundations subjected to symmetrical static vertical loads”, Bureau of Indian Standards, New Delhi.
6. IS Code 8009 (Part 2):1980 (Reaffirmed 1995)”Deep foundations subjected to symmetrical static vertical loading”, Bureau of Indian Standards, New Delhi.
7. IS Code 2911 (Part 1): 1979 (Reaffirmed 1997) “Concrete Piles” Bureau of Indian Standards, New Delhi.
8. IS Code 2911 (Part 2): 1979 (Reaffirmed 1997) “Timber Piles”, Bureau of Indian Standards, New Delhi.
9. IS Code 2911 (Part 3) : 1979 (Reaffirmed 1997) “Under Reamed Piles”, Bureau of Indian Standards, New Delhi.
10. IS Code 2911 (Part 4): 1979 (Reaffirmed 1997) “Load Test on Piles”, Bureau of Indian Standards, New Delhi.
11. IS Code 1904: 1986 (Reaffirmed 1995) “Design and Construction of Foundations in Soils”, Bureau of Indian Standards, New Delhi.
12. IS Code 2131: 1981 (Reaffirmed 1997) “Method for Standard Penetration test for Soils”, Bureau of Indian Standards, New Delhi.
13. IS Code 2132: 1986 (Reaffirmed 1997), “Code of Practice for Thin – walled tube sampling for soils”, Bureau of Indian Standards, New Delhi.
14. IS Code 1892 (1979): “Code of Practice for subsurface Investigation for Foundations”. Bureau of Indian Standards, New Delhi.
15. IS Code 14458 (Part 1): 1998 “Retaining Wall for Hill Area – Guidelines, Selection of Type of Wall”, Bureau of Indian Standards, New Delhi.

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

1903511 SOIL MECHANICS LABORATORY L T P C

0 0 4 2

OBJECTIVES:

- To study the particle size distribution of different soil.
- To enhance the knowledge on various index properties of soil.
- To gain knowledge about the compaction characteristics of soil.
- To learn about the shearing properties of soil.
- To study about the bearing capacity of soil.

EXERCISES:

1. DETERMINATION OF INDEX PROPERTIES 20

a. Specific gravity of soil solids

b. Grain size distribution of cohesionless soil – Sieve analysis

c. Grain size distribution of cohesive soil- Hydrometer analysis

d. Liquid limit and Plastic limit tests on cohesive soil

e. Shrinkage limit and Differential free swell tests for cohesive soil.

2. DETERMINATION OF INSITU DENSITY AND COMPACTION CHARACTERISTICS 12

a. Field density Test (Sand replacement method)

b. Determination of moisture – density relationship using standard Proctor Compaction test.

c. Determination of relative density for the given sample.

3. DETERMINATION OF ENGINEERING PROPERTIES 28

a. Constant Head Permeability determination for given sample.

b. Falling Head Permeability determination for given sample.

c. One dimensional consolidation test (Demonstration only)

d. Direct shear test in cohesionless soil

e. Unconfined compression test in cohesive soil

f. Laboratory vane shear test in cohesive soil

g. Tri-axial compression test in cohesionless soil (Demonstration only)

h. California Bearing Ratio Test for the given soil

TOTAL: 60 PERIODS

OUTCOMES:

- Students are able to classify the soil based on IS Code

- Students are able to conduct tests to determine both the index properties
- Students are able to conduct tests on engineering properties of soils
- Students are able to conduct tests on characterization of the soil based on their properties.
- Students are able to conduct field tests on soil.

REFERENCE BOOKS:

1. Soil Engineering Laboratory Instruction Manual, published by Engineering College Cooperative Society, Anna University, Chennai, 2010.
2. Lambe T.W., “Soil Testing for Engineers”, John Wiley and Sons, New York,1951. Digitized 2008.
3. Saibaba Reddy, E.Ramasastri, K. “Measurement of Engineering Properties of Soils” New Age International (P) Limited Publishers, New Delhi, 2002.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, and New Delhi.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

Sl.No.	Description of Equipment	Quantity
1.	Sieves	2 sets
2.	Hydrometer	2 sets
3.	Liquid and Plastic limit apparatus	2 sets
4.	Shrinkage limit apparatus	3 sets
5.	Proctor Compaction apparatus	2 sets
6.	UTM of minimum of 20kN capacity	1
7.	Direct Shear apparatus	1
8.	Thermometer	2
9.	Sand replacement method accessories	2
10.	Tri-axial Shear apparatus	1
11.	Three Gang Consolidation test device	1
12.	Relative Density apparatus	1
13.	Van Shear apparatus	1
14.	Weighing machine – 20kg capacity	1 No
15.	Weighing machine – 1kg capacity	1 No

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

1903512 HIGHWAY ENGINEERING LABORATORY L T PC

0 0 4 2

OBJECTIVES:

- To learn the principles and procedures of testing of coarse aggregates.
- To study about various test on bitumen.
- To enhance the knowledge on properties of fresh concrete.
- To gain knowledge about the strength properties of hardened concrete.
- To learn about the test on bituminous mixes.

EXCERCISES:

1. TESTS ON AGGREGATES 15

a) Specific Gravity on aggregates

b) Los Angeles Abrasion Test on aggregates

c) Water Absorption of Aggregates on aggregates

2. TESTS ON BITUMEN 15

a) Specific Gravity of Bitumen

b) Penetration Test of Bitumen

c) Viscosity Test of Bitumen

d) Softening Point Test of Bitumen

e) Ductility Test of Bitumen

3. TESTS ON CONCRETE 15

a) Flow table test of concrete

b) Vee bee Test of concrete

c) Test for Flexural strength of concrete

4. TESTS ON BITUMINOUS MIXES 15

a) Stripping Test on bituminous mixes

b) Determination of Binder Content on bituminous mixes

c) Marshall Stability and Flow Values on bituminous mixes

TOTAL: 60 PERIODS

OUTCOMES:

- Student knows the techniques to characterize various pavement materials through relevant tests.
- Students are able to conduct tests on aggregates.
- Students are able to conduct tests on bitumen.
- Students are able to conduct tests on concrete.
- Students are able to classify various mix of bitumen.

REFERENCE BOOKS:

1. Highway Materials and Pavement Testing, NemChand and Bros., Roorkee, Revised Fifth Edition, 2009.
2. Methods for testing tar and bituminous materials, IS 1201–1978 to IS 1220–1978, Bureau of Indian Standards.
3. Methods of test for aggregates, IS 2386 – 1978, Bureau of Indian Standards
4. Mix Design Methods Asphalt Institute Manual Series No. 2, Sixth Edition,1997, Lexington, KY, USA.

Sl.No.	Description of Equipment	Quantity
1.	Concrete cube moulds	6
2.	Concrete cylinder moulds	6
3.	Concrete Prism moulds	3
4.	IS Sieves 40 mm,31.5 mm, 25 mm, 20mm, 16mm, 12.5 mm, 10mm, 6.3 mm	2
5.	Concrete Mixer machine	1
6.	Slump cone	3
7.	Flow table	1
8.	Vibrator	1
9.	Trovels and planers	1
10.	UTM - 400 kN capacity	1
11.	Vee Bee Consistometer	1
12.	Pycnometer	2
13.	Bitumen Extractor	1
14.	Los - Angeles abrasion testing machine	1
15.	Marshall Stability Apparatus	1
16.	Compression testing machine	1
17.	Flexure testing machine	1
18.	Ductility Testing Machine	1

19.	IS sieves 12.5 mm, 10 mm and 2.36 mm	2
20.	Oven	1
21.	Tar Viscometer	1
22.	Ring and Ball apparatus	1
23.	Standard Penetrometer (Electrical)	1

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

1903513 **SURVEY CAMP** **L T P C**

0 0 0 2

(During IV semester Summer Vacation 2 weeks)

OBJECTIVES:

- The objective of the survey camp is to enable the students to do the experiments in the various types of surveying to provide better knowledge and skill in facing field work and working out of contour map and profile levelling.
- Acquire practical knowledge on handling survey instruments like Theodolite – to measure horizontal, vertical angles, calculation of area and elevation of ground surface.
- Acquire adequate knowledge to carryout Triangulation, understand the importance of Triangulation and their applications in surveying
- Tacheometery - to identify the elevation and horizontal distance between instrument and object
- Acquire field knowledge on handling survey instruments like Total station including general field marking for various engineering projects

Course content:

Groups of not more than six members in a group will carry out each exercise in survey camp. The camp must involve work on a large area of not less than 40 acres outside

the campus (Survey camp should not be conducted inside the campus). At the end of the camp, each student shall have mapped and contoured the area. The camp record shall include all original field observations, calculations and plots.

Two weeks Survey Camp will be conducted during summer vacation in the following activities:

1. Triangulation and Trilateration- using theodolite.
2. Traverse - using Total station.
3. Contouring

    (i) Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line.

    (ii) Block Level/ by squares of size at least 100 Meter x 100 Meter at least 20 Meter interval.

    (iii). L.S & C.S - Road and canal alignment for a Length of not less than 1 Kilo Meter at least L.S at Every 30M and C.S at every 90 M.
4. Offset of Buildings and Plotting the Location.
5. Sun observation to determine azimuth (guidelines to be given to the students).
6. Use of GPS to determine latitude and longitude and locate the survey camp location.
7. Traversing using GPS.
8. Curve setting by deflection angle.

Apart from above students may be given survey exercises in other area also based on site condition to give good exposure on survey.

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1	3	1	-	-	-	-	-	-	1	-	-	2	2	1	-	1
2	3	3	2	-	-	-	-	-	-	-	-	-	2	2	1	-
3	3	3	2	2	-	-	-	-	2	-	-	-	2	2	-	1
4	3	1	1	-	-	-	-	-	2	-	-	2	3	-	1	2
5	3	1	1	2	3	-	-	-	-	-	-	-	3	2	2	1

1919002 PROFESSIONAL COMMUNICATION L T P C
0 0 2 1

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 **6**

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

UNIT- II **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 **6**

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

UNIT- IV **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 **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 Periods: 30

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

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

OUTCOMES:

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

- Make effective presentations and participate confidently in Group Discussions
- Attend job interviews and interacting in different situations.
- Able to 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 Communication for Professional Success. Orient Blackswan: Hyderabad, 2015

4. Raman, Meenakshi and Sangeeta Sharma. Professional Communication. Oxford University Press: Oxford, 2014

5. S. Hariharan. Soft Skills. MJP Publishers: Chennai, 2010.

6. Successful Presentations: DVD and Student's Book. A video series teaching business communication skills for adult professionals by John Huges and Andrew Mallett- OUP 2012.

7. 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 2009.

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

1903601 DESIGN OF STEEL STRUCTURAL ELEMENTS L T P C

3 1 0 4

OBJECTIVES:

- Apply the IS (800-2007) code practice for the design of steel structural elements, analyses and design tension members.
- To understand the basic concepts of limit state design of structural members.
- Design bolted and welded connections.
- Under Stand the concept of lateral buckling and design various elements like gantry girder, plate girder, beam- column.
- Learn the design of connections, roof truss and purlin design.

UNIT- I: INTRODUCTION 9L+3T

Properties of steel – Structural steel sections – Limit State Design Concepts – Loads on Structures–Basic concepts of connection-Bolted connection: Types of bolts-modes of failures; Joints subjected to direct and eccentric load-Welded connection: Types and strength of welds Butt and fillet welds -Joints subjected to direct load and eccentric load.

UNIT- II: TENSION MEMBERS **9L+3T**

Types of sections – Net area – Net effective sections for angles and Tee in tension – Design of connections in tension members – Use of lug angles – Design of tension splice – Concept of shear lag.

UNIT- III: COMPRESSION MEMBERS **9L+3T**

Types of compression members – Theory of columns – Basis of current codal provision for compression member design – Slenderness ratio – Design of single section and compound section compression members – Design of laced and battened type columns.

UNIT- IV: BEAMS **9L+3T**

Beams: Types of steel beams- Modes of failure - Design of laterally supported and unsupported beams – Built up beams – Beams subjected to uniaxial and biaxial bending- Design for strength and serviceability- Web yielding- Web crippling-Bearing stiffeners. Welded plate girder, Components-Stiffener-Analysis and design using IS 800-2007 of welded plate girder.

UNIT- V: INDUSTRIAL STRUCTURES **9L+3T**

Roof Trusses - calculation of dead load- live load & wind load - Design of joints - supports members for pitched roof truss – Design of purlins and Design principles of gantry girder.

TOTAL: 45L+15T PERIODS

OUTCOMES:

- Able to understand about the various types of connections.
- Able to design tension splices and braced members.
- Understand about basic elements of steel structures such as Tension and compression members.
- Able to design the beams and beam-column
- Able to design the Industrial structures.

TEXT BOOKS:

1. Gambhir M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt. Ltd., 2013
2. Shiyekar M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2nd Edition, 2013.

3. Subramanian N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.

REFERENCE BOOKS:

1. Narayanan.R.et.al, "Teaching Resource on Structural Steel Design", INSDAG, Ministry of Steel Publications, 2002.
2. Duggal S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company, 2005.
3. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800–2007, IK International Publishing House Pvt. Ltd., 2009.
4. Shah.V.L and Veena Gore, "Limit State Design of Steel Structures", IS 800–2007 Structures Publications, 2009.
5. IS800:2007, General Construction In Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007.

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1	1	-	-	3	3	-	1	-	1	2	-	2	3	1	2	3
2	2	3	3	1	3	2	-	2	2	-	-	2	3	3	1	2
3	2	3	3	2	1	-	2	-	-	2	-	2	3	3	1	3
4	2	3	2	3	3	2	-	-	2	2	-	2	3	3	2	3
5	3	2	2	2	3	-	-	2	2	-	-	3	3	3	2	3

1903602 STRUCTURAL ANALYSIS II L T P C

3 0 0 3

OBJECTIVES:

- To learn the method of drawing the influence lines in determinate structures and its uses in various applications like beams and plane trusses.
- To learn the method of drawing the influence lines in in-determinate structures and its uses in various applications like beams and plane trusses.
- To learn the concepts of analysis in parabolic and circular arches .
- To learn the concepts of analysis in suspension cables
- To learn Plastic analysis of beams and rigid frames.

UNIT- I: INFLUENCE LINES FOR DETERMINATE BEAMS **9**

Analysis of moving loads-Influence line diagram(ILD)-Influence lines for reactions in statically determinate beams – Influence lines for shear force and bending moment in beam sections– Calculation of critical stress resultants due to concentrated and distributed moving loads – absolute maximum bending moment - influence lines for member forces in pin jointed plane frames.

UNIT- II: INFLUENCE LINES FOR INDETERMINATE BEAMS **9**

Muller Breslau‘s principle– Influence line for Shearing force, Bending Moment and support reaction components of propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams, Indirect model analysis for Indeterminate Structures.

UNIT- III: ARCHES **9**

Arches - Types of arches –Examples of Structures- Analysis of three hinged and two hinged arches with effect of temperature change-rib shortening-yielding of supports Parabolic and circular arches – Settlement effects.

UNIT- IV: CABLES AND SUSPENSION BRIDGES **9**

Equilibrium of cable – length of cable-Horizontal thrust on the cable- anchorage of suspension cables – stiffening girders - cables with three hinged stiffening girders – Influence lines for three hinged stiffening girders.

UNIT- V: PLASTIC ANALYSIS **9**

Plastic theory - Statically indeterminate structures – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – collapse load - Static and kinematic methods –Upper and lower bound theorems -Plastic analysis of indeterminate beams and frames.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Draw influence lines for statically determinate structures and calculate critical stress resultants.
- Understand Muller Breslau principle and draw the influence lines for statically indeterminate beams.
- Analyse of three hinged, two hinged and fixed arches.

- Analyse the suspension bridges with stiffening girders
- Understand the concept of Plastic analysis and the method of analyzing beams and rigid frames.

TEXT BOOKS:

1. Bhavikatti,S.S, “Structural Analysis,Vol.1 & 2”, Vikas Publishing House Pvt.Ltd., NewDelhi 4, 2014.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, “Theory of structures”, Laxmi, Publications, 2004.
3. Vazrani V.N and Ratwani M.M, “Analysis of Structures”, Vol.II, Khanna Publishers, 2015.

REFERENCE BOOKS:

1. Negi.L.S and Jangid R.S, “Structural Analysis”, Tata McGraw-Hill Publishers, 2004.
2. Reddy C.S, “Basic Structural Analysis”, Tata McGraw Hill Publishing Co.Ltd 2002.
3. Gambhir.M.L, “Fundamentals of Structural Mechanics and Analysis”, PHIL earning Pvt. Ltd, 2011.
4. Prakash Rao D.S, “Structural Analysis”, Universities Press, 1996.

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

1903603 RAILWAYS, AIRPORTS, DOCKS AND HARBOUR ENGINEERING L T PC

3 0 0 3

OBJECTIVES:

- To understand the planning and construction of railways, airport and harbour.
- To gain the knowledge of geometric design of railways and design principles of airport and harbour.
- To understand about maintenance of railways, airport and harbour.

- To learn the design concept of runway design and taxiway design of airport.
- To study the terms of harbour and also to learn about the planning and design of harbour.

UNIT- I: RAILWAY PLANNING AND CONSTRUCTION **9**

Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, Selection of gauges - Track Stress, coning of wheels, creep in rails, defects in rails – Route alignment surveys, conventional and modern methods--Geometric design of railway, gradient, super elevation, widening of gauge on curves- Level Crossings.

UNIT- II: RAILWAY CONSTRUCTION AND MAINTENANCE **9**

Earthwork – Stabilization of track on poor soil - Track drainage – Calculation of Materials required for track laying - Construction and maintenance of tracks – Railway Station and yards and passenger amenities- Signalling.

UNIT- III: AIRPORT PLANNING **9**

Air transport characteristics -airport components - airport classification – ICAO - airport planning: Site selection typical Airport Layouts, Case Studies, parking and Circulation Area.

UNIT- IV: AIRPORT DESIGN **9**

Runway Design: Orientation, Wind Rose Diagram, Problems on basic and Actual Length, Geometric Design – Elements of Taxiway Design – Airport Zones – Passenger Facilities and Services – Runway and Taxiway Markings.

UNIT- V: HARBOUR ENGINEERING **9**

Definition of Basic Terms: Harbour, Port, Satellite Port, Docks, Waves and Tides – Planning and Design of Harbours: Harbour Layout and Terminal Facilities – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage – Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works – Coastal Regulation Zone, 2011.

TOTAL: 45 PERIODS

OUTCOMES:

Students who successfully complete this course will be able to:

- Understand the methods of route alignment and design elements in Railway Planning and Constructions.
- Understand the Construction techniques and Maintenance of Track laying and Railway stations.

- Gain an insight on the planning and site selection of Airport Planning and design.
- Analyze and design the elements for orientation of runways and passenger facility systems.
- Understand the various features in Harbours and Ports, their construction, coastal protection works and coastal Regulations to be adopted.

TEXT BOOKS:

1. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", V Scitech Publications (India), Chennai, 2010.
2. Saxena Subhash, C.and Satyapal Arora, "A Course in Railway Engineering", Dhanapat Rai and Sons, Delhi, 1998.
3. Khanna.S.K. Arora.M.G and Jain.S.S, "Airport Planning and Design", Nemachand and Bros, Roorkee, 1994.

REFERENCE BOOKS:

1. Venkatramaiah. C., "Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press (India) Private Limited, Hyderabad, 2015.
2. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013.
3. Srinivasan.R, Harbour Dock and Tunnel Engineering, Charotar Publishing House, 29th Edition: 2018.

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

1903604 WATER SUPPLY AND WASTEWATER ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To know about the objectives and sources of water.
- To equip the students with the principles and design of water treatment units and distribution system.

- To develop the student ability to apply basic understanding of physical, chemical, and biological phenomena for successful design and maintenance of sewage treatment plants.
- To study the concept of water treatment and their sources.
- To gain the knowledge of treatment techniques of water and waste water.

UNIT-I: WATER SUPPLY SYSTEM - SOURCE AND CONVEYANCE 9

Objectives- Population forecasting- Design period- Water demand - Characteristics- Sources of water – Selection of water source-Water quality parameters & significance - standards-Intake structures -Conveyance- Laying, jointing & testing of pipes- pump selection - System of water supply-Distribution – rain water harvesting.

UNIT-II: DESIGN PRINCIPLES OF WATER TREATMENT 9

Objectives-Selection of unit operations and process-Principles of screening, flocculation, sedimentation, filtration, disinfection, Softening- demineralization -Aeration-Iron removal Defluoridation-Construction, Operation and maintenance aspects.

UNIT-III: SEWERAGE SYSTEM: COLLECTION AND TRANSMISSION 9

Sources of wastewater- Quantity of sanitary sewage-storm water runoff estimation-wastewater characteristics and significance - design of sewers - laying, jointing and testing of sewers-sewer appurtenances-pump selection – Grey water harvesting.

UNIT-IV: SEWEAGE TREATMENT AND DESIGN PRINCIPLES 9

Objectives-Selection of unit operations and process-Design principles of primary and secondary treatment, screen chamber, grit chamber, primary sedimentation tank, activated sludge process Modified activated sludge process and oxidation ditch-Trickling filter, Stabilization ponds-Septic tank with soak pits - Sludge: Treatment and disposal.

UNIT-V: SEWAGE DISPOSAL AND RURAL SANITATION 9

Disposal on land-Sewage farming-Disposal into water bodies-Oxygen sag curve - Wastewater reclamation techniques-Sanitary fittings-one pipe and two pipe system general layout of house drainage connection.

TOTAL: 45 PERIODS

OUTCOMES:

- Identify the quantity and quality of water from various sources and the processes involved in the water conveyance systems.

- Infer the design principles of unit operations and processes for water treatment.
- Illustrate the design concepts and implementation of sewage transmission systems.
- Design various sewage treatment systems.
- Justify the suitable advanced treatment techniques for water and wastewater treatment.

TEXT BOOKS:

1. Garg S.K, “Environmental Engineering Vol.I & II”, Khanna Publishers, New Delhi, 2009.
2. Punmia B.C, Jain A.K. and Jain A., “Environmental Engineering, Vol.I & II”, Lakshmi Publications, Newsletter, 2007.
3. Birdie.G.S, “Water supply and sanitation Engineering”, Dhanpat Rai & Sons, 2003.

REFERENCE BOOKS:

1. Metcalf and Eddy, “Wastewater Engineering – Treatment and Reuse”, Tata McGraw-Hill Company, New Delhi, 2003.
2. “Manual on Wastewater and Treatment CPHEECO”, Ministry of Urban Affairs and employment, Government of India New Delhi, 1990.
3. Shan.C.S, “Water supply and sanitation”, Galgotia Publishing Company , New Delhi 1994.

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

1903610 WATER AND WASTE WATER ANALYSIS LABORATORY LT PC

0 0 4 2

OBJECTIVES:

- To analyse the physical, chemical and biological characteristics of water and wastewater.

- To quantify the dosage requirement for coagulation process.
- To study the growth of micro-organism and its quantification.
- To study about the oxygen demand in water .
- To gain knowledge on water pollution and the treatment methods.

List of Experiments:

1. Determination of pH, Turbidity and conductivity in water.
2. Determination of Hardness in water.
3. Determination of Alkalinity and Acidity in water sample.
4. Determination of Chlorides in given samples.
5. Determination of Phosphates and Sulphates in given water samples.
6. Determination of Optimum Coagulant dosage in waste water sample.
7. Determination of residual chlorine and available chlorine in bleaching powder.
8. Determination of suspended, settleable, volatile and fixed solids in waste water.
9. Determination Dissolved Oxygen and BOD for the given sample.
10. Determination of COD for given sample.
11. Determination of Sodium and Potassium for the given sample.
12. Determination of SVI of Biological sludge and microscopic examination.
13. Determination of MPN index of given water sample.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

- Quantify the pollutant concentration in water and wastewater.
- Suggest the type of treatment required and amount of dosage required for the treatment.
- Examine the conditions for the growth of micro-organisms
- Understand the impact of water and waste water treatment on people and environment.
- Understand and apply ethical issues associated with water.

Sl.No.	Description of Equipment	Quantity
1.	pH meter	2
2.	Nephelometer	2
3.	Conductivity meter	1
4.	UV and Visible Spectrophotometer	1
5.	Jar test apparatus	2
6.	DO meter	2

7.	BOD incubator	1
8.	COD digester (with 6 heating mantle)	2
9.	Imhoff cone	4
10.	Sterilization chamber	1
11.	Water bath	1
12.	Hot air oven	1
13.	Weighing machine(0.0001g)	1
14.	China dish	6
15.	Weighing machine(0.001g)	1
16.	Autoclave	1
17.	Muffle furnace	1
18.	Bacteriological incubator	1
19.	Nesslers tube 100 mL	2
20.	Burette 50mL with stand	15
21.	Pipette 10mL	5
22.	Pipette 5mL	5
23.	Pipette 2 mL	5
24.	Conical flask 250 mL	25
25.	Standard flask 100ml	5
26.	Standard flask 250ml	3
27.	Standard flask 500ml	4
28.	Standard flask 1000ml	3
29.	Compound microscope	1
30.	Test tubes 20mL	10
31.	Beaker1000mL	3
32.	Beaker 500mL	5
33.	Beaker 100mL	5
34.	Beaker 50mL	10
35.	Measuring jar 1000mL	2
36.	Measuring jar 100mL	3
37.	Measuring jar 50mL	5
38.	Measuring jar 25mL	5
39.	Measuring jar 10mL	10
40.	Measuring jar 5mL	10
41.	Digital Flame photometer	1
42.	Round bottom flask 250ml	5
43.	Round bottom flask 500ml	2
44.	Round bottom flask 1000ml	3

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

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

1903611 **MINI PROJECT** **L T P C**

0 0 4 2

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information relate to the same through detailed review of literature.
- To develop the methodology to solve the identified problem
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To prepare the final report of project work in standard format.
- To present the work in International/National conference reputed journals.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 60 PERIODS

OUTCOMES:

On Completion of the project work students will be in a position

- To take up any challenging practical problems.
- Find the solution by formulating proper methodology.
- Understand the modeling, analysis and design concepts by taking up a structure.
- Gain and solve problems using software knowledge.
- Able to take up and solve practical problems.

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

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

1903701 ESTIMATION, COSTING AND VALUATION ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To provide the student with the ability to estimate the quantities of item of works involved in buildings.
- To equip the students to estimate the quantities of items of work in water supply and sanitary works, road works and irrigation works.
- To provide the student with the ability to prepare tender and contract.
- To equip the student with the ability to do rate analysis and valuation of properties.
- To gain the knowledge of preparation of reports for estimation of various items.

UNIT-I: ESTIMATE OF BUILDINGS 9

Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for paneled and glazed doors, windows, ventilators, handrails etc.

UNIT-II: ESTIMATE OF OTHER STRUCTURES 9

Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line– sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, syphon, fall.

UNIT-III: SPECIFICATION AND TENDERS 9

Data – Schedule of rates – Analysis of rates – Specifications – sources – Preparation of detailed and general specifications – Tenders – TTT Act – e-tender – Preparation of Tender Notice and Document – Contracts – Types of contracts – Drafting of contract documents – Arbitration and legal requirements.

UNIT-IV: VALUATION **9**

Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease

UNIT-V: REPORT PREPARATION **9**

Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells

TOTAL: 45 PERIODS

OUTCOMES:

The student shall be

- Able to estimate the material quantities.
- Able to prepare a bill of quantities.
- Able to make specifications.
- Able to prepare tender and contract documents.
- Able to prepare value estimates.

TEXT BOOKS:

1. Dutta, B.N., “Estimating and Costing in Civil Engineering”, UBS Publishers & Distributors Pvt. Ltd., 2003
2. Kohli, D.D and Kohli, R.C., “A Text Book of Estimating and Costing (Civil)”, S.Chand & Company Ltd., 2004

REFERENCE BOOKS:

1. PWD Data Book.
2. Tamilnadu Transparencies in Tender Act, 1998
3. Arbitration and Conciliation Act, 1996
4. Standard Bid Evaluation Form, Procurement of Goods or Works, The World Bank, April 1996.

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

1903702 IRRIGATION ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To impart the basics of requirements and estimation of crop water
- Student is exposed to different phases in irrigation practices
- Student is exposed to various types of hydraulic structure includes dams, spillways and dissipaters
- Design the components of irrigation canal includes canal drops and cross drainage works
- To gain the concepts of Irrigation water management.

UNIT-I: CROP WATER REQUIREMENT 9

Need and classification of irrigation- historical development and merits and demerits of irrigation- types of crops-crop season-duty, delta and base period- consumptive use of crops estimation of Evapotranspiration using experimental and theoretical methods

UNIT-II: IRRIGATION METHODS 9

Tank irrigation – Well irrigation – Irrigation methods: Surface and Sub-Surface and Micro Irrigation design of drip and sprinkler irrigation – ridge and furrow irrigation-Irrigation scheduling – Water distribution system- Irrigation efficiencies.

UNIT-III: DIVERSION AND IMPOUNDING STRUCTURES 9

Types of Impounding structures - Diversion Head works - Weirs and Barrages- Forces on a dam– Gravity dam -Design of Gravity dams; Earth dams, Arch dams.

UNIT-IV: CANAL IRRIGATION 9

Canal regulations – direct sluice - Canal drop – Cross drainage works-Canal outlets – Design of prismatic canal-canal alignments-Canal lining - Kennedy‘s and Lacey’s Regime theory Design of unlined canal

UNIT-V: WATER MANAGEMENT IN IRRIGATION 9

Modernization techniques- Rehabilitation – Optimization of water use-Minimizing water losses- On form development works - Participatory irrigation management - Water resources associations- Changing paradigms in water management-Performance evaluation-Economic aspects of irrigation

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Have knowledge and skills on crop water requirements.
- Understand the methods and management of irrigation.
- Gain knowledge on types of Impounding structures
- Understand methods of irrigation including canal irrigation.
- Get knowledge on water management on optimization of water use.

TEXT BOOKS:

1. Dilip Kumar Majumdar, “Irrigation Water Management”, Prentice-Hall of India, New Delhi, 2008.
2. Punmia B.C., et. al; “Irrigation and water power Engineering”, Laxmi Publications, 16th Edition, New Delhi, 2009
3. Garg S. K., “Irrigation Engineering and Hydraulic structures”, Khanna Publishers, 23rd Revised Edition, New Delhi, 2009

REFERENCE BOOKS:

1. Duggal, K.N. and Soni, J.P., “Elements of Water Resources Engineering”, New Age International Publishers, 2005
2. Linsley R.K. and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc,2000
3. Chaturvedi M.C., “Water Resources Systems Planning and Management”, Tata McGraw Hill Inc., New Delhi, 1997.
4. Sharma R.K.. “Irrigation Engineering”, S.Chand & Co. 2007.
5. Michael A.M., “Irrigation Theory and Practice”, 2nd Edition, Vikas Publishing House Pvt.Ltd., Noida, UP, 2008
6. Asawa, G.L., “Irrigation Engineering”, New Age International Publishers, New Delhi, 2000.
7. Basak, N.N, “Irrigation Engineering”, Tata McGraw Hill Publishing Co. New Delhi, 1999

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

1903703 STRUCTURAL DYNAMICS LT PC

3 0 0 3

OBJECTIVES:

- To gain knowledge of science and engineering fundamentals to idealize and formulate the equations of motion for SDOF system.
- To develop the equations of motion for MDOF system and to evaluate the natural frequencies and mode shapes.
- To gain knowledge about elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
- To identify various causes and effects of earthquakes on structures due to past earthquakes.
- To analyze the structures subjected to dynamic loading and to design for seismic loading as per codal provisions.

UNIT-I: SINGLE DEGREE OF FREEDOM SYSTEM 9

Definition of degree of freedom – Idealization of structure as Single Degree of Freedom (SDOF)system – Formulation of equation of motion for various SDOF system – D‘ Alemberts Principles– Effect of damping – Free and forced vibration of damped and undamped structures –Transmissibility - Response to harmonic forces and periodic forces.

UNIT-II: MULTI DEGREE OF FREEDOM SYSTEM 9

Formulation of equation of motion for multi degree of freedom (MDOF) system – Evaluation of natural frequencies and modes – Eigen values and Eigen vectors –

Response to free and forced vibration of undamped and damped MDOF systems – Modal superposition methods.

UNIT-III: INTRODUCTION TO EARTHQUAKE ENGINEERING 9

Elements of Engineering Seismology – Definitions, Introduction to Seismic hazard, Earthquake phenomenon – Seism tectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters.

UNIT-IV: EARTHQUAKE EFFECTS ON STRUCTURES 9

Effect of earthquake on different types of structures – Behaviour of RCC, Steel Structures under earthquake loading – Evaluation of Earthquake forces – IS Code 1893: 2002 – Response Spectra – Lessons learnt from past earthquakes.

UNIT-V: CONCEPTS OF EARTHQUAKE RESISTANT DESIGN 9

Causes of damage – Planning considerations/Architectural concept (IS 4326–1993) – Guidelines for Earthquake resistant design – Earthquake resistant design of masonry buildings – Design consideration – Guidelines – Earthquake resistant design of R.C.C. buildings – Lateral load analysis – Design and detailing (IS 13920:1993)

TOTAL: 45 PERIODS

OUTCOMES:

- Student will develop knowledge in the simulation and mathematical model development.
- Students will be trained to identify, formulate and solve complicated problem.
- Students will be able to understand the role of natural calamity in the damage of structures.
- Students will be able to develop the skill to analyse data and to apply the same in the practical problems.
- Students will be able to apply the developed methodologies for the safe and stable design of structures.

TEXT BOOKS:

1. Mario Paz, “Structural Dynamics – Theory and Computations”, Fourth Edition, CBS publishers, 1997.
2. Agarwal.P and Shrikhande.M. “Earthquake Resistant Design of Structures”, Prentice Hall of India Pvt. Ltd. 2007.

REFERENCE BOOKS:

1. Clough.R.W, and Penzien.J, “Dynamics of Structures”, Second Edition, McGraw Hill International Edition, 1995.
2. Jai Krishna, Chandrasekaran.A.R., and Brijesh Chandra, “Elements of Earthquake Engineering”, South Asia Publishers, 1994.
3. Minoru Wakabayashi, “Design of Earthquake Resistant Buildings”, Mc Graw – Hill Book Company, 1986
4. Humar.J.L, “Dynamics of Structures”, Prentice Hall Inc., 1990.
5. Anil K Chopra, “Dynamics of structures –Theory and applications to Earthquake Engineering”, Prentice Hall Inc., 2007.
6. Moorthy.C.V.R, “Earthquake Tips”, NICEE, IIT Kanpur, 2002.
7. IS13920-1993 Ductile detailing of reinforced concrete structures subjected to seismic forces Code of practice.
8. IS 1893 part 1 2002 Indian standard criteria for earthquake resistant design of structures
9. IS4326-1993 Earthquake Resistant Design and Construction of Buildings--Code of Practice (Second Revision)

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

1903711 **PROJECT WORK- PHASE I** **L T P C**

0 0 4 2

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information relate to the same through detailed review of literature.

- To develop the methodology to solve the identified problem
- To train the students in preparing project reports and to face reviews and viva voce examination.
- To prepare the final report of project work in standard format.
- To present the work in International/National conference reputed journals.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 60 PERIODS

OUTCOMES:

On completion of the project work students will be in a position

- To take up any challenging practical problems.
- Find the solution by formulating proper methodology.
- Understand the modeling, analysis and design concepts by taking up a structure.
- Gain and solve problems using software knowledge.
- Able to take up and solve practical problems.

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

1903712 COMPUTER AIDED DESIGN AND DRAFTING LABORATORY L T PC

0 0 4 2

OBJECTIVES:

- To introduce the students to draft the plan, elevation and sectional views of buildings using computer software.
- Students will be familiar with features of Building Information Modelling.
- To impart knowledge and skill relevant to drafting and design the R.C.C framed structure using computer software.
- To impart knowledge of drafting and design the Industrial structures.
- To impart knowledge of analysis and detailing of water tank by using software.

LIST OF EXPERIMENTS

1. Draw a Plan, Elevation and sectional view of Load Bearing and framed structures.
2. Building Information Modeling.
3. Drafting and analysis of R.C.C. framed structures.
4. Drafting and analysis of Industrial buildings.
5. Analysis and Design of circular and rectangular RCC water tanks.

TOTAL: 60 PERIODS

OUTCOMES:

- Draft the plan, elevation and sectional view of the buildings.
- Able to know about the Building Information Modelling.
- Draw the structural detailing of RCC elements.
- Draft the plan, elevation and sectional view of Industrial structures.
- Draw the structural detailing of RCC water tanks.

TEXT BOOKS:

1. Sikka V.B., “A Course in Civil Engineering Drawing”, 4th Edition, S.K.Kataria and Sons, 2015.
2. George Omura, “Mastering in AutoCAD 2005 and AutoCAD LT 2005”, BPB Publications, 2000.
3. Krishnamurthy, D., “Structural Design & Drawing – Vol. II and III”, CBS Publishers, 2010.
4. Sarma.T.S, Design of R C C Buildings using STAAD Pro V8i with Indian Code IS456-2000.

REFERENCE BOOKS:

1. Chuck Eastman, Paul Teicholz, Rafael Sacks, Kathleen Liston, BIM Handbook: A Guide to building information modeling for Owners, Managers, Designers, Engineers, and Contractors, John Wiley and Sons. Inc., 2011.
2. Marimuthu V.M., Murugesan R. and Padmini S., Civil Engineering Drawing-I, Pratheeba Publishers, 2008.
3. Verma.B.P, Civil Engineering Drawing and House Planning, Khanna Publishers, 2010.
4. RAM/STAAD Solution centre, Structural analysis and design of tank structures in STAAD. Pro 2007.

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

1903713 **INTERNSHIP** **L T P C**

0 0 0 1

OBJECTIVES:

- To train the students in the field work so as to have a firsthand knowledge of practical Problems related to Structural Engineering in carrying out engineering tasks.
- To develop skills in facing and solving the field problems.
- The students shall be required to present a technical report in PPT and submit a relevant report.
- Seminar is an important component of learning where the student gets acquainted with preparing and presentation of a technical report.
- Presentation schedules will be prepared by the course faculty in line witgh the academic calendar.

SYLLABUS:

The students individually undertake training in reputed Industries during the summer vacation of fourth and sixth semester for a specified period of two weeks. At the end of training, a detailed report on the work done should be submitted within ten days from the commencement of the semester. The students will be evaluated through a viva-voce examination by a team of internal staff.

OUTCOMES:

- They are trained in tackling a practical field/industry orientated problem related to Structural Engineering.
- To develop skills in facing and solving the field problems.
- Training is an important component of learning where the student gets acquainted with preparing and presentation of a technical report.
- Will have knowledge in different research works related to engineering.
- Students are trained to face the delegates during their project presentation.

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

1903809 **PROJECT WORK – PHASE II** **L T P C**

0 0 2 6

OBJECTIVES:

- To identify a specific problem for the current need of the society and collecting information relate to the same through detailed review of literature.
- To develop the methodology to solve the identified problem

- To train the students in preparing project reports and to face reviews and viva voce examination.
- To prepare the final report of project work in standard format.
- To present the work in International/National conference reputed journals.

STRATEGY:

The student works on a topic approved by the head of the department under the guidance of a faculty member and prepares a comprehensive project report after completing the work to the satisfaction. The student will be evaluated based on the report and the viva voce examination by a team of examiners including one external examiner.

TOTAL: 300 PERIODS

OUTCOMES:

- On Completion of the project work students will be in a position to take up any challenging practical problems.
- Find the solution by formulating proper methodology.
- Understand the modeling, analysis and design concepts by taking up a structure.
- Gain and solve problems using software knowledge.
- Able to take up and solve practical problems.

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

PROFESSIONAL ELECTIVE- I

SEMESTER IV

1903405	**DIGITAL CADASTRE**	**L T P C**
		3 0 0 3

OBJECTIVES:

- To introduce the students to the cadastral survey Methods.
- To gain the knowledge of applications in generation of Land information system.
- To understand the Government procedure in Land Record Management and computational procedure for modernization.
- To gain knowledge about the land record system
- To understand the Government procedure in Land Record Management.

UNIT-I: INTRODUCTION **9**

History of cadastral survey - Types of survey - Tax - Real Property – Legal cadastre - Graphical and Numerical Cadastre, Legal Characteristics of Records, Torrens System.

UNIT-II: CADASTRAL SURVEY METHODS **9**

Instruments used for cadastral survey & mapping - Orthogonal, Polar survey methods Boundary survey - Rectangulation - Calculation of area of Land- GPS and Total Station in Cadastral survey.

UNIT-III: PHOTOGRAMMETRIC METHODS **9**

Photogrammetry for cadastral surveying and mapping - Orthophoto map – Quality control measures - Case studies.

UNIT-IV: CADASTRAL MAPPINGAND LIS **9**

Cadastral map reproduction - Map projection for cadastral maps – Conventional symbols map - reproduction processes - Automated cadastral map, Management of Digital Cadastral. Creation of Land Information System. Integrating LIS –Land administration.

UNIT-V: MAINTENANCE AND MEASUREMENTS **9**

Cadastral survey maintenance - Resurveys - Measurement of sub-division - Measurement of obstructed lines - Control requirement for Urban survey use of Satellite Imagery in boundary fixing.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students will be able to

- Gain knowledge about cadastre survey.
- Understand the methods of cadastral survey.
- Get the knowledge about photogrammetric methods.
- Understand Land Record System and computational procedure for modernization of the same.
- Understand the Government procedure in Land Record Management.

TEXT BOOKS:

1. Paul. R Wolf., Bon A. DeWitt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014
2. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

REFERENCE BOOKS:

1. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007.
2. E. M. Mikhail, J. S. Bethel, J. C. McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001.
3. James, M. Anderson and Edward N. Mikhail, Introduction to Surveying, McGraw Hill Book Co, 1985.

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

1903406 ADVANCED SURVEYING L T P C

3 0 0 3

OBJECTIVES:

- To understand the use of Astronomy and Photogrammetric.
- To gain knowledge of Total Station and GPS.
- Gain knowledge of tides and route survey.
- To understand GPS Surveying and the Data Processing.
- To understand the route surveys and tunnel alignments.

UNIT-I: ASTRONOMICAL SURVEYING 9

Introduction - Instruments – purpose - Astronomical terms and definition - Time & conversion of time - Field observations and determinations of time, longitude, latitude and azimuth by attitude and Hour angle method.

UNIT-II: AERIAL SURVEYING 9

Terrestrial Photogrammetry – Terrestrial stereo photogrammetry – Aerial photogrammetry – overlaps – scale of photographs – Vertical and titled photographs distortion in aerial photographs – stereostopic vision - photo interpretation – Applications.

UNIT-III: TOTAL STATION SURVEYING 9

Introduction and Basics of Total station **-** Parts of Total station- Advantages, disadvantages and uses of Total Station, Types of Total Station, Advancement in Total Station Technology, Automatic Target Recognition ATR, Surveying using Total Station- Flow chart of data collection, Fundamental Parameters of Total Station, Precautions to be taken while using Total Station, Field equipments - Set up of Total Station - Centering, Levelling , back-sight,Azimuth Marks, Measurement with Total Station, Total Station Initial Setting, Field Book recording, Radial Shooting, Total Station Traversing - sources of errors - Care and Maintenance of total station.

UNIT-IV: GPS SURVEYING **9**

Global positioning system,Types, Applications of GPS, Method of operation, System Segmentation Integration of remote sensing and GIS, applications in civil engineering**.**

UNIT -V: MISCELLANEOUS **9**

Reconnaissance – Rout surveys for highways, railways and waterways – simple, compound, reverse, transition and vertical curve – setting out methods - hydrographic surveying – tides – MSL – Sounding methods – measurement of current and discharge – Tunnel alignment and setting out – Settlement and Deformation studies.

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course, the student shall be able to

- Know the concepts of astronomical Surveying
- Do the Photogrammetric Surveying and Interpretation
- Solve the Field Problems with Total Station
- Know the GPS Surveying and the Data Processing
- Understand the route surveys and tunnel alignments

TEXT BOOKS:

1. James M.Anderson and Edward M.Mikhail, "Surveying, Theory and Practices", 7th Edition, McGraw Hill, 2001.

2. Bannister and S.Raymond, "Surveying", 7th Edition, Longman 2004.
3. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004. Laurila, S.H. Electronic
4. John Wiley and Sons Inc,"Surveying in Practice", 1993.

REFERENCE BOOKS:

1. Roy S.K., —Fundamentals of Surveyingll, 2nd Edition, Prentice Hall of India, 2004.
2. Arora K.R. —Surveying Vol I & IIll, Standard Book House, 10th Edition2008.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer – Verlag, Berlin, 2003.
4. Seeber G, Satellite Geodesy, Water De Gruyter, Berlin,1998.

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

1903407 REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM L T P C

3 0 0 3

OBJECTIVES:

- To introduce the students to the basic concepts and principles of various components of remote sensing.
- To introduce the fundamentals and components of Geographic Information System
- To provide an exposure to GIS and its practical applications in civil engineering.
- To gain knowledge about data quality and standards.

- To understand about GIS data and interpreting the data for modeling applications.

UNIT-I: EMR AND ITS INTERACTION WITH ATMOSPHERE & EARTH MATERIAL 9

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory, Stefan-Boltzman and Wein's Displacement Law – Atmospheric scattering, absorption – Atmospheric windows – spectral signature concepts – typical spectral reflective characteristics of water, vegetation and soil.

UNIT-II: PLATFORMS AND SENSORS 9

Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active sensors – resolution concept – Pay load description of important Earth Resources and Meteorological satellites – Airborne and spaceborne TIR and microwave sensors.

UNIT-III: IMAGE INTERPRETATION AND ANALYSIS 9

Types of Data Products – types of image interpretation – basic elements of image interpretation -visual interpretation keys – Digital Image Processing – Pre-processing – image enhancement techniques – multispectral image classification – Supervised and unsupervised.

UNIT-IV: GEOGRAPHIC INFORMATION SYSTEM 9

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis –GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and nonspatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT-V DATA ENTRY, STORAGE AND ANALYSIS 9

Data models – vector and raster data – data compression – data input by digitization and scanning – attribute data analysis – integrated data analysis – Modeling in GIS Highway alignment studies – Land Information System.

TOTAL: 45 PERIODS

OUTCOMES:

This course equips the student to

- Understand the principles of Remote Sensing and GIS.
- Understand the types of data models.
- Get knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Analysis of RS and GIS data and interpreting the data for modeling applications.

TEXT BOOKS:

1. Lillesand,T.M., Kiefer, R.W. and J.W.Chipman. "Remote Sensing and Image Interpretation" 5th Edition., John Willey and Sons Asia Pvt. Ltd., New Delhi, 2004.
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd edition. BS Publications, Hyderabad, 2001.

REFERENCE BOOKS:

1. Lo.C.P., Albert K.W. Yeung,"Concepts and Techniques of Geographic Information Systems", Prentice-Hall India Publishers, 2006
2. Peter A.Burrough, Rachael A. McDonnell, " Principles of GIS", Oxford University Press,
3. Ian Heywood "An Introduction to GIS", Pearson Education Asia, 2000

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4	3	3	3	3	3	1	-	-	-	-	2	2	3	2	2	2
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1903408 GEOMATICS APPLICATIONS FOR CIVIL ENGINEERS L T P C

3 0 0 3

OBJECTIVES:

- To introduce the fundamentals of GIS
- To manage various resources efficiently using GIS Technique.
- To gain the knowledge of monitoring the advancements in Civil Engineering.
- To manage urban growth and management of transport infrastructure.
- To gain the knowledge about the model catchments and management of water resources.

UNIT-I: INTRODUCTION OF REMOTE SENSING AND GIS 9

Definition of remote sensing and its components – Electromagnetic spectrum – wavelength regions important to remote sensing – Wave theory, Particle theory. Types of platforms – orbit types, Sun-synchronous and Geosynchronous – Passive and Active -Sensors. Meteorological satellites – Airborne and space borne TIR and microwave sensors.

UNIT-II: GIS CONCEPT 9

Introduction – Maps – Definitions – Map projections – types of map projections – map analysis –GIS definition – basic components of GIS – standard GIS softwares – Data type – Spatial and non spatial (attribute) data – measurement scales – Data Base Management Systems (DBMS).

UNIT-III: LAND RESOURCE AND SOIL CONSERVATION MANAGEMENT 9

Topographic and Bathymetric Surveys – Cadastral Information –Soil and Land Use Surveys - Land Information System (LIS) – Real Estate Information System- Soil survey interpretation and mapping - impact of agricultural and industrial activity on soil properties - modeling soil characteristics using satellite data - soil degradation assessment using Remote Sensing and GIS.

UNIT-IV: URBAN AND TRANSPORTATION MANAGEMENT 9

Monitoring Urban Growth through Remote Sensing - Geo-demographic Analysis – traffic analysis - accident analysis - site suitability analysis for transport infrastructure – transportation databases: creation and maintenance - Vehicle routing – Highway maintenance system – Intelligent Transportation System - Planning for Sustainable Urban Transport Systems in India.

UNIT-V: WATER RESOURCES PLANNING AND MANAGEMENT 9

Location of storage/diversion works – capacity curve generation – sediment yield - modelling of catchments – Delineation of watershed - Watershed modelling for sustainable development Rainfall – Runoff modelling –LiDAR Mapping for Urban area – Water quality mapping and monitoring – Flood Risk Zoning - Flood damage assessment – Flood Modelling - Assessment of droughts and mitigation .

TOTAL: 45 PERIODS

OUTCOMES:

On completion of this course students will be able to

- Principles of Remote Sensing and GIS.
- Understand the types of data models.
- Model soil characteristics, soil degradation assessment and management.
- Monitor urban growth and management of transport infrastructure.
- Model catchments and management of water resources.

TEXT BOOKS:

1. Basudeb Bhatta, "Remote Sensing and GIS‘, Second edition, Oxford University Press 2011
2. Lo.C.P., Albert K.W.Yeung, "Concepts and Techniques of Geographic Information Systems", Second edition, PHI Learning Private Limited, Delhi, 2014

REFERENCE BOOKS:

1. Andrew N. Rencz, "Manual of Remote Sensing: Remote Sensing for Natural Resource Management and Environmental Monitoring", John Wiley & Sons Inc, April 2004
2. Rashed, Tarek; Jürgens, Carsten (Eds.), "Remote Sensing of Urban and Suburban Areas", Springer, 1st Edition. 2010.
3. Harvey J. Miller, Shih-Lung Shaw, "Geographic Information Systems for Transportation – Principles and Applications", Oxford University Press, 2001
4. Gert A. Schulitz Edwin T. Engman, "Remote Sensing in hydrology and Water Management", Springer - verlag Berlin Heidelberg Germany - 2000.

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

1903409 TOTAL STATION AND GPS SURVEYING L T P C

3 0 0 3

OBJECTIVES :

- To understand the working principles of Total Station equipment
- To gain the knowledge of applications of GPS and Total stations.
- To understand about mapping with Total station, GPS and solve the surveying problems.
- To gain knowledge about the various techniques available for surveying and mapping with total station and GPS.

- To understand the route surveys and tunnel alignments

UNIT-I: FUNDAMENTALS OF TOTAL STATION AND ELECTROMAGNETIC WAVES 9

Methods of Measuring Distance, Basic Principles of Total Station, Historical Development, Classifications, applications and comparison with conventional surveying. Classification applications of Electromagnetic waves, Propagation properties, wave propagation at lower and higher frequencies- Refractive index (RI) - factors affecting RI- Computation of group for light and near infrared waves at standard and ambient conditions-Computation of RI for microwaves at ambient condition - Reference refractive index- Real time application of first velocity correction. Measurement of atmospheric parameters- Mean refractive index- Second velocity correction Total atmospheric correction- Use of temperature - pressure transducers.

UNIT-II: ELECTRO-OPTICAL AND MICROWAVE SYSTEM 9

Electro-optical system: Measuring principle, Working principle, Sources of Error, Infrared and Laser Total Station instruments. Microwave system: Measuring principle, working principle, Sources of Error, Microwave Total Station instruments. Comparison between Electro-optical and Microwave system. Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.

UNIT-III: SATELLITE SYSTEM 9

Basic concepts of GPS - Historical perspective and development - applications - Geoid and Ellipsoid- satellite orbital motion - Keplerian motion – Kepler_s Law - Perturbing forces - Geodetic satellite - Doppler effect - Positioning concept –GNSS, IRNSS and GAGAN - Different segments - space, control and user segments - satellite configuration – GPS signal structure - Orbit determination and representation - Anti Spoofing and Selective Availability - Task of control segment - GPS receivers.

UNIT- IV: GPS DATA PROCESSING 9

GPS observables - code and carrier phase observation - linear combination and derived observables - concept of parameter estimation – downloading the data RINEX Format – Differential data processing – software modules -solutions of cycle slips, ambiguities, Concepts of rapid, static methods with GPS - semi Kinematic and pure Kinematic methods -satellite geometry & accuracy measures - long baseline processing- use of different softwares available in the market.

UNIT-V: HYDROGRAPHIC, MINE AND CADASTRAL SURVEYING 9

Reconnaissance – Route surveys for highways, railways and waterways – Hydrographic survey Tides – MSL – Sounding methods – Three point problem – River surveys – Measurement of current and discharge – Mine surveying Equipment – Weisbach triangle – Tunnel alignment and setting out – Transfer of azimuth – Gyro Theodolite – Shafts and audits - Cadastral survey- Legal – Real – Tax cadastre – Land record system – Settlement procedure – deformation studies.

TOTAL : 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to understand

- Working principles of total station and GPS instruments.
- Propagation of EMR through atmosphere and corrections for its effects.
- The functioning various types total station and GPS equipments and their applications.
- Various techniques available for surveying and mapping with total station and GPS.
- Understand the route surveys and tunnel alignments

TEXT BOOKS:

1. Rueger, J.M. "Electronic Distance Measuremen"t, Springer-Verlag, Berlin, 1996
2. Satheesh Gopi, rasathishkumar, N.madhu," Advanced Surveying , Total Station GPS and Remote Sensing " Pearson education , 2007 isbn: 978-81317 00679

REFERENCE BOOKS:

1. R.Subramanian, "Surveying and Levelling", Oxford University Press, Second Edition, 2012.
2. Laurila, S.H. "Electronic Surveying in Practice", John Wiley and Sons Inc, 1993.
3. Guocheng Xu, GPS, "Theory, Algorithms and Applications", Springer - Verlag, Berlin, 2003.
4. Alfred Leick, "GPS satellite surveying", John Wiley & Sons Inc., 3rd Edition, 2004.

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

PROFESSIONAL ELECTIVE – II

SEMESTER V

1903505	**GROUND IMPROVEMENT TECHNIQUES**	**L T P C**
		3 0 0 3

OBJECTIVES:

- Students will be exposed to various problems associated with soil deposits and methods to evaluate.
- To gain knowledge of different techniques to improve the characteristics of difficult soils
- To design techniques required to implement various ground improvement methods.
- To understand the concept of earth reinforcement.
- To gain knowledge about the types of grouts and grouting technique.

UNIT- I: PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 9

Role of ground improvement in foundation engineering – Methods of ground improvement – Geotechnical problems in alluvial, lateritic and black cotton soils – Selection of suitable ground improvement techniques based on soil conditions.

UNIT- II: DEWATERING 9

Dewatering Techniques - Well points – Vacuum and electroosmotic methods – Seepage analysis for two dimensional flow for fully and partially penetrated slots in homogeneous deposits – Design for simple cases.

UNIT- III: INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 9

Insitu densification of cohesionless soils – Shallow as deep compaction – Dynamic compaction -Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils -Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns.

UNIT- IV: EARTH REINFORCEMENT **9**

Types of reinforcement material – Reinforced earth wall – Mechanism – Simple design Applications of reinforced earth; Functions of Geosynthetics in filtration, drainage, separation, road works and containment applications.

UNIT- V: GROUTING TECHNIQUES **9**

Types of grouts – Grouting equipments and machinery – Injection methods – Grout monitoring –Stabilization with cement, lime and chemicals – Stabilization of expansive soil.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to

- Gain knowledge on methods and selection of ground improvement techniques.
- Understand dewatering techniques and design for simple cases.
- Get knowledge on insitu treatment of cohesion less and cohesive soils.
- Understand the concept of earth reinforcement and design of reinforced earth.
- Get to know types of grouts and grouting technique.

TEXT BOOKS:

1. Purushothama Raj. P, “Ground Improvement Techniques”, Lakshmi Publications, 2nd Edition, 2016.
2. Koerner, R.M. “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, 1994.
3. Nihar Ranjan Patra, “Ground Improvement Techniques”, Vikas Publishing House, First Edition, 2012.
4. Mittal.S, “An Introduction to Ground Improvement Engineering”, Medtech Publisher, First Edition, 2013.

REFERENCE BOOKS:

1. Moseley, M.P. “Ground Improvement” Blockie Academic and Professional, 1992.
2. Moseley, M.P and Kirsch. K., - “Ground Improvement”, Spon Press, Taylor and Francis Group, London, 2nd Edition,2004.

3. Jones C.J.F.P. “Earth Reinforcement and Soil Structure”, Thomas Telford Publishing, 1996.
4. Winterkorn, H.F. and Fang, H.Y. “Foundation Engineering” Hand Book. Van Nostrand Reinhold, 1994.
5. Das, B.M., “Principles of Foundation Engineering” (seventh edition), Cengage learning, 2010.
6. Coduto, D.P., “Geotechnical Engineering – Principles and Practices”, Prentice Hall of India Pvt.Ltd. New Delhi, 2011.
7. Koerner, R.M., “Designing with Geosynthetics” (Sixth Edition), Xlibris Corporation, U.S.A, 2012.
8. IS Code 9759 :1981 (Reaffirmed 1998) “Guidelines for Dewatering During Construction”, Bureau of Indian Standards, New Delhi.
9. IS Code 15284 (Part 1): 2003 “Design and Construction for Ground Improvement – Guidelines (Stone Column)", Bureau of Indian Standards, New Delhi.

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

1903506 INTRODUCTION TO SOIL DYNAMICS AND MACHINE FOUNDATIONS

L T P C

3 0 0 3

OBJECTIVES:

- To understand the basics of soil dynamics.
- To gain knowledge of dynamic behavior of soils.
- To gain effects of dynamic loads and the various design methods.

- To gain knowledge of foundation for different types of machines
- To understand liquefaction, motion isolation and vibration control.

UNIT- I: THEORY OF VIBRATION **9**

Introduction – Nature dynamic loads – Vibrations of single degree freedom system – Free vibrations of spring – mass systems – Forced vibrations – Viscous damping - Transmissibility – Principles of vibration measuring instruments – Effect of Transient and Pulsating loads.

UNIT- II: WAVE AND WAVE PROPAGATION **9**

Wave propagation in an elastic homogeneous isotropic medium- Raleigh, shear and compression waves-waves in elastic half space

UNIT - III: DYNAMIC PROPERTIES OF SOILS **9**

Dynamic stress – Strain characteristics – Principles of measuring dynamic properties – Laboratory Techniques – Field tests – Factors affecting dynamic properties – Typical values – Dynamic bearing capacity – Dynamic earth pressure.

UNIT- IV: FOUNDATION FOR DIFFERENT TYPES OF MACHINES **9**

Types of machines and foundation – General requirements – Modes of vibration of a rigid foundation – Method of analysis – Linear elastic weightless spring method – Elastic half space method – Analog Method – Design of block foundation – Special consideration for rotary, Impact type of machines – Codal Provisions.

UNIT- V: INFLUENCE OF VIBRATION AND REMEDIATION **9**

Mechanism of Liquefaction – Influencing factors – Evaluation of Liquefaction potential based on SPT-Force Isolation – Motion Isolation – Use of spring and damping materials – Vibration control of existing machine foundation – Screening of vibration – Open trenches – Pile Barriers – Salient construction aspects of machine Foundations.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to

- Understand the theory and measurement of vibration.
- Understand the concept of wave propagation in infinite medium and due to machine foundation.
- Get knowledge on dynamic properties of soils and laboratory and field testing.
- Design of foundation for different types of machines
- Understand liquefaction, motion isolation and vibration control.

TEXT BOOKS:

1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt.Ltd. New Delhi-110002, 3rd Edition 2016.
2. Kameswara Rao., "Dynamics Soil Tests and Applications", Wheeler Publishing, New Delhi, 2003.
3. P. Srinivasulu, and C.V. Vaidyanathan, "Handbookof Machine Foundations", Tata McGraw-Hill, 2007

REFERENCE BOOKS:

1. Kamaswara Rao., "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, New Delhi, 1998.
2. IS Code of Practice for Design and Construction of Machine Foundations, McGrew Hill, 1996.
3. Moore, P.J., "Analysis and Design of Foundation for Vibration", Oxford and IBH, 2005
4. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall, 1996.
5. IS Code 5249: 1992 (Reaffirmed 2006) - Determination of Dynamic Properties of Soil Method of Test Bureau of Indian Standards, New Delhi.
6. IS Code 2974: (Part 1) 1982 (Reaffirmed 2008) - Code of Practice for Design and Construction of Machine Foundations - Foundation for Reciprocating Type Machines Bureau of Indian Standards, New Delhi.

7. IS Code 2974: (Part 2) 1980 (Reaffirmed 2008) - Code of Practice for Design and Construction of Machine Foundations - Foundations for Impact Type Machines (Hammer Foundations) Bureau of Indian Standards, New Delhi.
8. IS Code 2974: (Part 3) 1992 (Reaffirmed 2006) - Code of Practice for Design and Construction of Machine Foundations - Foundations for Rotary Type Machines (Medium and High Frequency) Bureau of Indian Standards, New Delhi.

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4	2	1	3	2	-	-	-	2	-	-	1	1	2	1	-	2
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1903507 ROCK ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge on fundamentals of rock mechanics and its application.
- To gain knowledge of solving simple problems associated with rock slopes and underground openings.
- Student gains the knowledge on the mechanics of rock and its applications in underground structures and rock slope stability analysis.
- To impart knowledge about rock mechanics in engineering.
- To gain knowledge about rock stabilization.

UNIT- I: CLASSIFICATION AND INDEX PROPERTIES OF ROCKS 9

Geological classification – Index properties of rock systems – Classification of rock masses for engineering purpose – Rock Mass Rating and Q System.

UNIT- II: ROCK STRENGTH AND FAILURE CRITERIA **9**

Modes of rock failure – Strength of rock – Laboratory and field measurement of shear, tensile and compressive strength, Stress - strain behaviour of rock under Hydrostatic compression and deviatoric loading – Mohr-Coulomb failure criteria – Deformability of rock.

UNIT- III: INITIAL STRESSES AND THEIR MEASUREMENTS **9**

Estimation of initial stresses in rocks – influence of joints and their orientation in distribution of stresses – measurements of in-situ stresses – Hydraulic fracturing – Flat jack method – Over coring method.

UNIT- IV: APPLICATION OF ROCK MECHANICS IN ENGINEERING **9**

Simple engineering application – Underground openings – Rock slopes – Foundations and mining subsidence

UNIT- V: ROCK BOLTING **9**

Introduction – Rock bolt systems – rock bolt installation techniques – Testing of rock bolts – Choice of rock bolt based on rock mass condition.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course the student will be able to

- Classify the rocks, study the index properties of rock systems.
- Understand the modes of rock failure, stares-strain characteristics, failure criteria.
- Estimate the stresses in rocks.
- Apply rock mechanics in engineering.
- Get knowledge on rock stabilization.

TEXT BOOKS:

1. Goodman, P.E. "Introduction to Rock Mechanics", John Wiley and Sons, 1999.

2. Stillborg.B.,"Professional User Handbook for rock Bolting", Tran Tech Publications, 1996.
3. Ramamurthy T., "Engineering in Rocks for Slopes Foundations and Tunnels", PHI Learning Pvt. Ltd., 3rd Edition, 2014.

REFERENCE BOOKS:

1. Brown, E.T. "Rock Characterisation Testing and Monitoring", Pergaman Press 1991.
2. Arogyaswamy, R.N.P., "Geotechnical Application in Civil Engineering", Oxford and IBH, 1991.
3. Brady, B.H.G. and Brown, E.T., "Rock mechanics for underground mining", (Third Edition), Kluwer Academic Publishers, Dordrecht, 2006.
4. Hock E. and Bray J., "Rock Slope Engineering", Institute of Mining and Metallurgy, 1991.

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4	3	-	1	-	-	2	2	-	1	1	-	-	2	-	2	1
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1903508 URBAN PLANNING AND DEVELOPMENT L T P C

3 0 0 3

OBJECTIVES:

- To enable students to have the knowledge on planning process.
- To introduce to the students about the regulations and laws related to Urban Planning.
- To design and manage urban development projects.
- To Design of urban development projects.

- To Manage urban development projects

UNIT- I: BASIC ISSUES **9**

Definition of Human settlement, Urban area, Town, City, Urbanisation, Suburbanisation, Urban sprawl, Peri - urban areas, Central Business District (CBD), Classification of urban areas Trend of Urbanisation at International, National, Regional and State level.

UNIT- II: PLANNING PROCESS **9**

Principles of Planning – Types and Level of Plan, Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Surveys and Questionnaire Design.

UNIT- III: DEVELOPMENT PLANS, PLAN FORMULATION AND EVALUATION **9**

Scope and Content of Regional Plan, Master Plan, Detailed Development Plan, - Its Scope & Contents -Data Collection - Future proposals & Policies - Land Use-Maps - Development Regulations & Bye laws - Limitations- Development Control Rules, Transfer of Development Rights , Special Economic Zones- Development of small town and smart cities-case studies.

UNIT- IV: PLANNING AND DESIGN OF URBAN DEVELOPMENT PROJECTS **9**

Site Analysis, Layout Design, Planning Standards, Project Formulation – Evaluation, Plan Implementation, Constraints and Implementation, Financing of Urban Development Projects.

UNIT- V: LEGISLATION, DEVELOPMENTAND MANAGEMENT OF URBAN SYSTEM **9**

Town and Country Planning Act, Land Acquisition and Resettlement Act etc., Urban Planning Standards and Regulations, Involvement of Public, Private, NGO, CBO and Beneficiaries.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have the ability to

- Describe basic issues in urban planning.
- Formulate plans for urban and rural development.
- Plan and analyse socio economic aspects of urban and rural planning.

- Design of urban development projects.
- Manage urban development projects.

TEXT BOOKS:

1. Goel, S.L "Urban Development and Management", Deep and Deep publications, New Delhi 2002.
2. George Chadwick, "A Systems view of planning", Pergamon press, Oxford 1978.
3. Singh V.B, "Revitalised Urban Administration in India", Kalpaz publication, Delhi, 2001.
4. Edwin S.Mills and Charles M.Becker, "Studies in Urban development", A World Bank publication, 1986.

REFERENCE BOOKS:

1. "Tamil Nadu Town and Country Planning Act 1971", Government of Tamil Nadu, Chennai.
2. Goel S.L., "Urban Development and Management", Deep and Deep Publications, New Delhi, 2002.
3. Thooyavan, K.R., "Human Settlements – A Planning Guide to Beginners", M.A Publications, Chennai, 2005.
4. CMDA, Second Master Plan for Chennai, Chennai 2008.

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

1903509 AIR POLLUTION AND CONTROL ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge on the principle and design of control of Indoor/ particulate/ gaseous air pollutant and its emerging trends.
- To gain knowledge of characteristics of air pollution and noise pollution.
- To create awareness among the sources and effects of air pollution.
- To gain knowledge on air pollution control equipments.
- To develop a knowledge on air quality standards.

UNIT- I: INTRODUCTION 9

Definition, Scope and Scales of Air Pollution – Structure and composition of Atmosphere-Properties –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

Properties and effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Atmospheric Diffusion Theories – Dispersion models, Plume rise- Concept of Isoplates.

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 and applications.

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

OUTCOMES:

The students completing the course will have

- An understanding of the nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management.
- Ability to identify, formulate and solve air and noise pollution problems.
- Ability to design stacks and particulate air pollution control devices to meet applicable standards.
- Ability to select control equipments to analyse air pollutants.
- Ability to control effects of noise pollution and indoor air pollution.

TEXT BOOKS:

1. Lawrence K. Wang, Norman C. Pareira, Yung Tse Hung, "Air Pollution Control Engineering", Tokyo, springer science + science media LLC,2004.
2. Noel de Nevers, "Air Pollution Control Engineering", Waveland press,Inc 2017.
3. Anjaneyulu. Y, "Air Pollution and Control Technologies", Allied Publishers (P) Ltd., India 2002.

REFERENCE BOOKS:

1. David H.F. Liu, Bela G. Liptak, "Air Pollution", Lweis Publishers, 2000.
2. Arthur C. Stern, "Air Pollution (Vol.I – Vol.VIII)", Academic Press, 2006.
3. Wayne T.Davis,"Air Pollution Engineering Manual", John Wiley & Sons, Inc, 2000.

4. M.N Rao and HVN Rao, "Air Pollution",Tata Mcgraw Hill Publishing Company limited,2007.

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1903510 MUNICIPAL SOLID WASTE MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To make the students conversant with the types, sources, generation
- To gain the knowledge for municipal solid waste management for storage, collection, transport.
- To make the students to learn about processing and disposal of municipal solid waste.
- To impart knowledge on the issues on solid waste management
- To make the students to learn about the design and operation of sanitary landfill.

UNIT- I: SOURCES AND CHARACTERISTICS 9

Sources and types of municipal solid wastes - Waste generation rates - Public health and environmental impacts of improper disposal of solid wastes - Sampling and characterization of wastes - Factors affecting waste generation rate - Elements of integrated solid waste management - Requirements and salient features of Solid waste management rules (2016) Role of public and NGO's - Public and Private participation.

UNIT- II: SOURCE REDUCTION, WASTE STORAGE AND RECYCLING 9

Waste Management Hierarchy - Reduction, Reuse and Recycling - Source reduction of waste On-site storage methods - Effect of storage, materials used for containers - Segregation of solid wastes - Public health and economic aspects of open storage - Case studies under Indian conditions - Recycling of Plastics and Construction/Demolition wastes.

UNIT- III: COLLECTION AND TRANSFER OF WASTES 9

Methods of Residential and commercial waste collection - Collection vehicles - Manpower Collection routes - Analysis of waste collection systems; Transfer stations - Selection of location, operation and maintenance; Options under Indian conditions - Field problems and solving.

UNIT- IV: PROCESSING OF WASTES 9

Objectives of waste processing - Physical Processing techniques and Equipment; Resource recovery from solid waste - Composting and Biomethanation; Thermal processing options Incineration - Pyrolysis - Case studies under Indian conditions.

UNIT- V: WASTE DISPOSAL 9

Land disposal of solid waste - Sanitary landfills - Site selection, design and operation of sanitary landfills - Landfill liners - Management of leachate and landfill gas - Landfill bioreactor - Dumpsite Rehabilitation – Bio-mining.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will demonstrate

- Understanding of the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.
- Reduction, reuse and recycling of waste.
- Ability to plan and design systems for storage, collection, transport, processing and disposal of municipal solid waste.

- Knowledge on the issues on solid waste management from an integrated and holistic perspective, as well as in the local and international context.
- Design and operation of sanitary landfill.

TEXT BOOKS:

1. George Tchobanoglous and FrankKreith (2002), "Handbook of Solid waste management", McGraw Hill, New York.
2. William A. Worrell, P. Aarne Vesilind (2012) "Solid Waste Engineering", Cengage Learning, 2012.

REFERENCE BOOKS:

1. CPHEEO (2014), "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization", Government of India, New Delhi.
2. John Pitchel (2014), "Waste Management Practices-Municipal, Hazardous and industrial" CRC Press, Taylor and Francis, New York.
3. Bhide .A.D. and Sundaresan .B.B, "Solid Waste Management in Developing Countries", INSDOC, 2003.

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PROFESSIONAL ELECTIVE-III

SEMESTER VI

1903605	**PAVEMENT ENGINEERING**	**L T P C**
		3 0 0 3

OBJECTIVES:

- Student gains knowledge on various IRC guidelines for designing rigid and flexible pavements.
- To gain knowledge to assess quality and serviceability conditions of roads.
- To gain the knowledge of maintenance of pavements.
- To develop on pavement design.
- To gain knowledge on stabilization of rural roads.

UNIT- I: TYPE OF PAVEMENT AND STRESS DISTRIBUTION ON LAYERED SYSTEM **9**

Introduction – Pavement as layered structure – Pavement types rigid and flexible – Resilient modulus - Stress and deflections in pavements under repeated loading.

UNIT- II: DESIGN OF FLEXIBLE PAVEMENTS **9**

Flexible pavement design – Empirical – Semi empirical and theoretical methods – Design procedure as per IRC guidelines – Design and specification of rural roads.

UNIT- III: DESIGN OF RIGID PAVEMENTS **9**

Methods of construction of Cement concrete pavement layers – Modified Westergaard approach – Design procedure as per IRC guidelines – Concrete roads and their scope in India.

UNIT- IV: PERFORMANCE EVALUATION AND MAINTENANCE **9**

Pavement Evaluation - Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling,

Roughness, Skid Resistance. Structural Evaluation by Deflection Measurements - Pavement Serviceability index, - Pavement maintenance (IRC Recommendations only).

UNIT- V: STABILIZATION OF PAVEMENTS **9**

Stabilization with special reference to highway pavements – Choice of stabilizers – Testing and field control - Stabilization for rural roads in India – Use of Geosynthetics in roads.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will

- Get knowledge about types of rigid and flexible pavements.
- Able to design of rigid pavements.
- Able to design of flexible pavements.
- Determine the causes of distress in rigid and flexible pavements.
- Understand stabilization of pavements, testing and field control.

TEXT BOOKS:

1. Khanna, S.K. and Justo C.E.G.and Veeraragavan, A, "Highway Engineering", New Chand and Brothers, Revised 10th Edition, 2014.
2. Kadiyali, L.R., "Principles and Practice of Highway Engineering", Khanna tech. Publications, New Delhi, 2005.

REFERENCE BOOKS:

1. Yoder, R.J. and Witchak M.W. "Principles of Pavement Design", John Wiley 2000.
2. "Guidelines for the Design of Flexible Pavements", IRC-37 - 2001,The Indian roads Congress, New Delhi.
3. "Guideline for the Design of Rigid Pavements for Highways", IRC 58-1998, The Indian Road Congress, New Delhi.
4. Wright P.H. "Highway Engineers", John Wiley and Sons, Inc., New York, 1996.

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

1903606 TRAFFIC ENGINEERING AND MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To give an overview of traffic regulation and management.
- To gain the knowledge of traffic design on Intersection and signal design.
- To gain knowledge of traffic safety with integrated approach in traffic planning.
- To develop knowledge on traffic surveys.
- To gain knowledge on traffic signals.

UNIT- I: TRAFFIC PLANNING AND CHARACTERISTICS 9

Road Characteristics – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India – Integrated planning of town ,country, regional and all urban infrastructure – Towards Sustainable approach.– Land use & transport and modal integration.

UNIT- II: TRAFFIC SURVEYS 9

Traffic Surveys – Speed, journey time and delay surveys – Vehicles Volume Survey including non-motorized transports – Methods and interpretation – Origin Destination Survey – Methods and presentation – Parking analysis – Accident analyses -Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – Level of service – Concept, applications and significance.

UNIT- III: TRAFFIC DESIGN AND VISUAL AIDS **9**

Intersection Design - channelization, Rotary intersection design – Signal design – Coordination of signals –– Grade separation - Traffic signs including VMS and road markings – Significant roles of traffic control personnel - Networking pedestrian facilities & cycle tracks.

UNIT- IV: TRAFFIC SAFETY AND ENVIRONMENT **9**

Road accidents – Causes, effect, prevention, and cost – Street lighting – Traffic and environment hazards – Air and Noise Pollution, causes, abatement measures – Promotion and integration of public transportation – Promotion of non-motorized transport.

UNIT- V: TRAFFIC MANAGEMENT **9**

Area Traffic Management System - Traffic System Management (TSM) with IRC standards – Traffic Regulatory Measures-Travel Demand Management (TDM) – Direct and indirect methods – Congestion and parking pricing – All segregation methods-Coordination among different agencies – Intelligent Transport System for traffic management, enforcement and education.

TOTAL: 45 PERIODS

OUTCOMES:

On completing this course, the Students will be able to

- Analyse traffic problems and plan for traffic systems various uses.
- Design Channels, Intersections, signals and parking arrangements.
- Develop Traffic management Systems.
- Analyse the cause of road accidents.
- Understand the fundamentals of traffic survey.

TEXT BOOKS:

1. Kadiyali.L.R. "Traffic Engineering and Transport Planning", Khanna Publishers, Delhi, 2013.

2. Indian Roads Congress (IRC) Specifications: "Guidelines and Special Publications on Traffic Planning and Management".
3. Salter. R.I and Hounsell N.B, "Highway Traffic Analysis and design", Macmillan Press Ltd. 1996.

REFERENCE BOOKS:

1. Fred L. Mannering, Scott S. Washburn and Walter P.Kilareski, "Principles of Highway Engineering and Traffic Analysis", Wiley India Pvt. Ltd., New Delhi, 2011.
2. Garber and Hoel, "Principles of Traffic and Highway Engineering", CENGAGE Learning,New Delhi, 2010.
3. SP:43-1994, IRC Specification, "Guidelines on Low-cost Traffic Management Techniques" for Urban Areas, 1994.
4. John E Tyworth, "Traffic Management Planning, Operations and control", Addison Wesly Publishing Company, 1996.
5. Hobbs.F.D. "Traffic Planning and Engineering", University of Brimingham, Peragamon Press Ltd, 2005.
6. Taylor MAP and Young W, "Traffic Analysis – New Technology and New Solutions", Hargreen Publishing Company, 1998.

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

1903607 TRANSPORT AND ENVIRONMENT L T P C

3 0 0 3

OBJECTIVES:

- To create an awareness of the impact of Transportation Projects on the environment and society.
- To gain knowledge on Methods of Impact analysis.
- To develop knowledge on Project assessment.
- To gain a knowledge on case studies in different modes of transport.
- To develop knowledge on environmental mitigation on natural and man made environment.

UNIT- I: INTRODUCTION 9

Environmental Inventory, Environmental Assessment, Environmental Impact Assessment (EIA), Environmental Impact of Transportation Projects, Need for EIA, EIA Guidelines for Transportation Project, Historical Development.

UNIT- II: METHODOLOGIES 9

Elements of EIA – Screening and Scoping – Methods of Impact Analysis – Applications – Appropriate methodology.

UNIT- III: ENVIRONMENTAL IMPACT, PREDICTION AND ASSESSMENT 9

Prediction and Assessment of Impact of Transportation Project at various stages on water, air, noise, land acquisition and resettlement, Socio economic impact, indigenous people, aesthetics, health and safety, energy studies, IRC guidelines- Overview of Transportation Impacts on Wildlife Movement and Populations-Case study.

UNIT- IV: ENVIRONMENTAL MITIGATION AND MANAGEMENT PLAN 9

Mitigation of the impact on Natural and Man-made Environment, Health, Water, Land, Noise, Air, Public participation, Environmental Management Plan, Energy Conservation, Methods to reduce Global Warming.

UNIT- V: EIA CASE STUDIES **9**

EIA Case Studies on Highway, Railway, Airways and Waterways Projects - India.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to

- Understood the impact of Transportation projects on the environment.
- Get knowledge on methods of impact analysis and their applications.
- Understand environmental Laws on Transportation Projects.
- Predict and assess the impact of transportation projects.
- Understand the mitigative measures adopted in the planning stage

TEXT BOOKS:

1. Canter, L.R., Environmental Impact Assessment, McGraw Hill, New Delhi, 1996.
2. Indian Road Congress (IRC), Environmental Impact of Highway Projects, IRC, Delhi, 1998.
3. P. Meenakshi, Elements of Environmental Science and Engineering, Prentice Hall of India, New Delhi, 2006
4. Thirumurthy A.M., Introduction to Environmental Science and Management, Shroff Publishers, Bombay, 2005

REFERENCE BOOKS:

1. John G.Rau and David, C.Hooten, "Environmental Impact Analysis Handbook", McGraw Hill Book Company, 1995.
2. James H.Banks, "Introduction to Transportation Engineering", McGraw Hill Book Company, 2000.
3. World Bank, "A Handbook on Roads and Environment, Vol.I and II", Washington DC,1997.

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1903608 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT L T P C

3 0 0 3

OBJECTIVES:

- To impart the knowledge of screening of environmental and social assessment.
- To gain the knowledge of methods for impact assessment.
- To mitigate the environmental and social impacts of developmental projects.
- To develop knowledge on assessment on land, water, air, noise and energy, flora and fauna.
- To study on report preparation of EIA.

UNIT- I: INTRODUCTION 9

Impacts and Development of on Environment – RIO Principles of Sustainable Development Environmental Impact Assessment (EIA) – Objectives – Historical development – EIA Types – EIA in project cycle –EIA Notification and Legal Framework–Stakeholders and their Role in EIA– Selection & Registration Criteria for EIA Consultants

UNIT- II: ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and

fauna - Matrices – Networks – Checklist Methods - Analytical models for Impact prediction.

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 – Issues related to the Project Affected People -Environmental Clearance Post Project Monitoring

UNIT- IV: SOCIO ECONOMIC ASSESSMENT **9**

Baseline monitoring of Socio economic environment – Identification of Project Affected Personal – Rehabilitation and Resettlement Plan- Economic valuation of Environmental impacts – Cost benefit Analysis.

UNIT- V: CASE STUDIES **9**

EIA case studies pertaining to Infrastructure Projects – Real Estate Development - Roads and Bridges – Multi-storey Buildings Mass Rapid Transport Systems - Ports and Harbor – Airports - Dams and Irrigation projects - Power plants – Water supply and drainage projects- Waste water treatment plants, STP – Mining Projects.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have ability 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.
- Analyse 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 Asiall, Volume 1 - Overview", Asian Development Bank,1997.
3. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers, 2009.

REFERENCE BOKKS:

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 Guide", Government of India, New Delhi, 2010.

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1903609 CONSTRUCTION PLANNING AND SCHEDULING L T P C

3 0 0 3

OBJECTIVES:

- To make the students to learn about planning of construction projects, scheduling procedures and techniques.
- To gain the knowledge of cost and quality control projects.
- To use project information as decision making tool.
- To gain knowledge on quality control.
- To develop knowledge on safety measures in construction.

UNIT- I: CONSTRUCTION PLANNING 9

Basic concepts in the development of construction plans-choice of Technology and Construction method-Defining Work Tasks- Work breakdown structure - Definition-Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

UNIT- II: SCHEDULING PROCEDURES AND TECHNIQUES 9

Relevance of construction schedules-Bar charts - The critical path method-Calculations for critical path scheduling and PERT -Activity float and schedules-Presenting project schedules Critical path scheduling for Activity-on-node and with leads, Lags and Windows- Resource oriented scheduling-Scheduling with resource constraints and precedences -Use of Advanced Scheduling Techniques-Scheduling with uncertain durations-Calculations for Monte Carlo Schedule Simulation- Crashing and time/cost tradeoffs -Improving the Scheduling process – Introduction to application software(Primavera, MS Project)

UNIT- III: COST CONTROL MONITORING AND ACCOUNTING 9

The cost control problem-The project Budget-Forecasting for Activity cost control - financial accounting systems and cost accounts-Control of project cash flows-Schedule control-Schedule and Budget updates-Relating cost and schedule information.

UNIT- IV: QUALITY CONTROL AND SAFETY DURING CONSTRUCTION 9

Quality and safety Concerns in Construction-Organizing for Quality and Safety-Work and Material Specifications-Total Quality control-Quality control by statistical methods - Statistical Quality control with Sampling by Attributes-Statistical Quality control with Sampling by Variables Safety.

UNIT- V: ORGANIZATION AND USE OF PROJECT INFORMATION 9

Types of project information-Accuracy and Use of Information-Computerized organization and use of Information -Organizing information in databases-relational model of Data bases-Other conceptual Models of Databases-Centralized database Management systems-Databases and application programs-Information transfer and Flow.

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have ability to

- Understand basic concepts of construction planning.
- Schedule the construction activities.
- Forecast and control the cost in a construction.
- Understand the quality control and safety during construction.
- Organize information in Centralized database Management systems.

TEXT BOOKS:

1. Chitkara, K.K. "Construction Project Management Planning, Scheduling and Control", Tata McGraw Hill Publishing Co., New Delhi, 2005.
2. Srinath,L.S., "PERT and CPM Principles and Applications", Affiliated East West Press, 2001.

REFERENCE BOOKS:

1. Chris Hendrickson and Tung Au, "Project Management for Construction – Fundamentals Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pitsburgh, 2000.

2. Moder.J., Phillips. C. and Davis E, "Project Management with CPM, PERT and Precedence Diagramming", Van Nostrand Reinhold Co., 3rd Edition, 1985.
3. Willis., E.M., "Scheduling Construction projects", John Wiley and Sons, 1986.
4. Halpin,D.W., "Financial and Cost Concepts for Construction Management", John Wiley and Sons, New York, 1985.

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1904606 INTELLECTUAL PROPERTY RIGHTS L T P C

3 0 0 3

OBJECTIVE:

- 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 compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
- 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.

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 LEGISLATIONS **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 **10**

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 **8**

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

TOTAL: 45 PERIODS

OUTCOMES:

- 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 Secretary ship, Law Business (MBA), International Affairs, Public Administration and Other fields.
- Employability as the Compliance Officer, Public Relation Officer and Liaison Officer.
- Establishment of Legal Consultancy and service provider.

TEXT BOOKS:

1. V. Scople Vinod, “Managing Intellectual Property”, Prentice Hall of India Pvt Ltd, 2012.
2. S. V. Satakar, “Intellectual Property Rights and Copy Rights, 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.

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1915003 TOTAL QUALITY MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

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

- To understand and apply QMS and EMS in any organization.

UNIT- I: INTRODUCTION **9**

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

UNIT- II: TQM PRINCIPLES **9**

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

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

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

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

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

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

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation— Documentation—Internal Audits—Registration--

Environmental Management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001 -Requirements of ISO 14001—Benefits of EMS – National and International Awards.

TOTAL: 45 PERIODS

OUTCOMES:

- 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 in business processes with an understanding on customer requirements.
- Students can apply QMS and EMS in any organisation.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

5. ISO 9001-2015 standard.

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1903612 DISASTER MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

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

UNIT- I: INTRODUCTION TO DISASTERS 9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate

change- Dos and Don’ts during various types of Disasters.

UNIT- II: APPROACHES TO DISASTER RISK REDUCTION (DRR) 9

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

UNIT- III: INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT-IV: DISASTER RISK MANAGEMENT IN INDIA 9

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

UNIT- V: DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Differentiate the types of disasters, causes and their impact on environment and society.
- Assess factors of vulnerability and its impacts.
- Knowledge of various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India and Scenarious in the Indian context.
- Assess Disaster damage assessment and management.

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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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

OUTCOMES:

- Students should be able to understand human values and apply ethics in societal issues.

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

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Langford, Duncan (EDT): Internet Ethics, London, Macmillan Press Ltd., 2000.
2. Erwann, M. David, Michele S. Shauf, Computers, Ethics and Society, Oxford University Press,2003
3. Alan Kitson and Robert Campbell:" The Ethical Organisation", Red Globe Press, 2008.
4. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Professional Ethics and Human Values", Prentice Hall of India, New Delhi, 2013.
5. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 3rd edition (2017).

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PROFESSIONAL ELECTIVE- IV

SEMESTER VII

1903704 COASTAL ENGINEERING L T PC

3 0 0 3

OBJECTIVES:

- The main purpose of coastal engineering is to protect harbors.
- It helps in improving navigation.
- The students are exposed to the diverse topics of wave mechanics and wave climate.
- To gain knowledge about shoreline protection methods.
- To inculcate knowledge on laboratory investigations using model studies.

UNIT-I: INTRODUCTION TO COASTAL ENGINEERING 9

Indian Scenario - Classification of Harbours Introduction - wind and waves - Sea and Swell introduction to small amplitude wave theory - use of wave tables- Mechanics of water waves Linear (Airy) wave theory, Introduction to Tsunami.

UNIT-II: WAVE PROPERTIES AND ANALYSIS 9

Behaviour of waves in shallow waters, Introduction to non-linear waves and their properties Waves in shallow waters - Wave Refraction, Diffraction and Shoaling - Hindcast wave generation models, wave shoaling; wave refraction; wave breaking; wave diffraction random and 3D waves Short term wave analysis - wave spectra and its utilities - Long term wave analysis- Statistics analysis of grouped wave data.

UNIT-III: COASTAL SEDIMENT TRANSPORT **9**

Dynamic beach profile; cross-shore transport; along shore transport (Littoral transport), sediment movement- Dredging – Dredgers - Environmental effects of dredging - Remote sensing and GIS application in coastal engineering

UNIT-IV: COASTAL DEFENSE **9**

Field measurement; models, groyne, sea walls, offshore breakwaters, artificial nourishment planning of coast protection works - Design of shore defense structures- Maintenance of coastal structures.

UNIT-V: MODELING IN COASTAL ENGINEERING **9**

Physical modeling in Coastal Engineering - Limitations and advantages - Role of physical modeling in coastal engineering - Numerical modeling - Modeling aspects - limitations – Tsunami mitigation measures

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Understand coastal engineering aspects of harbors methods to improve navigation
- Understand the wave properties and analysis of wave.
- Understand the concepts of sediment transport.
- Design of shore defense structures.
- Gain knowledge in modeling in coastal engineering.

REFERENCE BOOKS:

1. Mani J.S., “Coastal Hydrodynamics”, PHI Pvt. Ltd. New Delhi - 2012.
2. Dean, R.G. and Dalrymple, R.A., “Water wave mechanics for Engineers and Scientists”, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1994.
3. Ippen, A.T., “Estuary and Coastline Hydrodynamics”, McGraw-Hill, Inc., New York, 1978.
4. Sorenson, R.M., “Basic Coastal Engineering”, A Wiley-Inter science Pub. New York, 1978.
5. Coastal Engineering Manual, Vol. I-VI, Coastal Engineering Research Centre, Dept. of the Army, US Army Corps of Engineers, Washington DC, 2006.

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1903705 PARTICIPATORY WATER RESOURCES MANAGEMENT ` L T P C

3 0 0 3

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: INTRODUCTION TO PARTICIPATORY APPROACH 9

Sociology – Basic concepts – Perspectives- Social Stratification –Social Status– Irrigation as a Socio technical Process - Participatory concepts– Needs for participatory -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 affecting 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

Definition of watershed management-Concept and significance of watershed - Basic factors influencing watershed development –Principles 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

OUTCOMES:

The students will 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.

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1903706 GREEN BUILDING DESIGN L T P C

3 0 0 3

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

OUTCOMES:

The students completing the course will have ability to

- Describe the concepts of sustainable design and green building techniques including energy efficiency and indoor environmental quality management.
- Create drawings and models of their own personal green building project.
- Reducing waste, pollution and environmental degradation.
- Efficiently using energy, water, and other resources.
- Protecting occupant health and improving employee productivity.

TEXT BOOKS:

1. K.S.Jagadish, B. U. Venkatarama Reddy and K. S. Nanjunda Rao. "Alternative Building Materials and Technologies". New Age International, 2007.
2. "Low Energy Cooling For Sustainable Buildings". John Wiley and Sons Ltd, 2009.
3. Sustainable Building Design Manual. Vol 1 and 2, Teri, New Delhi, 2004.

REFERENCE BOOKS:

1. Osman Attmann, Green Architecture Advanced Technologies and Materials, McGraw Hill, 2010.
2. Jerry Yudelson, Green building Through Integrated Design, McGraw Hill, 2009.
3. Fundamentals of Integrated Design for Sustainable Building by Marian Keeler, Bill Burke.]

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1903707 GROUNDWATER ENGINEERING L T PC

3 0 0 3

OBJECTIVES:

- To enhance the knowledge on hydrogeological parameters
- To introduce the student to the principles of Groundwater governing Equations and characteristics of different aquifers.
- To understand the techniques of development and management of groundwater.
- To learn about the importance of ground water quality.
- To gain the knowledge of conservation and recharge of ground water.

UNIT-I: HYDROGEOLOGICAL PARAMETERS 9

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – Hydrogeological Cycle - Steady state flow - Darcy‘s Law - Groundwater Velocity –- Dupuit Forchheimer assumption – water level fluctuations.

UNIT-II: WELL HYDRAULICS 9

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery

UNIT-III: GROUNDWATER MANAGEMENT **9**

Need for Management Model – Database for Groundwater Management – Groundwater balance study – Introduction to Mathematical model – Model Conceptualization – Initial and Boundary Condition – Calibration – Validation – Future Prediction – Sensitivity Analysis – Uncertainty – Development of a model

UNIT-IV: GROUNDWATER QUALITY **9**

Ground water chemistry - Origin, movement and quality - Water quality standards – Drinking water – Industrial water – Irrigation water - Ground water Pollution and legislation - Groundwater Modeling

UNIT-V: GROUNDWATER CONSERVATION **9**

Artificial recharge techniques – Reclaimed wastewater recharge – Soil aquifer treatment (SAT) – Aquifer Storage and Recovery (ASR) Seawater Intrusion and Remediation – Ground water Basin management and Conjunctive use – Protection zone delineation, Contamination source inventory and remediation schemes

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Understand aquifer properties and its dynamics
- Get an exposure towards well design and practical problems
- Develop a model for groundwater management.
- Students will be able to understand the importance of artificial recharge and groundwater quality concepts.
- Gain knowledge on conservation of groundwater.

TEXT BOOKS:

1. Raghunath H.M., “Ground Water Hydrology”, New Age International (P) Limited, New Delhi, 2010.
2. Todd D.K., “Ground Water Hydrology”, John Wiley and Sons, New York, 2000.

REFERENCE BOOKS:

1. Fitts R Charles, “Groundwater Science”, Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, “Ground Water”, K.J. Graph arts, Chennai, 1998
3. Schwartz F. W, Hubao Zhang, “Fundamentals of Ground Water”, Wiley student edition, 2003

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1903708 WATER RESOURCES SYSTEMS ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To introduce the student to the concept of Mathematical approaches for managing the water resources system.
- To enhance software programming knowledge involved in water resources system.
- To make the students apply an appropriate system approach to optimally operate a water resource system.
- To gain the knowledge of simulation models in water resource.
- To expose students to advanced techniques

UNIT-I: SYSTEM APPROACH **9**

Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering.

UNIT-II: LINEAR PROGRAMMING **9**

Introduction to Operation research - Linear programming Problem Formulation- graphical solution- Simplex method –Sensitivity analysis - application to operation of single purpose reservoir.

UNIT-III: DYNAMIC PROGRAMMING **9**

Bellman‘s optimality criteria, problem formulation and solutions – Water Allocation for three state (user), Forward and Backward Recursion techniques in Dynamic Programming Shortest pipe line route problem - Application to reservoirs capacity expansion

UNIT-IV: SIMULATION **9**

Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation

UNIT-V: ADVANCED OPTIMIZATION TECHNIQUES **9**

Integer and parametric linear programming – Goal programming types – Applications to reservoir release optimization – application of evolutionary algorithms like Genetic algorithm, Particle swarm, Simulated Annealing to reservoir release optimization

TOTAL: 45 PERIODS

OUTCOMES:

The students will be

- Exposed to the economic aspects and analysis of water resources systems by which they will get an idea of comprehensive and integrated planning of a water resources project.
- Understanding the concept of linear programming and apply in water resource system.
- Understanding the concept of dynamic programming and apply in water resource system.
- Develops simulation models.
- Developing skills in solving problems in operations research through LP, DP and Simulation techniques.

TEXT BOOK:

1. Vedula, S., and Majumdar, P.P. "Water Resources Systems" – Modeling Techniques and Analysis Tata McGraw Hill, 5th reprint, New Delhi, 2010.

REFERENCE BOOKS:

1. Hall Warren, A. and John A. Dracup., “Water Resources System Engineering”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1998
2. Chadurvedi M.C., “Water resource Systems Planning and Management”, Tata McGraw Hill INC., New Delhi, 1997
3. Taha H.A., “Operation Research”, McMillan Publication Co., New York, 1995.
4. Maass A., Husfchimidt M.M., Dorfman R., Thomas H A., Marglin S.A and Fair G. M., “Design of Water Resources System”, Hardward University Press, Cambridge, Mass.,1995.
5. Goodman Aluvin S., “Principles of Water Resources Planning”, Prentice Hall of India, 1984

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

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

1903709 GEO-ENVIRONMENTAL ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- The student acquires the knowledge on the Geotechnical engineering problems.
- The students learn about the causes of waste generation.
- To gain the knowledge of soil contamination and safe disposal of waste.
- To understand the importance of waste stabilisation.
- To remediate the contaminated soils by different techniques thereby protecting environment.

UNIT-I: GENERATION OF WASTES AND CONSQUENCES OF SOIL POLLUTION 9

Introduction to Geo environmental engineering – Environmental cycle – Sources, production and classification of waste – Causes of soil pollution – Factors governing soil pollution interaction clay minerals - Failures of foundation due to waste movement.

UNIT-II: SITE SELECTION AND SAFE DISPOSAL OF WASTE 9

Safe disposal of waste – Site selection for landfills – Characterization of land fill sites and waste – Risk assessment – Stability of landfills – Current practice of waste disposal – Site Assessment and Monitoring – Passive containment system – Application of geosynthetics in solid waste management – Rigid or flexible liners.

UNIT-III: TRANSPORT OF CONTAMINANTS **9**

Contaminant transport in sub surface – Advection, Diffusion, Dispersion – Governing equations – Contaminant transformation – Sorption – Biodegradation – Ion exchange – Precipitation – Hydrological consideration in land fill design – Ground water pollution.

UNIT-IV: WASTE STABILIZATION **9**

Stabilization - Solidification of wastes – Micro and macro encapsulation – Absorption, Adsorption, Precipitation – Detoxification – Mechanism of stabilization – Organic and inorganic stabilization – Utilization of solid waste for soil improvement – case studies.

UNIT-V: REMEDIATION OF CONTAMINATED SOILS **9**

Exsitu and Insitu remediation-Solidification, bio-remediation, incineration, soil washing, phyto remediation, soil heating, verification, bio-venting - Contaminated site characterization and risk assessment.

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Assess the contamination in the soil
- Understand the current practice of waste disposal
- To prepare the suitable disposal system for particular waste.
- Stabilize the waste and utilization of solid waste for soil improvement.
- Select suitable remediation methods based on contamination.

TEXT BOOKS:

1. Hari D. Sharma and Krishna R. Reddy, “Geo-Environmental Engineering” John Wiley and Sons, INC, USA, 2004.
2. Daniel B.E., “Geotechnical Practice for waste disposal”, Chapman & Hall, London 1993.

3. Manoj Datta, “Waste Disposal in Engineered landfills”, Narosa Publishing House, 1997.
4. Manoj Datta, B.P. Parida, B.K. Guha, “Industrial Solid Waste Management and Landfilling Practice”, Narosa Publishing House, 1999.

REFERENCE BOOKS:

1. Westlake, K, “Landfill Waste pollution and Control”, Albion Publishing Ltd., England, 1995.
2. Wentz, C.A., “Hazardous Waste Management”, McGraw Hill, Singapore, 1989113 Proceedings of the International symposium on Environmental Geotechnology (Vol.I and II) Environmental Publishing Company, 1986 and 1989.
3. Ott, W.R., “Environmental indices”, Theory and Practice, Ann Arbor, 1978.
4. Fried, J.J., “Ground Water Pollution”, Elsevier, 1975.
5. ASTM Special Tech. Publication 874, Hydraulic Barrier in Soil and Rock, 1985.
6. Lagrega, M.D., Buckinham, P.L. and Evans, J.C., “Hazardous Waste Management” McGraw Hill Inc. Singapore, 1994.

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

1903710 HYDROLOGY AND WATER RESOURCES ENGINEERING LT PC

3 0 0 3

OBJECTIVES:

- To introduce the student to the concept of hydrological aspects of water availability and requirements.
- Students should be able to quantify, control and regulate the water resources.
- To have an insight on runoff, flow measurements and hydrographs, flood, drought.
- To have exposure on flood and drought analysis.
- To have a deep learning on principles and design of reservoirs, ground water and its management.

UNIT-I: PRECIPITATION, EVAPORATION AND ABSTRACTIONS **9**

Hydrological cycle- Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges-Spatial analysis of rainfall data using Thiessen and Isohyetal methods-Interception - Evaporation. Horton‟s equation, pan evaporation measurements and evaporation suppression - Infiltration- double ring infiltrometer, infiltration indices

UNIT-II: RUNOFF **9**

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical – Strange's table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH- S-curve.

UNIT-III: FLOOD AND DROUGHT **9**

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

UNIT-IV: RESERVOIRS **9**

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area capacity - storage estimation, sedimentation –Effect of sedimentation on dams- life of reservoirs.

UNIT-V: GROUNDWATER AND MANAGEMENT **9**

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

TOTAL: 45 PERIODS

OUTCOMES:

The students completing the course will have

- An understanding of the key drivers on water resources, hydrological processes and their integrated behavior in catchments.
- Apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and Hydrograph.
- Explain the concept of hydrological extremes such as Flood and Drought and management strategies.
- Ability to conduct spatial analysis of rainfall data and design water storage reservoirs.
- Understand the concept and methods of ground water management.

TEXT BOOKS:

1. Subramanya .K. “Engineering Hydrology”- Tata McGraw Hill, 2010
2. Jayarami Reddy .P. “Hydrology”, Tata McGraw Hill, 2008.
3. Linsley, R.K. and Franzini, J.B. “Water Resources Engineering”, McGraw Hill International Book Company, 1995.

REFERENCE BOOKS:

1. David Keith Todd. “Groundwater Hydrology”, John Wiley & Sons, Inc. 2007
2. Ven Te Chow, Maidment, D.R. and Mays, L.W. “Applied Hydrology”, McGraw Hill International Book Company, 1998.
3. Raghunath .H.M., “Hydrology”, Wiley Eastern Ltd., 1998.

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PROFESSIONAL ELECTIVE –V & VI

SEMESTER VIII

1903801 COMPUTER AIDED DESIGN OF STRUCTURES LT PC

3 0 0 3

OBJECTIVES:

- To widen the knowledge of CAD applications.
- To innovate the students by Computer Graphics.
- To develop the concepts in Structural Analysis.
- To design and optimize structures.
- To gain knowledge on Expert systems.

UNIT-I: INTRODUCTION 9

Fundamental reason for implementing CAD - Software requirements – Hardware components in CAD system – Design process - Applications and benefits

UNIT-II: COMPUTER GRAPHICS 9

Graphic Software – Graphic primitives - Transformations - 2 Dimensional and 3 Dimensional transformations – Concatenation - Wire frame modeling - Solid modeling - Graphic standards-Drafting packages – Auto CAD.

UNIT-III: STRUCTURAL ANALYSIS 9

Principles of structural analysis - Fundamentals of finite element analysis - Concepts of finite elements – Stiffness matrix formulation – Variational Method – Weighted residual

method – Problems – Conditions of convergence of functions – Analysis packages and applications.

UNIT-IV: DESIGN AND OPTIMIZATION **9**

Principles of design of steel and RC structures - Beams and Columns - Applications to simple design problems - Optimization techniques - Algorithms - Linear programming.

UNIT-V: EXPERT SYSTEMS **9**

Introduction to artificial intelligence - Knowledge based expert systems – Applications of KBES- Rules and decision tables - Inference mechanisms - simple applications.

TOTAL: 45 PERIODS

OUTCOMES:

- Able to implement ideas of Computer aided design.
- Able to gain knowledge of Computer graphics.
- Able to develop knowledge of Structural analysis packages.
- Knowledge of design and optimization.
- Able to apply knowledge of expert system.

TEXT BOOKS:

1. Groover M.P. and Zimmers E.W. Jr., CAD/CAM, “Computer Aided Design and Manufacturing”, Prentice Hall of India Ltd, New Delhi, 1993.
2. Krishnamoorthy C.S.Rajeev S., “Computer Aided Design”, Narosa Publishing House, New Delhi, 1993.

REFERENCE BOOKS:

1. Harrison H.B., “Structural Analysis and Design”, Part I and II Pergamon Press, Oxford, 1990.
2. Rao S.S., “Optimisation Theory and Applications”, Wiley Eastern Limited, New Delhi, 1977.
3. Richard Forsyth (Ed), “Expert System Principles and Case Studies”, Chapman and Hall, London, 1989.

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

1903802 MAINTENANCE, REPAIR AND REHABILITATION OF STRUCTURES

L T PC

3 0 0 3

OBJECTIVES:

- To gain knowledge of causes of deterioration and assessment of distressed structures.
- To acquire the knowledge on Quality of concrete and durability aspects.
- To know the materials used for repair of concrete structures and various special concretes.
- To gain knowledge of Testing Techniques, Load testing of structures and corrosion protection techniques.
- To acquire knowledge of repairing of structures and demolition procedures.

UNIT-I: MAINTENANCE AND REPAIR STRATEGIES **9**

Definitions: Maintenance, Repair and Rehabilitation - Facets of Maintenance - Preventive measures based on various aspects of Inspection - Assessment procedure for evaluating damaged structure - Causes of deterioration and diagnosis.

UNIT-II STRENGTH AND DURABILITY OF CONCRETE **9**

Quality assurance for concrete - Strength, Durability - Cracks, different types, causes - Effects due to climate, temperature, Sustained elevated temperature, Corrosion

UNIT-III SPECIAL CONCRETES AND MATERIALS **9**

Mortar - Expansive cement – Ferro cement - Polymer concrete - Sulphur infiltrated concrete Fibre reinforced concrete - High strength concrete - High performance concrete - Geopolymer concrete - Reactive powder concrete - Concrete made with industrial wastes.

UNIT-IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS **9**

Non-destructive Testing Techniques - Load Testing of structures - Epoxy injection – Shoring – Underpinning - Corrosion protection techniques - Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, Cathodic protection.

UNIT-V REPAIR, REHABILITATION AND RETROFITTING OF STRUCTURES **9**

Strengthening of Structural elements - Repair of structures distressed due to fire, leakage, earthquake - Transportation of Structures from one place to other - Structural Health Monitoring - Demolition of structures using engineered and non- engineered techniques - Case studies

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to understand

- The importance of maintenance and assessment method of distressed structures.
- The strength and durability properties their effects due to climate and temperature.
- Recent development in concrete.
- The techniques for repair and protection methods
- Repair, rehabilitation and retrofitting of structures and demolition methods.

TEXT BOOKS:

1. Shetty.M.S. Concrete Technology - Theory and Practice, S.Chand and Company, 2008.
2. Vidivelli.B. “Rehabilitation of Concrete Structures”, Standard Publishes Distribution 1st edition 2009.
3. Varghese.P.C, “Maintenance Repair and Rehabilitation & Minor works of building”, Prentice Hall India Pvt Ltd 2014.

REFERENCE BOOKS:

1. DovKominetzky.M.S., “Design and Construction Failures”, Galgotia, Publications Pvt.Ltd.,2001
2. Ravishankar.K. Krishnamoorthy.T.S, “Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures”, Allied Publishers, 2004.
3. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.
4. Hand Book on “Repair and Rehabilitation of RCC Buildings” Director General works CPWD ,Govt of India , New Delhi–2002

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

1903803 PREFABRICATED STRUCTURES L T P C

3 0 0 3

OBJECTIVES:

- To impart knowledge to students on modular construction.
- To design the prefabricated components.

- To adopt design philosophy based on material efficiency.
- To design connections between Structural members.
- To apply Codal provisions.

UNIT-I: INTRODUCTION **9**

Need for prefabrication – Principles of prefabrication – Modular coordination – Standardization – Materials – Systems – Production – Transportation -Prefabrication of load carrying members – Disuniting of structures – Erection.

UNIT-II: PREFABRICATED COMPONENTS **9**

Behaviour and types of structural components – Large panel systems – roof and floor slabs – Walls panels - Beams - Columns - Shear walls

UNIT-III: DESIGN PRINCIPLES **9**

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems.

UNIT-IV: JOINTS AND CONNECTIONS IN STRUCTURAL MEMBERS **9**

Types of Joints – based on action of forces - compression joints - shear joints - tension joints based on function - construction, contraction, expansion. Design of expansion joints Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

UNIT-V: DESIGN FOR ABNORMAL LOADS **9**

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse.

TOTAL: 45 PERIODS

OUTCOMES:

- The student will have good knowledge about design principles, layout of factory and stages of loading in precast construction.
- Acquire knowledge about panel systems, slabs, connections used in precast construction and they will be in a position to design the elements.
- Acquire knowledge about joint flexibility.
- Acquire knowledge on Structural Connections.
- Acquire knowledge of codal provisions related to design of abnormal loads.

TEXT BOOKS:

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA, 1991.
2. Lewitt,M. "Precast Concrete- Materials, Manufacture, Properties And Usage", Applied Science Publishers , London And New Jersey, 1982.
3. Bachmann, H. and Steinle, A. "Precast Concrete Structures", Ernst & Sohn, Berlin, 2011.

REFERENCE BOOKS:

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016.
3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

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

1903804 BRIDGE ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To acquire knowledge on types of bridges.
- To adopt the analysis for Bridges.
- To widen the knowledge of steel bridge design concepts.
- To apply the concept of launching and erection for RC and PSC bridges.
- To know the behaviour of Substructure components.

UNIT-I: INTRODUCTION 9

History of bridges - Components of a bridge - Classification of road bridges - Selection of site and initial decision process - Survey and alignment; Geotechnical investigations and interpretations River Bridge: Selection of Bridge site and planning - Collection of bridge design data - Hydrological calculation-Road Bridges - IRC codes - Standard Loading for Bridge Design - Influence lines for statically determinate and indeterminate structures - Transverse distribution of Live loads among deck longitudinal - Load combinations for different working state and limit state designs-Railway Bridges: Loadings for Railway Bridges; Railroad data. Pre-design considerations - Railroad vs. Highway bridges

UNIT-II: SUPERSTRUCTURES 9

Bridge decks – Structural forms and behaviour – Choices of superstructure types – Behaviour and modeling of bridge decks – Simple beam model – Plate model – Grillage method – Finite Element method - Different types of superstructure (RCC and PSC); Longitudinal Analysis of Bridge.- Transverse Analysis of Bridge - Temperature Analysis - Distortional Analysis - Effects of Differential settlement of supports - Reinforced earth structures

UNIT-III: DESIGN OF STEEL BRIDGES 9

Design of Truss Bridges – Design of Plate girder bridges. Types of steel bridges - Design principles of Lattice girder bridges - Design principles of cable stayed bridge - Components of suspension bridge

UNIT-IV: DESIGN OF RC AND PSC BRIDGES **9**

Design of slab bridges – T beam bridges – PSC bridges- Analysis and design principles of box type girder- Launching and erection details with case studies - Segmental construction principles.

UNIT-V: SUBSTRUCTURE, BEARINGS AND EXPANSION JOINTS, PARAPETS AND RAILINGS **9**

Substructure **-** Pier; Abutment - Wing walls- Importance of Soil-Structure Interaction - Types of foundations - Open foundation- Pile foundation- Well foundation- Simply supported bridge Continuous Bridge - Bearings and Expansion Joints - Different types of bridge bearings and expansion joints - Parapets and Railings for Highway Bridges - General features - Types of bearings, Forces on bearings, Basis for selection of bearings -Design of steel rocker bearing Design of roller bearing

TOTAL: 45 PERIODS

OUTCOMES:

On successful completion of this course, students will be able to

- Identify loads on bridges and selection of type of bridge for the site condition
- Analyze the super structure by various methods.
- Design the trussed bridge and plate girder bridges
- Design reinforced concrete slab and T-beam bridges and prestressed concrete bridges.
- Design of substructure, parapet and railings.

TEXT BOOKS:

1. Johnson Victor D., “Essentials of Bridge Engineering”, Oxford and IBH Publishing Co., New Delhi, 2009.

2. Jagadeesh. T.R. and Jayaram. M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd, Learning Pvt. Ltd., 2013

REFERENCE BOOKS:

1. Phatak D.R., “Bridge Engineering”, Satya Prakashan, New Delhi, 1990.
2. Ponnuswamy S., “Bridge Engineering”, Tata McGraw-Hill, New Delhi,1996.
3. Rajagopalan. N. “Bridge Superstructure”, Alpha Science International,2006

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

1903805 INTEGRATED WATER RESOURCES MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

- To introduce the students to the interdisciplinary analysis of water and conceptual design of intervention strategies.
- To gain knowledge on institutional transformation and contextualizing IWRM
- To know more about issues in IWRM
- To understand the importance and development of IWRM in India.
- To develop a knowledge-base on capacity building on IWRM.

UNIT-I: IWRM FRAMEWORK 9

Definition –Objectives– Principles - Evolution of IWRM - IWRM relevance in water resources management – Paradigm shift.

UNIT-II: CONTEXTUALIZING IWRM **9**

UN formulations - SDG goals -IWRM in Global, Regional and Local water partnership - Institutional transformation - Bureaucratic reforms - Inclusive development

UNIT-III: EMERGING ISSUES IN WATER MANAGEMENT **9**

Emerging Issues -– Drinking water management in the context of climate change – IWRM and irrigation - Flood – Drought – Pollution – Linkages between water, health and poverty

UNIT-IV: IWRM AND WATER RESOURCES DEVELOPMENT IN INDIA **9**

Rural Development - Ecological sustainability- -Watershed development and conservation Ecosystem regeneration – Wastewater reuse - Sustainable livelihood - Food security

UNIT-V: ASPECTS OF INTEGRATED DEVELOPMENT **9**

Capacity building - Conceptual framework of IWRM – Problems and policy issues - Solutions for effective integrated water management - Case studies

TOTAL: 45 PERIODS

OUTCOMES:

The students will be able to

- Understand objectives, principles and evolution of integrated water resources management.
- Have an idea of contextualizing IWRM.
- Gain knowledge in emerging issues in water management, flood, drought, pollution and poverty.
- Understand the water resources development in India and wastewater reuse.
- Gain knowledge on integrated development of water management.

TEXT BOOKS:

1. Mollinga P. *et al.* “Integrated Water Resources Management”, Water in South Asia Volume I, Sage Publications, 2006.
2. Sithamparanathan, Rangasamy, A., and Arunachalam, N., “Ecosystem Principles and Sustainable Agriculture”, Scitech Publications (India) Pvt. Ltd, Chennai, 1999.

REFERENCE BOOKS:

1. Cech Thomas V., “Principles of Water Resources: History, Development, Management and Policy”. John Wiley and Sons Inc., New York. 2003.
2. Murthy, J.V.S., “Watershed Management in India”, Wiley Eastern Ltd., New York, 1995.
3. Dalte, S.J.C., “Soil Conservation and Land Management”, International Book Distribution, India, 1986

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1903806 DESIGN OF PRESTRESSED CONCRETE STRUCTURES L T P C

3 0 0 3

OBJECTIVES:

- To gain knowledge of Principle of prestressing.
- To design End blocks.
- To design Continuous members.
- To design Prestressed Concrete water storage structures.

- To widen the knowledge of prestressed Concrete bridges.

UNIT-I: PRINCIPLES AND BEHAVIOUR OF PRESTRESSING 9

Basic concepts of Prestressing - Types and systems of prestressing - Need for High Strength materials, Analysis methods, losses of prestress – Short and Long term deflections – Cable layouts

UNIT-II: DESIGN OF FLEXURAL MEMBERS 9

Behaviour of flexural members, determination of ultimate flexural strength – Various Codal provisions - Design of flexural members, Design for shear, bond and torsion Design of end blocks

UNIT-III: DESIGN OF CONTINUOUS AND CANTILEVER BEAMS 9

Analysis and design of continuous beams - Methods of achieving continuity - concept of linear transformations- concordant cable profile and gap cables – Analysis and design of cantilever beams

UNIT-IV: DESIGN OF TENSION AND COMPRESSION MEMBERS 9

Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks - Design of compression members with and without flexure - its application in the design piles, flag masts and similar structures.

UNIT-V: DESIGN OF PRESTRESSED CONCRETE BRIDGES 9

Composite beams - analysis and design, Composite sections ultimate strength Application in prestressed concrete bridges - Design of pre- tensioned and post tensioned girder bridges - Partial prestressing - advantages and applications.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of this course, the students will be able

- To explain the principle, types and systems of prestressing and analyse the deflections.
- Determine the flexural strength and design the flexural members, end blocks

- Analyse the statically indeterminate structures and design the continuous beam.
- Design the tension and compression members and apply it for design of piles.
- Analyse the stress, deflections, flexural and shear strength and apply it for the design of bridges.

REFERENCE BOOKS:

1. Arthur H. Nilson, “Design of Prestressed Concrete”, John Wiley and Sons Inc, New York, 2004.
2. Krishna Raju, “Prestressed Concrete”, Tata McGraw Hill Publishing Co., New Delhi, 2008.
3. Lin.T.Y, and Burns.H, “Design of Prestressed Concrete Structures”, John Wiley and Sons Inc, New York, 2009.
4. Rajagopalan.N, “Prestressed Concrete”, Narosa Publications, New Delhi, 2008.
5. Sinha.N.C.and.Roy.S.K, “Fundamentals of Prestressed Concrete”, S.Chand and Co., 1998.

CODE BOOKS:

1. IS456 - 2000 - IS Code of Practice for Plain and Reinforced Concrete.
2. IS1343 - 1980 - IS Code of Practice for Prestressed Concrete.
3. IS1678-1998-Specification for Prestressed Concrete Pole for overhead Power Traction and Telecommunication lines.
4. IRC:6-2010 Standard Specifications and Code of Practice for Road Bridges, Section II Loads and Stresses (Fifth Revision).
5. IRC:18-2000 Design Criteria for Prestressed Concrete Road Bridges(Post-Tensioned Concrete) (3rd Revision).
6. IRS - Indian Railway Standard Specifications.
7. BS8110 - 1985 - Code of Practice for Design and Construction.
8. IS784 - 2001 - IS Specification for Prestressed Concrete Pipes.
9. IS3370 - 1999 - Part III - IS Code of Practice for Concrete Structures for the storage of liquids.
10. IS875 - 1987 - Part I - IV - IS Code of Practice for Design load

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

1903807 **INDUSTRIAL STRUCTURES** **L T P C**

3 0 0 3

OBJECTIVES:

- To learn about planning, layout and functional aspects of industries.
- To design of major steel and R.C structures needed for industries.
- To gain knowledge of prefabrication in Industrial structures.
- To study the requirements, planning and design of steel structures.
- To study the requirements, planning and design of R.C structures.

UNIT-I: PLANNING **9**

Classification of industries and industrial structures – Site Planning and Selection – Exterior and interior Layout for Industries and buildings - Guidelines from factories act

UNIT-II: FUNCTIONAL REQUIREMENTS **9**

Lighting – Ventilation – Noise and Vibration control – Fire safety- Codal Provisions

UNIT-III: DESIGN OF STEEL STRUCTURES **9**

Pre-engineered buildings - Mill buildings –– Power Plant Structures –- Design of Chimney

UNIT-IV: DESIGN OF R.C. STRUCTURES **9**

Corbels, Canopy and Nibs - Design of bunkers and silos –Cooling Towers (Principles only)

UNIT-V: PREFABRICATION **9**

Principles of prefabrication and pre cast construction – Prestressed precast roof trusses – Floor slabs - Wall panels- Handling and erection stresses –joints in precast structures.

OUTCOMES:

Upon completion of this course, students will be able to

- Know the requirements of various industries and get an idea about the materials used and planning of various industrial components.
- Understand the functional requirements for industrial structures.
- Design special steel structures like bunkers, silos, power plant structures, chimneys and pre-engineered buildings.
- Design special RC structures like corbels, Canopy, silos, bunkers, and chimneys.
- Understand the principles of prefabrication and prestressing.

TEXT BOOKS:

1. Ramamrutham.S., “Design of Reinforced Concrete Structures”, Dhanpat Rai Publishing Company, 2007.
2. Varghese.P.C., “Advanced Reinforced Concrete Design”, PHI, Eastern Economy Editions, Second Edition, 2005.
3. Subramanian, N., “Design of Steel Structures”, Oxford University Press, 2008.
4. Ramachandra and Virendra Gehlot, “Design of steel structures” Vol. 2, Scientific Publishers, 2012

REFERENCE BOOKS:

1. Henn W., “Buildings for Industry”, Vol.I and II, London Hill Books, 1995

2. Handbook on Functional Requirements of Industrial buildings, SP 32–1986, Bureau of Indian Standards, 1990.
3. Handbook of Industrial Lighting, Stanley L.Lyons, Butterworths, London.1981
4. Koncz, J., Manual of Precast Construction Vol. I and II, Bauverlay GMBH, 1971.
5. Handbook on Precast Construction, An Indian Concrete Institute Publication, 2016.

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

OPEN ELECTIVE- I
SEMESTER V

1902512 ENVIRONMENT AND AGRICULTURE L T P C

3 0 0 3

OBJECTIVES:

- To emphasize on the importance of environment and agriculture on changing global scenario and the emerging issues connected to it.
- To understand the ecological context of agriculture and its concerns.
- To study the context of climate change and emerging global issues.
- To gain knowledge on water balance.
- To understand the importance of virtual water.

UNIT-I: ENVIRONMENTAL CONCERNS 9

Environmental basis for agriculture and food – Land use and landscape changes – Water quality issues – Changing social structure and economic focus – Globalization and its impacts – Agro ecosystems.

UNIT-II: ENVIRONMENTAL IMPACTS 9

Irrigation development and watersheds – mechanized agriculture and soil cover impacts – Erosion and problems of deposition in irrigation systems – Agricultural drainage and downstream impacts – Agriculture versus urban impacts.

UNIT- III: CLIMATE CHANGE 9

Global warming and changing environment – Ecosystem changes – Changing blue-green-grey water cycles – Water scarcity and water shortages – Desertification.

UNIT-IV: ECOLOGICAL DIVERSITY AND AGRICULTURE 9

Ecological diversity, wild life and agriculture – GM crops and their impacts on the environment – 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

OUTCOMES:

- Students may be able to know how the environment and agriculture are related and the changes in the environmental due to agriculture.
- Students will be able to gather idea on about how the mechanization helps and impacts of soil erosion due to agricultural activities.
- Students will have a wide knowledge of changing environment due to global warming and climate change and its impact on water.
- Students are exposed to the ecological diversity in agriculture and different technologies used in farming activities.
- Students are able to understand the global governance system and agricultural policies involved in the sustainable agricultural systems.

TEXT BOOKS:

1. M.Lakshmi Narasaiah, Environment and Agriculture, Discovery Pub. House, 2006.
2. Arvind Kumar, Environment and Agriculture, ABH Publications, New Delhi, 2005

REFERENCE BOOKS:

1. T.C. Byerly, Environment and Agriculture, United States Dept. of Agriculture, Economic Research Service, 2006.
2. Robert D. Havener, Steven A. Breth, Environment and agriculture: rethinking development issues for the 21st century: proceedings of a symposium, Winrock International Institute for Agricultural Development, 1994.

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

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

Upon completion of this course,

- Students can able to apply the different manufacturing process and use this in industry for component production.
- Students will be able to understand the working principle of lathe and various operations done on it.
- Students will be able to gather idea on welding and soldering process.
- Students will gain wide knowledge on various advance manufacturing process.

- Students will gain knowledge in CNC machine and improving the machining accuracy.

TEXTBOOKS:

1. “Manufacturing Engineering and Technology”, Kalpakjian and Schmid, Pearson, 2010.
2. Hajra Choudry, “Elements of workshop technology - Vol II”, Media promoters, 2002.

REFERENCE BOOKS:

1. Gupta. K.N., and Kaushik, J.P., 1998, Workshop Technology Vol I and II, New Heights, Daryaganj, New Delhi.
2. Arthur. D., et. al. 1998, General Engineering Workshop Practice, Asia Publishing House, Bombay.
3. Chapman W.A.J., Workshop Technology, 1992, Part I, II, III, E.L.B.S. and Edward Amold Publishers Ltd, London.

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

1921501 ADVANCED ENGINEERING CHEMISTRY L T P C

3 0 0 3

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 Periods: 45

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											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	3	2	2	2	2	2	3	-	-	-	-	2
2	3	3	2	2	3	3	2	-	-	-	-	3
3	2	2	1	2	2	2	1	-	-	-	-	1
4	1	1	1	1		1	2	-	1	-	-	2
5	2	2	2	3	1	1	2	-	-	-	-	1

1921502 INDUSTRIAL NANOTECHNOLOGY L T P C

3 0 0 3

OBJECTIVES

- To elucidate on advantages of nanotechnology based applications in each industry
- To provide instances of contemporary industrial applications of nanotechnology
- To provide an overview of future technological advancements and increasing role of nanotechnology in each industry
- To provide an awareness on the nanomaterial synthesis for electronic materials
- To make the student conversant with the latest characterization techniques

UNIT-I: NANO ELECTRONICS 9

Micro and Nanoelectromechanical 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-Nanoindentation.

Total Periods: 45

OUTCOMES

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

- Analyze the nanoparticle coatings for electrical products.
- Define various therapeutic applications of bionanotechnology.
- Explain the process of molecular encapsulation and nanoreactors.
- Ability to understand the uses of nanotechnology in food industry.
- Outline the nanofiber production and formulation of gels.

TEXTBOOKS:

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											
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
1	2	2	2	-	2	1	1	-	1	-	-	3
2	1	2	3	-	1	3	1	-	1	-	-	2
3	2	1	2	-	1	1	1	-	1	-	-	2
4	3	2	1	-	2	1	1	-	1	-	-	3
5	2	2	1	2	1	1	1	-	1	-	-	2

1904007 **DATA STRUCTURES** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand Linear Data structures programs.
- To understand Nonlinear Data structures program
- To have an idea about implementing search techniques.
- To have a better understanding in sorting techniques.
- To understand the various Indexing 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 - 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- GRAPHS **9**

.Binary Trees – Binary tree representation and traversals – Application of trees: – Graph and its representations – Graph Traversals – Connected components.

UNIT-IV: SORTING **9**

Selection sort-Insertion sort – Merge sort – Quick sort – Heap sort – Bubble sort- Shell sort – Radix sort.

UNIT-V: SEARCHING AND INDEXING **8**

Linear Search – Binary Search - Hash tables – Overflow handling – Hash Index – B-Tree Indexing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures, Galgotia Book Source, Gurgaon, 1976.
2. Gregory L. Heilman, Data Structures, Algorithms and Object Oriented Programming, Tata Mcgraw-Hill, New Delhi, 2002.

REFERENCES:

1. Jean-Paul Tremblay and Paul G. Sorenson, An Introduction to Data Structures with Applications, Second Edition, Tata McGraw-Hill, New Delhi, 1991.
2. Alfred V. Aho, John E. Hopcroft and Jeffry D. Ullman, Data Structures and Algorithms, Pearson Education, New Delhi, 2006.

OUTCOMES:

- To learn about Linear Data structures
- Ability to describe stack queue and linked list operation
- Ability to analyze algorithms
- To understand about the tree concepts.
- Ability to summarize searching and sorting techniques.

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

1904504 GEOGRAPHIC INFORMATION SYSTEM L T P C

3 0 0 3

OBJECTIVES

- To introduce the fundamentals and components of Geographic Information System.
- To provide details of spatial data structures and input, management and output processes.
- To provide details about raster input data structures.
- To be familiar with network topologies.
- To Analyze data analytics and various applications of GIS.

UNIT - I: FUNDAMENTALS OF GIS 9

Introduction to GIS - Basic spatial concepts - Coordinate Systems - GIS and Information Systems – Definitions – History of GIS - Components of a GIS – Hardware, Software, Data, People, Methods – Proprietary and open source Software - geographical data types - Spatial, Attribute data- types of attributes – scales/ levels of measurements.

UNIT – II: SPATIAL DATA MODELS 9

Database Structures – Relational, Object Oriented – ER diagram - spatial data models – Raster Data Structures – Raster Data Compression - Vector Data Structures - Raster vs Vector Models TIN and GRID data models - OGC standards - Data Quality.

UNIT - III: DATA INPUT AND TOPOLOGY 9

Scanner - Raster Data Input – Raster Data File Formats – Vector Data Input –Digitiser – Topology - Adjacency, connectivity and containment – Topological Consistency rules – Attribute Data linking – ODBC – GPS - Concept GPS based mapping.

UNIT - IV: DATA ANALYSIS 9

Vector Data Analysis tools - Data Analysis tools - Network Analysis - Digital Education models - 3D data collection and utilisation.

UNIT - V: APPLICATIONS **9**

GIS Applicant - Natural Resource Management - Engineering - Navigation - Vehicle tracking and fleet management - Marketing and Business applications - Case studies

TOTAL: 45 PERIODS

OUTCOMES:

This course equips the student to

- Have basic idea about the fundamentals of GIS.
- Understand the types of data models.
- Get knowledge about data input and topology.
- Gain knowledge on data quality and standards.
- Understand data management functions and data output.

TEXT BOOKS:

1. Kang - Tsung Chang, Introduction to Geographic Information Systems, McGraw Hill Publishing, 2nd Edition, 2011.

2. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction Geographical Information Systems, Pearson Education, 2nd Edition, 2007.

REFERENCE BOOKS:

1. Lo.C.P., Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, Prentice-Hall India Publishers, 2006.

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

1904508 DATABASE MANAGEMENT SYSTEM L T P C

3 0 0 3

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 DATABASE 9

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

UNIT –II: RELATIONAL DATABASE 9

Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL.

UNIT –III: DATABASE DESIGN 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.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, students will 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, 2011
2. Ramez Elmasri, Shamkant B. Navathe, —Fundamentals of Database Systems, Sixth Edition, Pearson, 2011.

REFERENCE BOOKS:

1. C. J. Date, A.Kannan, S. Swamynathan, —An Introduction to Database Systems‖, Eighth Edition, Pearson Education, 2006.

2. Raghu Ramakrishnan, —Database Management Systems‖, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta, "Database Management Systems‖, Tata McGraw Hill, 2011.

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

1904509 CLOUD COMPUTING L T P C

3 0 0 3

OBJECTIVES:

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

UNIT- I: INTRODUCTION 9

Introduction to Cloud Computing – Definition of Cloud – Evolution of Cloud Computing – Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics.

UNIT- II: CLOUD ENABLING TECHNOLOGIES 9

Service Oriented Architecture – REST and Systems of Systems – Web Services –

Publish Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels of Virtualization – Virtualization Structures – Tools and Mechanisms – Virtualization of CPU –Memory – I/O Devices.

UNIT –III: CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

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 9

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

UNIT –V: CLOUD TECHNOLOGIES AND ADVANCEMENTS 9

Hadoop – Map Reduce –Google App Engine – Programming Environment for Google App Engine –– Amazon Web services-Open Stack – Federation in the Cloud.

TOTAL: 45 PERIODS

OUTCOMES:

On Completion of the course, the students should be able to:

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

TEXT BOOKS:

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

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

REFERENCE BOOKS:

1. 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												PSO			
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1906505 **PHOTONIC NETWORKS** **L T P C**

3 0 0 3

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 PERIODS: 45

OUTCOMES:

The student should be able to:

- Elucidate the components in an optical system.
- Use the backbone infrastructure for our present and future communication needs.
- Analyze the architectures and the protocol stack.
- Compare the differences in the design of data plane, control plane, routing, switching, resource allocation methods.
- Annotate the network management and protection methods in vogue.

TEXT BOOKS:

1. Rajiv Ramaswami and Kumar N. Sivarajan, “Optical Networks: A Practical Perspective”, Second Edition, Harcourt Asia Pte Ltd., 2004.
2. Siva Ram Moorthy and Mohan Gurusamy, “WDM Optical Networks: Concept, Design and Algorithms”, 1st Edition, Prentice Hall of India, 2002.

REFERENCE BOOKS:

1. John M. Senior ,“Optical Fiber Communication”,3rd edition, Prentice Hall,2009.
2. 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.

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4	2	2	-	2	1	-	-	-	-	-	-	-	-	-	-	-
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1906506 TELECOMMUNICATION NETWORK MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

The student should be made:

- To understand the concept of network management standards.
- To design the common management information service element model.
- To analyze the various concept of information modeling.
- To examine the concept of SNMPv1 and SNMPv2 protocol.
- To exhibit the 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 9

Rationale for information modeling–management information model–object oriented modeling paradigm– structure of management information–managed object class definition–management information base.

UNIT - IV: SIMPLE NETWORK MANAGEMENT PROTOCOL 9

SNMPv1: Managed networks–SNMP models– organization model– Information model– SNMPv1 communication model–functional model. SNMPv2-major changes in SNMPv2– structure of management information, MIB–SNMPv2 protocol– compatibility with SNMPv1. SNMPv3– architecture–applications–MIB- security, SNMP Management: remote monitoring–SMI and MIB– RMON1 and RMON2.

UNIT - V: NETWORK MANAGEMENT EXAMPLES 9

ATM integrated local management interface–ATM MIB–M1– M2–M3–M4–interfaces–ATM digital exchange interface management–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

OUTCOMES:

On completion of the course, the student should be able to,

- Design and analyze of fault management.
- Analyze the common management information protocol specifications.
- Explain the functioning and design of management information model.
- Describe the simple network management protocol.
- Interpret the various types of network management tools with case studies.

TEXT BOOKS:

1. Mani Subramanian, “Network Management: Principles and Practice”, Pearson Education, Second edition, 2010.
2. Lakshmi G Raman, “Fundamentals of Telecommunications Network Management”, Wiley, 1999.

REFERENCE BOOKS:

1. Henry Haojin Wang, “Telecommunication Network Management”, Mc- Graw Hill, 1999.
2. Salah Aidarous & Thomas Plevyak, “Telecommunication Network Management: Technologies and Implementations”, Wiley, 1997.
3. Singh B, “Network Security and Management”, Eastern Economy Edition, 2012.

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

3 0 0 3

OBJECTIVES:

The student should be made:

- To understand the basics of display devices.
- To enhance the student knowledge in Audio broadcasting systems.
- To enable the student to learn about Television systems.
- To develop the student knowledge in Interactive Gaming Applications.
- To apply the knowledge of Consumer Electronic Applications.

UNIT - I: DISPLAY DEVICES **9**

Introduction – Underlying technologies of displays -Types of Electronic displays – Segment displays –Two dimensional displays: Liquid Crystal display, Light emitting diode display – Three dimensional displays: Laser display, Holographic display – Applications.

UNIT - II: AUDIO BROADCASTING SYSTEMS **9**

Loud Speakers: construction, working principles and applications of crystal, condenser and dynamic loudspeakers – Tweeters, Squawkers & Woofers - Public address system - Requirements of Public Addressing system -Microphones: construction, working principles and applications of Carbon, Moving coil and Crystal microphones. Headphones: Principle of operation of crystal and dynamic and Bluetooth based headphones.

UNIT - III: TELEVISION SYSTEMS **9**

Basics of Television: Television standards, frequency bands, Scanning method, interlacing and synchronization, bandwidth, Advanced TV systems: LCD, LED, HDTV,3DTV, Smart TV. Color concepts, concepts of luminance, Hue and Saturation, Color TV (PAL Systems). Cable TV concepts, Closed Circuit Television.

UNIT - IV: INTERACTIVE GAMING APPLICATIONS **9**

Fundamental of game design - Gaming scenarios – Interfaces- Multi player interactive gaming – Programming concepts – educational games – Privacy and security in games – Introduction to Android games and its development – Online games.

UNIT - V: CONSUMER ELECTRONIC APPLICATIONS **9**

Principle of operation of digital clocks, electronic calculator, cellular phones- smart phonesmicrowave ovens, washing machines, air conditioners, ATMs and set-top-boxes – Compact Ultrafast Fiber lasers for Consumer electronics – Virtual reality applications, Alexa.

TOTAL: 45 PERIODS

OUTCOMES:

The student should be able to:

- Understand the basic applications of display devices.
- Analyze the operation of Audio devices and its applications.
- Know the basic TV Standards and the basics of Television.
- Design the Gaming scenarios and knowing programming concepts.
- Apply the knowledge on the applications of Consumer electronics.

TEXT BOOKS:

1. Shoichi Matsumoto, “Electronic display devices”, Wiley, 1990.
2. Ajay Sharma, “Audio video and TV Engineering-Consumer Electronics”, Dhanpat Rai and co, 2003.
3. R.G. Gupta, “Audio and Video systems”, Tata Mc Graw Hill Publishing Co.Ltd, 2010.

REFERENCE BOOKS:

1. R. Gulati, “Monochrome and Color Television”, New Age International (P) Ltd, New Delhi, 2014.
2. S P Bali, “Consumer Electronics”, Pearson, 2007.

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3	3	3	2	2	-	-	-	-	-	-	-	-	2	3	-	-
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1905001 ENERGY CONSERVATION AND MANAGEMENT L T P C

3 0 0 3

OBJECTIVES:

At the end of the course, the student is expected to

- Understand and analyse 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 analyse of Energy Economics.

UNIT-I: INTRODUCTION 9

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT-II: ELECTRICAL SYSTEMS 9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT-III: THERMAL SYSTEMS 9

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

- Can able to analyse the energy data.
- Can carryout energy accounting and balancing.
- Can suggest methodologies for energy savings.
- Can carry out Energy Conservation in Major Utilities.
- Can suggest methodologies for Energy Economics.

TEXTBOOKS:

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

REFERENCES:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford,1981.
3. Dryden. I.G.C., “The Efficient Use of Energy” Butterworths, London, 1982.
4. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987.

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1905508 RENEWABLE ENERGY SOURCES L T P C

3 0 0 3

OBJECTIVES:

- To get exposure on solar radiation and its environmental impact to power.
- To know about the various collectors used for storing solar energy.
- To know about the various applications in solar energy.
- To learn about the wind energy and biomass and its economic aspects.
- To know about geothermal energy with other energy sources.

UNIT-I: PRINCIPLES OF SOLAR RADIATION 10

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on 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:

- 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.

TEXTBOOKS:

1 Rai G.D., “Non-Conventional Energy Sources”, Khanna Publishers, 2011.

2. Twidell & Wier, “Renewable Energy Resources”, CRC Press (Taylor & Francis), 2011.

REFERENCE BOOKS:

1. Tiwari and Ghosal, “Renewable energy resources”, Narosa Publishing House, 2007.
2. Ramesh R & Kumar K.U, “Renewable Energy Technologies”, Narosa Publishing House, 2004.
3. Mittal K M, “Non-Conventional Energy Systems”, Wheeler Publishing Co. Ltd, New Delhi, 2003.

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1905509 SCADA SYSTEM MANAGEMENT L T P C

3 0 0 3

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:

- 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

TEXTBOOKS:

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, Cybersecurity for SCADA systems, PennWell Books, 2006

REFERENCE BOOKS:

1. David Bailey, Edwin Wright, Practical SCADA for industry, Newnes, 2003

2. Michael Wiebe, A guide to utility automation: AMR, SCADA, and IT systems for electric Power, PennWell 1999

3. Dieter K. Hammer, Lonnie R. Welch, Dieter K. Hammer, “Engineering of Distributed Control Systems”, Nova Science Publishers, USA, 1st Edition, 2001

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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

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.

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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.

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1908001 **3D PRINTING AND DESIGN** **L T P C**

3 0 0 3

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:

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

TEXT 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.

REFERENCE BOOKS:

1. Khanna Editorial, “3D Printing and Design”, Khanna Publishing House, Delhi.
   CK Chua, Kah Fai Leong, “3D Printing and Rapid Prototyping- Principles and Applications”, World Scientific, 2017.
2. J.D. Majumdar and I. Manna, “Laser-Assisted Fabrication of Materials”, Springer Series in Material Science, 2013.
3. L. Lu, J. Fuh and Y.S. Wong, “Laser-Induced Materials and Processes for Rapid Prototyping”, Kulwer Academic Press, 2001.
4. Zhiqiang Fan And Frank Liou, “Numerical Modelling of the Additive Manufacturing (AM) Processes of Titanium Alloy”, InTech, 2012.

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

1908002 SCRIPTING LANGUAGES L T P C

3 0 0 3

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

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)

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CO 5		2				3							3	3		

1910504 PRINCIPLES OF FOOD PRESERVATION L T P C

3 0 0 3

OBJECTIVES:

The student should be made:

- 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.
- 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. Psychometric chart, freezing and cold storage, freeze concentration, dehydro-freezing, freeze drying, IQF; calculation of refrigeration load, design of freezers and cold storages.

UNIT - V: NON-THERMAL METHODS 9

Super Critical Technology for Preservation - Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking, membrane technology. Hurdle technology.

TOTAL: 45 PERIODS

OUTCOMES:

The student should be able to:

- Aware of the different methods applied to preserving foods.
- Explain the food handling and storage processes.
- Analyze the thermal processing and osmotic methods.
- Explore the drying process of foods.
- Apply the non-thermal methods for food preservation.

TEXT BOOKS:

1. Karnal, Marcus and D.B. Lund, “Physical Principles of Food Preservation”, Second Edition, 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. Neelam Khetarpaul, “Food Processing and Preservation”, Daya Publishing House, A division of Astral International (P) Ltd., 2015.

REFERENCE BOOKS:

1. Shafiur M Rahman, “Handbook of Food Preservation”, Second Edition, CRC Press, 2007.
2. Zeuthen Peter, Bogh-Sorensen Leif, “Food Preservation Techniques”, Wood Head Publishing, Cambridge, England, 2005.
3. Ranganna S, “Handbook of Canning and Aseptic Packaging”, Tata McGraw-Hill, 2000.

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

1909510 PRODUCT DESIGN AND DEVELOPMENT L T P C

3 0 0 3

OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Product design and development
- Apply the concept of prototyping in a real-life problem.
- Reduce the waste by using product architecture**.**
- Understand the concepts of industrial design.
- Understand the concepts of DFM

UNIT-I: INTRODUCTION 9

Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements.

UNIT-II: CONCEPT GENERATION AND SELECTION 9

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT-III: PRODUCT ARCHITECTURE 9

Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions.

UNIT-IV: INDUSTRIAL DESIGN 9

Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT-V: DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9

Definition – Estimation of manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of this course, the students will be able to:

- 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

TEXTBOOKS:

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												PSO			
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1	2	1	1	1				1		1		1			1	1
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1909511 VIBRATION AND NOISE CONTROL L T P C

3 0 0 3

OBJECTIVES:

- The main learning objective of this course is to prepare the students for:
- 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: CONTROL TECHNIQUES 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

OUTCOMES:

Upon Completion of this course, the students will 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

TEXTBOOKS:

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

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1909512 INDUSTRIAL SAFETY ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Identify unsafe conditions and recognize unsafe alerts.
- Interpret the rules and regulations for safety operations.
- Capable of solving problem of accidents.
- Capable of solving the present for criticizing the present for improved safety.
- Collaborate and modify processes / procedures for safety.

UNIT-I: INTRODUCTION 9

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT-II: CHEMICAL HAZARDS 9

Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT-III: ENVIRONMENTAL CONTROL 9

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT-IV: HAZARD ANALYSIS 9

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

UNIT-V: SAFETY REGULATIONS 9

Explosions – Disaster management – catastrophe control, hazard control , Factories Act, Safety regulations Product safety – case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Upon Completion of this course, the students will 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.

TEXTBOOKS:

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.

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4	2	1	2			2	1					1	1	1		
5	2	1	2			2	1					1	1	1		

1920501 **NANOTECHNOLOGY** **L T P C**
3 0 0 3

OBJECTIVES

- Make the students to understand the fundamentals of nanomaterials.
- 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

OUTCOMES

- Able to understand the basics of nanoscience.
- Able to differentiate the materials based on their structures.
- Ability to understand the different synthesis techniques of nanomaterials.
- Ability to identify various fabrication techniques and characterization of nanostructures.
- Able to apply them for suitable applications.

TEXT BOOKS:

1.Bhusan, Bharat (Ed), “Springer Handbook of Nanotechnology”, 2nd Edition, 2007.
2. Hari Singh Nalwa, “Nanostructured Materials and Nanotechnology”, Academic Press, 2002.
3. Pradeep T., “A Textbook of Nanoscience and Nanotechnology”, Tata McGraw Hill Education Pvt. Ltd., 2012.

REFERENCE BOOKS:

1. Charles P. Poole Jr., Frank J. Ownes, ‘Introduction to Nanotechnology”, Wiley Interscience, 2003.

2. Dupas C., Houdy P., Lahmani M., “Nanoscience: Nanotechnologies and Nanophysics”,Springer-Verlag Berlin Heidelberg, 2007.
3. Mark Ratner and Daniel Ratner, “Nano Technology”, Pearson Education, New Delhi, 2003.
4. Nabok A., “Organic and Inorganic Nanostructures”, Artech House, 2005.

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

1920502 MICROSCOPY L T P C
3 0 0 3

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

OUTCOMES

- Able to understand the physics behind the microscopy.
- Ability to describe the principle, construction and working of light microscopy.
- Ability to describe electron microscopy.
- Ability to understand about the important of sample preparation technique.
- Ability to identify the appropriate spectroscopy technique for chemical analysis.

TEXT BOOKS:

1. Douglas B. Murphy, Fundamentals of light microscopy and electronic imaging, 2001,
   Wiley- Liss, Inc. USA
2. David B. Williams and C. Barry Carter, Transmission Electron Microscopy-A Textbook for Materials Science, Springer US, 2nd edition, 2009.

REFERENCE BOOKS:

1. Brandon D. G, “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA,1986.
2. Whan R E (Ed), ASM Handbook, Volume 10, Materials Characterization“, Ninth Edition, ASM international, USA, 1986.
3. Thomas G., “Transmission electron microscopy of metals”, John Wiley, 1996.

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

1921701 WASTE WATER TREATMENT L T P C
3 0 0 3

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 Periods: 45

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.

TEXTBOOKS:

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.

1904703 **TAMIL COMPUTING** **L T P C**

3 0 0 3

OBJECTIVES:

- To understand the Tamil grammar and programming basics for Tamil computing.
- To understand the various types of Tamil Computing applications.
- To make the students understand the use of Tamil computing tools and Resources.
- To strengthen the students' ability to carry out the Computational Linguistics in Tamil computing.
- To understand the concepts of Tamil text processing using open – Tamil python library.

UNIT - I: TAMIL GRAMMAR **9**

Alphabets: Classification & Properties - Words: classification and components - Sentences: Structures and word ordering.

UNIT - II: PROGRAMMING BASICS FOR TAMIL COMPUTING **9**

History of Tamil Computing - Standards & Fonts - UNICODE - Object Oriented Tamil Computing -Tamil text processing using open-tamil python library.

UNIT - III: COMPUTATIONAL LINGUISTICS **9**

Basic linguistics - Phonology – Phonology computing – Tholkappiar's Morphological pattern– lexicography – syntax – semantics – pragmatics, Languages for specific purpose & disconise computing

UNIT - IV: TAMIL COMPUTING TOOLS & RESOURCES **9**

POS Tagger - Morphological Analyser - Morphological Generator - Sentence Parser - Named Entity Recognizer - Word Sense Disambiguator - Ontologies – Universal Networking Language & UNL Enconvertor.

UNIT - V: TAMIL COMPUTING APPLICATIONS 9

Machine Translation – Speech : Synthesis & Processing - Information : retrieval & Extraction – Question Answering – Text Summarization – Automatic Indexing – Text Mining – Conceptual Search.

TOTAL: 45 PERIODS

OUTCOMES:

- Explain classification of Tamil grammar and properties
- Adopt a suitable process for tamil computing tools.
- Analyze the different types of computational linguistics such as phonology, Morphology, lexicography.
- Perform and analyze the Tamil computing applications.
- Analyze and process the Tamil python library.

TEXT BOOKS:

1. The Oxford Handbook of Computational Linguistics, Edited by RuslanMitkov, Oxford University Press, 2014.

REFERENCE BOOKS:

1. Translation - Theory and Application, Valarmathi, International Institute of Tamil Studies, First Edition, 2001.
2. Tholkaappiyam - Thodariyal, Shanmugam, International Institute of Tamil Studies, First Edition, 2004.
3. Tholkaappiyam: Phonology & Morphology, Albert, International Institute of Tamil Studies, First Edition, 1985.
4. Natural language processing and computational linguistics, Bhargav Srinivasa-Desikan Packt Publishing, first edition 2018.
5. The Phonology and morphology of tamil chrisdas Prathima, 2016.
6. Pos Tasser R Morphological Analzser Shodhganga inflibnet.ac.in
7. A tamil Programming language ayxiv.org, muthiah Annamalai.

CO	PO												PSO			
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1904010 OBJECT ORIENTED PROGRAMMING L T P C

3 0 0 3

OBJECTIVES:

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

UNIT- I: INTRODUCTION TO OOP AND JAVA FUNDAMENTALS 9

Object Oriented Programming - Abstraction – objects and classes - Encapsulation- Inheritance - Polymorphism- OOP in Java – Characteristics of Java – The Java Environment - Java Source File - Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers - static members -Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages - JavaDoc comments**.**

UNIT-II: INHERITANCE AND INTERFACES 9

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 - Strings.

UNIT- III: EXCEPTION HANDLING AND I/O 9

Exceptions - exception hierarchy - throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files.

UNIT- IV: MULTITHREADING 9

Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, thread groups.

UNIT- V: EVENT DRIVEN PROGRAMMING 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Develop Java programs using OOP 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 generics classes
- Develop interactive Java programs using swings.

TEXT BOOKS:

1. Herbert Schildt, ―Java The complete reference‖, 8th Edition, McGraw Hill Education, 2011.

2. Cay S. Horstmann, Gary cornell, —Core Java Volume –I Fundamentals‖, 9th Edition, Prentice Hall, 2013.

REFERENCE BOOKS:

1. Paul Deitel, Harvey Deitel, —Java SE 8 for programmers‖, 3rd Edition, Pearson, 2015.
2. Steven Holzner, —Java 2 Black book‖, Dreamtech press, 2011.
3. Timothy Budd, —Understanding Object-oriented programming with Java‖, Updated Edition, Pearson Education, 2000**.**

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
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1904712 SOFTWARE ENGINEERING L T P C

3 0 0 3

OBJECTIVES:

- To understand the phases in a software development project
- To understand the concepts of requirements analysis and modeling.
- To understand software design methodologies
- To learn various testing methodologies
- To be familiar with issues related to software maintenance

UNIT –I: SOFTWARE PROCESS 9

Introduction to Software Engineering, scope – software crisis – principles of software engineering- Software process – Life cycle models – Traditional and Agile Models - Team organization.

UNIT- II: PLANNING AND ESTIMATION 9

Planning and the software process – cost estimation: LOC, FP Based Estimation, COCOMO I & II Models – Duration estimation and tracking – Gantt chart - Software Project Management – plan – risk analysis and management.

UNIT- III: REQUIREMENTS ANALYSIS AND SPECIFICATION 9

Software Requirements: Functional and Non-Functional, Software Requirements specification– Structured system Analysis – modeling: UML based tools, DFD - Requirement Engineering Process.

UNIT- IV: SOFTWARE DESIGN AND IMPLEMENTATION 9

Design process – Design principles and guidelines – design techniques – coupling and cohesion - metrics – tools. Implementation: choice of programming language, programming practices – coding standards – code walkthroughs and inspections.

UNIT –V: TESTING AND MAINTENANCE 9

Software testing fundamentals- Testing techniques: white box, black box, glass box testing - unit testing – integration testing –system testing – acceptance testing – debugging. Post-delivery maintenance: Types – objectives - metrics - Reverse Engineering.

TOTAL: 45 PERIODS

OUTCOMES:

- At the end of this course, the students will be able to understand different software life cycle models.
- Perform software requirements analysis
- Apply systematic methodologies for software design and deployment.

- Understand various testing approaches and maintenance related issues.
- Plan project schedule, and estimate project cost and effort required.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Rajib Mall, “Fundamentals of Software Engineering”, Third Edition, PHI Learning PrivateLimited, 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 CompanyLimited,2007.
5. http://nptel.ac.in/.

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

3 0 0 3

OBJECTIVES:

The student should be made:

- 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 PERIODS: 45

OUTCOMES:

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.
- Acquire the knowledge on the Applications of acoustics.

TEXT BOOKS:

1. Rossing T. D., Moore R. F., Wheeler P. A.," The Science of Sound", 3rd edition San Francisco: Addison Wesley, 2002.
2. Hall D. E.," Musical Acoustics", 3rd edition Pacific Grove, CA: Brooks/Cole, 2001.
3. Howard D. M., Angus J. A. S.," Acoustics and psychoacoustics", 5th edition New York, London: Routledge, 2017.

REFERENCE BOOKS:

1. Everest F. A., Pohlmann K. C.," Master Handbook of Acoustics", 5th edition New York: McGraw-Hill, 2001.
2. Rossing T. D., ed.," Springer Handbook of Acoustics", 2nd edition Berlin, Heidelberg: SpringerVerlag 2014.
3. Chakrabarti, Pradip Kumar and Chowdhury, Satyabrata, "A Textbook on Waves and Acoustics", New Central book agency, 2010.

COURSE OUTCOMES - PROGRAM OUTCOMES MATRIX

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	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
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3	2	2	2	-	-	2	3	-	-	-	-	-	2	-	-	-
4	2	3	2	2	-	2	2	-	-	-	-	-	3	3	-	-
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1906706 **VISUAL COMMUNICATION** **L T P C**

3 0 0 3

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, Elements/Elements of Design: Line, Shape, Space, Color, Texture. Form Etc. Principles of Design: Symmetry. Rhythm, Contrast, Balance Mass/Scale etc. Design and Designers (Need, role, process, methodologies etc.).

UNIT - IV: DESIGN PROCESS **9**

Principles of Visual and other Sensory Perceptions. Color psychology and theory (some aspects) Definition, Optical / Visual Illusions Etc., Various stages of design process-problem identification, search for solution refinement, analysis, decision making, Implementation.

UNIT - V: GRAPHIC DESIGN **9**

Basics of Graphic Design. Definition, Elements of GD, Design process-research, a source of concept, the process of developing ideas-verbal, visual, combination & thematic, visual

thinking, associative techniques, materials, tools (precision instruments etc.) design execution, and presentation.

TOTAL PERIODS: 45

OUTCOMES:

The student should be able to:

- Learn about the history & evolution of Communication.
- Understand the Nature & functions of Visual Communication.
- Acquire knowledge on different types of perception & illusion.
- Get knowledge on semiotics.
- Remember the world of ideation creating.

TEXT BOOKS:

1. Lester, E, “Visual Communications: Images with Messages”, Thomson Learning, 2013.
2. Jonathan Baldwin, “Visual Communication: From Theory to Practice”, AVA publishing, 2006.

REFERENCE BOOKS:

1. Schildgen, T., “Pocket Guide to color with digital applications”, Thomsom Learning, 2000.
2. Palmer, Frederic, “Visual Elements of Art and Design”, Longman, 1990.
3. Carter, “Typographic Design : Form and Communication”, 6/e, John Wiley, 2014.

COURSE OUTCOMES - PROGRAM OUTCOMES MATRIX

CO	PO												PSO			
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4
1	3	2	1	1	1	-	-	-	-	-	-	1	3	-	-	-
2	3	2	3	2	3	-	-	-	-	-	-	1	3	-	2	-
3	3	2	1	2	-	-	-	-	-	-	-	-	3	2	2	-
4	3	3	3	3	-	-	-	-	-	-	-	-	3	-	3	-
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1906707	MEMS AND NEMS	L T P C
		3 0 0 3

OBJECTIVES:

The student should be made:

- To introduce the concepts of micro and nano electromechanical devices.
- To know the fabrication process of microsystems.
- To know the design concepts of micro sensors.
- To understand the design of various micro actuators.
- To introduce the concepts of quantum mechanics and nano systems.

UNIT – I: INTRODUCTION TO MEMS AND NEMS 9

Introduction to Design of MEMS and NEMS, Overview of Nano and Microelectromechanical Systems, Applications of Micro and Nanoelectromechanical systems, Materials for MEMS and NEMS: Silicon, silicon compounds, polymers, metals.

UNIT – II: MEMS FABRICATION TECHNOLOGIES 9

Photolithography, Ion Implantation, Diffusion, Oxidation, CVD, Sputtering Etching techniques, Micromachining: Bulk Micromachining, Surface Micromachining, LIGA, Micromolding.

UNIT – III: MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, Vibratory gyroscope, Capacitive Pressure sensors, Case study: Piezoelectric energy harvester.

UNIT – IV: MICRO ACTUATORS 9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces, Case Study: RF Switch.

UNIT – V: NANO DEVICES 9

Atomic Structures and Quantum Mechanics, Shrodinger Equation, ZnO nanorods based NEMS device: Gas sensor.

TOTAL PERIODS: 45

OUTCOMES:

After studying this course, the student should be able to,

- Interpret the basics of micro/nano electromechanical systems including their applications and advantages.

- Recognize the use of materials in micro fabrication and describe the fabrication processes including surface micromachining, bulk micromachining and LIGA.
- Analyze the key performance aspects of electromechanical sensors.
- Illustrate the design of micro actuators using various actuations.
- Comprehend the theoretical foundations of quantum mechanics and Nano systems.

TEXT BOOKS:

1. Marc Madou, “Fundamentals of Microfabrication”, CRC press 1997.
2. Stephen D. Senturia, “Micro system Design”, Kluwer Academic Publishers, 2001.

REFERENCES BOOKS:

1. Tai Ran Hsu, “MEMS and Microsystems Design and Manufacture”, Tata McGraw Hill, 2002.
2. Chang Liu, “Foundations of MEMS”, Pearson education India limited, 2006.
3. Sergey Edward Lyshevski, “MEMS and NEMS: Systems, Devices, and Structures”, CRC Press, 2002.

COURSE OUTCOMES - PROGRAM OUTCOMES MATRIX

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	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
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4	3	2	3	3	-	-	-	1	-	2	-	-	3	3	-	-
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1905711	ELECTRICAL CIRCUITS	L	T	P	C
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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.

COURSE OUTCOMES:

- Ability to introduce electric circuits and its analysis
- Ability to impart knowledge on solving circuit equations using network theorems.
- Ability to introduce the phenomenon of resonance in coupled circuits.
- Ability to introduce Phasor diagrams of three phase circuits
- Ability to analysis of three phase circuits

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.

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1905712 RENEWABLE ENERGY SYSTEMS L T P C

3 0 0 3

OBJECTIVES:

- About the stand alone and grid connected renewable energy systems. .
- Design of power converters for renewable energy applications.
- Wind electrical generators.
- 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.

9

UNIT-II: ELECTRICAL MACHINES FOR RENEWABLE ENERGY CONVERSION

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

Stand alone 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).

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.

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1905713 ELECTRIC VEHICLES AND POWER MANAGEMENT

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- **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:

- 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.

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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 will 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.

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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”, Second Edition, PHI Learning Ltd, 2012.
4. Amiya K. Jana, ”Chemica lProcess Modelling and Computer Simulation” Second Edition, PHI Learning Ltd, 2012.

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CO 1	3	3	2	3	2							1
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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.

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1908003 SOFTWARE QUALITY MANAGEMENT L T P C

3 0 0 3

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

UNIT - 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

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.
2. Stephen H. Kan, “Metrics and Models in Software Quality Engineering”, Pearson Education (Singapore) Pte Ltd., 2002.

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 CO - PSO MAPPING:

CO	PO												PSO			
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1908004 C# and .NET PROGRAMMING L T P C

3 0 0 3

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 – App domains – 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

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 CO - PSO MAPPING:

CO	PO												PSO			
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1908005 VIRTUAL REALITY L T P C

3 0 0 3

OBJECTIVES:

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

UNIT - I: INTRODUCTION TO VIRTUAL REALITY 9

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

image.

UNIT - II: GEOMETRIC MODELLING 9

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

UNIT - III: VIRTUAL ENVIRONMENT 9

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

UNIT - IV: VR HARDWARES & SOFTWARES 9

Human factors: Introduction – the eye-the ear-the somatic senses-VR Hardware : Introduction – sensor hardware – Head-coupled displays –Acoustic hardware – Integrated VR systems-VR Software: Introduction –Modeling virtual world –Physical simulation- VR toolkits – Introduction to VRML.

UNIT - V: VR APPLICATION 9

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

TOTAL: 45 PERIODS

OUTCOMES:

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

- Understood the basic concept of virtual reality

- Understood 3D computer Graphics System
- Design object objects using geometric modeling
- Develop Virtual environment.
- Apply study about Virtual Hardwares, Softwares and Develop Virtual Reality applications

TEXT BOOK:

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 CO - PSO MAPPING:

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1910703 CLINICAL TRIALS L T P C

3 0 0 3

OBJECTIVES:

The student should be made:

- To highlight the epidemiologic methods, study design, protocol preparation.
- To learn about the crossover and factorial trial designs.
- To acquire knowledge in the basic bio-statistical techniques involved in clinical research.
- To describe the principle involved in ethical, legal and regulatory issues in clinical trials.
- To explore the reporting of trials.

UNIT – I: ROLE OF CLINICAL TRIALS IN NEW DRUG DEVELOPMENT 9

Drug Discovery, Regulatory guidance and governance, Pharmaceutical manufacturing, Non-clinicalresearch, 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 PERIODS: 45

OUTCOMES:

The student should be able to:

- Explain key concepts in the design of clinical trials.
- Describe study designs used in data management for clinical trials.
- Identify key issues and determine alternate trial designs.
- Recognize the roles of regulatory affairs in clinical trials.
- Provide the overview of reporting trials.

TEXT BOOKS:

1. Lawrence M. Friedman, “Fundamentals of Clinical Trials”, Springer Science & Business Media, Fifth Edition, 2015.
2. Stuart J. Pocock, “Clinical Trials: A Practical Approach”, John Wiley & Sons, 2013.

REFERENCE BOOKS:

1. David Machin, Simon Day, Sylvan Green, “Textbook of Clinical Trials”, Second Edition, John Wiley & Sons, 2007.
2. Duolao Wang, Ameet Bakhai, “Clinical trials, A practical guide to design, analysis and reporting”, First Edition, Remedica, 2006.
3. T.A. Durham, J Rick Turner, “Introduction to statistics in pharmaceutical clinical trials”, First Edition, Pharmaceutical Press, 2008.
4. Tom Brody, “Clinical Trials: Study Design, Endpoints and Biomarkers, Drug Safety, and FDA and ICH Guidelines”, Second Edition, Academic Press, 2016.

COURSE OUTCOMES - PROGRAM OUTCOMES MATRIX

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1910704 REGULATORY REQUIREMENTS IN PHARMACEUTICAL INDUSTRIES **L T P C**

3 0 0 3

OBJECTIVES:

The student should be made:

- To acquire knowledge in pharmaceutical industry regulations.
- To learn about the packaging and labeling of drugs.
- To understand the patent filling process.
- To analyze the quality guidelines in drug products.
- To explore the process of 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 newdrug 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 PERIODS: 45

OUTCOMES:

The student should be able to:

- Explain the pharmaceutical industry manufacturing practices and regulatory aspects of pharmacy products.
- Describe the process of patenting activities.
- Assess the different types of patents and filling process.
- Explore the quality guidelines followed for pharmaceutical products.
- Enumerate the aspects involved in document preparation for pharmaceutical product registration.

TEXT BOOKS:

1. C. V. Subbrahmanyam & J. Thimmasetty, “Pharmaceutical regulatory affairs”, First Edition, Vallabh Prakashan, New Delhi, 2012.
2. Willig, H., Tuckerman, M.M. and Hitchings, W.S., “Good Manufacturing Practices for Pharmaceuticals”, Fifth 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”, First Edition, Manipal University Press (MUP); 2015.

REFERENCE BOOKS:

1. Ira R. Berry, “The Pharmaceutical Regulatory Process, marcel dekker Series: Drugs and the Pharmaceutical Sciences”, 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”, Third Edition, Vandana Publications, 2006.

COURSE OUTCOMES - PROGRAM OUTCOMES MATRIX

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1910705 **MICROBIOLOGY** **L T P C**

3 0 0 3

OBJECTIVES:

The student should be made:

- To understand the principles of Microbiology.
- To emphasize the structure and biochemical aspects of various microbes.
- To learn about the Nutritional classification of microorganisms.
- To gain knowledge on the physical and chemical control of microorganisms.
- To acquire knowledge about the preservation of food.

UNIT – I: INTRODUCTION TO MICROBIOLOGY 9

Classification and nomenclature of microorganisms, Microscopic examination of microorganisms: Light, Fluorescent, Dark field, Phase contrast, and Electron microscopy.

UNIT – II: MICROBES- STRUCTURE AND REPRODUCTION 9

Structural organization and multiplication of bacteria, Viruses (TMV, Hepatitis B), Algae(cyanophyta, rhodophyta) and Fungi (Neurospora), Life history of actinomycetes (Streptomyces), Yeast (Sacharomyces), Mycoplasma (M. pneumoniae) and Bacteriophages (T4 phage, ʎphage)

UNIT – III: MICROBIAL NUTRITION, GROWTH AND METABOLISM 9

Nutritional classification of microorganisms based on carbon, Energy and electron sources. Definition of growth, Balanced and unbalanced growth, Growth curve and different methods to quantify bacterial growth:(counting chamber, viable count method, counting without equipment),Different media used for bacterial culture (defined, complex, selective, differential, enriched),The mathematics of growth-generation time, Specific growth rate.

UNIT – IV: CONTROL OF MICROORGANISMS 9

Physical and chemical control of microorganisms, Definition of sterilization, Dry and moist heat, Pasteurization, Tyndalization, Radiation, Ultrasonication, Filtration.

Disinfections anitization, 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. Quality assurance – Quality control – Practice of cGMP – Schedule M – USFDA.

TOTAL PERIODS: 45

OUTCOMES:

The student should be able to:

- Explain the fundamentals of Microbiology.
- Explore the scope of Microbiology.
- Apply knowledge to solve the problems in microbial infection and their control.
- Analyze the concept of food preservation.
- Describe the industrial use of microbes.

TEXT BOOKS:

1. Ananthanarayanan, R. and C.K. Jayaram Paniker, “Textbook of Microbiology”, University Press, Ninth Edition, 2015.
2. Prescott L.M., Harley J.P., Klein DA, “Microbiology”, Eleventh Edition, McGraw -Hill Inc., 2020.

REFERENCE BOOKS:

1. Pelczar, M.J. “Microbiology”, Fifth Edition, Tata McGraw-Hill, 1993.
2. Talaron K, Talaron A, Casita, Pelczar and Reid. Foundations in Microbiology, W.C. Brown Publishers, 1993.
3. Schlegel, H.G. “General Microbiology”, Seventh Edition, Cambridge University Press, 1993.

COURSE OUTCOMES - PROGRAM OUTCOMES MATRIX

CO	PO												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
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1909718	ROBOTICS	L T P C
		3 0 0 3

OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understand the functions of robots and review the need and application of robots in different engineering fields.
- Exemplify the different types of robot drive systems as well as robot end effectors.
- Apply the different sensors and image processing techniques in robotics to improve the ability of robots.
- Develop robotic programs for different tasks and analyze the kinematics motions of robot.
- Implement robots in various industrial sectors and interpolate the economic analysis of robots.

UNIT-I: FUNDAMENTALS OF ROBOT **9**

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT-II: ROBOT DRIVE SYSTEMS AND END EFFECTORS **9**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two 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

OUTCOMES: Upon Completion of this course, the students will 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.

TEXTBOOKS:

1. Klafter R.D., Chmielewski T.A and Negin M., “Robotic Engineering - An Integrated Approach”, Prentice Hall, 2003.

2. Groover M.P., “Industrial Robotics -Technology Programming and Applications”, McGraw Hill, 2001.

REFERENCE BOOKS:

1. Craig J.J., “Introduction to Robotics Mechanics and Control”, Pearson Education, 2008.
2. Deb S.R., “Robotics Technology and Flexible Automation” Tata McGraw Hill Book Co., 1994.
3. Koren Y., “Robotics for Engineers", McGraw Hill Book Co., 1992.

4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., “Robotics Control, Sensing, Vision and Intelligence”,McGraw Hill Book Co., 1987.

5. Rajput R.K., “Robotics and Industrial Automation”, S.Chand and Company, 2008.

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

1909719 TESTING OF MATERIALS L T P C

3 0 0 3

OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Apply the concept of testing to various materials and result analysis.
- Apply various mechanical testing procedures to different materials.
- Apply different nondestructive testing procedures to different materials.
- Apply material characterization testing for analysis.
- Apply advanced testing techniques for thermal and chemical fields.

UNIT-I: INTRODUCTION TO MATERIALS TESTING 9

Overview of materials, Classification of material testing, Purpose of testing, Selection of material, Development of testing, Testing organizations and its committee, Testing standards, Result Analysis, Advantages of testing

UNIT-II: MECHANICAL TESTING 9

Introduction to mechanical testing, Hardness test (Vickers, Brinell, Rockwell), Tensile test, Impact test (Izod, Charpy) - Principles, Techniques, Methods, Advantages and Limitations, Applications. Bend test, Shear test, Creep and Fatigue test - Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT-III: NON DESTRUCTIVE TESTING 9

Visual inspection, Liquid penetrant test, Magnetic particle test, Thermography test – Principles, Techniques, Advantages and Limitations, Applications. Radiographic test, Eddy current test, Ultrasonic test, Acoustic emission- Principles, Techniques, Methods, Advantages and Limitations, Applications.

UNIT-IV: MATERIAL CHARACTERIZATION TESTING 9

Macroscopic and Microscopic observations, Optical and Electron microscopy (SEM and TEM) - Principles, Types, Advantages and Limitations, Applications. Diffraction techniques, Spectroscopic Techniques, Electrical and Magnetic Techniques- Principles, Types, Advantages and Limitations, Applications.

UNIT-V: OTHER TESTING **9**

Thermal Testing: Differential scanning calorimetry, Differential thermal analysis. Thermo- mechanical and Dynamic mechanical analysis: Principles, Advantages, Applications. Chemical Testing: X-Ray Fluorescence, Elemental Analysis by Inductively Coupled Plasma-Optical Emission Spectroscopy and Plasma-Mass Spectrometry.

TOTAL : 45 PERIODS

OUTCOMES: Upon Completion of this course, the students will 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.

TEXTBOOKS:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu “Practical Non-Destructive Testing”, Narosa Publishing House, 2009.
2. Cullity, B. D., “Elements of X-ray diffraction”, 3rd Edition, Addison-Wesley Company Inc., New York, 2000.

REFERENCE BOOKS:

1. P. Field Foster, “The Mechanical Testing of Metals and Alloys” 7th Edition, Cousens Press, 2007.
2. Metals Handbook: Mechanical testing, (Volume 8) ASM Handbook Committee, 9th Edition, American Society for Metals, 1978.
3. ASM Metals Handbook, “Non-Destructive Evaluation and Quality Control”, American Society of Metals, Metals Park, Ohio, USA.
4. Brandon D.G., “Modern Techniques in Metallography”, Von Nostrand Inc. NJ, USA, 1986.

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

1909720 DESIGN OF ELECTRIC VEHICLES **L T P C**

3 0 0 3

OBJECTIVES:

The main learning objective of this course is to prepare the students for:

- Understand about electric vehicle technology.
- Understand the load distribution and stability of vehicles.
- Analyze the handling characteristics of road vehicles.
- Analyze the steering, suspension and designing of breaks.
- Understand hybrid vehicles, power electronics and fuel cell vehicles.

UNIT-I: INTRODUCTION TO ELECTRIC VEHICLES **9**

Electric Vehicle – Need - Types – Cost and Emissions – End of life. Electric Vehicle Technology – layouts, cables, components, Controls. Batteries – overview and its types. Battery plug-in and life. Ultra-capacitor, Charging – Methods and Standards. Alternate charging sources – Wireless & Solar.

UNIT-II: STABILITY OF VEHICLES **9**

Load distribution for three wheeler and four wheeler-Stability of vehicle running on slope, banked road and during turn-calculation of Tractive effort, maximum acceleration and reaction forces for different drives.

UNIT-III: HANDLING CHARACTERISTICS OF ROAD VEHICLES **9**

Steering geometry-Steady state handling characteristics- Steady state response to steering input-Testing of handling characteristics-Transient response characteristics-Directional stability.

UNIT-IV: STEERING, SUSPENSION AND BRAKE 9

Steering System - Ackerman Principle of Steering - Front End Geometry - Steering Gearbox- Types- Recirculating Ball - Rack and Pinion - Power Steering. Suspension - Front and Rear Forks - Springs for Suspension - Telescopic Suspension - Monoshock Suspension - Hydraulic Shock Absorber - Dampers. Design Consideration – Brake - Drum Brakes - Disc Brakes - ABS

UNIT-V: POWER ELECTRONICS AND CONTROL FOR HYBRID AND FUEL CELL VEHICLES 9

Series Hybrid Vehicle Propulsion System, Parallel Hybrid Vehicle Propulsion System, Fuel Cell Vehicles, Power Electronics Requirements, Propulsion Motor Control Strategies, APU Control System in Series Hybrid Vehicles, Fuel Cell for APU Applications.

TOTAL : 45 PERIODS

OUTCOMES: Upon Completion of this course, the students will 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.

TEXTBOOKS:

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												PSO			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1		2	1	1		1		1			1	2	2	1	2	
2	2			1	2				1							
3	1		1			1					1			1	1	
4		2	2	1			2									
5	2	2		1							2		2	1	1	

1920701 ANALYTICAL METHODS AND INSTRUMENTATION L T P C
3 0 0 3

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.Mass spectrometer.Applications of molecular mass - Electron paramagnetic resonance- g values – instrumentation.

UNIT- IV: SEPARATION METHODS 9

General description of chromatography – Band broadening and optimization of column performance-Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography- principles of GC and applications – HPLC- Capillary electrophoresis – Applications.

UNIT-V: ELECTRO ANALYSIS AND SURFACE MICROSCOPY 9

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ionselective and molecular selective electrodes – Instrument for

potentiometric studies – Voltametry – Cyclic and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probemicroscopes – AFM and STM.

TOTAL: 45 PERIODS

OUTCOMES

- 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.

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” GoelPublishing House, 1972.
2. Haven, Mary C., etal., “Laboratory Instrumentation “. IVth Edition, John Wiley, 1995.

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

1920702	MEDICAL PHYSICS	L T P C
		3 0 0 3

OBJECTIVES

- To study the complete non-ionizing radiations including light and its effect in humanbody.
- To understand the principles of ultrasound radiation and its applications inmedicine.
- To learn about radioactive nuclides.
- To know the interactions of radiation with matters and how isotopes areproduced.
- To study the harmful effects of radiation and radiation protectionregulations.

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

OUTCOMES

- 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. (Unit I &II)
2. Gopal B. Saha, Physics and Radiobiology of Nuclear Medicine, 4th Edition, Springer, 2013. (Unit III &IV)
3. R.Hendee and Russell Ritenour “Medical Imaging Physics”, Fourth Edition William, Wiley-Liss, 2002. (Unit V).

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.

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

1920703 ELECTRONIC MATERIALS L T P C
3 0 0 3

OBJECTIVES

- To Understand the various materials and its properties towards electrical and electronics field.
- To cover the properties of conducting materials.
- Make the students to understand various semiconducting and magnetic materials and their properties.
- To give an idea on dielectric and insulating materials.
- To explore the knowledge on optoelectronic and nano materials.

UNIT- I: INTRODUCTION 7

Structure: atomic structures and bonding, types of bonding, band formation.Defects and imperfections in solids: Point, Line and Planar defects; Interfacial defects and volume defects.Classification of materials based on bonding: conductors, semiconductors and insulators.

UNIT- II: CONDUCTING MATERIALS 9

Introduction, factors affecting the conductivity of materials, classification based on conductivity of materials, temperature dependence of resistivity, Low resistivity materials (graphite, Al, Cu and steel) and its applications, high resistivity materials (manganin, constantan, nichrome, tungsten) and their applications. Superconductors: Meissner effect, classification and applications.

UNIT- III: SEMICONDUCTING AND MAGNETIC MATERIALS 10

Semiconductors: Introduction, types of semiconductors, temperature dependence of semiconductors, compound semiconductors, basic ideas of amorphous and organic semiconductors. Magnetic Materials: classification of magnetic materials, ferromagnetism-B-H curve (Qualitative), hard and soft magnetic materials, magneto materials applications.

UNIT- IV: DIELECTRIC AND INSULATING MATERIALS 9

Dielectric Materials: Introduction, classification, temperature dependence on polarization, properties,dielectric loss, factors influencing dielectric strength and capacitor materials, applications. Insulators: Introduction, thermal and mechanical properties required for insulators, Inorganic materials, organic materials, liquid insulators, gaseous insulators and ageing of insulators, applications.

UNIT –V: OPTOELECTRONIC 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

OUTCOMES:

- 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.

Course Outcomes	PROGRAM OUTCOMES												Program Specific Outcomes			
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**	**4**
1	1	1	2	1	1	1	1	-	-	-	1	1	1	-	1	1
2	2	2	2	1	2	-	-	-	-	-	-	1	-	-	2	2
3	3	3	3	-	3	2	-	-	-	-	-	1	1	2	1	2
4	2	3	3	1	3	3	-	-	-	-	-	1	-	-	1	2
5	2	3	2	1	3	3	-	-	-	-	1	1	1	-	1	2