SRI VENKATESWARA COLLEGE OF ENGINEERING

(An Autonomous Institution, Affiliated to Anna University, Chennai – 600025)

B.E. Civil Engineering

CURRICULUM AND SYLLABUS

REGULATION – 2022

CHOICE BASED CREDIT SYSTEM

Curriculum Revision No:	02	Board of Studies recommendation date :	24.09.2024 18.04.2024 19.09.2023 31.03.2023 03.10.2022 18.03.2022 16.09.2021	Academic Council Approved date:	18.10.2024 09.05.2024 14.01.2024 18.10.2023 21.04.2023 08.10.2022 12.04.2022
Salient Points of the revision	01.	Addition of a new value added course – Data Analytics for Civil Engineers			

Chairman
Board of Studies
Faculty of Civil Engineering

Chairperson
Academic Council

SRI VENKATESWARA COLLEGE OF ENGINEERING

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REGULATIONS 2022

B. E. CIVIL ENGINEERING

CHOICE BASED CREDIT SYSTEM

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Civil Engineering graduates during the first few years of graduation will:

I. Practice civil engineering in construction industry, public sector undertaking or as an entrepreneur by applying ethical principles and following norms of civil engineering practice. (Technical Competence)

II. Pursue higher education for professional development. (Life-long Learning)

III. Exhibit leadership and team working skills in their profession and other activities with demonstrable attributes to contribute to the societal needs and to adapt to the changing global scenario. (Professionalism)

PROGRAM OUTCOMES (POs)

PO	GRADUATE ATTRIBUTES
1.	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and concepts of Civil Engineering to the solution of complex engineering problems.
2.	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3.	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions for complex problems.
5.	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6.	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7.	**Environment and sustainability**: Understand the impact of the professional

engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

Students in the Civil Engineering program should, at the time of their graduation, be able to

1. Provide solutions for real life problems related to core areas of civil engineering by applying knowledge of mathematics, Basic and Engineering Sciences and by using appropriate engineering tools.
2. Plan, analyse, design, execute and manage infrastructure projects considering safety, societal and environmental factors.

PEOs – POs & PSOs MAPPING:

POs/PSOs	PEOs		
	I	II	III
PO 1	3	2	
PO 2	3	2	
PO 3	3	2	
PO 4	3		
PO 5	3		
PO 6	2		
PO 7	2		
PO 8	3		
PO 9	3		3
PO 10	2	2	
PO 11	3		3
PO 12	1	3	
PSO 1	3	2	2
PSO 2	3		3

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REGULATIONS 2022

CHOICE BASED CREDIT SYSTEM

B. E. CIVIL ENGINEERING

CURRICULUM AND SYLLABI FOR SEMESTERS I AND VIII

SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
1.	IP22151	Induction Programme (Common to all Branches)		-	-	-	-	-	-	-
Theory Subjects										
2.	HS22151	Tamil language and Heritage of Ancient Tamil Society (Common to all branches)	HS	1	0	0	1	1	NIL	F
3.	HS22152	Communicative English (Common to all Branches)	HS	3	0	0	3	3	NIL	F
4.	MA22151	Applied Mathematics I (Common to all Branches except MR)	BS	3	1	0	4	4	NIL	F
5.	PH22152	Engineering Physics (Common to AE, CE, ME, MN, MR)	BS	3	0	0	3	3	NIL	F
6.	CY22153	Technical Chemistry (Common to BT, CH, CE)	BS	3	0	0	3	3	NIL	F
7.	CE22101	Engineering Geology and Construction Materials	PC	3	0	0	3	3	NIL	F
8.	CE22102	Engineering Drawing for Civil Engineers	ES	1	0	4	3	5	NIL	F
Practical Subjects										
9.	PH22161	Physics Laboratory (Common to all Branches except BT)	BS	0	0	2	1	2	NIL	F
10.	CY22161	Chemistry Laboratory (Common to all Branches except AD,	BS	0	0	2	1	2	NIL	F

		CS, IT)								
11.	ME22161	Basic Civil and Mechanical Engineering Laboratory (Common to CE, EE, EC)	ES	0	0	2	1	2	NIL	F
			Total	**17**	**1**	**10**	**23**	**28**		

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	HS22251	Science and Technology in Ancient Tamil Society (Common to all Branches)	HS	2	0	0	2	2	NIL	F
2.	HS22252	Technical English (Common to all Branches)	HS	3	0	0	3	3	NIL	F
3.	MA22251	Applied Mathematics II (Common to all Branches except MR)	BS	3	1	0	4	4	NIL	F
4.	IT22251	Computer Programming and Practice (Common to AE, BT, CE, CH)	ES	2	0	2	3	4	NIL	F
5.	EE22151	Basic Electrical and Electronics Engineering (Common to all Branches except CH, EE, EC)	ES	3	0	0	3	3	NIL	F
6.	CE22201	Building Planning and Drawing	PC	2	0	2	3	4	NIL	F
7.	CE22202	Engineering Mechanics for Civil Engineers	ES	3	1	0	4	4	NIL	F
Practical Subjects										
8.	EE22111	Basic Electrical and Electronics Engineering Laboratory (Common to all Branches except EC)	ES	0	0	2	1	2	NIL	F
9.	CE22211	Construction Materials Laboratory	PC	0	0	2	1	2	NIL	F
			Total	**18**	**2**	**8**	**24**	**28**		

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	CE22301	Soil Mechanics	PC	3	0	0	3	3	NIL	F
2.	CE22302	Construction Techniques Equipment and Practices	PC	3	0	0	3	3	NIL	F
3.	CE22303	Strength of Materials	PC	3	1	0	4	4	NIL	F
4.	CE22308	Surveying: Theory and Practices	PC	3	0	2	4	5	NIL	F
5.	CE22309	Fluid Mechanics: Theory and Practices	PC	3	0	2	4	5	NIL	F
6.	CE22310	Highway Engineering: Theory and Practices	PC	2	0	2	3	4	NIL	F
Practical Subjects										
7.	CE22311	Strength of Materials Laboratory	PC	0	0	2	1	2	NIL	F
			Total	**17**	**1**	**8**	**22**	**26**		

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	GE22451	Environmental Sciences and Sustainability (Common to all Branches)	BS	3	0	0	3	3	NIL	F
2.	MA22453	Statistics and Numerical Methods	BS	3	1	0	4	4	NIL	F
3.	CE22401	Structural Analysis I	PC	3	0	0	3	3	NIL	F
4.	CE22402	Water Supply and Wastewater Engineering	PC	4	0	0	4	4	NIL	F
5.	CE22403	Foundation Engineering	PC	3	0	0	3	3	NIL	F

6.	CE22409	Applied Hydraulic Engineering: Theory and Practices	PC	3	0	2	4	5	NIL	F
Practical Subjects										
7.	CE22411	Survey Practical	PC	0	0	2	1	2	NIL	F
8.	CE22412	Soil Mechanics Laboratory	PC	0	0	2	1	2	NIL	F
			Total	**19**	**1**	**6**	**23**	**26**		

SEMESTER V

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	CE22501	Structural Analysis II	PC	3	0	0	3	3	NIL	F
2.	CE22502	Design of Reinforced Concrete Elements	PC	3	1	0	4	4	NIL	F
3.	CE22503	Environmental and Social Impact Assessment	PC	3	0	0	3	3	NIL	F
4.	CE22504	Remote Sensing and GIS	PC	3	0	0	3	3	NIL	F
5.	****	Professional elective I	PE	3	0	0	3	3	NIL	M
6.	****	Open elective I	OE	3	0	0	3	3	NIL	M
7.	****	Mandatory Course	MC	3	0	0	0	3	NIL	M
Practical Subjects										
8.	CE22511	Water and Wastewater Analysis Laboratory	PC	0	0	2	1	2	NIL	F
9.	CE22512	Structural and Applied Mechanics Laboratory	PC	0	0	2	1	2	NIL	F
			Total	**18**	**1**	**4**	**21**	**26**		

SEMESTER VI

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	CE22601	Estimation and Quantity Surveying	PC	3	0	0	3	3	NIL	F
2.	CE22602	Transportation Systems	PC	3	0	0	3	3	NIL	F
3.	CE22603	Advanced Reinforced Concrete Design	PC	3	0	0	3	3	NIL	F
4.	CE22609	Design of Steel Structures: Theory and Practices	PC	3	0	2	4	5	NIL	F
5.	****	Professional elective II	PE	3	0	0	3	3	NIL	M
6.	****	Professional Elective III	PE	3	0	0	3	3	NIL	M
7.	****	Open Elective II	OE	3	0	0	3	3	NIL	M
Practical Subjects										
8.	CE22611	Structural Analysis and Design Laboratory	PC	0	0	4	2	4	NIL	F
			Total	**21**	**0**	**6**	**24**	**27**		

SEMESTER VII

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK				TOTAL Hours	Prerequisite	Position
				L	T	P	C			
Theory Subjects										
1.	CE22701	Hydrology and Irrigation Engineering	PC	3	0	0	3	3	NIL	F
2.	CE22702	Ethics in Civil Engineering Practice	PC	2	0	0	2	2	NIL	F
3.	CE22703	IoT in Civil Engineering	PC	2	0	0	2	2	NIL	F

4.	CE22709	Planning Scheduling and Control of Construction Projects: Theory and Practices	PC	2	0	2	3	4	NIL	F
5.	****	Professional Elective IV	PE	3	0	0	3	3	NIL	M
6.	****	Professional Elective V	PE	3	0	0	3	3	NIL	M
7.	****	Professional Elective VI	PE	3	0	0	3	3	NIL	M
Practical Subjects										
8.	CE22711	Industrial Training/Internship	EEC	-	-	-	2	4 weeks	NIL	M
			Total	**19**	**0**	**2**	**19**	**20**		

SEMESTER VIII

SL. NO.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**PERIODS PER WEEK**				**TOTAL Hours**	**Prerequisite**	**Position**
				L	**T**	**P**	**C**			
Theory Subjects										
1.	CE22811	Project Work	PC	0	0	20	10	20	NIL	F
			Total	**0**	**0**	**20**	**10**			

Total Credits : 168

List of Verticals

S. No	Course Code	Course Title	L	T	P	C
Vertical I – Special elective Group						
1	SE22001*	Financial Statement Analysis (Common to All branches)	3	0	0	3
2	SE22002*	Introduction to Securities Market (Common to All branches)	3	0	0	3
3	SE22003*	Option Trading Strategies (Common to All branches)	3	0	0	3
4	SE22004*	Corporate Finance (Common to All branches)	3	0	0	3
5	SE22005*	Managerial Economics (Common to All branches)	3	0	0	3
6	SE22006*	Project Management (Common to All branches)	3	0	0	3
7	SE22007*	Mathematics for AI & ML (Common to All branches)	3	0	0	3
Vertical II - Structural Engineering						
1	CE22021	Concrete Technology	3	0	0	3
2	CE22022	Prestressed Concrete Structures	3	0	0	3
3	CE22023	Prefabricated Structures	3	0	0	3
4	CE22024	Repair and Rehabilitation of Structures	3	0	0	3
5	CE22025	Advanced Strength of Materials	3	0	0	3
6	CE22026	Structural Dynamics	3	0	0	3
7	CE22027	Earthquake Resistant Design of Structures	3	0	0	3
8	CE22028	Smart Materials and Structures	3	0	0	3
9	CE22029	Design of Bridges	3	0	0	3
10	CE22020	Mini Project	0	0	4	2
Vertical III - Construction Management						
1	CE22031	Construction Materials and Management	3	0	0	3
2	CE22032	Construction Equipment and Management	3	0	0	3
3	CE22033	Formwork Scaffolding and Shoring	3	0	0	3
4	CE22034	Construction Quality and Safety Management	3	0	0	3
5	CE22035	Risk Management in Construction Projects	3	0	0	3

S. No	Course Code	Course Title	L	T	P	C
6	CE22036	Contract Management and Dispute Resolution	3	0	0	3
7	CE22037	Sustainable Construction	3	0	0	3
8	CE22038	Building Services and Maintenance	3	0	0	3
9	CE22030	Mini Project	0	0	4	2
Vertical IV - Transportation Engineering						
1	CE22041	Pavement Engineering	3	0	0	3
2	CE22042	Design of Pedestrian and Bicycle Tracks	3	0	0	3
3	CE22043	Airport and Harbour Engineering	3	0	0	3
4	CE22044	Urban Planning and Development	3	0	0	3
5	CE22045	Traffic Engineering and Management	3	0	0	3
6	CE22046	Traffic Management Plan for Construction Site	3	0	0	3
7	CE22047	Intelligent Transportation Systems	3	0	0	3
8	CE22048	Smart Cities	3	0	0	3
9	CE22040	Mini Project	0	0	4	2
Vertical V- Environmental Engineering						
1	CH22051	Industrial Waste Management	3	0	0	3
2	CH22052	Air Pollution Management	3	0	0	3
3	CH22053	Disaster Mitigation and Management	3	0	0	3
4	CH22054	Global Climate Change	3	0	0	3
5	CE22051	Municipal Solid Waste Management	3	0	0	3
6	CE22052	Environmental Policy and Legislations	3	0	0	3
7	CE22053	Environment Health and Safety	3	0	0	3
8	CE22054	Sustainability and Social Development	3	0	0	3
9	CE22050	Mini Project	0	0	4	2
Vertical VI - Geo-Informatics						
1	CE22061	Total Station and GPS Surveying	3	0	0	3
2	CE22062	Geoinformatics and its Applications	3	0	0	3
3	CE22063	Geographic Information Systems	3	0	0	3

S. No	Course Code	Course Title	L	T	P	C
4	CE22064	Photogrammetry	3	0	0	3
5	CE22065	Cartography	3	0	0	3
6	CE22066	Airborne and Terrestrial Laser Mapping	3	0	0	3
7	CE22067	Satellite Image Processing	3	0	0	3
8	CE22068	Cadastral and Hydrographic Surveying	3	0	0	3
9	CE22060	Mini Project	0	0	4	2
		Vertical VII - Geotechnical Engineering				
1	CE22071	Subsurface Investigation and Instrumentation	3	0	0	3
2	CE22072	Earth Pressure and Earth Retaining Structures	3	0	0	3
3	CE22073	Deep Foundation	3	0	0	3
4	CE22074	Soil Dynamics and Machine Foundations	3	0	0	3
5	CE22075	Tunneling	3	0	0	3
6	CE22076	Rock Mechanics	3	0	0	3
7	CE22077	Ground Improvement Techniques	3	0	0	3
8	CE22078	Geosynthetics Design and Applications	3	0	0	3
9	CE22070	Mini Project	0	0	4	2
		Vertical VIII - Water Resources Engineering				
1	CE22081	Groundwater Engineering	3	0	0	3
2	CE22082	Participatory Water Resources Management	3	0	0	3
3	CE22083	Urban Water Infrastructure	3	0	0	3
4	CE22084	Watershed Conservation and Management	3	0	0	3
5	CE22085	River Engineering	3	0	0	3
6	CE22086	Water Resources Systems Engineering	3	0	0	3
7	CE22087	Integrated Water Resources Management	3	0	0	3
8	CE22088	Environmental Hydraulics	3	0	0	3
9	CE22080	Mini Project	0	0	4	2

List of Value Added Courses

S.No.	Course Code	Course Title	Contact Periods	L	T	P	C
1.	VD22401	Application of Planning Tool in Construction Projects	2	2	0	0	2
2.	VD22402	GIS Tools in Civil Engineering	2	2	0	0	2
3.	VD22403	Finite Element Analysis using Computer Tools	2	2	0	0	2
4.	VD22404	Water Conservation Techniques	2	2	0	0	2
5.	VD22405	Vastu in Construction	2	2	0	0	2
6.	VD22406	Building Valuation	2	2	0	0	2
7.	VD22407	Design of Multistorey Building	2	2	0	0	2
8.	VD22408	Corrosion of Steel in Concrete and Preventive Measures	2	2	0	0	2
9.	VD22409	Wastewater Treatment Techniques	2	2	0	0	2
10.	VD22410	Automation in Construction	2	2	0	0	2
11.	VD22411	Biomimicry in Civil Engineering	2	2	0	0	2
12.	VD22412	Building Acoustics	2	2	0	0	2
13.	VD22413	Forensic Civil Engineering	2	2	0	0	2
14.	VD22414	Optimization Techniques	2	2	0	0	2
15.	VD22415	In-situ Soil Testing and Instrumentation	2	2	0	0	2
16.	VD22416	Non Destructive Testing Techniques	2	2	0	0	2
17.	VD22417	Base Isolation and Damping Techniques in Aseismic Design	2	2	0	0	2
18.	VD22418	Interior Designing	2	2	0	0	2
19.	VD22419	Landscaping Architecture	2	2	0	0	2
20.	VD22420	Green Building Concepts	2	2	0	0	2
21.	VD22421	Basics of Steel Concrete Composite Construction	2	2	0	0	2
22.	VD22422	BIM for Civil Engineers	2	2	0	0	2
23.	VD22423	Plumbing for Water and Sanitation	2	2	0	0	2
24.	VD22424	Data Analytics for Civil Engineers	2	2	0	0	2
25.	VC22001*	Basics of Entrepreneurship Development(Common to all branches)	2	2	0	0	2
26.	VC22002*	Advances in Entrepreneurship Development (Common to all branches)	2	2	0	0	2
27.	VC22003*	Communicative German (Common to all branches)	2	2	0	0	2
28.	VC22004*	Communicative Hindi (Common to all branches)	2	2	0	0	2
29.	VC22005*	Communicative Japanese (Common to all branches)	2	2	0	0	2
30.	VC22006*	Design Thinking and Prototyping laboratory (Common to all branches)	2	2	0	0	2

List of Open Electives offered by the Department of Civil Engineering

S.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	OE22401	Basic Civil Engineering	OE	3	3	0	0	3
2.	OE22402	Fundamentals of Remote Sensing and GIS	OE	3	3	0	0	3
3.	OE22403	Electronic Waste Management	OE	3	3	0	0	3
4.	OE22404	Basics and Principles of Green Building Design	OE	3	3	0	0	3
5.	OE22405	Principles of Vastu in Interior Design	OE	3	3	0	0	3
6.	OE22406	Integrated Solid Waste Management	OE	3	3	0	0	3
7.	OE22407	Life Cycle Assessment	OE	3	3	0	0	3
8.	OE22408	Water Pollution and its Management	OE	3	3	0	0	3

List of Mandatory Courses

S.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	MC22001*	Indian Constitution and Society(Common to all branches)	MC	3	2	0	0	0
2.	MC22002*	Essence of Indian Traditional Knowledge (Common to all branches)	MC	3	2	0	0	0
3.	MC22003*	Gender Sensitization (Common to all branches)	MC	3	2	0	0	0

List of General Elective Courses

S.No	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1.	GN22001*	Introduction to NCC for Engineers. (Common to all branches)	GE	4	2	0	2	0
2.	GN22002*	Yoga and physical culture (Common to all branches)	GE	2	0	0	2	0
3.	GN22003*	Introduction to Fine arts (Common to all branches)	GE	2	2	0	0	0

* - For syllabus, refer General curriculum and syllabus

Overall Program Structure

S.No.	Category	Credits In Semester								Total Credits
		I	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	
1	Humanities and Social Sciences including Management courses (HS)	4	5							9
2	Basic Science courses (BS)	12	4		7					23
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc (ES)	4	11							15
4	Professional Core courses (PC)	3	4	22	16	15	15	10		85
5	Professional Elective courses relevant to chosen specialization/branch (PE)					3	6	9		18
6	Open subjects - Electives from other technical and /or emerging subjects (OE)					3	3			6
7	Project work, skill oriented lab, industry oriented theory and internship in industry or elsewhere (EEC)							2	10	12
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Knowledge Tradition] (MC)									
Total		**23**	**24**	**22**	**23**	**21**	**24**	**21**	**10**	**168**

HS22151	**தமிழ் மொழியும் தமிழர் மரபும்** **TAMIL LANGUAGE AND HERITAGE OF ANCIENT TAMIL SOCIETY** **(Common to all branches)**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

OBJECTIVES:
பாடத்தின் நோக்கங்கள்:

1. They will learn about the origin of the Tamil language and the ways of life through five types of lands.
2. They will also learn about the contribution of Tamils in the Indian National Freedom Movement and the management methods of Tamils.

1. தமிழ் மொழியின் தோற்றம் பற்றியும், திணை கருத்துக்கள் வாயிலாக வாழ்வியல் முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.
2. இந்திய தேசிய சுதந்திர இயக்கத்தில் தமிழர்களின் பங்களிப்பு மற்றும் தமிழர்களின் மேலாண்மை முறைகளை பற்றியும் கற்றுக் கொள்வார்கள்.

UNIT I LANGUAGE AND HERITAGE
அலகு 1 தமிழுக்கும் தொழில்நுட்பக் கல்விக்கும் உள்ள தொடர்பு **3**

Language families in India – Dravidan Languages – Tamil as a Classical language – Classical Literature in Tamil – Contribution of U. Ve. Saminathaiyar. Arumuka Navalar – Importance of Tamil language in technical education.

மொழி மற்றும் பாரம்பரியம்: இந்தியாவில் உள்ள மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழில் செம்மொழி இலக்கியம் - உ.வே.. சாமிநாதய்யர். ஆறுமுகநாவலர் ஆகியோரின் பங்களிப்பு – தொழில் நுட்பக் கல்வியில் தமிழ் மொழியின் முக்கியத்துவம்.

UNIT II THINAI CONCEPTS
அலகு 2 திணை கருத்துக்கள் **9**

Five types of lands, animals, Gods, occupation, life styles, music, dance , food style, Floara and Fauna of Tamils - Agam and puram concept from Tholkappiyam and Sangam Literature – Aram concept of Tamil – Education and Literacy during Sangam Age – Ancient cities and Ports of Sangam Age – Export and Import during Sangam Age - Overseas Conquest of Cholas

திணை கருத்துக்கள்: -ஐந்து வகை நிலங்கள், விலங்குகள், கடவுள்கள், தொழில், வாழ்க்கை முறைகள், இசை, நடனம், உணவு முறை, தமிழர்களின் தாவரங்கள் மற்றும் விலங்கினங்கள் – தொல்காப்பியம் மற்றும் சங்க இலக்கியங்களில் இருந்து அகம் மற்றும் புரம் கருத்து – தமிழ் பற்றிய அறம் கருத்து – கல்வி மற்றும் எழுத்தறிவு சங்க காலம் – சங்ககாலத்தின் பண்டைய நகரங்கள் மற்றும் துறைமுகங்கள் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – சோழர்களின் வெளிநாட்டு வெற்றி.

UNIT III HERITAGE OF TAMILS **3**

அலகு 3 தமிழரின் மரபு

Contribution of Tamils to Indian National Freedom Movement and Indian Culture : Contributions of Subramanya Bharathi, Vanchinathan, Subramaniya Siva, Veerapandiya Kattabomman, V O Chidambaram Pillai, Dheeran Chinnamalai, The Maruthu Pandiyar, Puli Thevar, Tiruppur Kumaran, Veera Mangai Velunachiyar

இந்திய தேசிய சுதந்திர இயக்கம் மற்றும் இந்திய கலாச்சாரத்திற்கு தமிழர்களின் பங்களிப்பு:- சுப்ரமணிய பாரதி, வாஞ்சிநாதன், சுப்பிரமணிய சிவா, வீரபாண்டிய கட்ட பொம்மன், வா..ஊ சிதம்பரம் பிள்ளை, தீரன் சின்னமலை, மருது பாண்டிய சகோதரர்கள், பூலி தேவர், திருப்பூர் குமரன், வீரமங்கை வேலு நாச்சியார் - ,தமிழர் இலக்கியங்களில் மேலாண்மை கருத்துக்கள் (கி. மு. 500 முதல் கி. பி 200 வரை) – அகநானூறு, புறநானூறு, திருக்குறள் ஆகியவற்றில் மேலாண்மைக் கருத்துகள்.

TOTAL : 15 PERIODS

OUTCOMES :

பாடநெறி முடிவுகள் :

CO	CO statements Upon successful completion of the course, the students should be able to படிப்பை வெற்றிகரமாக முடித்தவுடன், மாணவர்கள் பின்வருவனவற்றைச் செய்ய முடியும்.	RBT level
CO1	Students will learn about the origin of the Tamil language மாணவர்கள் தமிழ் மொழித் தோற்றம் பற்றித் தெரிந்து கொள்வார்கள்.	1
CO2	They will know the ways of life of Tamils. தமிழர்களின் வாழ்வியல் முறைகளைத் தெரிந்து கொள்வார்கள்.	2
CO3	They will know about the freedom fighters of Tamils and the management of Tamils தமிழர்களின் சுதந்திர போராட்ட வீரர்களை பற்றியும், மேலாண்மைகளை பற்றியும் தெரிந்து கொள்வார்கள்.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

பாடநூல்கள்:

1. **பொன். முத்துகுமாரன்** (2002), "தமிழ் மரபு", காந்தளகம், 68, அண்ணா சாலை, சென்னை 600 002
2. **பி. டிஸ்ரீனிவாச ஐயங்கார்** (தமிழக்கமும் திறனாய்வும்) புலவர் கா. கோவிந்தன் (1988), "தமிழர் வரலாறு (முதல் பகுதி)", திருநெல்வேலி தென்னிந்திய சைவ சித்தாந்த நூற்பதிப்பு கழகம் ,154, TTK சாலை, சென்னை 18.
3. **டாக்டர். கே. கே. பிள்ளை** (2009), "தமிழக வரலாறு மக்களும் பண்பாடும்", உலக தமிழாராய்ச்சி நிறுவனம், தரமணி , சென்னை 600113
4. **முனைவர். ச. இராஜேந்திரன்** (2004), "தமிழில் சொல்லாக்கம்", தஞ்சாவூர் தமிழ் பல்கலைக் கழகம் வெளியீட

HS22152	**COMMUNICATIVE ENGLISH (Common to all branches)**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

1. Enable learners to interact fluently on everyday social contexts.
2. Train learners to engage in conversations in an academic/scholarly setting.
3. Instil confidence in learners to overcome public speaking barriers.
4. Develop learners' ability to take notes and in the process, improve their listening Skills
5. Enhance learners' reading skill through reading text passages for comprehension and contemplation.
6. Improve learners' skills to write on topics of general interest and drafting correspondences for general purposes.

UNIT I **9**

Listening - short video clips - conversational scenes form movies, celebrities' speeches /interviews. Speaking - several ways of introducing oneself at several situations, introducing others at several situations, inviting people for several occasions, describing people and their places. Reading - short comprehension passages - making inferences, critical analysis. Writing - completing the incomplete sentences - developing hints from the given information. Grammar - Wh-Questions and Yes or No questions - Parts of speech. Vocabulary development - prefixes - suffixes - articles - countable / uncountable nouns.

UNIT II **9**

Listening - customer care voice files, short narratives - identifying problems and developing telephone etiquettes. Speaking - speaking over skype/ whatsapp, making business calls, making self-recorded informative videos, inquiring about a concept/activity, describing a concept/activity. Reading - reading the headlines on news magazines - slogans and taglines from advertisements. Writing - free writing - writing - headlines, slogans and taglines individual inspirations. Grammar- conjunctions, idioms, phrases, quotes. Vocabulary development - guessing the meanings of words in different contexts.

UNIT III **9**

Listening - courtroom scenes from movies, debates and talks from news channels, notes taking. Speaking - language and tone for arguments, discussion, deliberation, contemplation, expressing opinions, reacting to different situations in an alien country. Reading - language used in instruction manuals of household appliances, cookery and other basic instructions. Writing- understanding the structure of texts - use of reference words, discourse markers- coherence, rearranging the jumbled sentences. Grammar - adjectives - degrees of comparison, framing direct and indirect questions. Vocabulary development - concise approach, single word substitution.

UNIT IV **9**

Listening - Sports commentaries, advertisements with users' criticisms; Speaking - for social causes, for promoting a concept, negotiating and bargaining; Reading - review of a product, movie, movement or a system; Writing - writing for advertisements, selling a product; Grammar – Tenses - Simple Past, Present and Future, Continuous - Past, Present and Future; Vocabulary Development - synonyms, antonyms and phrasal verbs.

UNIT V **9**

Listening - video lectures, video demonstration of a concept; Speaking – presenting papers/concepts, delivering short speeches, discourses on health, suggesting natural home remedies, cleanliness, civic sense and responsibilities; Reading - columns and articles on home science; Writing - correspondences of requests, basic enquiry/observation and basic complaints; Grammar - modal verbs, perfect tenses - Vocabulary development - collocations.

TOTAL: 45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Acquire adequate vocabulary for effective communication	3
CO2	Listen to formal and informal communication and read articles and infer meanings from specific contexts from magazines and news papers.	3
CO3	Participate effectively in informal/casual conversations; introduce themselves and their friends and express opinions in English.	4
CO4	Comprehend conversations and short talks delivered in English.	6
CO5	Write short write-ups and personal letters and emails in English	6

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Department of English, Anna University, Mindscapes : English for Technologists and Engineers. Orient Black Swan, Chennai, 2017.
2. Downes and Colm, “Cambridge English for Job-hunting”;, Cambridge University Press, New Delhi, 2008.
3. Murphy and Raymond, “Intermediate English Grammar with Answers Cambridge University Press, 2000.
4. Thomson, A.J., “Practical English Grammar 1 & 2”;, Oxford, 1986.

WEBSITES:

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

SOFTWARE:

1. Face 2 Face Advance – Cambridge University Press, 2014.
2. English Advance Vocabulary- Cambridge University Press.
3. IELTS test preparation – Cambridge University Press 2017.
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition.
5. Cambridge Preparation for the TOEFL TEST- Cambridge University Press, 2017.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

3-High, 2-Medium, 1-Low

3 means 'a strong correlation' as **the students will use all the four skills (Listening, Speaking, Reading and Writing) with appropriate body language in formal and informal environment.**

MA22151	APPLIED MATHEMATICS I (Common to all Branches except MR)	L T P C 3 1 0 4

COURSE OBJECTIVES:

The Student should be made to:

1. Compute eigen values and eigen vectors and use in diagonalization and in classifying real quadratic forms.
2. Study differential calculus and its applications to relevant Engineering problems.
3. Compute derivatives using the chain rule or total differentials.
4. Understand the rotation of two dimensional geometry using definite integrals.
5. Acquaint with the Mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I MATRICES (9+3)

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 –Diagonalization of matrices– Reduction of a quadratic form into canonical form by orthogonal transformation-Nature of quadratic forms.

UNIT II APPLICATION OF DIFFERENTIAL CALCULUS (9+3)

Curvature and radius of Curvature– Centre curvature – Circle of curvature –Evolutes– Envelopes- Evolute as Envelope of Normals.

UNIT III DIFFERENTIAL CALCULUS FOR SEVERAL VARIABLES (9+3)

Limits and Continuity - Partial derivatives – Total derivatives – Differentiation of implicit functions – 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 APPLICATION OF DEFINTE INTEGRALS (9+3)

Integration by Parts-Bernoulli's formula for integration- Definite integrals and its Properties-Solids of Revolution- Disk Method- Washer Method- Rotation about both x and y axis and Shell method.

UNIT V MULTIPLE INTEGRALS (9+3)

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

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Solve the Eigen value problems in matrices.	3
CO2	Apply the basic notion of calculus in Engineering problems and to tackle for different geometries.	3
CO3	Perform calculus for more than one variable and its applications in Engineering problems.	3
CO4	Apply definite integrals for design of three dimensional components.	3
CO5	Evaluate multiple integral in Cartesian and polar coordinates.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics",10thEdition, John Wiley, (2015)
2. Grewal B.S, Grewal J.S, "Higher Engineering Mathematics",43rdEdition, Khanna Publications, Delhi, (2015).

REFERENCES:

1. Bali N.P and Manish Goyal, "A Text book of Engineering Mathematics", Nineth Edition, Laxmi Publications Pvt. Ltd.,(2014).
2. Glyn James, "Advanced Modern Engineering Mathematics", 4th Edition, Pearson Education,(2016).
3. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2013).

WEB LINKS:

1. https://home.iitk.ac.in/~peeyush/102A/Lecture-notes.pdf
2. https://www.sydney.edu.au/content/dam/students/documents/mathematics-learning-entre/integration-definite-integral.pdf

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	2	2	-	-	-	-	-	-	-	3	-	-

3-High, 2-Medium, 1-Low

PH22152	ENGINEERING PHYSICS (Common to AE, CE, ME, MN, MR)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various Streams of Engineering.

UNIT I MECHANICS 9

Moment of inertia (M.I) - Radius of gyration - Theorems of M. I - M.I of circular disc, solid cylinder, hollow cylinder, solid sphere and hollow sphere - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule - centre of mass – conservation of linear momentum – Relation between Torque and angular momentum - Torsional pendulum.

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 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.

Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel)

UNIT III ACOUSTICS AND ULTRASONICS 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. Production of Ultrasonics by Magnetostriction and Piezoelectric methods – Acoustic grating -Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, medical applications – Sonogram.

UNIT IV PHOTONICS AND FIBER OPTICS 9

Photonics: population of energy levels, Einstein's A and B coefficients derivation – resonant cavity, optical amplification (qualitative) – Nd-YAG laser – $C0_2$ Laser – 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 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 – interplanar 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

TOTAL : 45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Formulate general mechanics parameters and explain conservation laws in mechanics	2
CO2	Explain the properties of fluid and thermal flow through various materials	2
CO3	Demonstrate the production and propagation of Acoustical waves	2
CO4	Apply fundamental laws of optics in different types of LASER and Optic fiber communication	3
CO5	Classify and demonstrate the fundamentals of crystals and their defects in solids	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Arumugam M, "Materials Science", Anuradha Publications, 2015.
2. Gaur R.K. and Gupta S.L, "Engineering Physics", Dhanput Publications, 2015.
3. Rajendran V, "Engineering Physics", Tata McGraw Hill, 2009.
4. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2006.

REFERENCES:

1. Arthur Beiser, Shobhit Mahajan, Rai Choudhury S, "Concepts of Modern Physics", 7th Edition, McGraw Hill Education, 2017.
2. David Halliday, Robert Resnick, Jearl Walker, "Principles of Physics", 10th Edition, Wiley,2015.
3. Peter Atkins and Julio De Paula, "Physical Chemistry", 10th Edition, Oxford University Press,2014.
4. Raghavan V, "Materials Science and Engineering", PHI Learning Pvt. Ltd., 2010.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	2	-	2	-	-
CO2	3	2	2	2	-	-	2	-	-	2	-	2	-	-
CO3	3	-	2	2	-	-	2	-	-	2	-	2	-	-
CO4	3	2	-	-	-	-	-	-	-	2	-	2	-	-
CO5	3	-	-	-	-	-	-	-	-	2	-	2	-	-

3-High, 2-Medium, 1-Low

CY22153	TECHNICAL CHEMISTRY (Common to BT, CH, CE)	L	T	P	C
		3	0	0	3

OBJECTIVES:

make the student conversant with the

- Electrodes, Corrosion and Protective coatings
- Photochemical process
- Synthesis and applications of nanoparticles
- Characteristics and analysis of water
- Materials like polymers, composites and binding materials

UNIT I ELECTROCHEMISTRY 9

Electrodes and electrochemical cells – electrode potential, standard electrode potential, single electrode potential and its determination, types of electrodes – calomel, quinhydrone and glass electrode. Nernst equation – determination of pH of a solution by using quinhydrone and glass electrode. Electrochemical series and its applications. Batteries – Primary (dry cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery) and next generation batteries.

UNIT II PHOTOCHEMISTRY 9

Laws of photochemistry – Grotthuss-Draper law, Stark–Einstein law and Lambert Beer Law – determination iron by spectrophotometer. Quantum efficiency – Photo physical processes - internal conversion, inter-system crossing, fluorescence, phosphorescence and photo-sensitization-Quenching of fluorescence and its kinetics, Stern-Volmer relationship. Applications of photochemistry.

UNIT III NANOCHEMISTRY 9

Basics and scale of nanotechnology, different classes of nanomaterials, Distinction between molecules, nanoparticles and bulk materials; size-dependent properties. Synthesis of nanomaterials, fabrication (lithography) and its applications – Basics of nanophotonics and quantum confined materials (surface plasmon resonance).

UNIT IV WATER TECHNOLOGY 9

Sources, impurities in water and their effects. WHO guideline and BIS guideline for drinking water. Water characteristics – Hardness – Types of hardness – Disadvantages of hard water. Boiler troubles: Scale, Sludge, Priming and Foaming, Caustic embrittlement and Boiler corrosion. Water softening methods - Internal treatment of water: Carbonate conditioning, Phosphate conditioning and Calgon conditioning - External treatment of water: Ion exchange process. Domestic water treatment. Water analysis: Hardness – determination by EDTA method, Alkalinity – determination by double indicator method, Determination of dissolved oxygen by

Winkler's method and Determination of chloride by Mohr's method.

UNIT V MATERIALS CHEMISTRY 9

Polymers: Introduction – Monomers, functionality and its significance, Free radical polymerization mechanism. Conducting polymers – mechanism of conduction in polyacetylene and applications.

Composites: Definition, need for composites. Constitution – Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). Properties and applications of composites materials. Hybrid composites, Binding materials and its applications

TOTAL (L: 45): 45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Identify electrochemical cells, corrosion and fundamental aspects of batteries	2
CO2	Interpret the photochemical reactions and make use of spectroscopic techniques	2
CO3	Realize the structures, properties and applications of nanoparticles.	2
CO4	Describe the hardness of water, the problems caused by the hard water and their removals methods.	4
CO5	Illustrate the significance of various materials like polymer, composites their composition, properties and applications.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry", Dhanpet Rai & Sons, New Delhi, 17th Edition, 2018.
2. Dara, "A Text Book of Engineering Chemistry", S.Chand & Co. Ltd., New Delhi, 12th Edition, 2016.

REFERENCES:

1 B.R. Puri, L.R. Sharma, M.S. Pathania., "Principles of Physical Chemistry" Vishal Publishing Company, 2008.
2 Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company, Ltd., New Delhi, 2008.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	-		-	-	-	-	-	3	-	-
CO2	3	3	-	-	-	3	3	-	-	-	-	3	-	-
CO3	3	3	3	-	-	3	3	1	-	-	-	3	-	-
CO4	3	3	-	2	1	3	3	3	-	-	-	3	-	-
CO5	3	3	3	-	-	3	3	3	-	-	-	3	-	-

3-High, 2-Medium, 1-Low

CE22101 **ENGINEERING GEOLOGY AND CONSTRUCTION MATERIALS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- This course will give insights on the basics of geology and significance of rocks and minerals.
- This course will introduce students to various materials commonly used in civil engineering construction and their properties.

UNIT I MINERALS AND ROCKS **9**

Relevance and importance of Engineering Geology of Civil Engineers, Minerals, their physical properties, composition and their use in the manufacture of construction materials– rock forming minerals, physical and engineering properties of igneous, metaphoric and sedimentary rocks

UNIT II LIME, STONE, BRICK AND MASONRY **9**

Lime mortar, Stone as building material – Criteria for selection – Tests on stones – Bricks – Classification, Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption, Efflorescence – Brick and Stone Masonry – Concrete hollow blocks –Paver Blocks.

UNIT III CEMENT, MORTAR, AGGREGATES **9**

Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Sand - Grading – Sand Bulking

UNIT IV CONCRETE **9**

Concrete – Ingredients, Manufacturing Process, Properties of fresh concrete – Slump, Flow and compaction Factor, Properties of hardened concrete –Compressive strength, tensile strength, flexural strength, modulus of elasticity, Mix specification and proportioning, Mix design using BIS.

UNIT V MODERN MATERIALS **9**

Timber – types and applications, Metals used in construction industry – steel, alumnium – Characteristics, forms available and applications, Bitumen, Fibre Reinforced Polymer, Glass, geotextiles, High Density Polyethylene, self healing materials.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain about minerals and rock formation.	2
CO2	Summarise the significance of lime, stone, brick and masonry in construction.	2
CO3	Describe the properties of cement, mortar and aggregates.	2
CO4	Explain about concrete, its ingredients, properties and tests.	2
CO5	Ennumerate on the modern construction materials.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Varghese, P.C., Engineering Geology for Civil Engineering Prentice Hall of India Learning Private Limited, New Delhi, 2012.
2. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2015.

REFERENCES:

1. Parbin Singh. A "Text book of Engineering and General Geology", Katson publishing house, Ludhiana 2009
2. Chenna Kesavulu N. "Textbook of Engineering Geology", Macmillan India Ltd., 2009.
3. Blyth F.G.H. and de Freitas M.H., Geology for Engineers, Edward Arnold, London, 2010.
4. Bell .F.G.. "Fundamentals of Engineering Geology", B.S. Publications. Hyderabad 2011.
5. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
6. Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd.,2008
7. Gambhir.M.L., "Concrete Technology", 3rd Edition, Tata McGraw Hill Education, 2004
8. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
9. Gambhir. M.L., &Neha Jamwal., "Building Materials, products, properties and systems", Tata McGraw Hill Educations Pvt. Ltd, New Delhi, 2012.
10. IS 456 - 2000: Indian Standard specification for plain and reinforced concrete, 2011
11. IS 4926 - 2003: Indian Standard specification for ready–mixed concrete, 2012
12. IS 383 - 2016: Indian Standard specification for coarse and fine aggregate from natural Sources for concrete.
13. IS 1542-1992: Indian standard specification for sand for plaster, 2009
14. IS 10262-2019: Indian Standard Concrete Mix Proportioning –Guidelines.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	2

3-High, 2-Medium, 1-Low

CE22102 ENGINEERING DRAWING FOR CIVIL ENGINEERS

L	T	P	C
1	0	4	3

COURSE OBJECTIVES:

- This course will introduce students to Engineering Drawing and build their ability to read drawings and interpret the position and form of simple geometry, culminating into understanding of simple technical assemblies.

UNIT I FUNDAMENTALS OF DRAWING AND CONIC SECTIONS 12

Drawing standards: BIS, Lettering, Dimensioning, Type of lines, BIS Conventions, size, layout and folding of drawing sheets, use of drafting tools, Basic geometrical constructions.
Projection: Principal Planes, Projection of Points using Four Angles of Projection, Projection of Straight Lines - Lines parallel or inclined to one plane.
Conic Sections - Ellipse, Parabola, Hyperbola using Eccentricity method

UNIT II PROJECTION OF PLANES AND SOLIDS 15

Projection of Plane Figures - Inclined to any one Principal Plane
Projection of Solids - Simple Solids (Prisms, Pyramids, Cone and Cylinder) axis inclined to any one Principal Plane.

UNIT III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15

Section of Solids - Sectional views of simple vertical solids cut by section plane inclined to any one Principal Plane.
Development of Surfaces - Development of lateral surfaces of truncated and frustum of simple solids.

UNIT IV ORTHOGRAPHIC AND ISOMETRIC PROJECTION 15

Isometric Projection - Principle, Isometric Planes, Isometric Scales, Isometric Projection of simple solids and their combination.
Orthographic Projection - Orthographic views of simple blocks from their Isometric view, Isometric view of simple blocks from their Orthographic views.

UNIT V COMPUTER AIDED DRAWING 18

Basics of Computer Tools – basic drawing and modifying commands, hatching, plotting drawings. Drawing simple solids, orthographic and simple 3D models.
Civil Drawing Conventions, Building Plan standards, layer creation, Drawing plan of a single room building using software.

.TOTAL: 75 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the basic engineering drawing principles to construct conic sections and sketch the orthographic views of lines as per drawing standards	3
CO2	Draw projections of plane surfaces and simple solids in various positions.	3
CO3	Draw projections of sectioned solids and develop the lateral surfaces of simple solids.	3
CO4	Draw orthographic and isometric projections of simple solids and their combinations	3
CO5	Apply the engineering drawing fundamentals to draw solids and building plan using software application	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Bhatt N.D, Panchal Pramod V.M and Ingle R, "Engineering Drawing", Charotar Publishing House, 2019.
2. Gupta B.V.R and Raja Roy.M, "Engineering Drawing with AutoCAD", Dream Tech Press and Wiley Publications, third edition, 2021

REFERENCES:

1. Venugopal K and Prabhu Raja V, "Engineering Graphics", New Age International (P) Limited, 2014.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2009.
3. Gopalakrishna K.R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 2010.
4. Natrajan K.V, "A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.
5. Gowri S and Jeyapoovan T, "Engineering Graphics", Vikas Publishing House Pvt. Ltd., 2012.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	2	-	-	3	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

PH22161 **PHYSICS LABORATORY**

(Common to all Branches except BT)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics and properties of matter.

LIST OF EXPERIMENTS (Any eight Experiments)

1. a) Determination of Wavelength, and particle size using Laser.
   b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic Interferometer.
3. Determination of wavelength of mercury spectrum – spectrometer grating.
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by Non uniform bending method.
6. Determination of specific resistance of a given coil of wire – Carey Foster's Bridge.
7. Determination of Rigidity modulus of a given wire -Torsional Pendulum
8. Energy band gap of a Semiconductor
9. Determine the Hysteresis loss of a given Specimen
10. Calibration of Voltmeter & Ammeter using potentiometer.

TOTAL: 30 Periods

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the physical principle involved in the various instruments; also relate the principle to new application.	3
CO2	Utilized the principle of optics, mechanics and thermal physics to cater the need of various engineering field.	3
CO3	Make use of the basic concept of physical science to think innovatively and develop engineering skills	3
CO4	Evaluate the process and outcomes of an experiment quantitatively and qualitatively	3
CO5	Extend the scope of an investigation whether or not results come out as expected	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. "Physics Laboratory practical manual", 1st Revised Edition by Faculty members, 2018.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	3	-	-	-	2	3	2	-	3	-	-
CO2	3	3	2	3	-	-	-	2	3	2	-	3	-	-
CO3	3	3	2	3	-	-	-	2	3	2	-	3	-	-
CO4	3	3	2	3	-	-	-	2	3	2	-	3	-	-
CO5	3	3	2	3	-	-	-	2	3	2	-	3	-	-

3-High, 2-Medium, 1-Low

CY22161	Chemistry Laboratory (Common to all Branches except AD, CS, IT)	L	T	P	C
		0	0	2	1

OBJECTIVES

The objective of the ChemistryLaboratory is to acquaint the students with the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and Engineering field.

1. To appreciate the need and importance of water quality parameters for industrial and domestic use.
2. To gain the knowledge on electrochemical instrumention techniques like potentialand current measuring used in electrochemistry applications
3. To impart knowledge on separation of components using paper chromatography.
4. To enhance the thinking capabilityabout polymer and properties like molecular weight.

LIST OF EXPERIMENTS (Minimum 8 Experiments)

1. Determination of DO content of water sample by Winkler's method.
2. Determination of strength of given hydrochloric acid using pH meter
3. Determination of strength of acids in a mixture using conductivity meter
4. Estimation of iron content of the water sample using spectrophotometer (phenanthroline / thiocyanate method)
5. Determination of total, temporary & permanent hardness of water by EDTA Method.
6. Estimation of iron content of the given solution using potentiometer.
7. Determination of alkalinity in water sample.
8. Determination of Single electrode potential.
9. Separation of components from a mixture of red and blue inks using Paper chromatography.
10. Determination of molecular weight of polymer by using Ostwald's/Ubbelohde viscometer.

TOTAL: 15 Periods

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Distinguish hard and soft water, solve the related numerical problems on water, purification and its significance in industry and daily life.	3
CO2	Interpret the knowledge of instruments to measure potential and current related parameters.	2
CO3	Demonstrate the basic principle for separation of components using paper chromatography.	3
CO4	Evaluate the molecular weight of polymer using Ostwald's/Ubbelohde viscometer.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Daniel R. Palleros, “Experimental organic chemistry” John Wiley & Sons, Inc., New York 2001.
2. Furniss B.S. Hannaford A.J, Smith P.W.G and Tatchel A.R., “Vogel‟s Textbook of practical organic chemistry”, LBS Singapore 1994.
3. Jeffery G.H., Bassett J., Mendham J.and Denny vogel‟s R.C, “Text book of quantitative analysis chemical analysis”, ELBS 5th Edn. Longman, Singapore publishers, Singapore, 1996.
4. Kolthoff I.M., Sandell E.B. et al. “Quantitative chemical analysis”, Mcmillan, Madras 1980

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	3	3	3	1	-	1	2	-	-
CO2	3	2	1	-	-	3	3	3	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	-	-	-	-	2	-	-
CO4	3	-	-	1	-	3	3	3	-	-	-	-	-	-

3-High, 2-Medium, 1-Low

ME22161	BASIC CIVIL AND MECHANICAL ENGINEERING LABORATORY (Common to CE, EE, EC)	L	T	P	C
		0	0	2	1

OBJECTIVES:
To provide an exposure and hands on experience to the students on various civil and mechanical engineering processes.

LIST OF EXPERIMENTS

1- Carpentry – Preparation of Cross half lap joint and Tee joint using power tools.
2- Plumbing – Basic pipe line connection used in houses with PVC pipes, valves, taps, couplings, unions, reducers, elbows.
3- Welding - Butt joint and lap joint using Electric Arc welding.
4- Machining – Turning and facing using Centre Lathe.
5- Sheet metal work – Making of a cylinder using GI sheet and finishing using rivets.
6- Fitting – Preparation of metal pieces by grinding and filing to maintain flat sides at right angles
7- Drilling and Tapping – Drilling of holes precisely and making internal threads by Tapping for various sizes.
8- Casting – Mould preparation using simple solid pattern and casting.
9- Automation – Basic pneumatic circuit using single and double acting cylinder.
10- 3D printing –Demonstration of printing of simple solids using Additive Manufacturing/3D printing.

TOTAL: 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Prepare various joints used for assembling wooden parts.	3
CO2	Make required pipeline connection by selecting the suitable components	3
CO3	Fabricate components by various manufacturing processes.	3
CO4	Understand the principles of low-cost automation using pneumatic circuits.	2
CO5	Understand the principle of additive manufacturing/3D printing	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Jeyachandran K., Natarajan S. & Balasubramanian S., "A Primer on Engineering Practices Laboratory", Anuradha Publications, 2007.

2. Jeyapoovan T., Saravanapandian M. & Pranitha S., "Engineering Practices Lab Manual", Vikas Publishing House Pvt.Ltd, 2006.
3. Bawa H.S., "Workshop Practice", Tata McGraw Hill Publishing Company Limited, 2007.
4. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
5. Anthony Esposito, Fluid Power with Applications, Pearson Education, 7th edition, 2009.
6. Civil & Mechanical engineering practices lab manual, SVCE, 2022.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	1	-	-	-	2	-	-	-	-	-	-	-	-	-
CO5	1	-	-	-	2	-	-	-	-	-	-	-	-	-

3-High, 2-Medium, 1-Low

HS22251	அறிவியல் மற்றும் தொழில்நுட்பத்தில் தமிழ் **SCIENCE AND TECHNOLOGY IN ANCIENT TAMIL SOCIETY** **(Common to all Branches)**	**L**	**T**	**P**	**C**
		2	**0**	**0**	**2**

OBJECTIVES:

பாடத்தின் நோக்கங்கள்:

1. They will know about the use of Tamil in science.
2. Learn about the impact of Tamil heritage on technology.
1. அறிவியலில் தமிழின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள்.
2. தொழில்நுட்பத்தில் தமிழ் பாரம்பரியத்தின் தாக்கம் பற்றி அறிந்து கொள்வார்கள்

UNIT I SCIENTIFIC TAMIL **6**

அலகு 1 அறிவியல் தமிழ்

Tool Development - Research Development - Educational Development - Scientific Tamil words Creation

கருவி உருவாக்கம் – ஆராய்ச்சி மேம்பாடு – கல்வி வளர்ச்சி – அறிவியல் தமிழ் சொற்கள் உருவாக்கம்

UNIT II TAMIL IN TECHNOLOGY **24**

அலகு 2 தொழில்நுட்பத்தில் தமிழ்

Design and Construction Technology : Building materials in Sangam age – Great temples of Cholas and other workship places – Sculptures and Temples of Pallavas (Mamallapuram) – Temples of Nayakas period (Madurai Meenakshi amman temple), Thirumalai Nayakar Mahal, Chetti Nadu Houses.

Manufacturing Technology : Art of Ship building, Metallurgical studies, Knowledge about Gold, Copper, Iron – Archeological evidences – Terracotta beads, Shell beads, Bone beads.

Agriculture and Irrigation Technology: Dams, Tank, ponds, sluice, Significance of Kumuzhi Thoompu of Cholas period- Animal Husbandry, Wells designed for cattle use. Agriculture and Agro processing, - Knowledge about Sea – Fisheries, Pearl, Conche diving.

Tamil Computing : Development of Scientific Tamil – Tamil Computing, Digitization of Tamil books, Tamil Digital Library, Development of Tamil Softwares – Tamil virtual Academy – Sorkuvai project. Future of Tamil and Information Technology- Globalization and Information Technology-Teaching Tamil for Computer-Resources in Tamil Language Technology.

வடிவமைப்பு மற்றும் கட்டுமான தொழில்நுட்பம் : சங்க காலத்தில் கட்டுமானப் பொருட்கள் – சோழர்களின் பெரியகோவில்கள் மற்றும் பிற வழிபாட்டுதலங்கள் – பல்லவர்களின் சிற்பங்கள் மற்றும் கோவில்கள் (மாமல்லபுரம்) - நாயக்கன் கால

கோவில்கள் (மதுரை மீனாட்சி அம்மன் கோவில்), திருமலை நாயக்கர் மஹால், செட்டிநாட்டு வீடுகள்.

உற்பத்தி தொழில் நுட்பம் : கப்பல் கட்டும் கலை, உலோகவியல் ஆய்வுகள், தங்கம், தாமிரம், இரும்பு பற்றிய அறிவு – தொல்பொருள் சான்றுகள் – சுட்டக் களிமண் மணிகள், சங்கு மணிகள், எலும்பு மணிகள்.

விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பம் : அணைகள், ஏரிகள், குளங்கள், மதகுகள், சோழர் கால குமுழி தூம்பு ஆகியவற்றின் முக்கியத்துவம் – கால்நடை பராமரிப்பு, கால்நடைகளின் பயன்பாட்டிற்காக வடிவமைக்கப்பட்ட கிணறுகள். விவசாயம் மற்றும் வேளாண் செயலாக்கம் – கடல் பற்றிய அறிவு – மீன் பிடித்தல், முத்து குளித்தல், சங்கு சேகரித்தல்.

தமிழ் கணினி: அறிவியல் தமிழ் வளர்ச்சி – தமிழ் கணினி, தமிழ் புத்தகங்களின் டிஜிட்டல்மயமாக்கல், தமிழ் டிஜிட்டல் நூலகம், தமிழ் மென்பொருள் உருவாக்கம் – தமிழ் மெய் நிகர் அகாடமி – சொற்குவை திட்டம்.

தமிழின் எதிர்காலமும் தகவல் தொழில்நுட்பமும்- உலகமயமாக்கலும் தகவல் தொழில்நுட்பமும் – கணினிக்கு தமிழ் கற்று கொடுத்தல் – தமிழ்மொழித் தொழில்நுட்பத்தில் வளங்கள்.

TOTAL : 30 PERIODS

OUTCOMES :

பாடநெறி முடிவுகள் :

CO	CO statements Upon successful completion of the course, the students should be able to படிப்பை வெற்றிகரமாக முடித்தவுடன், மாணவர்கள் பின்வருவனவற்றைச் செய்ய முடியும்.	RBT level
CO1	They will know about the use of Tamil language in science அறிவியலில் தமிழ் மொழியின் பயன்பாடு பற்றி தெரிந்து கொள்வார்கள்.	2
CO2	They will learn about the influence of Tamil language in various technologies. பல்வேறு தொழில்நுட்பத்தில் தமிழ்மொழியின் தாக்கம் பற்றி அறிந்து கொள்வார்கள்	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:
பாடநூல்கள்:

1. டாக்டர், வா.செ .குழந்தைசாமி (1985), "அறிவியல் தமிழ்" , பாரதி பதிப்பகம், 126/108, உஸ்மான் சாலை, தியாகராய நகர் , சென்னை 600017

2. சுப. திண்ணப்பன், (1995), “கணினியும் தமிழ் கற்பித்தலும்”, புலமை வெளியீடு, 38-B மண்ணத்நதோட்டத் தெரு, ஆழ்வார்பேட், சென்னை 600018

3. மு. பொன்னவைக்கோ, (2003), "வளர்தமிழில் அறிவியல் – இணையத் தமிழ்", அனைத்திந்திய அறிவியல் தமிழ்க் கழகம், தஞ்சாவூர் 615 005.

4. துரை. மணிகண்டன், (2008), "இணையமும் தமிழும்", நல்நிலம் பதிப்பகம், 7-3, சிமேட்லி சாலை, தியாகராய நகர், சென்னை 600 017.

HS22252 **TECHNICAL ENGLISH**
(Common to all Branches)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. Enable learners to define and understand technical communication and scientific writing
2. Expose learners to the technicalities of seminar presentation, group discussion, and public speaking
3. Develop learners' writing skills for scientific and documenting purposes
4. Improve learners' ability to draft correspondences for business purposes
5. Cultivate learners' ability to holistically understand the nuances of job interviews and recruiting process.

UNIT I **9**

Listening - AV files pertaining to manufacturing processes of products, scientific documentaries; Speaking - syllable division and word stress, intonation, sharing opinions; Reading - news articles related to science and technology; Writing - definitions, instruction, recommendation, data interpretation, resume; Grammar -tenses and their aspects, sentence connectors – discourse markers, sequential words, active and passive voice, subject-verb agreement.

UNIT II **9**

Listening - AV pertaining to marketing strategies, peer reading and pronunciation; Speaking- turn taking, sharing opinions; conducting and attending a meeting, understanding the nuances of spoken communication among internal audience and external audience; Reading - analytical documents, descriptive documents; Writing - fliers, brochures, resume - letter of application, checklists; Grammar - modal verbs, clauses - types and uses, conditional clauses, articles.

UNIT III **9**

Listening - AV related to how to use components, scientific description, Speaking - speaking for motivation and initiation, speaking at a seminar presentation; Reading - scientific journals, papers; Writing - Technical descriptions - process description, purpose and function, PowerPoint, Google forms, user manuals; Grammar - phrasal verbs, prepositions, technical and scientific affixes.

UNIT IV **9**

Listening - scientific debates, crisis management; Speaking - handling conflicts, speaking about the loss of benefits, progress or decline of business, identifying the connotative meanings, Reading- documented evidences of uses and functions of a product, review of a product, Writing - memos, follow-up letters, reports - proposal, project, progress reports, sales reports, reports on industrial visits, executive summary. Grammar - reported speech and tag questions, sentence structure - comparative, imperative, cause and effect, infinitive of result.

UNIT V **9**

Listening - AV of Group discussions, panel discussions, face to face interviews for recruitment purposes; Speaking- speaking at group discussions, interviewing a personality, answering at the interviews; Reading - WebPages of top notch engineering companies, Writing - blogging, e-mails, letter of complaint, minutes of the meeting; Grammar - one word substitution, collocations, better word/sentence substitution (rephrasing the content/improvising ideas).

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Understand the nuances of technical communication and scientific writing	3
CO2	Present papers and give seminars	6
CO3	Discuss in groups and brainstorm	6
CO4	Draft business correspondences and write for documenting purposes	6
CO5	Face job interviews with confidence	6

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012.
2. Downes, Colm, Cambridge English for Job-hunting, Cambridge University Press, New Delhi. 2008
3. Murphy, Raymond, Intermediate English Grammar with Answers, Cambridge University Press 2000.
4. Thomson, A.J., Practical English Grammar 1 & 2, Oxford, 1986.
5. Herbert A J, The Structure of Technical English, Longman, 1965.

Websites

1. http://www.usingenglish.com
2. http://www.uefap.com3
3. https://owl.english.purdue.edu/owl/
4. www.learnenglishfeelgood.com/esl-printables-worksheets.html

Software

1. Face 2 Face Advance – Cambridge University Press, 2014.
2. English Advance
   Vocabulary- Cambridge University Press.
3. IELTS test preparation – Cambridge University
   Press 2017.
4. Official Guide to the TOEFL Test With CD-ROM, 4th Edition.
5. Cambridge Preparation for the TOEFL TEST- Cambridge University Press, 2017.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	-	-	-

3-High, 2-Medium, 1-Low

3 denotes 'a strong correlation' as **the students will use all the four skills (Listening, Speaking, Reading and Writing) with appropriate body language in technical and professional situations.**

MA22251 **APPLIED MATHEMATICS II** **L T P C**

(Common to all Branches except MR)

OBJECTIVES:

The students should be made to

- Acquire the concepts of vector calculus needed for problems in all engineering disciplines and compute different types of integrals using Green's, Stokes' and Divergence theorems.
- Skilled at the techniques of solving ordinary differential equations that model engineering problems.
- Extend their ability of using Laplace transforms to create a new domain in which it is easier to handle the problem that is being investigated.
- Explain geometry of a complex plane and state properties of analytic functions.
- Understand the standard techniques of complex variable theory so as to apply them with confidence in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.

UNIT I VECTOR CALCULUS (9+3)

Gradient, divergence and curl - Directional derivative - Vector identities – Irrotational and solenoidal vector fields - Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Verification and application in evaluating line, surface and volume integrals.

UNIT II ORDINARYDIFFERENTIAL EQUATIONS AND ITS APPLICATIONS (9+3)

Differential equations of first order – Equations of the first order and first degree – Linear equations – Higher order linear differential equations with constant coefficients - Method of variation of parameters - Cauchy's and Legendre's linear equations - Simultaneous first order linear equations with constant coefficients – Applications of Linear differential equations – Oscillatory electrical circuit – Deflection of beams.

UNIT III LAPLACE TRANSFORM (9+3)

Conditions for existence - Transform of elementary functions - Transforms of unit step function and impulse functions – Basic properties – Shifting theorems - Transforms of derivatives and integrals of functions - Derivatives and integrals of transforms - Initial and final value theorems - Transform of periodic functions. Inverse Laplace transforms - Convolution theorem – Application to solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

UNIT IV ANALYTIC FUNCTIONS (9+3)

Analytic functions - Necessary and sufficient conditions (Cauchy-Riemann equations) -

Properties of analytic function - Harmonic conjugates - Construction of analytic functions - Conformal mapping – Mapping by functions W = Z + C, CZ, 1/Z, Z^2 – Joukowski's transformation- Bilinear transformation.

UNIT V COMPLEX INTEGRATION (9+3)

Cauchy's integral theorem - Cauchy's integral formula - Taylor's and Laurent's series expansions - Singular points - Residues - Cauchy's Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semi-circular contour.

TOTAL (L:45+T:15):60 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Interpret the fundamentals of vector calculus and execute evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems.	3
CO2	Solve first order linear, homogeneous differential equations and use series solution method to solve second order differential equations.	3
CO3	Determine the methods to solve differential equations using Laplace transforms and Inverse Laplace transforms.	3
CO4	Explain Analytic functions and Categorize transformations.	3
CO5	Perform Complex integration to evaluate real definite integralsusing Cauchy integral theorem and Cauchy's residue theorem.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Erwin Kreyszing, Herbert Kreyszing, Edward Norminton, "Advanced Engineering Mathematics", 10th Edition, John Wiley, (2015).
2. Grewal .B.S, Grewal .J.S "Higher Engineering Mathematics",43rd Edition, Khanna Publications, Delhi, (2015).

REFERENCES:

1. Dass, H.K., and Rajnish Verma, "Higher Engineering Mathematics", S.Chand Private Ltd., 2011.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, (2013).
3. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", 9th edition, Laxmi Publications(p) Ltd., 2014.

WEB LINK:

1. https://nptel.ac.in/courses/111/105/111105134/
2. https://nptel.ac.in/courses/111/105/111105121/

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	3	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	3	-	-	-	-	-	-	-	-	-	3	-	-

3-High, 2-Medium, 1-Low

IT22251 **Computer Programming and Practice**
(Common to AE, BT, CE, CH)

L	T	P	C
2	0	2	3

OBJECTIVES:

To know the basics of algorithmic problem solving
To learn programming using a structured programming language.
To implement programs with basic features of C.

Unit 1 Fundamentals of Computing 6+3
Computing Devices – Identification of Computational Problems – Algorithms – Building Blocks of Algorithms - Pseudocodes and Flowcharts- Notion of memory, addresses, variables, instructions, execution of instructions- Operating system commands, file editing, compiling, linking, executing a program. Introduction to different programming languages.
Suggested Activities:
Practical - Use of operating system commands and file editing operations

Unit 2 Basics of C 6+9
Data types - constants, variables - operators - expressions - basic input/output. Statements and blocks - Selection - if-else construct - iteration - while - for constructs.
Suggested Activities
Practical
Demonstration of programs using data types, operators and basic input/output.
Demonstration of programs using if else, else-if, switch.
Demonstration of programs using, while, for do-while, break, continue

Unit 3 Arrays and Strings 6+6
Array, declaration, initialization. Multi dimensional arrays. Strings and character arrays, string operations on arrays
Suggested Activities
Practical
Demonstration of programs using arrays and operations on arrays
Demonstration of programs implementing string operations on arrays

Unit 4 Functions and Structures 6+6
Functions, definition, call, arguments, call by value. Call by reference. Recursion, Introduction to structures and unions.
Suggested Activities
Practical
Demonstration of programs using functions.
Demonstration of programs using recursion
Demonstration of programs using Structures and Unions

Unit 5 Pointers and File handling in c 6+6

Introduction to Pointers- pointers to basic variables, pointers and arrays. Pointers to strings Dynamic Memory Allocation, Files - binary, text - open, read, write, random access, close. Preprocessor directives

Suggested Activities

Practical

Demonstration of programs using pointers

Demonstration of programs using files

Total (L:30+P:30)

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the model of a computer, software design methodologies, and represent solutions to computational problems as algorithms	3
CO2	Analyze the problem scenarios and develop C programs using sequential, conditional, and iterative constructs	3
CO3	Appraise problem scenarios and develop C programs using complex storage structures.	3
CO4	Design modularized solutions for larger problems	3
CO5	Inspect the storage structure in a computer and design C programs to access permanent storage	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Pradip Dey, Manas Ghosh, " Programming in C ", First Edition, Oxford University Press, 2018.
2. R G Dromey, "How to Solve it using Computer", Pearson,2006.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson
Education, 2015.
2. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.
3. Byron S Gottfried, "Programming with C", Schaum's Outlines, Third Edition, Tata McGrawHill, 2010
4. Reema Thareja, "Programming in C", 2nd ed., Oxford University Press, 2016

Evaluation Method
60% theory+40% practical

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	3	2	2	1	-	1	3	2	-	2	1	-
CO2	2	3	2	2	2	1	-	1	3	2	-	2	1	-
CO3	2	3	2	2	2	1	-	1	3	2	-	2	1	-
CO4	3	3	2	2	2	1	-	1	3	2	-	2	1	-
CO5	1	1	1	1	2	1	-	1	3	2	-	2	1	-

3-High, 2-Medium, 1-Low

EE22151	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to all Branches except CH, EE, EC)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand the basic theorems used in Electrical circuits.
2. To educate on the different concepts and functions of electrical machines.
3. To introduce electron devices and its applications.
4. To explain the principles of digital electronics.
5. To impart knowledge on the principles of measuring instruments.

UNITI ELECTRICALCIRCUITS 9

Ohm's Law – Kirchhoff's Laws - Steady State Solution of DC Circuits using Mesh and Nodal Analysis -Introduction to AC Circuits - Waveforms and RMS Value - Power and Power factor - Single Phase and Three Phase AC Balanced Circuits.

UNIT II ELECTRICAL MACHINES 9

Construction, Principle of Operation, Basic Equations and Applications of DC Generators, DC Motors, Single phase induction Motor, Single Phase Transformer.

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 9

Characteristics of PN Junction Diode - Zener Effect - Zener Diode - LED, Photo diode and its Characteristics-Half Wave and Full Wave Rectifiers-Voltage Regulation. Bipolar Junction Transistor-Common Emitter Configuration, Characteristics and CE as an Amplifier - Photo transistors.

UNIT IV DIGITAL ELECTRONICS 9

Number System Conversion Methods–Simplification of Boolean Expression using K-Map – Half and Full Adders – Flip-Flops – Shift Registers - SISO, SIPO, PISO, PIPO and 4-bit Synchronous and Asynchronous UP Counters.

UNIT V MEASURING INSTRUMENTS 9

Types of Signals: Analog and Digital Signals- Construction and working Principle of Moving Coil Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and En meters. Instrumentation Amplifier, – R-2R ladder Type D/A Converter - Flash Type and Succes Approximation Type A/D Converter.

TOTAL: 45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Compute the electric circuit parameters for simple problems	4
CO2	Understand the construction and characteristics of different electrical machines.	4
CO3	Describe the fundamental behavior of different semiconductor devices and circuits.	4
CO4	Design basic digital circuits using Logic Gates and Flip-Flops.	4
CO5	Analyze the operating principle and working of measuring instruments.	4

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", Second Edition, McGraw Hill Education, 2020.
2. Sedha. R.S., "A Text Book of Applied Electronics", S.Chand & Co., 2014.

REFERENCES:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics Engineering", Tata McGraw Hill, 2013.
2. Mehta VK, "Principles of Electronics", S. Chand &Company Ltd, 2010.
3. M. Morris Mano, "Digital Logic & Computer Engineering", Prentice Hall of India, 2004.
4. Mahmood Nahvi and Joseph A.Edminister, "Electric Circuits", Schaum' Outline Series, McGraw Hill, Fourth Edition, 2007.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	-	-	2	-	-	-	-	2	-	-
CO2	3	3	3	3	-	-	2	-	-	-	-	2	-	-
CO3	3	3	3	3	-	-	2	-	-	-	-	2	-	-
CO4	3	3	3	3	-	-	2	-	-	-	-	2	-	-
CO5	3	3	3	3	-	-	2	-	-	-	-	2	-	-

3-High, 2-Medium, 1-Low

CE22201 **BUILDING PLANNING AND DRAWING**

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- The objective of this course is to inculcate in the student the ability to plan any building with appropriate dimensions.

UNIT I FUNDAMENTALS OF BUILDINGS AND ITS ELEMENTS 6

Buildings – Classifications based on nature of occupancy, based on their fire resistance, built in environment, load transfer- components of a building (Dimensions of building) –Foundation and super-structure– Doors – Windows – Lintels and arches – Stairs – Roof – Flooring – Plastering.

UNIT II PRINCIPLES OF PLANNING OF BUILDINGS & ORIENTATION OF BUILDINGS 6

Aspect – Prospect – Privacy –furniture requirement – roominess – grouping – circulation – lighting –ventilation– economy – Practical considerations – Orientation of building – Factors affecting orientation – Vaastu considerations.

UNIT III PLANNING OF RESIDENTIAL BUILDINGS 6

Single storey Residential buildings – Rooms meant for various activities – Drawing or living room, dining room, kitchen, bedroom, bath and water-closets, veranda, store room, Prayer room, study room, guest room, office room, stairs, garage – minimum dimensions – doors, windows and ventilators

UNIT IV PLANNING OF PUBLIC BUILDINGS 6

Public buildings - Schools, Library, Hospital, Theatre, Auditorium,– site selection, components, Principles of planning

UNIT V ANTHROPOMETRIC STUDIES AND BUILDING BYE-LAWS 6

Engineering anthropometry – application of anthropometric data in design of residential building components. Building bye-laws as per National Building Code – Minimum plot sizes and building frontage – Floor Area Ratio- Open spaces – Minimum standard dimensions of building elements – provisions for lighting and ventilation, safety from fire and explosions, means of access, drainage and sanitation, safety against hazards or accidents, off street parking

PRACTICAL SESSIONS:

Expt. No.	Title of the Experiment	Unit Mapped	CO	Contact Hours
1	Drawing of Cross-section of a load bearing wall with foundation details and specifications	I	1	2
2	Drawing of Cross-section of a RCC column along with foundation details and specifications	I	1	2
3	Joinery details - door	I	1	2
4	Plan and elevation of a 1 BHK residential building considering the principles of orientation.	II	2	2
5	Cross sectional elevation of 1 BHK residential building	II	2	2
6	Furnishing details of a residential building using computer application	II	2	2
7	Plan of an individual house with all amenities, furniture and specifications.	III	3	2
8	Elevation of an individual house.	III	3	2
9	Sectional elevation of an individual house.	III	3	2
10	Plan of a school/any educational institution building	IV	4	2
11	Plan of a library building	IV	4	2
12	Plan of a hospital/healthcare building	IV	4	2
13	Specifications for a layout of a 200 units residential complex	V	5	2
14	Layout of a 200 units residential complex	V	5	4
			Total	30

TOTAL: 60 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the fundamentals of buildings and components of a building.	2
CO2	Apply the basic principles of building planning and orientation.	3
CO3	Plan residential buildings	3
CO4	Summarise the important aspects of planning public buildings.	3
CO5	Implement anthropometric studies and bye laws while planning a building.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Dr. N. Kumara Swamy, A. KameswaraRao, “Building planning and drawing”, Charotar Publishing house Pvt. Ltd , 9th edition, 2023.
2. National Building Code of India, Part V, "Building Materials”, 2016.

REFERENCES:

1. SS Bhavikatti& M V Chitawadagi , “Building planning and drawing”, I.K. International Publishing house Pvt. Ltd. , 2014.
2. Shah.M.G., Kale. C.M. and Patki. S.Y., "Building Drawing with an Integrated Approach to Built Environment", Tata McGraw Hill Publishers Limited, 2004.
3. Verma.B.P., "Civil Engineering Drawing and House Planning", Khanna Publishers, 2010. 4. National Building Code of India, BIS.

EVALUATION SCHEME:

FA 1 – Theory
FA 2 – Theory
FA 3 – Practical
Summative Assessment – Theory – 50% and Practical – 50%
Observation and Records will be maintained for Practical Sessions

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	-	-	-	-	3	-	-	-	-	-	1	3	3
CO2	2	-	-	-	-	3	-	-	-	-	-	1	3	3
CO3	2	-	-	-	-	3	-	-	-	-	-	1	3	3
CO4	2	-	-	-	-	3	-	-	-	-	-	1	3	3
CO5	2	-	-	-	-	3	-	3	-	-	-	1	3	3

3-High, 2-Medium, 1-Low

CE22202 ENGINEERING MECHANICS FOR CIVIL ENGINEERS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To introduce the various systems of forces and resolution of forces
- To illustrate the concepts of equilibrium of particles and rigid bodies in two and three dimensions
- To make the students to determine the centroid and moment of inertia of composite plane areas and to analyse trusses
- To impart knowledge on determination of shear force and bending moment in determinate beams

UNIT I STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports –Action and reaction forces – stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Varignon's theorem – Single equivalent force - Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions.

UNIT III CENTROID AND MOMENT OF INERTIA 12

Centroids – Centroids of lines and areas - Rectangular, circular, triangular areas by integration – Parallel axis theorem and perpendicular axis theorem- Centroids of T section, I section, - Angle section, Hollow section by using standard formula – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Product of Inertia – Principal axes and Principal moments of inertia of plane area.

UNIT IV ANALYSIS OF TRUSSES 12

Analysis of pin jointed plane determinate trusses by method of joints, method of sections and method of tension coefficient

UNIT V ANALYSIS OF DETERMINATE BEAMS 12

Types of beams and their supports –- Determinate and Indeterminate Beams - Types of loadings

– Shear force and bending moment – Shear force Diagram and Bending Moment Diagram for Simply supported, Cantilever and over-hanging beams - Theory of simple bending – Bending stress distribution – shear stress distribution.

TOTAL: 60 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the concepts of mechanics to solve problems on statics of particles in two and three dimensions	3
CO2	Solve problems on equilibrium of rigid bodies in two and three dimensions	3
CO3	Evaluate centroid and moment of inertias of simple plane figures and composite plane areas	3
CO4	Determine member forces in truss using different methods of analysis	3
CO5	Draw the Shear force and Bending moment diagrams for determinate beams	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. David Mazurek, E. Russell Johnston, Ferdinand Beer, “Vector Mechanics for Engineers: Statics”, McGraw-Hill Education (India) Pvt. Ltd. 12th Edition, 2019.
2. Rajput.R.K. “Essentials of Strength of Material”s, S.Chand & Company Ltd., New Delhi Reprint 2017.

REFERENCES:

1. Bhavikatti, S.S and Rajashekarappa, K.G., “Engineering Mechanics”, New Age International (P) Limited Publishers,1998.
2. Hibbeller, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education2010.
3. Punmia.B.C., Ashok Kumar Jain and Arun Kumar Jain, SMTS –I Strength of materials, Laxmi publications. New Delhi, 2015
4. Bansal. R.K. “Strength of Materials”, Laxmi Publications Pvt. Ltd., New Delhi, 2010
5. Timoshenko.S.B. and Gere.J.M, “Mechanics of Materials”, Van NosReinbhold, New Delhi 1999.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

EE22111 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY (Common to all Branches except EC)

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To provide exposure to the students with hands on experience in basic of Electrical and Electronics wiring connection and measurements.
- To introduce the students to Electrical Machines and basic laws of Electrical Circuits.

LIST OF EXPERIMENTS

1. Wiring – Residential house wiring and Stair case wiring.
2. (a) AC Analysis- Measurement of electrical quantities–voltage, current, power, and power factor using RLC.
   (b) Study of three phase system.
3. Energy conservation - Measurement and comparison of energy for incandescent lamp and LED lamp.
4. (a) Identification of circuit components (Resistor, Capacitor, Diode and BJT) and soldering practice.
   (b) Signal Measurement- Measurement of peak to peak, RMS, average, period, frequency of signals using CRO.
5. (a) VI Characteristics of Solar photovoltaic panel.
   (b) Design of Solar PV Array and Battery sizing for Residential solar PV system.
6. Design a 5V/12V Regulated Power Supply using FWR and IC7805/IC7812.
7. DC Analysis- Verification of Ohm's Law and Kirchhoff's Laws.
8. Study of Transformer and motor characteristics.

TOTAL: 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Verify the basic laws of Electric circuits and select various Electrical Machines.	4
CO2	Listen to formal and informal communication and read articles and infer meanings from specific contexts from magazines and news papers.	4
CO3	Construct electronic circuits and design solar photovoltaic system.	4
CO4	Apply the concept of three-phase system.	4
CO5	Construct a fixed voltage regulated power supply.	4

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Mittle V.N, Arvind Mittal, "Basic Electrical Engineering", Tata Mc Graw Hill (India), Second Edition, 2013.
2. Sedha R.S., "A Text Book of Applied Electronics", S.Chand & Co., 2014.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	-	-	-	-	2	-	-	2	-	-
CO2	3	3	3	3	-	-	-	-	2	-	-	2	-	-
CO3	3	3	3	3	-	-	-	-	2	-	-	2	-	-
CO4	3	3	3	3	-	-	-	-	2	-	-	2	-	-
CO5	3	3	3	3	-	-	-	-	2	-	-	2	-	-

3-High, 2-Medium, 1-Low

CE22211 CONSTRUCTION MATERIALS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

To develop skills to test various construction materials

LIST OF EXPERIMENTS

1. Tests on Cement
   a. Determination of fineness of cement
   b. Determination of consistency of cement
   c. Determination of specific gravity of cement
   d. Determination of initial and final setting time of cement
   e. Soundness test
2. Tests on Fine Aggregates
   a. Determination of specific gravity of fine aggregates
   b. Determination of Grading of fine aggregates
   c. Determination of water absorption of fine aggregates
3. Tests on Coarse Aggregates
   a. Determination of compacted and loose bulk density of coarse aggregate
   b. Determination of specific gravity and water absorption of coarse aggregate
4. Tests on Bricks
   a. Determination of compressive strength of bricks
   b. Determination of water absorption of bricks
   c. Determination of efflorescence of bricks
5. Tests on Concrete
   a. Determination of workability
      i. Slump cone test
      ii. Compaction factor test
      iii. Flow table test
      iv. Vee bee test
   b. Determination of compressive strength - Cubes
   c. Determination of split tensile strength - Cylinders
   d. Determination of Flexural strength - prisms
6. Exercise for demonstration only – Determination of compressive strength of concrete by using Rebound Hammer.

TOTAL: 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Determinate the physical and mechanical properties of cement and aggregates.	3
CO2	Determine the characteristics of bricks	3
CO3	Investigate the properties of fresh and hardened concrete.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. M. S. Shetty & A K Jain, Concrete Technology: Theory and Practice, S. Chand Publishing, 2019.

REFERENCES:

1. S.D Hasan, Civil Engineering Materials and Their Testing, Narosa Publication, reprinted in 2020.
2. IS 383– 2016 Indian Standard specification for coarse and fine aggregates from natural sources for concrete .
3. IS 516 -1959 – Indian Standard methods of tests for strength of concrete.
4. IS10262 -2019 – Indian standard Concrete Mix Proportioning — Guidelines.
5. IS 2386 – 1978, Methods of test for aggregates, Bureau of Indian Standards.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1	1	-	-	-	-	3	1	-	-	3	3
CO2	3	1	1	1	-	-	-	-	3	1	-	-	3	3
CO3	3	1	1	1	-	-	-	-	3	1	-	-	3	3

3-High, 2-Medium, 1-Low

CE22301	SOIL MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to impart knowledge to classify the soil based on index properties and to assess their engineering properties based on the classification. To familiarize the students about the fundamental concepts of compaction, flow through soil, stress transformation, stress distribution, consolidation and shear strength of soils. To impart knowledge of design of both finite and infinite slopes.

UNIT I SOIL CLASSIFICATION AND COMPACTION 9

Formation of soil - Soil description – Particle – Size shape and colour – Composition of gravel, sand, silt, clay particles – Particle behaviour – Soil structure – Phase relationship – Index properties –Significance – BIS classification system – Unified classification system – Compaction of soils –Theory, Laboratory and field tests – Field Compaction methods – Factors influencing compaction of soils.

UNIT II EFFECTIVE STRESS AND PERMEABILITY 9

Soil - water – Static pressure in water - Effective stress concepts in soils – Capillary phenomena– Permeability interaction – Hydraulic conductivity – Darcy’s law – Determination of Hydraulic Conductivity – Laboratory Determination (Constant head and falling head methods) and field measurement pumping out in unconfined and confined aquifer – Factors influencing permeability of soils – Seepage - Two dimensional flow – Laplace’s equation – Introduction to flow nets – Simple problems. (Sheet pile and weir).

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Stress distribution in homogeneous and isotropic medium – Boussinesq theory – (Point land, Line land and udl) Use of New marks influence chart –Components of settlement — Immediate and consolidation settlement – Terzaghi’s one dimensional consolidation theory – Computation of rate of settlement. - √t and log t methods – e-log p relationship.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesion less soils – Mohr-Coulomb failure theory – Measurement of shear strength - Direct shear, Triaxial compression, UCC and Vane shear tests – Pore pressure parameters – Cyclic mobility – Liquefaction.

UNIT V SLOPE STABILITY 9

Stability Analysis - Infinite slopes and finite slopes – Total stress analysis for saturated clay – Friction circle method – Use of stability number – Method of slices – Fellenious and Bishop’s method – Slope protection measures.

TOTAL :45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Demonstrate an ability to identify various types of soils and its properties, formulate and solve engineering Problems	3
CO2	Describe the basic understanding of flow through soil medium and its impact of engineering Solution	3
CO3	Describe the basic concept of stress distribution in loaded soil medium and soil settlement due to consolidation	3
CO4	Estimate the shear strength parameters of different types of soils using the data of different shear tests and comprehend Mohr-Coulomb failure theory.	3
CO5	Demonstrate an ability to design both finite and infinite slopes, component and process as per needs and specifications.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd., New Delhi. 2015
2. Gopal Ranjan and Rao, A.S.R., "Basic and Applied Soil Mechanics", New Age Ltd. International Publisher New Delhi (India) 2006.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Coduto, D.P., "Geotechnical Engineering – Principles and Practices", Prentice Hall of India Pvt.Ltd. New Delhi, 2010.
3. Das, B.M., "Principles of Geotechnical Engineering". Brooks / Coles / Thompson Learning, Singapore, 8th Edition, 2013.
4. Punmia, B.C., "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd. New Delhi, 2005

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	2	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22302	CONSTRUCTION TECHNIQUES, EQUIPMENT AND PRACTICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The primary objective of this course is to make students aware of the various construction techniques, practices, and equipment required for various types of construction activities.

UNIT I CONSTRUCTION TECHNIQUES 9

Structural systems - Load Bearing Structure - Framed Structure - Load transfer mechanism – Development of construction techniques - High rise Building Technology - Seismic effect - Environmental impact - Eco Building (Green Building) - Construction methods and Material used - Natural Buildings - Passive buildings – Intelligent (Smart) buildings - 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 – Building foundations – basements – temporary shed – centering and shuttering – slip forms – scaffoldings – de- shuttering forms – 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 standby 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, braceddomes 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 and mixing and concreting - Equipment for material handling and erection of structures - Equipment for dredging, trenching, tunneling

TOTAL PERIODS :45

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the different construction techniques and structural systems	2
CO2	Identify suitable site and techniques involved in good construction practices	2
CO3	Apply appropriate technique for sub structure in a construction project.	2
CO4	Apply appropriate technique for super structure in a construction project.	2
CO5	Identify the different construction equipment for various applications	2

TEXT BOOKS:

1. Shetty.M.S., Concrete Technology(Theory and Practice), S.Chand& Company Ltd., 2018.
2. Varghese.P.C., Building Constructions, PHI Learning Private Limited, 2016
3. Santhakumar.A.R., Concrete Technology, Oxford University Press ,India, 2018.
4. Deodhar, S.V.Construction Equipment and Job Planning, Khanna Publishers, New Delhi,2016

REFERENCES:

1. Peurifoy, R.L, Schexnayder,C.J., Shapira,A., Schmitt. R., Construction Planning, Equipment and Methods, Tata McGraw-Hill, 2018.
2. Punmia, B.C., Building Construction, Laxmi Publications (P) Ltd., 2016
3. Peurifoy, R.L., Form work for Concrete Structures, McGraw Hill Book Co., 2010.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	-	-	-	3	-	-	-	-	-	1	3	3
CO2	2	-	-	-	-	3	-	-	-	-	-	1	3	3
CO3	2	-	-	-	2	3	-	-	-	-	-	1	3	3
CO4	2	-	-	-	2	3	-	-	-	-	-	1	3	3
CO5	2	-	-	-	2	3	-	-	-	-	-	1	3	3

3-High, 2-Medium, 1-Low

CE22303 **STRENGTH OF MATERIALS**

L	T	P	C
3	1	0	4

COURSE OBJECTIVES:

- To learn fundamental concepts of Stress, Strain and deformation of solids and to analyse a complex two dimensional state of stress.
- To know the slopes and deformations in beams.
- To know the concept of analyzing indeterminate beams
- To understand the effect of torsion on shafts and springs.
- To know the method of finding slope and deflection of beams and trusses using energy theorems

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12

Simple Stresses and strains – Stress Strain Diagram – Deformation of axially loaded member - Composite Bars - Thermal Stresses – Elastic constants - State of Stress in two dimensions – Stresses on inclined planes – Principal Stresses and Principal Planes – Mohr's circle method

UNIT II DEFLECTION OF BEAMS 12

Elastic curve – Differential equation of deflected beam - Double integration method - Macaulay's methods - Area moment method - conjugate beam method for computation of slopes and deflections of determinate beams.

UNIT III INDETERMINATE BEAMS 12

Concept of Analysis - Propped cantilever and fixed beams-fixed end moments and reactions – Theorem of three moments – analysis of continuous beams – shear force and bending moment diagrams.

UNIT IV TORSION AND SPRINGS 12

Torsion of Circular and Hollow Shafts – Elastic Theory of Torsion – Stresses and Deflection in Circular Solid and Hollow Shafts – combined bending moment and torsion of shafts - strain energy due to torsion - Modulus of Rupture – Power transmitted to shaft – Closed and Open Coiled helical springs

UNIT V ENERGY PRINCIPLES 12

Strain energy and strain energy density – strain energy due to axial load (gradual, sudden and impact load),shear, flexure and torsion–Castigliano’s theorems–Maxwell’s reciprocal theorems - Principle of virtual work – unit load method- application of energy theorems for computing deflections in determinate beams, plane frames and plane trusses – lack of fit- temperature effects- Williot Mohr's Diagram.

TOTAL: 60 PERIODS

OUTCOMES:

CO	**Statements** After successful completion of this course, the students will be able to	RBT* Level
CO1	Solve problems applying the fundamental concepts of stress, strain, principal stresses and principal planes in mechanics of solids and structures.	3
CO2	Analyse and determine slope and deflection of determinate beams using appropriate method	4
CO3	Analyse indeterminate beams and draw shear force diagram and bending moment diagram.	4
CO4	Design shafts to transmit required power and also design helical springs for its maximum energy storage capacities.	3
CO5	Estimate strain energy and deflections of beams, trusses and frames using strain energy principles.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2015.
   2. Rattan. S. S, "Strength of Materials", Tata McGraw Hill Education Private Limited, New Delhi, 2012

REFERENCES:

1. Timoshenko.S.B. and Gere.J.M, "Mechanics of Materials", Van Nos Reinbhold, New Delhi 2006.
2. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
3. Beer. F.P. & Johnston.E.R."Mechanics of Materials", Tata McGraw Hill, Sixth Edition, New Delhi 2010.
3. James M.Gere., Mechanics of Materials, Thomas Canada Ltd., Canada, 2006.
4. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition New Delhi 2015.

COURSE ARTICULATION MATRIX:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2									3	3
CO2	3	3	2	2									3	3
CO3	3	3	2	2									3	3
CO4	3	3	2	2									3	3
CO5	3	3	2	2									3	3

3 - High, 2 -Medium, 1-Low

CE22308 **SURVEYING: THEORY AND PRACTICES**

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

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

UNIT I FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Definition – Classifications – Basic principles – Equipment and accessories for ranging and chaining – Methods of ranging – Well conditioned triangles – Chain traversing – Compass – Basic principles – Types – Bearing – System and conversions – Sources of errors and Local attraction – Magnetic declination – Dip – compass traversing – Plane table and its accessories – Merits and demerits – Radiation – Intersection – Resection – Plane table traversing

UNIT II LEVELLING 9

Level line – Horizontal line – Datum – Benchmarks – Levels and staves – Temporary and permanent adjustments – Methods of leveling – Fly leveling – Check leveling – Procedure in leveling – Booking – Reduction – Curvature and refraction – Reciprocal leveling – Precise leveling - Contouring.

UNIT III THEODOLITE SURVEYING 9

Horizontal and vertical angle measurements – Temporary and permanent adjustments – Heights and distances – Tacheometric surveying – Stadia Tacheometry – Tangential Tacheometry – Trigonometric leveling – Single Plane method – Double Plane method.

UNIT IV CONTROL SURVEYING AND ADJUSTMENT 9

Horizontal and vertical control – Methods – Triangulation – Traversing – Gale‘s table – Trilateration – Concepts of measurements and errors – Error propagation and Linearization – Adjustment methods - Least square methods – Angles, lengths and levelling network.

UNIT V MODERN SURVEYING 9

Total Station: Digital Theodolite, EDM, Electronic field book – Advantages – Parts and accessories – Working principle – Observables – Errors - COGO functions – Field procedure and applications. GPS: Advantages – System components – Signal structure – Selective availability and antispoofing receiver components and antenna – Planning and data acquisition – Data processing – Errors in GPS – Field procedure and applications.

TOTAL: 45 PERIODS

PRACTICAL SESSIONS:

Chain Survey

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

Compass Survey

c. Compass Traversing – Measuring Bearings & arriving included angles

Levelling - Study of levels and levelling staff

d. Fly levelling using Dumpy level
e. Check leveling
f. L.S & C.S - Road

Exp No.	Title of the Experiment	Unit mapped	CO	Contact hours
1.	Determination Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset.	**I**	**1**	**6**
2.	Setting out works – Foundation marking using tapes single Room and Double Room	**I**	**1**	**6**
3.	Compass Traversing – Measuring Bearings & arriving included angles	**I**	**1**	**4**
4.	Fly levelling using Dumpy level	**II**	**2**	**4**
5.	Check leveling	**II**	**2**	**4**
6.	L.S & C.S - Road	**II**	**2**	**6**
Total				**30**

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Introduce the fundamentals of various surveying and its principles.	3
CO2	Imparts knowledge in computation of levels of terrain and ground features	3
CO3	Imparts concepts of Theodolite Surveying for complex surveying operations	3
CO4	Understand the procedure for establishing horizontal and vertical control	3
CO5	Imparts the knowledge on modern surveying instruments	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2. T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.
3. K. R. Arora, Surveying Vol I & II, Standard Book house, Twelfth Edition 2013.

EVALUATION SCHEME:

FA 1 – Theory
FA 2 – Theory
FA 3 – Practical
Summative Assessment – Theory – 60% and Practical – 40%
Observation and Records will be maintained for Practical Sessions

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22309 **FLUID MECHANICS: THEORY AND PRACTICES**

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

- To introduce the students about properties of the fluids, behaviour of fluids under static conditions and to impart basic knowledge of the dynamics of fluids through the control volume approach
- To expose to the applications of the conservation laws to a) flow measurements b) flow through pipes (both laminar and turbulent) and c) forces on pipe bends with an exposure to the significance of boundary layer theory and its applications.

UNIT I **FLUIDS PROPERTIES AND FLUID STATICS** **9**

Scope of fluid mechanics - Definitions of a fluid - Methods of analysis - Dimensions and units viscosity , density , perfect gas, vapour pressure and surface tension - Basic equation of fluid statics- Pressure measurements - Manometers. - Forces on plane and curved surfaces - Buoyancy and floatation - Stability of floating bodies.

UNIT II **BASIC CONCEPTS OF FLUID FLOW** **9**

Kinematics – Methods of describing fluid motion - Classification of flows - Streamline, streak-line and path-lines - Stream function and velocity potentials – Flow nets;
Dynamics Dimensional Concepts of System and Control volume - Application of control volume to continuity , energy and momentum – Euler's equation of motion along a stream line – Bernoulli's equation - Applications to velocity and discharge measurements - Linear momentum equation and their applications. Moment of momentum equation and its application.

UNIT III **DIMENSIONAL ANALYSIS AND MODEL STUDIES** **9**

Fundamental dimensions - dimensional homogeneity – Rayleigh's method and Buckingham Pi Theorem - Dimensionless parameters - Similitude and model studies - Distorted and Undistorted Models.

UNIT IV **INCOMPRESSIBLE VISCOUS FLOW** **9**

Laminar flow between parallel plates, and pipes - Development of laminar and turbulent flows in pipes - Reynolds experiment - Darcy-Weisbach equation - Moody diagram - Major and minor losses of flow in pipes - Pipes in series and in parallel.

UNIT V **BOUNDARY LAYER** **9**

Definition of boundary layers - Displacement, momentum and energy thickness - Laminar and turbulent boundary layers -Momentum integral equation –Boundary layer separation and control- drag in flat plate – drag and lift co efficients.

TOTAL: 45 PERIODS

PRACTICAL SESSIONS:

Expt. No.	Title of the Experiment	Unit Mapped	CO	Contact Hours
1.	Determination of Metacentric height of floating bodies	I	1	2
2.	Calibration of Rotameter	II	2	2
3.	Calibration of Orifice apparatus	II	2	4
4.	Calibration of Orificemeter	II	2	2
5.	Calibration of Venturimeter	II	2	2
6.	Bernouli's Experiment	II	2	2
7.	Calibration of Pitot tube	II	2	2
8.	Determination of discharge through rectangular notch	III	3	2
9.	Determination of discharge through V notch	III	3	2
10.	Determination of friction coefficient in aluminum pipe	IV	4	2
11.	Determination of friction coefficient in stainless steel pipe	IV	4	2
12.	Determination of friction coefficient in copper pipe	IV	4	2
13.	Determination of Minor Losses in pipes	IV	4	4
			Total	30

TOTAL: 75 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the differences between the solid and fluid and apply the fluid properties and its behaviour in static conditions to solve problems.	3
CO2	Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics.	3
CO3	Analyze the model for flow studies and to predict the performance of prototype.	3
CO4	Analyze the losses in pipe lines for both laminar and turbulent conditions.	3
CO5	Apply the boundary layer concepts to find the drag force exerted by fluid on the flat solid surface.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Modi P. N and Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2017.
2. Dr.R.K.Bansal, A textbook of Fluid Mechanics and Hydraulic Machines,10th edition 2018.

REFERENCES:

1. Streeter, V .L. Wylie, E. B. and Bedford K.W, Fluid Mechanics. (9thed) Tata McGraw Hill,New Delhi, 2010.
2. Fox W.R. and McDonald A.T., Introduction to Fluid Mechanics John-Wiley and Sons, Singapore, 1995.
3. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi,2014.
4. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University , 2004.
5. https://www.vlab.co.in/broad-area-civil-engineering

EVALUATION SCHEME:

FA 1 – Theory
FA 2 – Theory
FA 3 – Practical
Summative Assessment – Theory – 60% and Practical – 40%
Observation and Records will be maintained for Practical Sessions

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	-	3	-	3	2	1	2	-	-	1	3	3
CO2	3	3	-	3	-	3	2	1	2	-	-	1	3	3
CO3	3	2	-	-	-	3	-	1	-	-	-	1	3	3
CO4	3	3	-	3	-	3	2	1	2	-	-	1	3	3
CO5	3	2	-	-	-	3	-	1	-	-	-	1	3	3

3-High, 2-Medium, 1-Low

CE22310 **HIGHWAY ENGINEERING: THEORY AND PRACTICES**

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To give an overview on the basics of highway engineering and to impart the various process and methods involved in planning, development, design, construction and maintenance of highways with possible practical exposure.

UNIT I HIGHWAY PLANNING 6

Classification of highways – Institutions for highway planning, design and construction in India – factors influencing highway alignment – Engineering surveys for alignment – application of statistics in transportation engineering: Regression analysis

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 6

Stopping Sight Distance – Overtaking Sight Distance – Super elevation design, extra widening of curves – Summit curve design – IRC standards

UNIT III PAVEMENT DESIGN 6

Design of Flexible Pavement as per IRC – Design of Rigid Pavement as per IRC

UNIT IV PAVEMENT MATERIALS 6

Desirable properties of subgrade soil (CBR Test), tests on road aggregates: Impact Test, Los Angeles Abrasion Test, Shape test, Crushing Strength Test and Test on Bitumen-Penetration test, Ductility test, softening point test, viscosity test

UNIT V PAVEMENT MAINTENANCE 6

Types and causes of failures in flexible and rigid pavements – Maintenance of highway pavements – Strengthening existing pavements - evaluation, overlay design

TOTAL : 30 PERIODS

PRACTICAL SESSIONS:

S. No.	Title of the Experiment	Unit mapped	CO mapped	Practical hours
	Site Visit			
1	Local site visit (half a day)	II	2	3
	Test on Soil			
2	CBR Test l	IV	4	3
	Tests on Road Aggregate			
3	Impact test	IV	4	3
4	Shape test	IV	4	3
5	Los Angeles Abrasion test	IV	4	3
6	Crushing Strength test	IV	4	3
	Tests on Bitumen			
7	Penetration test	IV	4	3
8	Ductility test	IV	4	3
9	Softening point test	IV	4	3
10	Viscosity test	IV	4	3
	Total			**30**

TOTAL: 60 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe various factors considered in fixing alignment for a highway	2
CO2	Explain different components involved in highway geometric design	3
CO3	Design a flexible and rigid pavement as per IRC procedure.	3
CO4	Demonstrate different tests for highway materials and the relevant tests	2
CO5	Describe the procedure for pavement evaluation and maintenance methods	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Veeraragavan.A, Khanna.K and Justo C.E.G. Highway Engineering, Nem Chand and Brothers Publishers, 2016 (10thedition).
2. Kadiyali L.R. Principles and Practices of Highway Engineering, Khanna Technical Publisher, Delhi, 2019.

REFERENCES:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010.
2. Subhash C Saxena, Textbook of Highway and Traffic Engineering., CBS Publishers, 2014.

3. R.Srinivasa Kumar., Textbook of Highway Engineering Universities Press (India) Private Limited, Hyderabad, 2011.

EVALUATION SCHEME:

FA 1 – Theory
FA 2 – Theory
FA 3 – Practical
Summative Assessment – Theory – 50% and Practical – 50%
Observation and Records will be maintained for Practical Sessions

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	3	3	-	1	-	-	3	-	-	-	-	-	3
CO3	3	-	-	-	1	-	-	-	-	-	-	-	-	3
CO4	3	3	3	-	-	-	-	3	-	-	-	-	-	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	-	3

3-High, 2-Medium, 1-Low

CE22311 STRENGTH OF MATERIALS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

LIST OF EXPERIMENTS

1. Determination of Rockwell's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper by conducting hardness test.
2. Determination of Brinell's hardness numbers of (a) Steel (b) Brass (c) Aluminium (d) Copper by conducting hardness test.
3. Determination of impact resistance of mild steel specimen by conducting Izod Impact test.
4. Determination of impact resistance of mild steel specimen by conducting Charpy Impact test.
5. Study the stress -strain characteristics of (a) Mild Steel and (b) Tor steel by conducting tension test using Universal Testing Machine.
6. Determination of shear strength of mild steel rod by conducting double shear test using Universal Testing Machine.
7. Determination of Modulus of rigidity of the material by conducting Torsion test on solid shaft
8. Determination of Modulus of rigidity of the material of a helical spring by conducting Compression test
9. Determination of Young's modulus of the material by conducting deflection test on a simply supported beam.
10. Determination of Modulus of elasticity of the material by conducting deflection test on a cantilever beam
11. Verification of Maxwell's reciprocal theorem by conducting deflection test on simply supported beam

TOTAL PERIODS : 30

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Determine the hardness and impact strength of metals using appropriate test apparatus	3
CO2	Evaluate the tensile and shear strength of materials using the relevant test procedures	3
CO3	Evaluate the elastic properties of material under compression, torsion and deflection tests	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. R.C. Hibbler, “ Mechanics of Materials”, 9th edition, Pearson Prentice Hall, 2014
2. U.C. Jindal, “Strength of materials”, Pearson Education in South Asia, 2012
3. Rattan.S.S., "Strength of Materials", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011

REFERENCES:

1. Strength of Materials Laboratory Manual, 2013, Anna University, Chennai - 600 025.
2. IS1608-2005, Metallic materials – tensile testing at ambient temperature

COURSE ARTICULATION MATRIX:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	3	-	2	2	1	3	1	-	2	2	2
CO2	2	2	1	3	2	2	2	1	3	1	-	2	2	2
CO3	2	2	1	3	-	2	2	1	3	1	-	2	2	2

3-High, 2-Medium, 1-Low

GE22451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY
(Common to All Branches)

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution.
- To study and understand the various types of renewable sources of energy and their applications.
- To familiarize the concept of sustainable development goals, economic and social aspects of sustainability, recognize and analyze climate changes, and environmental management challenges.
- To inculcate and embrace sustainability practices, develop a broader understanding of green materials and energy cycles, and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– food chains, food webs and ecological pyramids, ecological succession. Biodiversity- types- genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: fragmentation and habitat loss, poaching of wildlife, human-wildlife conflicts – endangered and endemic species of India –conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition, causes, effects and preventive measures of air, water and soil pollution. Marine and thermal pollution - causes, effects and control measures. Light and noise pollution - effect on flora and fauna. Nuclear pollution- Sources, effects and control measures. Disposal of radioactive wastes (Nuclear hazards). Pollution case studies. Role of an individual in the prevention of pollution. Solid, hazardous and E-waste management. Occupational health and safety management system (OHASMS). Environmental protection, Environmental protection acts, categorization of spices according to IUCN.

UNIT III RENEWABLE SOURCES OF ENERGY 9

Energy resources: Growing energy needs, Nonrenewable resources – types, uses. Energy management and conservation - New energy sources, Need of new sources - geo suitability of establishing renewable energy sources, different types new energy sources. Applications of hydrogen energy, ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Role of an individual in conservation of energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 9

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols, Sustainable Development Goals-targets, indicators and intervention areas - Principles of green chemistry, Climate change- Global, Regional and local environmental issues and possible solutions-case studies - Role of non-governmental organization, Concept of carbon credit, carbon footprint - Environmental management in industry - A case study

UNIT V SUSTAINABILITY PRACTICES 9

Zero waste and R concept, circular economy, ISO 18000 series, material life cycle assessment, environmental impact assessment. Wasteland reclamation, Sustainable habitat: green buildings, green materials, energy efficiency and energy audit, sustainable transports. Energy cycles, carbon cycle, emission and sequestration, Green engineering: sustainable urbanization- socio-economical and technological change. Rainwater harvesting, watershed management, environmental ethics: Issues and possible solutions.

TOTAL : 45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Recognize the fundamental role of ecosystems and suggest an appropriate method for the conservation of biodiversity.	3
CO2	Describe the different types of pollution, their effects and strategies to control pollution.	3
CO3	Identify the various renewable energy resources and use the appropriate one thereby conserving non-renewable resources for future generation.	3
CO4	Explain the various goals of sustainable development applicable to suitable technological advancement and societal development.	3
CO5	Summarize the various sustainability practices, green materials, energy cycles, and the role of green engineering in sustainable urbanization.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik’s “Perspectives in Environmental Studies”, 7th Edition, New Age International Publishers, 2022.
2. Benny Joseph, ‘Environmental Science and Engineering’, Tata McGraw-Hill, New Delhi, 2016.
3. Gilbert M. Masters, ‘Introduction to Environmental Engineering and Science’, 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Pearson. 2011.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, CL Engineering, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 3rdedition, 2015.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 3rd edition, 2021.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	-	-	3	3	2	-	2	-	-	-	-
CO2	3	-	-	-	-	3	3	2	-	2	-	-	-	-
CO3	3	-	1	-	-	3	3	1	-	2	-	-	-	-
CO4	3	-	-	-	-	3	3	3	-	2	-	-	-	-
CO5	3	-	-	-	-	3	3	3	-	2	-	-	-	-

3-High, 2-Medium, 1-Low

MA22453	STATISTICS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES:

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

UNIT I TESTING OF HYPOTHESIS 9+3

Introduction for random variable – Special distributions – Binomial, Geometric and Normal-Sampling distributions–Large sample test – Test for mean, proportion –Small sample test – Tests based on t and F – distribution for mean and variance– Chi square test for goodness of fit – Independence of attributes.

UNIT II DESIGN OF EXPERIMENTS 9+3

One way and two way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT III SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations–Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method–Iterative methods-Gauss Seidel- Eigenvalues of a matrix by Power method.

UNIT IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3

Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

UNIT V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

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

TOTAL : 60 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the concept of testing of hypothesis for small and large samples to real life problems.	3
CO2	Apply the basic concepts of classifications of design of experiments to real life problems.	3
CO3	Appreciate the numerical techniques of interpolation in various intervals	3
CO4	Apply the numerical techniques of differentiation and integration for engineering problems.	3
CO5	Understand the knowledge of various techniques and methods for solving first order ordinary differential equations.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

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

REFERENCES:

1. Burden, R.L and Faires, J.D, "Numerical Analysis",9th Edition, Cengage Learning,2016.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4. GuptaS.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics",Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5. Spiegel. M.R., Schiller. J. and Srinivasan R.A., "Schaum's Outline on Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.

WEBLINKS:

1. https://archive.nptel.ac.in/courses/111/107/111107105/
2. https://online.stat.psu.edu/stat503/lesson/1
3. https://online.stat.psu.edu/statprogram/reviews/statistical-concepts/hypothesis-testing

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	3	-	-	-	-	-	-	-	2	-	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	-	-	2	-	-
CO4	3	3	2	-	-	-	-	-	-	-	-	2	-	-
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	-

3-High, 2-Medium, 1-Low

CE22401 **STRUCTURAL ANALYSIS I**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the basic theory and concepts of classical methods of structural analysis of beams, frames, arches and cable structures.

UNIT I INDETERMINATE FRAMES 9

Degree of static and kinematic indeterminacies for plane frames - analysis of indeterminate pin-jointed frames and rigid frames (Degree of static indeterminacy up to two) - Consistent deformation method.

UNIT II SLOPE DEFLECTION METHOD 9

Continuous beams and rigid frames (with and without sway) – Symmetry and antisymmetry– Support displacements

UNIT III MOMENT DISTRIBUTION METHOD 9

Distribution and carryover of moments – Stiffness and carry over factors – Analysis of continuous beams – Plane rigid frames with and without sway

UNIT IV ARCHES 9

Arches as structural forms – Examples of arch structures – Types of arches – Analysis of three hinged and two hinged, parabolic and circular arches – Settlement and temperature effects.

UNIT V CABLE STRUCTURES 9

Suspension cables – Cables subjected to point and uniformly distributed loads - suspension bridges with two and three hinged stiffening girders

TOTAL : 45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Analyse the pin-jointed and rigid jointed frames using consistent deformation method	3
CO2	Analyse the continuous beams and rigid frames by slope deflection method.	3
CO3	Apply the concept of moment distribution and analyse continuous beams and rigid frames with and without sway.	3
CO4	Analyse two and three hinged parabolic and circular arches for given loading	3
CO5	Analyse the cable structures and suspension bridges with stiffening girders..	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Bhavikatti, S.S,Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2021.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications,2017.

REFERENCES:

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., Third Edition, 2010.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22402 WATER SUPPLY AND WASTEWATER ENGINEERING

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To introduce students to various components and design of water supply scheme, sewerage system, sewage treatment and disposal.

UNIT I WATER SUPPLY 12

Water demand - Surface and subsurface water resources - Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water. Intake of water: Pumping and gravity schemes.

UNIT II WATER TREATMENT 12

Objectives - Unit operations and processes - Principles, functions, and design of water treatment plant units - Coagulation and flocculation - Clariflocculator - Plate and tube settlers - Pulsator clarifier - Sand filters - Disinfection – Water softening - Removal of iron and manganese - Defluoridation - Desalination process – Residue Management - Construction, Operation and Maintenance aspects.

UNIT III WATER STORAGE AND DISTRIBUTION 12

Storage and balancing reservoirs - types, location and capacity. Distribution system: layout, hydraulics of pipe lines, pipe fittings, valves including check and pressure reducing valves, meters, analysis of distribution systems, leak detection, maintenance of distribution systems, pumping stations and their operations - House service connections.

UNIT IV PLANNING AND DESIGN OF SEWERAGE SYSTEM 12

Characteristics and composition of sewage - Sanitary sewage flow and Storm runoff estimation – Sewer materials – Hydraulics of flow in sanitary sewers – Sewer design - Sewer appurtenances – Sewage pumping - Drainage in buildings-plumbing systems for drainage.

UNIT V SEWAGE TREATMENT AND DISPOSAL 12

Objectives - Selection of Treatment Methods - Principles, Functions - Activated Sludge Process and Extended aeration systems - Trickling filters - Sequencing Batch Reactor(SBR) - UASB - Waste Stabilization Ponds - Other treatment methods - Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects. - Discharge standards - Sludge treatment - Disposal of sludge

TOTAL : 60 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the various sources and characteristics of water and determine the sizes of intake structure and conveyance system for water transmission	3
CO2	Describe the various unit operation and process of water treatment and compute the sizes of the water treatment units.	3
CO3	Determine the capacity of service reservoir, analyse the water distribution networks and describe the maintenance of distribution systems, pumping stations and house service connections.	3
CO4	Estimate sewage flow and storm runoff, describe the characteristics and composition of sewage and compute the sizes of sewerage system components.	3
CO5	Compute the sizes of the treatment units and explain the unit operations and processes that are involved in the treatment of sewage and sludge.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Garg, S.K. Environmental Engineering, Vol.I Khanna Publishers, New Delhi, 35th Edition, 2022.
2. Garg, S.K. Environmental Engineering, Vol.II Khanna Publishers, New Delhi, 42nd Edition, 2022.

REFERENCES:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
2. Manual on Sewerage and Sewage Treatment Systems, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.
3. Metcalf and Eddy – Waste water Engineering – Treatment and Reuse, Tata McGraw – Hill Company, New Delhi, 2017.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	1	-	2	3	-	-	-	-	-	3	2
CO2	3	2	2	1	-	2	3	-	-	-	-	-	3	2
CO3	3	2	2	1	-	2	3	-	-	-	-	-	3	2
CO4	3	2	2	1	-	2	3	-	-	-	-	-	3	2
CO5	3	2	2	1	-	2	3	-	-	-	-	-	3	2

3-High, 2-Medium, 1-Low

CE22403 **FOUNDATION ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is 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.

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Objectives – Various steps of investigation – Types of boring–auguring and boring – Wash boring and rotary drilling – Depth of boring – Spacing of bore hole – Sampling techniques – Representative and undisturbed sampling – methods - Split spoon sampler, Thin wall sampler, Stationery piston sampler – Penetration tests (SPT and SCPT) - Bore log report – Data interpretation – Geophysical methods-seismic and electrical - Selection of foundation based on soil condition – Strength Parameters and Evaluation of Liquefaction potential

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – Codal provisions – Bearing capacity of shallow foundation on homogeneous deposits – Terzaghi's formula and BIS formula – 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 depth for rigid behaviour – Applications – Floating foundation – Special foundations – Seismic force consideration

UNIT IV PILE FOUNDATION 9

Types of piles and their functions – Factors influencing the selection of pile – Carrying capacity of single pile in granular and cohesive soil – Static formula – Dynamic formulae (Engineering news and Hiley's) – Capacity from insitu tests (SPT, 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 – Lateral Load capacity of the pile.

UNIT V RETAINING WALLS 9

Retaining Wall - Types and application - 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 Graphical method – Pressure on the wall due to line load – Stability analysis of retaining walls

TOTAL : 45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Plan and execute a detailed site investigation to select geotechnical design parameters and type of foundation	3
CO2	Design shallow foundations, its component or process as per the needs and specifications.	3
CO3	Design combined footings and raft foundations, its component or process as per the needs and specifications.	3
CO4	Design deep foundations, its component or process as per the needs and specifications.	3
CO5	Design retaining walls, its component or process as per the needs and specifications.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Gopal Ranjan and Rao A.S.R., Basic and Applied Soil Mechanics- (2016), New Age International (P) Ltd., New Delhi.
2. Arora K.R. “Soil Mechanics and Foundation Engineering”, Standard Publishers and Distributors, New Delhi, 2009

REFERENCES:

1. Murthy V.N.S., Principles of Soil Mechanics and Foundation Engineering- (2009), 4th Edition, UBS Publishers and Distributors, New Delhi.
2. Braja, M. Das, Geotechnical Engineering; (2002), 5th Edition, Thomson Business Information India (P) Ltd., India
3. Donold P Coduto, Geotechnical Engineering- Phi Learning Private Limited, New Delhi,2017

4. Shashi K. Gulathi & ManojDatta, Geotechnical Engineering-. (2017), "Tata McGraw Hill
5. Muni Budhu ,Soil Mechanics and Foundation Engg.- (2011), 3rd Edition, John Wiely& Sons

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO2	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO3	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO4	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO5	3	3	3	2	-	2	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22409 **APPLIED HYDRAULIC ENGINEERING: THEORY AND PRACTICES**

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

- To impart basic knowledge about the open channel flows with analysis of uniform flow, gradually varied flows and rapidly varied flows
- To expose to basic principles of working of hydraulic machineries and to design Pelton wheel, Francis and Kaplan turbine, centrifugal and reciprocating pumps.

UNIT I UNIFORM FLOW 9

Definition and differences between pipe flow and open channel flow - Types of Flow - Properties of open channel - Fundamental equations - Velocity distribution in open channel - Computation in Steady uniform flow- Chezy equation, Manning equation - Best hydraulic sections for uniform flow- Specific energy and specific force.

UNIT II GRADUALLY VARIED FLOW 9

Dynamic equations of gradually varied and spatially varied flows - Water surface flow Profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by: Direct step method and Standard step method -Applications.

UNIT III RAPIDLY VARIED FLOW 9

Application of the energy equation for RVF - Critical depth and velocity - Critical, Sub-critical and Super-critical flow - Application of the momentum equation for RVF - Hydraulic jumps - Types - Energy dissipation – Surges - positive and negative surges.

UNIT IV TURBINES 9

Turbines - Classification - Impulse turbine – Pelton wheel - Reaction turbines - Francis turbine - Kaplan turbine - Draft tube - Cavitation - Performance of turbine - Specific speed - Runaway speed

UNIT V PUMPS 9

Centrifugal pumps - Minimum speed to start the pump - NPSH - Cavitations in pumps - Operating characteristics - Multistage pumps - Reciprocating pumps - Negative slip - Air vessels, indicator diagrams and its variations-Savings in work done - Rotary pumps- Gear pump.

TOTAL: 45 PERIODS

PRACTICAL SESSIONS:

Expt. No.	Title of the Experiment	Unit Mapped	CO	Contact Hours
1.	Determination of conjugate depth of hydraulic jump	I	1	4
2.	Characteristics of Pelton wheel turbine	II	2	4
3.	Characteristics of Francis turbine	II	2	4
4.	Characteristics of Kaplan turbine	III	3	4
5.	Characteristics of Centrifugal pump /submersible pump	IV	4	6
6.	Characteristics of Gear pump	IV	4	4
7.	Characteristics of Reciprocating pump	V	5	4
			Total	30

TOTAL: 75 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Compute the discharge in a steady uniform flow in a channel using the concepts of energy equation	3
CO2	Analyse the various water surface profiles in the steady gradually varied flow.	3
CO3	Calculate the depth of flow before and after hydraulic jump using the concepts of momentum equation in the rapidly varied flows.	3
CO4	Analyse the performance of the various types of turbines.	3
CO5	Analyse the performance of rotodynamic pumps and reciprocating pumps	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Modi P. N and Seth, Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House New Delhi. 2017.
2. Subramanya K., "Flow in open channels", Tata McGraw Hill, New Delhi, 2014.

REFERENCES:

1. VenTe Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
2. Jain A. K. Fluid Mechanics including Hydraulic Machines, Khanna Publishers, New Delhi,2014.
3. Rajesh Srivastava, " Flow through open channels", Oxford University Press, New Delhi, 2008
4. Dr.R.K.Bansal, A textbook of Fluid Mechanics and Hydraulic Machines,10th edition 2018.

5. Hydraulic Laboratory Manual, Centre for Water Resources, Anna University, 2004.
6. https://www.vlab.co.in/broad-area-civil-engineering

EVALUATION SCHEME:

FA 1 – Theory
FA 2 – Theory
FA 3 – Practical
Summative Assessment – Theory – 60% and Practical – 40%
Observation and Records will be maintained for Practical Sessions

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	3	-	1	2	-	-	1	3	3
CO2	3	2	-	-	-	3	-	1	2	-	-	1	3	3
CO3	3	3	-	3	-	3	2	1	-	-	-	1	3	3
CO4	3	3	-	3	-	3	2	1	2	-	-	1	3	3
CO5	3	3	-	3	-	3	2	1	-	-	-	1	3	3

3-High, 2-Medium, 1-Low

CE22411 **SURVEY PRACTICAL**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To impart knowledge about survey field techniques.

LIST OF EXPERIMENTS

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. Curve setting by deflection angle

Tacheometry – Tangential system – Stadia system

4. Determination of Tacheometric Constants
5. Heights and distances by stadia Tacheometry
6. Heights and distances by Tangential Tacheometry

Contouring

7. Radial tachometric contouring
8. Grid Contouring
9. Heights and distances by Tangential Tacheometry

Total Station - Study of Total Station, Measuring Horizontal and vertical angles

10. Traverse using Total station and Area of Traverse
11. Determination of distance and difference in elevation between two inaccessible points using Total station

TOTAL PERIODS : 30

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the principles of Theodolite to carry out various measurements in the field	3
CO2	Apply basic surveying knowledge to survey plain terrain	3
CO3	Use advanced instruments like Total station & EDM for efficient surveying	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2016.
2. T. P. Kanetkarand S. V. Kulkarni, Surveying and Levelling, Parts 1 & 2, Pune Vidyarthi Griha Prakashan, Pune, 2008.

REFERENCES:

1. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.
2. James M. Anderson and Edward M. Mikhail, Surveying, Theory and Practice, Seventh Edition, Mc Graw Hill 2001.
3. K. R. Arora, Surveying Vol I & II, Standard Book house, Twelfth Edition 2013.

COURSE ARTICULATION MATRIX:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	1	-	-	-	-	3	1	-	-	3	3
CO2	3	2	-	1	-	-	-	-	3	1	-	-	3	3
CO3	3	2	-	1	-	-	-	-	3	1	-	-	3	3

3-High, 2-Medium, 1-Low

CE22412 **SOIL MECHANICS LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

To develop skills to test the soils for their index and engineering properties and to characterize the soil based on their properties.

LIST OF EXPERIMENTS

1. Determination of Index Properties
   a. Specific gravity test
   b. Grain size distribution curve using sieve analysis
   c. Liquid limit and Plastic limit test
   d. Shrinkage limit and differential free swell test
2. Determination of In-situ Density and Compaction Characteristics
   a. Core cutter test
   b. Sand replacement test
   c. Standard Proctor Compaction Test
3. Determination of Engineering Properties
   a. Constant and Variable head permeability test
   b. Bearing capacity of the soil from load settlement curve of the footing using the loading frame setup
   c. Direct shear test
   d. Unconfined compression test
   e. Vane shear test
4. Exercise for Demonstration only
   a. Triaxial Compression Test (Demo Only)
   b. One Dimensional Consolidation Test (Demo Only)

TOTAL PERIODS : 30

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Conduct tests to determine the index properties of soils.	3
CO2	Determine the characteristics of bricks	3
CO3	Conduct tests to determine the engineering properties of soils	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. "Soil Engineering Laboratory Instruction Manual" published by Engineering College Co- operative Society, Anna University, Chennai, 2010
2. Saibaba Reddy, E. Ramasastri, K. "Measurement of Engineering Properties of Soils", New age International (P) limited publishers, New Delhi, 2008.
3. Lambe T.W., "Soil Testing for Engineers", John Wiley and Sons, New York, 1951. Digitized 2008.
4. IS Code of Practice (2720) Relevant Parts, as amended from time to time, Bureau of Indian Standards, New Delhi.
5. G.Venkatappa Rao and Goutham .K. Potable, "Geosynthetics Testing – A laboratory Manual", Sai Master Geoenvironmental Services Pvt. Ltd., 1st Edition 2008
6. Braja M.Das., "Soil Mechanics: Laboratory Manual", Oxford University Press, eighth edition, 2012.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	3	1	-	-	3	2
CO2	3	2	-	-	-	-	-	-	3	1	-	-	3	2
CO3	3	2	-	-	-	-	-	-	3	1	-	-	3	2

3-High, 2-Medium, 1-Low

CE22501 **STRUCTURAL ANALYSIS II**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the concepts of matrix methods of analysis
- To learn the method of drawing influence lines and its uses in various applications.
- To understand the plastic analysis and finite element analysis of structures.

UNIT I PLASTIC ANALYSIS OF STRUCTURES 9

Statically indeterminate axial problems – Beams in pure bending – Plastic moment of resistance – Plastic modulus – Shape factor – Load factor – Plastic hinge and mechanism – Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems

UNIT II FLEXIBILITY MATRIX METHOD 9

Primary structure – Compatibility conditions – Analysis of indeterminate pin-jointed plane frames, continuous beams, rigid jointed plane frames (with redundancy restricted to two).

UNIT III STIFFNESS MATRIX METHOD 9

Element and global stiffness matrices – Analysis of continuous beams – Analysis of pin-jointed plane frames and rigid frames (with degree of freedom limited to two) – Analysis using software

UNIT IV FINITE ELEMENT METHOD 9

Introduction – Discretisation of a structure – Displacement functions – One dimensional elements – bar element – stiffness matrices for truss and beam elements – problems on beams and trusses – software application

UNIT V MOVING LOADS AND INFLUENCE LINES 9

Influence lines for reactions in statically determinate structures – Influence lines for shear force and bending moment in beam sections – Calculation of critical stress resultants due to concentrated and distributed moving loads. Muller Breslau's principle for indeterminate beams, Begg's deformeter.

TOTAL : 45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Perform plastic analysis of structures	3
CO2	Analyse the indeterminate pin jointed plane frames, continuous beams and rigid frames using matrix flexibility method.	3
CO3	Apply the concept of matrix stiffness method to analyse continuous beams, pin jointed trusses and rigid plane frames.	3
CO4	Analyse bars, trusses and beams using finite element method	3
CO5	Analyse the members subjected to moving loads using the concept of influence lines.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Bhavikatti, S.S,Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2021.
2. Punmia.B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi, Publications,2017.

REFERENCES:

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., Third Edition, 2010.
3. Gambhir.M.L., Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.
4. Vazrani.V.N And Ratwani,M.M, Analysis of Structures, Vol.II, Khanna Publishers,2015
5. Ghali.A, Nebille,A.M. and Brown,T.G. “Structural Analysis” A unified classical and Matrix approach” 6th edition. Spon Press, London and New York, 2013.
6. William Weaver, Jr and James M.Gere, Matrix analysis of framed structures, CBS Publishers & Distributors, Second Edition, Delhi, 2004
7. Reddy C.S., Basic Structural Analysis, Tata McGraw Hill Publishing Co. Ltd., Third Edition, 2010.
8. Pandit G.S. & Gupta S.P. "Structural Analysis – A Matrix Approach", Tata McGraw Hill 2004.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE222502 DESIGN OF REINFORCED CONCRETE ELEMENTS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES::

To introduce the different types of philosophies related to design of basic structural elements such as slab, beam, column and footing which form part of any structural system with reference to Indian standard code of practice.

UNIT I DESIGN CONCEPTS AND DESIGN OF BEAMS 12

Design concepts – Design of Singly Reinforced beam by working stress method - Limit State philosophy as detailed in IS code - Advantages of Limit State Method over other methods - Analysis and design of singly and doubly reinforced rectangular beams by limit State Method.

UNIT II DESIGN FOR BENDING, SHEAR AND TORSION 12

Design of flanged beams - Behaviour of RC members in bond and Anchorage - Behaviour of RC beams in shear and torsion - Design of RC members for combined bending, shear and torsion

UNIT III DESIGN OF SLABS 12

Design of one way and two way slabs – simply supported, continuous and restrained – using coefficients in IS code – reinforcement detailing - curtailment of reinforcement.

UNIT IV DESIGN OF COLUMNS 12

Design of columns for axial load – square, rectangular and circular cross sections with lateral and spiral ties – design of short and long columns for uniaxial and biaxial eccentricities using interaction charts – reinforcement detailing.

UNIT V DESIGN OF FOOTINGS 12

Shallow foundation – Isolated footing – square and rectangular – combined footing – rectangular and trapezoidal – reinforcement detailing.

TOTAL PERIODS : 60 (45 L + 15 T)

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Explain the various design concepts and design a beam under flexure and draw the reinforcement details.	3
CO2	Design the beam under shear and torsion, Calculate the anchorage and development length and check the serviceability requirements for RC	3

	structural elements.	
CO3	Design a RC slab and draw the reinforcement details.	3
CO4	Design columns for axial, uniaxial and biaxial eccentric loadings.	3
CO5	Design the axially and eccentrically loaded footings by limit state method.	3

.TEXT BOOKS:

1. B.C. Punmia. Ashok K. Jain and Arun K. Jain, Limit State design of Reinforced Concrete, Laxmi Publications (P) Ltd., New Delhi, 2016.
2. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2017

REFERENCES :

1. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design (Third Edition), Tata Mc Graw Hill Publishing Company Ltd., New Delhi, 3rd Edition, 2017.
2. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2014.
3. P.C. Varghese, Limit State Design of Reinforced Concrete, Prentice Hall of India, Pvt. Ltd., New Delhi, Second Edition, 2008.
4. S.N. Sinha, Reinforced Concrete Design, Tata McGraw-Hill, New Delhi, 2015
5. N. Subramanian, Design of Reinforced Concrete Structures, Oxford University Press, New Delhi, 2014
6. N. Krishna Raju and R.N. Pranesh, Reinforced Concrete Design IS 456-2000, Principles and practice, New Age International (P) Ltd Publishers, New Delhi, 2006.
7. Edward G. Nawy, Reinforced Concrete – A fundamental Approach, 6th Edition, Prentice Hall, 2008.

IS CODES:

1. IS 456:2000 Plain and Reinforced Concrete – Code of Practice.
2. SP16, IS456:1978 “Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999
3. IS 875(1-5):1987 Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures
4. SP 34:1987 Handbook of concrete reinforcement and detailing.
5. National Building Code of India 2016 (NBC 2016)
6. Handbook for Limit State Design of Reinforced Concrete Structures – Roorkee.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	2	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22503 ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart the knowledge and skills to identify, assess and mitigate the environmental and social impacts of developmental projects.

UNIT I OVERVIEW OF EIA 9

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

UNIT II ENVIRONMENTAL ASSESSMENT 9

Screening and Scoping in EIA – Drafting of Terms of Reference, Baseline monitoring, Prediction and Assessment of Impact on land, water, air, noise and energy, flora and fauna - Matrices – Networks – Checklist Methods - Mathematical models for Impact prediction – Analysis of alternatives.

UNIT III ENVIRONMENTAL MANAGEMENT PLAN 9

Plan for mitigation of adverse impact on water, air and land, water, energy, flora and fauna – Environmental Monitoring Plan – EIA Report Preparation – Review of EIA Reports – Public Hearing-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 – Mass Rapid Transport Systems - Ports and Harbor – Airports - Dams and Irrigation projects - Power plants – CETPs- Waste Processing and Disposal facilities – Mining Projects.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the fundamentals of Environmental Impact Assessment (EIA).	3
CO2	Describe the scoping and screening of developmental projects for environmental and social assessments and explain different methodologies for environmental impact prediction and assessment.	3
CO3	Prepare environmental impact assessments and environmental management plans	3
CO4	Describe the principles of socio economic assessment	3
CO5	Analyse the environmental impact assessment reports.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Canter, R.L, "Environmental impact Assessment ", 2nd Edition, McGraw Hill Inc, New Delhi,1995.
2. Peter Morris, Riki Therivel "Methods of Environmental Impact Assessment", Routledge Publishers,2009.

REFERENCES:

1. Lohani, B., J.W. Evans, H. Ludwig, R.R. Everitt, Richard A. Carpenter, and S.L. Tu, "Environmental Impact Assessment for Developing Countries in Asia", Volume 1 – Overview, Asian Development Bank,1997.
2. Becker H. A., Frank Vanclay,"The International handbook of social impact assessment" conceptual and methodological advances, Edward Elgar Publishing, 2003.
3. Barry Sadler and Mary McCabe, "Environmental Impact Assessment Training Resource Manual", United Nations Environment Programme, 2002.
4. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I and II", Blackwell Science New York, 2009.
5. Ministry of Environment and Forests EIA Notification and Sectoral Guides, Government of India, New Delhi, 2010.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	1	-	-	3	3	3	-	-	-	-	3	3
CO2	3	1	1	-	-	3	3	3	-	-	-	-	3	3
CO3	3	1	1	-	-	3	3	3	-	-	-	-	3	3
CO4	3	1	1	-	-	3	3	3	-	-	-	-	3	3
CO5	3	1	1	-	-	3	3	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22504 **REMOTE SENSING AND GIS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the basic concepts and principles of various components of remote sensing.
- To provide an exposure to GIS and its practical applications in Civil engineering field.

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – Wave theory, Planck's law, Wien's Displacement Law, Stefan's Boltzmann law – Radiation sources: active & passive; Radiation Quantities

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL 9

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows – Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance – Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III PLATFORMS AND SENSORS 9

Ground based platforms –Airborne platforms – Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Resolution concepts – Scanners - Along and across track scanners – Orbital and sensor characteristics of different satellites – Airborne and Space borne TIR sensors – Calibration – S/N ratio – Passive/Active microwave sensing – Airborne and satellite borne RADAR –SAR –LIDAR , UAV – High Resolution Sensors.

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 INTERPRETATION AND CIVIL ENGINEERING APPLICATIONS 9

Photographic and digital products – Types, levels and open-source satellite data products – selection and procurement of data– Visual interpretation: basic elements and interpretation keys – Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification – Civil Engineering applications: highway and railway alignments, site selection for dams, town and regional planning.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Explain the concepts and laws related to remote sensing	2
CO2	Discuss the interaction of electromagnetic radiation with atmosphere and earth material	2
CO3	Acquire knowledge about different types of remote sensors and satellites	2
CO4	Summarise the fundamentals of maps and their characteristics, GIS and its components	2
CO5	Describe about the concepts of interpretation of satellite imagery and civil engineering applications	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Universities Press (India) Private limited, Hyderabad, 2018
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd edition. BS Publications, Hyderabad, 2012.

REFERENCES:

1. Thomas .M.Lillesand, Ralph W. Kiefer and Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley & Sons Inc; 7th edition,2015
2. Paul Curran P.J. Principles of Remote Sensing. Longman, Rawat Publications, 2020.
3. Introduction to Physics and Techniques of Remote Sensing, Charles Elachi and Jacob Van Zyl, 2006 Edition II, Wiley Publication.
4. https://onlinecourses.nptel.ac.in/
5. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, 2020.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	3	-	1	-	-	-	1	3	3
CO2	3	2	-	-	-	-	-	-	-	3	-	1	3	3
CO3	3	2	-	-	3	3	3	1	-	-	-	1	3	3
CO4	3	2	2	-	-	-	-	-	-	-	-	1	3	3
CO5	3	3	2	3	3	2	3	3	1	1	1	1	3	3

3-High, 2-Medium, 1-Low

CE22511 WATER AND WASTEWATER ANALYSIS LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- This subject includes the list of experiments to be conducted for characterization of water and municipal sewage. At the end of the course, the student is expected to be aware of the procedure for quantifying quality parameters for water and sewage.

LIST OF EXPERIMENTS

ANALYSIS OF WATER SAMPLE

1. Measurement of pH, Electrical conductivity and Turbidity.
2. Determination of Optimum Coagulant Dosage by Jar test.
3. Determination of Iron in Water. (Demo)
4. Determination of Fluoride in Water.
5. Determination of Calcium in Water.
6. Determination of Potassium in Water.
7. Determination of Sodium in Water.

ANALYSIS OF WASTEWATER SAMPLE

8. Determination of Suspended, Volatile, Fixed and Settleable Solids.
9. Determination of Ammonia Nitrogen.
10. Determination of Phosphate.
11. Determination of Biochemical Oxygen Demand (BOD).
12. Determination of Chemical Oxygen Demand (COD).

TOTAL: 30 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Test the characteristics of water.	3
CO2	Test the characteristics of wastewater.	3
CO3	Interpret the characteristics of water and wastewater.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Standard Methods for the Examination of Water and Wastewater, APHA, 22nd Edition, Washington, 2012.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1	1	-	2	3	-	3	1	-	-	3	3
CO2	3	1	1	1	-	2	3	-	3	1	-	-	3	3
CO3	3	1	1	1	-	2	3	-	3	1	-	-	3	3

3-High, 2-Medium, 1-Low

CE22512 **STRUCTURAL AND APPLIED MECHANICS LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

- To provide hands on experience in analyses related to structural mechanics and understand the behaviour while comparing with manual and computer aided analyses.

LIST OF EXPERIMENTS

The following experiments will include theoretical calculation and computer aided analysis

A. Graphical methods of analysis

1. Determination of centroid of planar shapes
2. Determination of resultant of concurrent forces and parallel force system by graphical method
3. Qualitative and quantitative behaviour of truss

B. Experimental analysis

4. Verification of Maxwell Reciprocal Theorem
5. Buckling of columns with different support conditions
6. Analysis of fixed portal frame for different loading conditions
7. Analysis of portal frame with one end fixed and other end pinned for different loading conditions
8. Analysis of three hinged arch
9. Analysis of two hinged arch
10. Determination of shear force
11. Determination of Bending moment
12. Analysis of a suspension bridge
13. Measurement of horizontal and vertical displacements in a redundant joint

TOTAL: 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the basic concepts of engineering mechanics.	3
CO2	Apply the principles of determining strength of materials.	3
CO3	Apply the classical structural analysis methods.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Hibbeller, R.C and Ashok Gupta, “Engineering Mechanics: Statics and Dynamics”, 11th Edition, Pearson Education, 2010.
2. Rajput.R.K. “Strength of Materials”, S.Chand and Co, New Delhi, 2015.
3. Bhavikatti, S.S,Structural Analysis,Vol.1,& 2, Vikas Publishing House Pvt. Ltd., NewDelhi-4, 2021.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1	1	-	2	3	-	3	1	-	-	3	3
CO2	3	1	1	1	-	2	3	-	3	1	-	-	3	3
CO3	3	1	1	1	-	2	3	-	3	1	-	-	3	3

3-High, 2-Medium, 1-Low

CE22601 **ESTIMATION AND QUANTITY SURVEYING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

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

UNIT I **ESTIMATE OF BUILDINGS** **12**

Load bearing and framed structures – Calculation of quantities of PCC, RCC, brick work, Plastering, whitewashing, 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 panelled and glazed doors, windows, ventilators, handrails – Estimation using software tool

UNIT II **ESTIMATE OF OTHER STRUCTURES** **12**

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** **7**

Data – Schedule of rates – Analysis of rates – Specifications – sources – Preparation of detailed and general specifications – Tenders – types of tenders – e-tender – Preparation of Tender notice and Document – Contracts – Types of contracts –Arbitration and legal requirements.

UNIT IV **VALUATION** **7**

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

UNIT V **REPORT PREPARATION** **7**

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

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements After successful completion of this course, the students will be able to	RBT level
CO1	Estimate the quantities of item of works involved in buildings	3

CO2	Estimate the quantities of item of works involved in water supply and sanitary works, road works and irrigation works.	3
CO3	Do rate analysis and also gain knowledge about tenders and contracts	3
CO4	Prepare value estimates.	3
CO5	Prepare report for various civil engineering structures.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Dutta, B.N., "Estimating and Costing in Civil Engineering (Theory & Practice)", 28th edition, UBS Publishers & Distributors Pvt. Ltd., 2020
2. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2013.

REFERENCES:

1. Hand Book of Consolidated Data – 8/2000, Vol.1, TNPWD.
2. Standard Data Book for Analysis and Rates, IRC, New Delhi, 2019.
3. Arbitration and Conciliation Act, 1996

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	-	-	-	2	-	-	-	-	3	-	3	3
CO2	3	3	-	-	-	2	-	-	-	-	3	-	3	3
CO3	3	3	-	-	-	2	-	1	-	-	3	-	3	3
CO4	3	3	-	-	-	-	-	-	-	3	3	-	3	3
CO5	3	3	-	-	-	-	-	-	-	3	3	-	3	3

3-High, 2-Medium, 1-Low

CE22602	TRANSPORTATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to make the students to grasp knowledge on different modes and its interconnectivity.

UNIT I MODES OF TRANSPORTATION 9

Transportation Engineering (Definition) – The Transportation System Concept (India) – Modes of Transportation – Highways – Urban Transit – Air – Rail – Water – Pipelines – other modes – Relative importance – Institutional structure (India) – Civil Engineering involvement in Transportation – Career in Transportation Engineering - Summary

UNIT II RAILWAY PLANNING 9

Developments on Indian Railways (mile stones) – Classification of Railway lines in India – Gauges on World Railways – Different gauges on Indian Railways – Choice of gauge – track – requirements of a good track – Coning of Wheels – Tilting of rails – Rails – Functions of rails – types of rails – Standard rail sections (table) – Length of rails – Sleepers – Functions of sleepers – Requirements – Sleeper density – Types of sleepers – Ballast – Functions – Requirements of good ballast.

UNIT III RAILWAY TRACK DESIGN 9

Creep in rails – Geometric design of track – necessity – Gradients – Types – Grade compensation at curves – Curves and super elevation (cant)– Circular curves – Radius of degree of curve – cant formula – Equilibrium speed – Maximum speed – Cant deficiency – Negative cant – Safe speed on curves – Problems – Concept of points & crossings (model lab).

UNIT IV AIRPORT DESIGN AND PLANNING 9

Advantages and disadvantages of air transport – Airport terminology – Airport surveys; Approach zone survey – Drainage survey – Meteorological survey – Natural resources survey – Soil survey – Topographic survey – Traffic survey – Air traffic forecasting using PSPP software – Airport site selection – Runway design – Runway orientation – Head wind – Cross wind – Wind coverage – wind rose diagram – Type I – Type II – Runway corrections – Problems.

UNIT V HARBOUR ENGINEERING 9

Water transportation – Harbours – Natural – semi-natural – Artificial Harbours – Natural phenomenon – Tides – Wind – Waves – Breakwaters – Classification of Breakwaters – Tetrapod – Docks – Repair docks – dry dock – Marine railway dock – Dredging – Dredger types – Navigational aids – fixed and floating stations – Lighthouse – Visibility design

TOTAL:45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Comprehend and synthesize on various modes of transportation and the scope of Civil Engineers	2
CO2	Summarize the various components of a railway track	2
CO3	Design the cant or superelevation for a railway track as per Indian Railway PW manual	3
CO4	Relate the wind direction with the runway orientation and design the runway length for the given site conditions	3
CO5	Demonstrate the various components of a typical harbour.	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi,2003
2. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
3. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi, 2013.

REFERENCES:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India),Chennai, 2010
2. C.Venkatramaiah, Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press (India) Private Limited, Hyderabad, 2015.
3. Mundrey J S, Railway Track Engineering, McGraw Hill Education (India) Private Ltd, New Delhi, 2013

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO3	3	2	1	-	-	-	-	3	-	-	-	3	3	3
CO4	3	2	1	-	-	-	-	-	-	-	-	3	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	3	3	3

3-High, 2-Medium, 1-Low

CE22603 ADVANCED REINFORCED CONCRETE DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To strengthen the basic fundamentals of design of RCC structures and to apply these basic fundamentals for the design of advanced reinforced concrete structures.

UNIT I RETAINING WALLS 9

Types, behavior and application of retaining wall, stability criteria, design and detailing of cantilever & counterfort type retaining wall for various ground conditions.

UNIT II DESIGN OF FLAT SLABS 9

Direct Design Method – Distribution of Moments in column strips and middle strip – moment and shear transfer from slabs to columns – shear in flat slabs – check for one way shear – Introduction to equivalent frame method. Limitation of direct design method – Distribution of moments in column strips and middle strip.

UNIT III DESIGN OF CORBELS, BRACKETS AND NIBS 9

Introduction – Allowable shear, Dimensioning, Analysis and Design of Corbels and Brackets. Design of Nibs- Reinforcement Detailing.

UNIT IV DESIGN OF WATER TANKS 9

Classification of water tank and method of analysis, permissible stresses, codal provisions, Design of Tank resting on ground and underground water tanks (rectangular and circular) - Elevated circular water tank – Reinforcement detailing of water tanks.

UNIT V BUNKERS AND SILOS 9

Introduction, Design of rectangular bunkers, circular bunkers and silos, including reinforcement detailing.

TOTAL:45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Analyze and design cantilever and counterfort retaining walls.	3
CO2	Analyse and design a flat slab system	3
CO3	Analyse and design corbels, brackets and nibs.	3
CO4	Design water tank overhead and tank resisting on ground	3

CO5	Analyse and design bunkers, silos and chimneys	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Pillai and Devadas Menon, Reinforced Concrete Design, 3rd Edition, Tata McGraw Hill Publishing Co. Ltd., 2017.
2. Varghese P.C. Advanced Reinforced Concrete Design, 2ndEdition, Prentice - Hall of India, , 2009.
3. Krishna Raju, N. Design of Reinforced Concrete Structures,4th Edition, CBS Publishers and Distributors, New Delhi, 2017.

REFERENCES

1. S. R. Karve and V.L Shah, Limit State Theory and Design of Reinforced Concrete, 8th Edition, Structures publicaton, 2018.
2. P. Purushotham, Reinforced concrete structural elements – behavior, Analysis and design by Tata Mc.Graw-Hill, 1994.
3. Arthus H. Nilson, David Darwin, and Chorles W. Dolar , Design of concrete structures –, Tata Mc. Graw-Hill, 3rd Edition, 2005.

IS CODES:

1. IS 456-2000 Plain and Reinforced concrete book of Practice.
2. SP 16- Design Aids for Reinforced Concrete to IS 456
3. SP 34 - Hand Book as Concrete Reinforcement and retaining

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO2	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO3	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO4	3	3	3	2	-	2	-	3	-	-	-	-	3	3
CO5	3	3	3	2	-	2	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22609 DESIGN OF STEEL STRUCTURES : THEORY AND PRACTICES

L	T	P	C
3	0	2	4

COURSE OBJECTIVES:

- To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
- To provide the students the tools necessary for designing structural systems such as roof trusses and gantry girders as per provisions of current code (IS 800 - 2007) of practice.

UNIT I BASICS OF STRUCTURAL STEEL AND DESIGN OF CONNECTIONS 9+6

Properties and merits of structural steel - sections – Design philosophies - Design of Simple Bolted and welded connections – Design principles of Eccentric connections - efficiency of joint – Design of HSFG bolts
Practical : connection detailing drawings, design of connections using computer software

UNIT II TENSION MEMBERS 9+6

Behaviour and Design of simple and built-up members subjected to tension – Design of lug angles – Tension splice
Practical : design of tension member using programming language

UNIT III COMPRESSION MEMBERS 9+6

Theory of columns – buckling class -Design of simple and built-up compression members – laced and battened columns - Design of column bases
Practical : Design using programming language and spreadsheet application.

UNIT IV BEAMS 9+6

Section classification - Design of laterally supported and unsupported beams - Design of built-up beams - Design of plate girders
Practical : Design using spreadsheet application

UNIT V INDUSTRIAL STRUCTURES 9+6

Components of industrial structure – loads on trusses – purlin design using angle and channel sections - Design procedure of gantry girders - Introduction to pre-engineered buildings
Practical : Modelling and analysis using computer tools.

TOTAL: 75 PERIODS (45T + 30P)

PRACTICAL SESSIONS:

Expt. No.	Title of the Experiment	Unit Mapped	CO	Contact Hours
1.	Interpretation of connection detailing drawings	I	1	2
2.	Introduction to connection design software	I	1	2
3.	Design of simple connection using software	I	1	2
4.	Algorithm to solve a tension member design problem	II	2	2
5.	Design of tension member (angle) using simulating programming language	II	2	2
6.	Design tension member (plate) using basic programming language	II	2	2
7.	Analysis of a compression member using basic programming language	III	3	2
8.	Design of a compression member of angle section using spreadsheet application	III	3	2
9.	Design of a base plate member using spreadsheet application	III	3	2
10.	Beam design using spreadsheet application	IV	4	2
11.	Design of laterally supported beam using spreadsheet application	IV	4	2
12.	Design of laterally unsupported beam using spreadsheet application	IV	4	2
13.	Introduction to an Analysis software	V	5	2
14.	Analysis and Design of PEB in analysis software	V	5	2
15.	Modelling a PEB in a modelling software	V	5	2
			Total	30

TOTAL: 75 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Design the appropriate connection for the problem statement using codal provisions.	3
CO2	Design of tension members using codal provisions.	3
CO3	Design columns and columns bases.	3
CO4	Design bending member with appropriate section using design principles.	3
CO5	Compute the wind loads and others loads on industrial structures based on codal provisions.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2017.
2. Bhavikatti S.S, Design of Steel Structures, Ik International Publishing House, New Delhi, 2017.

REFERENCES:

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013
2. Jack C. McCormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013.
3. Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014
4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016
5. INSDAG teaching resources.

EVALUATION SCHEME:

FA 1 – Theory
FA 2 – Theory
FA 3 – Practical
Summative Assessment – Theory – 60% and Practical – 40%
Observation and Records will be maintained for Practical Sessions

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	2	2	-	3	-	-	-	-	3	3
CO2	3	3	3	2	2	2	-	3	-	-	-	-	3	3
CO3	3	3	3	2	2	2	-	3	-	-	-	-	3	3
CO4	3	3	3	2	2	2	-	3	-	-	-	-	3	3
CO5	3	3	3	2	2	2	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22611 STRUCTURAL ANALYSIS AND DESIGN LABORATORY

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To acquire hands on experience in design and preparation of structural drawings for common civil engineering structures and structural elements.

LIST OF EXPERIMENTS

Analysis and Design of

1. Beam with different types of loading – simply supported, cantilever
2. Beam with different types of loading – fixed and continuous
3. 2D pin jointed frame
4. Plane frame with different end and loading (gravity) conditions
5. Plane frame with lateral loads
6. 3D building frame (concrete)
   a. Manual load calculations as per IS code
   b. Modelling and analysis
   c. Design of elements – beam, slab, column, footing
   d. Detailing drawing
7. Industrial warehouse with wind loads
8. Dynamic analysis
   a. Mode shapes
   b. Seismic loads and time history analysis
9. Finite Element Analysis of a bar element
10. Finite element analysis of a beam element

TOTAL: 60 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Analyse and design of basic structural elements	3
CO2	Perform dynamic analysis	3
CO3	Apply FEA methods to analyse elements	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Krishnaraju N, Structural Design and drawing, Universities Press, 2022
2. Krishnamurthy D, Structural Design and Drawing vol I, II and III, CBS Publishers, 2018
3. Neelam Sharma - R.C.C. Design & Drawing -S.K. Kataria & Sons; Reprint 2013 edition (2013)

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	3	-	-	3	-	3	1	-	-	3	3
CO2	3	3	3	3	-	-	3	-	3	1	-	-	3	3
CO3	3	3	3	3	-	-	3	-	3	1	-	-	3	3

3-High, 2-Medium, 1-Low

CE22701 **HYDROLOGY AND IRRIGATION ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the student to the concept of hydrological aspects of water availability and requirements and should be able to quantify, control and regulate the water resources.
- To expose the students to the irrigation principles & types of canal irrigation

UNIT I SURFACE WATER HYDROLOGY 9

Hydrologic cycle; Precipitation types; Rain gauges; Computation of average rain fall over a basin; Abstraction from rainfall; evaporation, factors affecting evaporation, measurement of evaporation; Infiltration, factors affecting infiltration, measurement of infiltration, infiltration indices; Run off; Factors affecting run off; Computation of runoff; Design flood, Estimation of maximum rate of run-off.

UNIT II HYDROGRAPHS 9

Hydrograph analysis; Unit hydrograph; Construction of UH for an isolated storm, Application of UH to the construction of a flood hydrograph resulting from rainfall of unit duration; Construction of unit hydrograph of different unit duration from a unit hydrograph of some given unit duration by superposition method and S-curve method.

UNIT III GROUNDWATER HYDROLOGY 9

Introduction; Aquifer; Aquiclude; Aquifuge; Specific yield; Specific retention; Divisions of sub–surface water; Water table; Types of aquifers; Well hydraulics- Steady radial flow to a well– Dupuit's theory for confined and unconfined aquifers; Tube wells - Open wells; Yield of an open well–Constant level pumping test and Recuperation test.

UNIT IV IRRIGATION PRINCIPLES & CROP WATER REQUIREMENT 9

Introduction to Irrigation - Water Requirement of Crops–Irrigation efficiencies - Determination of irrigation requirements of crops; crop rotation, Assessment of Irrigation water - Standards for irrigation water- Planning and Development of irrigation projects.

UNIT V DIVERSION AND IMPOUNDING STRUCTURES &CANAL IRRIGATION 9

Head works –Weirs and Barrages –Types of impounding structures - Classification of canals- Alignment of canals – Design of irrigation canals– Regime theories - Canal Head works – Canal regulators - Canal drops – Cross drainage works – Canal Outlets, Escapes –Water Logging and Canal Lining; Saline and alkaline soils and their reclamation.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the basic principles of hydrology.	2
CO2	Summarise the basics of different type of hydrographs	2
CO3	Explain the concepts of groundwater and hydraulics of subsurface flows.	2
CO4	Summarize the different irrigation principles & concepts related to crop water requirements	2
CO5	Describe about the diversion and impounding structures & types of canal irrigation.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS

1. Subramanya K., Engineering Hydrology, Tata-McGraw Hill 5th edition ,2013
2. Sharma R.K. and Sharma T.K., Hydrology and Water Resources Engineering, Dhanpat Rai and Sons, 2002.

REFERENCES

1. Punmia B.C. and Pande B.B.Lal, Irrigation and water Power Engineering, Laxmi Publications Pvt Ltd., New Delhi,2009.
2. Raghunath H.M., Hydrology, Wiley Eastern Limited, New Delhi,1990.
3. Santhosh Kumar Garg, Hydrology and Water Resources Engineering Khanna Publications Pvt.Ltd.,New Delhi,2008.
4. Linsley R.K. and Franzini J.B, WaterResources Engineering, McGraw-Hill Inc, 2002.
5. Chow V.T. and Maidment, Hydrology for Engineers, McGraw-Hill Inc., Ltd., 2000.
6. IS 11624 : 2019 - (Active)Quality of Irrigation Water - Guidelines (First Revision)

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COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	-	-	-	3	-	3	1	3	3	3
CO2	3	3	3	-	-	-	-	3	-	3	2	3	3	3
CO3	3	3	3	-	-	-	-	3	-	3	3	3	3	3
CO4	3	3	3	-	-	-	-	3	-	3	2	3	3	3
CO5	3	3	3	-	-	-	-	3	-	3	2	3	3	3

3-High, 2-Medium, 1-Low

CE22702	ETHICS IN CIVIL ENGINEERING PRACTICE	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

UNIT I HUMAN VALUES 6

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management

UNIT II ENGINEERING ETHICS 6

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 6

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 6

Safety and Risk – Assessment of Safety and Risk – Respect for Authority – Collective Bargaining – Confidentiality – Professional Rights – Employee Rights – Intellectual Property Rights (IPR).

UNIT V ETHICAL CONSIDERATIONS IN CIVIL ENGINEERING PRACTICE 6

Sustainable Development – Environmental Ethics – Ethical Use of Resources and Materials in Construction – Resilience and Disaster Preparedness in Civil Engineering Design — Ethical Issues in Urban Planning and Development.

TOTAL :30 PERIODS

OUTCOMES :

CO	CO statements After successful completion of this course, the students will be able to	RBT level
CO1	Summarise the importance of core values that shape the ethical behavior of a professional.	3
CO2	Apply ethical theories in controversial issues while playing the role of engineering professionals.	3
CO3	Solve moral and ethical problems through exploration and assessment by established experiments and relate the code of ethics to social experimentation.	3
CO4	Enumerate the importance of safety, responsibilities and rights of an engineer at work place	3
CO5	Explain the ethical attributes of engineers in various roles and in different domains of engineering in the global context.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, “Ethics in Engineering”, Tata McGraw Hill, New Delhi, 2015
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, “Engineering Ethics”, Prentice Hall of India, New Delhi, 2004.

REFERENCES:

1. Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2012.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, “Engineering Ethics – Concepts and Cases”, Cengage Learning, 2012.
3. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2017.
4. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2008.
5. Laura P. Hartman and Joe Desjardins, “Business Ethics: Decision Making for Personal Integrity and Social Responsibility” Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, ‘ Value Education’, Vethathiri publications, Erode, 2011.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	-	-	-	2	-	2	-	-	3	-	3	3
CO2	3	3	-	-	-	2	-	2	-	-	3	-	3	3
CO3	3	3	-	-	-	2	-	2	-	-	3	-	3	3
CO4	3	3	-	-	-	-	-	2	-	3	3	-	3	3
CO5	3	3	-	-	-	-	-	2	-	3	3	-	3	3

3-High, 2-Medium, 1-Low

CE22703	IOT IN CIVIL ENGINEERING	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

To introduce to the students about the basic concepts and applications of Internet of Things in Civil Engineering.

UNIT I FUNDAMENTALS OF INTERNET OF THINGS (IOT) 6

Definition of Internet of Things (IoT) – data analytic systems – smart devices – softwares enabling IoT – drones – remote operation – wearable technology – artificial intelligence – automation – robotics

UNIT II APPLICATIONS IN CONSTRUCTION 6

IoT in construction – Roles of IoT in construction – benefits of IoT in construction - Safety applications - Real time reporting – Robotics - Construction tools, machinery and equipment tracking - Construction management – Scheduling - Waste management - Structural health monitoring - IoT for contractors - IoT in rehabilitation

UNIT III INTEGRATION OF IOT AND BUILDING INFORMATION MODELLING 6

Definition of BIM - From CAD to BIM - Necessity of BIM - BIM Benefits - Viewing controls – modeling - Tools and methods for digital project construction management – BIM and IoT integration – construction, operation and monitoring, on site environment monitoring, resource monitoring, construction progress monitoring.

UNIT IV AUGMENTED AND VIRTUAL REALITY 6

CAD to VR - Visualizing plans - Interactive design - Walk through - Better marketing of projects - Review of project designs - Virtual labs – Augmented reality – Hybrid Reality

UNIT V SMART HOMES AND ENERGY MANAGEMENT 6

Smart home –origin, technologies, smart home implementation, home area networks (HANs), smart grids, smart cities – characteristics, challenges, smart parking, smart thermostats, circuit breakers, digital power meters – information collection, energy management -IoT Sensors for Air Quality, Water Quality, and Noise Pollution Monitoring.

TOTAL :30 PERIODS

OUTCOMES :

CO	CO statements After successful completion of this course, the students will be able to	RBT level
CO1	Summarize the concepts of IoT and describe the different smart devices used.	2
CO2	Explain the different applications of IoT in various civil engineering sectors.	2
CO3	Explain BIM concepts and also understand the integration with IoT.	2
CO4	Describe the concepts of augmented and virtual reality.	2
CO5	Enumerate the applications of IoT in constructing smart homes and energy management.	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri. Internet of Things: Architectures, Protocols and Standards, 2019, 1st Edition, Wiley Publications, USA.
2. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A Hands-on Approach, 2014,1st Edition, Universities press, India.

REFERENCES:

1. Rafael Sacks, BIM Handbook – A Guide to Building Information Modelling for Owners Designers, Engineers, Contractors and Facility Managers, 3rd edition, John Wiley Publishers, 2018.
2. Vlasios Tsiatsis, Jan Holler, Catherine Mulligan, Stamatis Karnourskos and David Boyle. Internet of Things: Technologies and Applications for a New Age of Intelligence, 2018, 2nd Edition, Academic Press, USA.
3. Mayank Mishra, Paulo B. Lourenço, G.V. Ramana, 'Structural health monitoring of civil engineering structures by using the internet of things: A review' Journal of Building Engineering, Volume 48, 2022, 103954, ISSN 2352-7102, https://doi.org/10.1016/j.jobe.2021.103954. (https://www.sciencedirect.com/science/article/pii/S235271022101812X).
4. Ke Yan, Xiaokang Zhou, Bin Yang, 'Editorial: AI and IoT applications of smart buildings and smart environment design, construction and maintenance', Building and Environment, Volume 229, 2023, 109968, ISSN 0360-1323, https://doi.org/10.1016/j.buildenv.2022.109968. (https://www.sciencedirect.com/science/article/pii/S0360132322011982)
5. Meric Yilmaz Salman, Halil Hasar, 'Review on environmental aspects in smart city concept: Water, waste, air pollution and transportation smart applications using IoT techniques',Sustainable Cities and Society, Volume 94, 2023, 104567, ISSN 2210-6707,https://doi.org/10.1016/j.scs.2023.104567 (https://www.sciencedirect.com/science/article/pii/S2210670723001786)

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	3	2	-	-	-	-	-	-	2	2
CO2	3	2	-	-	3	2	-	-	-	-	-	-	2	2
CO3	3	2	-	-	3	2	-	-	-	2	-	-	2	2
CO4	3	2	-	-	3	2	-	-	-	3	-	-	2	2
CO5	3	2	-	-	3	2	3	-	-	3	-	-	2	2

3-High, 2-Medium, 1-Low

CE22709 PLANNING, SCHEDULING AND CONTROL OF CONSTRUCTION PROJECTS: THEORY AND PRACTICES

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To study and understand the basic concepts of construction planning. To impart knowledge on advanced scheduling techniques using computer applications. To adopt cost control approach and measure the project performance using earned value management method.

UNIT I CONSTRUCTION PROJECT PERSPECTIVES 6

Project Life Cycle – Project Management – Functions and Role - Types of Construction - Stake-holders of Construction Project - Structure of Project Organization – Matrix organization - Financing of Constructed Facilities - Role of Project Managers – Leadership – Importance of integrating planning, scheduling and control process

UNIT II CONSTRUCTION PLANNING 6

Construction planning – Objectives, Principles and Types – Choice of Technology and Construction Method – Defining Work Tasks - Work Breakdown Structure – Defining Precedence Relationships among Activities – Estimating Activity Durations – Estimating Resource Requirements for Work Activities – Coding Systems

UNIT III NETWORK REPRESENTATION AND ANALYSIS 6

Elements of Network - Critical Path Method – PERT network analysis - Construction Schedules – Scheduling Calculations - Float – Slack - AOA and AON diagrams - Scheduling for Activity-on-Node and with Leads, Lags, and Windows - Scheduling with Resource Constraints

UNIT IV SCHEDULING TECHNIQUES 6

Types of Project Scheduling – Introduction to Precedence Diagramming Method (PDM) - PDM network representation – Crashing and Time/Cost Trade-offs - Case Illustrations – Computer applications in scheduling, Monitoring, Reporting – Resource Allocation - Leveling

UNIT V COST CONTROL, MONITORING AND ACCOUNTING 6

The Cost Control Approach – Objectives – Activity Cost Control – Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts – Control of Project Cash Flows – S-Curve - Performance Control using Earned Value Management Concepts – Schedule and Cost Variance - Project Progress Control

TOTAL: 30 PERIODS

PRACTICAL SESSIONS:

Ex. No.	Title of the Experiment	Unit Mapped	CO	Contact Hours
1.	Draft a plan, elevation and section views of R.C.C. Framed building	I, II	1,2	4
2.	Estimation of a building based on the given plan and material specifications.	I, II	1,2	2
3.	Preparation of Detailed Estimate	I, II	1,2	4
4.	Preparation of Abstract Estimate	I, II	1,2	2
5.	**Planning, Scheduling and Control of Construction Projects using Primavera Software:** Establishing OBS and EPS in a Project - Creating new project with Planned Start Date - Defining Calendars - Organizing Work Breakdown Structure - Define WBS structure - Adding Activities - Assigning Relationship to the Activities - Assigning Resources and Costs to Activities - Roles, Resource and Risk Assignment - Progress Updating as per actual site condition - Budgeted and Actual Cost Comparison based on S-Curve – Filters & Printout settings	I, II, III, IV, V	1,2,3,4,5	14
6.	Preparation of Project Progress Report	IV, V	4, 5	4
			Total	**30**

TOTAL: 60 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the scope of project life cycle and apply the general principles of project management	3
CO2	Identify the work task and create an appropriate work breakdown structure for a construction project.	3
CO3	Schedule the construction activities using network diagrams	3
CO4	Select an appropriate scheduling technique to manage time and cost effectively.	3
CO5	Evaluate the project performance using earned value management approach	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Kumar Neeraj Jha, Construction Project Management - Theory and Practice, Pearson Publications - Dorling Kindersley (India) Pvt. Ltd., 2012.
2. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000
3. Choudhury. S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988
4. Jongpil Nam, "Construction Scheduling with Primavera P6" Author House UK Ltd. 2016
5. Vinayagam.P, Vimala.A., "Planning and Managing Projects with Primavera P6 Project Planner" I.K. International Publishing House Pvt. Ltd. 2017.

REFERENCES:

1. Albert Lester, Project Management, Planning and Control, 7th Edition, Butterworth Heinemann, USA, 2017.
2. Chitkara K K., Construction project management, planning, scheduling and control, McGraw Hill (INDIA) publishers, New Delhi, third edition 2014.
3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopaedia of terms and Applications, Wiley, New York, 1995.
3. Harold Kerzner – Project Management – systems approach to planning, scheduling & controlling – 7th edition, John wiley & sons, Canada.

EVALUATION SCHEME:

FA 1 – Theory
FA 2 – Theory
FA 3 – Practical
Summative Assessment – Theory – 60% and Practical – 40%
Observation and Records will be maintained for Practical Sessions

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	-	3	3	-	-	-	-	-	3	-	3	3
CO2	3	3	-	3	3	-	-	-	-	-	3	-	3	3
CO3	3	3	-	3	3	-	-	-	-	-	3	-	3	3
CO4	3	3	-	3	3	-	-	-	-	-	3	-	3	3
CO5	3	3	-	3	3	-	-	-	-	-	3	-	3	3

3-High, 2-Medium, 1-Low

CE22811 **PROJECT WORK**

L	T	P	C
0	0	20	10

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

PROFESSIONAL ELECTIVE

VERTICAL 2

STRUCTURAL ENGINEERING

CE22021	CONCRETE TECHNOLOGY	L	T	P	C
		3	0	0	3

Objectives:

- To outline the properties of concrete making materials, tests and mix design for concrete.
- To introduce the use of special concretes
- To give an idea about the behaviour of concrete under different loading conditions.

UNIT I CONSTITUENT MATERIALS 9

Cement-Different types-Chemical composition and Properties -Tests on cement-IS Specifications-Fine aggregate (sand and m sand), coarse aggregates -Classification - Mechanical properties and tests as per BIS Grading requirements-Water- Quality of water for use in concrete

UNIT II CHEMICAL AND MINERAL ADMIXTURES 9

Accelerators-Retarders- Plasticisers- Super plasticizers- Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag and Metakaoline -Their effects on concrete properties

UNIT III PROPORTIONING OF CONCRETE MIX 9

Principles of Mix Proportioning-Properties of concrete related to Mix Design-Physical properties of materials required for Mix Design - Design Mix and Nominal Mix-BIS Method of Mix Design – ACI method of mix design - Mix Design Examples.

UNIT IV FRESH AND HARDENED PROPERTIES OF CONCRETE 9

Workability-Tests for workability of concrete-Slump Test and Compacting factor Test - Segregation and Bleeding-Determination of Compressive and Flexural strength as per BIS - Properties of Hardened concrete-Determination of Compressive and Flexural strength-Stress strain curve for concrete-Determination of Young's Modulus-NDT Techniques – Rebound Hammer and Ultrasonic Pulse Velocity Test.

UNIT V SPECIAL CONCRETES 9

Light weight concretes - Self Compacting Concrete - High strength concrete - Fibre reinforced concrete – Ferrocement – Ready mix concrete - SIFCON-Shotcrete – Polymer concrete - High performance concrete- Geopolymer Concrete

TOTAL PERIODS :45

OUTCOMES :

CO	**CO statements** After successful completion of this course, the students will be able to	**RBT level**
CO1	Describe the various constituent materials used in concrete and their functions	2

CO2	Explain the effects of chemical and mineral admixtures on the properties of concrete.	2
CO3	Design concrete mixes using BIS and ACI Codes.	3
CO4	Describe the procedures to determine the properties of fresh and hardened concrete.	2
CO5	Summarise the suitability of special concretes for different practical situations.	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. Shetty,M.S, "Concrete Technology", S.Chand and Company Ltd, New Delhi, Seventh Revised edition 2013, Reprint 2015
2. Santhakumar,A.R; "Concrete Technology" , Oxford University Press, New Delhi, Second edition 2018.

REFERENCES:

1. Gupta.B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
2. Neville, A.M; "Properties of Concrete", Pitman Publishing Limited, London, Fifth edition 2011
3. Gambir, M.L; "Concrete Technology", 3rd Edition, Tata McGraw Hill Publishing Co Ltd, New Delhi, Third Edition, Eleventh Reprint 2008
4. IS10262:2009 - Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi
5. ACI : 211.1-91, (reapproved 2002) - Standard Practice for selecting proportions for normal, heavyweight, and mass concrete : American Concrete Institute

CE22022 PRESTRESSED CONCRETE STRUCTURES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the need for prestressing as well as the methods, types and advantages of prestressing and the design of prestressed concrete elements and structures.

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 9

Basic concepts – Advantages – Materials – Systems and methods of prestressing – Analysis of sections – Stress concept – Strength concept – Load balancing concept – Effect of tendon profile on deflections – Factors influencing deflections – Losses of prestress – Estimation of crack width.

UNIT II DESIGN FOR FLEXURE AND SHEAR 9

Assumptions for calculating flexural stresses – Permissible stresses in steel and concrete – Design of sections of Type I and Type II post-tensioned and pre-tensioned beams – Check for strength limit based on I.S. 1343 Code – Layout of cables in post-tensioned beams – Location of wires in pre-tensioned beams – Design for shear

UNIT III DEFLECTION AND DESIGN OF ANCHORAGE ZONE 9

Factors influencing deflections – Short term and long term deflections - Determination of anchorage zone stresses in post-tensioned beams by Magnel's method, Guyon's method and IS1343 code – design of anchorage zone reinforcement – Check for transfer bond length in pre-tensioned beams.

UNIT IV COMPOSITE BEAMS AND CONTINUOUS BEAMS 9

Analysis and design of composite beams – Methods of achieving continuity in continuous beams – Analysis for secondary moments – Concordant cable and linear transformation – Calculation of stresses – Principles of design.

UNIT V MISCELLANEOUS STRUCTURES 9

Design of tension and compression members – Tanks, pipes and poles – Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements After successful completion of this course, the students will be able to	RBT level
CO1	Compute the stresses and assess the losses of prestressed concrete members.	4
CO2	Design a prestressed concrete member for flexure and shear based on IS code.	4
CO3	Calculate the short term and long term deflection and to design an anchorage zone of prestressed concrete beams.	4
CO4	Analyse and design composite and continuous prestressed concrete beams.	4
CO5	Design prestressed concrete structures such as tanks, pipes, poles, tension and compression members.	4

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, sixth edition, 2018.
2. Pandit.G.S. And Gupta.S.P. Prestressed Concrete, CBS Publishers and Distributers Pvt. Ltd., Second edition, 2014.

REFERENCES:

1. Lin T.Y. and Ned.H.Burns, Design of prestressed Concrete Structures, John Wiley and Sons, Third Edition, 1981.
2. Rajagopalan.N, Prestressed Concrete, Narosa Publishing House, 2002.
3. Dayaratnam.P., Sarah P, Prestressed Concrete Structures, Seventh Edition, Oxford and IBH, 2017.
4. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	2	-	2	-	3	-	-	-	-	3	3
CO2	3	2	3	2	-	2	-	3	-	-	-	-	3	3
CO3	3	2	3	2	-	2	-	3	-	-	-	-	3	3
CO4	3	2	3	2	-	2	-	3	-	-	-	-	3	3
CO5	3	2	3	2	-	2	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22023	PREFABRICATED STRUCTURES	L	T	P	C
		3	0	0	3

OBJECTIVE:

- To understand the principles of prefabrication, behavior and design of prefabricated components and structural connections.

UNIT I INTRODUCTION 9

Need for prefabrication – Principles - advantages and disadvantages - comparison of precast construction method and in-situ method – Materials – Modular coordination – Standardization - Systems – Production – Transportation – Erection

UNIT II PREFABRICATED COMPONENTS 9

Behavior of structural components – Large panel constructions – Construction of roof, floor slabs and Wall panels – Columns – Shear walls.

UNIT III DESIGN PRINCIPLES 9

Design of Structural components – Beam, Column and Corbel - Stress limitations – Handling without cracking, handling with controlled cracking – Design for stripping forces.

UNIT IV JOINTS IN STRUCTURAL MEMBERS 9

Joints for different structural connections – Beam to Column, Beam to Beam, Column to Column, Column to Foundation, Connections between wall panels, Connections between floor panels - Dimensions and detailing – Design of expansion joints- Jointing Materials.

UNIT V DESIGN FOR EARTHQUAKES AND CYCLONES 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:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Understand the principles of modular coordination	2
CO2	Know the construction of roof and floors	2
CO3	Design for stripping forces	2
CO4	Identify the different types of connections between structural members	2
CO5	Understand the concept of progressive collapse	2

TEXTBOOKS:

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 ,CRC Press, 2019
3. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift . "Precast Concrete Structures", Ernst & Sohn, Berlin, 2019.

REFERENCES:

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. Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

LIST OF NATIONAL AND INTERNATIONAL STANDARDS:

1. IS: 15916 -2011, Building Design and Erection using Prefabricated Concrete – Code of Practice
2. IS 11447:1985 - Code of practice for construction with large panel prefabricates
3. American Society of Civil Engineers, Reston, V "Minimum Design Loads for Buildings and Other Structures,2002 edition" ASCE 7-02, 2002.
4. ACI 318, "Building Code Requirements for Structural Concrete and Commentary, ACI 318-02" American Concrete Institute.
5. General Services Administration "Progressive Collapse Analysis and Design Guidelines for New Federal Office" GSA 2003b

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	2	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22024 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C
3	**0**	**0**	**3**

OBJECTIVE:

To acquire the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

UNIT I MAINTENANCE AND REPAIR STRATIGES 9

Maintenance, Repair and Rehabilitation - Facets of Maintenance - Importance of Maintenance - Various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration.

UNIT II STRENGTH AND DURABILITY OF CONCRETE 9

Quality assurance for concrete – Strength, Durability, of concrete - Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated, Corrosion - - Effects of cover thickness.

UNIT III SPECIAL CONCRETES 9

Polymer concrete - Sulphur infiltrated concrete - Fibre reinforced concrete - High strength concrete - High performance concrete - Vacuum concrete - Self compacting concrete - Geopolymer concrete - Reactive powder concrete - Concrete made with industrial wastes.

UNIT IV TECHNIQUES FOR REPAIR AND PROTECTION METHODS 9

Non-destructive Testing Techniques, 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 corrosion, fire, leakage and earthquake - Demolition techniques - Engineered demolition methods - Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Know the importance of inspection and maintenance.	2
CO2	Study the Impacts of cracks, corrosion and climate on structures.	2
CO3	Know about High Performance concrete.	2

CO4	Understand the materials and techniques needed for repairs.	2
CO5	Know the failures of the structures and demolition techniques	2

TEXT BOOKS:

1. Shetty.M.S. Jain A K., Concrete Technology - Theory and Practice, S.Chand and Company, Eighth Edition, 2019.
2. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution.1st edition 2009.

REFERENCES:

1. Hand book on Seismic Retrofit of Buildings, CPWD and Indian Buildings Congress, Narosa Publishers, 2008.

2. Hand Book on “Repair and Rehabilitation of RCC Buildings” – Director General works CPWD ,Govt of India , New Delhi – 2002

3. P.C.Varghese, Maintenance Repair and Rehabilitation & Minor works of building, Prentice Hall India Pvt Ltd 2014.

4. R. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth-Heinemann, Elsevier,New Delhi 2012.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	1	2	-	1	-	-	-	-	-	-	3	3
CO2	2	-	1	1	-	1	-	-	-	-	-	-	3	3
CO3	3	-	-	-	3	1	-	-	-	-	-	-	3	3
CO4	2	-	-	2	2	1	-	-	-	-	-	-	3	3
CO5	2	-	1	1	2	1	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22025 **ADVANCED STRENGTH OF MATERIALS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the advanced topics on strength of materials.

UNIT I CURVED BEAMS AND UNSYMMETRICAL BENDING 9

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

UNIT II STATE OF STRESS IN THREE DIMENSIONS 9

Stress tensor at a point – Stress invariants -Determination of principal stresses and principal planes – Volumetric strain –Theories of failure – Principal stress - Principal strain – shear stress – Strain energy and distortion energy theories – application problems.

UNIT III COLUMNS AND CYLINDERS 9

Euler's theory of long columns – critical loads for prismatic columns with different end conditions; Rankine-Gordon formula for eccentrically loaded columns – Eccentrically loaded short columns – middle third rule – core section

UNIT IV SPACE FRAMES, SHELLS and CYLINDERS 9

Analysis of Space trusses using method of tension coefficients - Thin cylindrical and spherical shells – stresses and change in dimensions - Thick cylinders – Compound cylinders

UNIT V FRICTION 9

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance – friction of solid materials – friction in fluid

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Estimate the stresses due to unsymmetrical bending and stresses in curved beams.	3
CO2	Estimate the principal stresses and principal planes due to three dimensional states of stresses and also study the theories of failure in materials.	3
CO3	Estimate the critical load of columns.	3

CO4	Analyse the space frames, shells and thick cylinders.	3
CO5	Determine the frictional forces in various applications.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Rajput.R.K. "Strength of Materials", S.Chand and Co, New Delhi, 2015.
2. Rattan . S. S, "Strength of Materials", Tata McGraw Hill Education Private Limited, New Delhi, 2012

REFERENCES:

1. Timoshenko.S.B. and Gere.J.M, "Mechanics of Materials", Van Nos Reinbhold, New Delhi 2006.
3. Irwing H.Shames, James M.Pitarresi, Introduction to Solid Mechanics, Prentice Hall of India, New Delhi, 2002
4. Beer. F.P. & Johnston.E.R."Mechanics of Materials", Tata McGraw Hill, Sixth Edition, New Delhi 2010.
5. Egor. P.Popov, Engineering Mechanics of Solids, Prentice Hall of India, Second Edition New Delhi 2015.
6. Srinath L. S., "Advance mechanics of solids", Tata McGraw-Hill Publishing Co., New Delhi, 2017.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22026 **STRUCTURAL DYNAMICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the basic concepts of modelling and analysis of systems subjected to dynamic forces.

UNIT-I INTRODUCTION TO STRUCTURAL DYNAMICS 9

Theory of vibrations – Lumped mass and continuous mass systems – Formulation of equations of motion by different methods - Single Degree of Freedom (SDOF) Systems – Un damped and damped free vibration - Forced vibrations – Response to harmonic excitation, periodic and impulsive loads – response to general dynamic loading – effect of damping – methods of evaluation of damping.

UNIT II TWO DEGREES OF FREEDOM SYSTEM 9

Formulation of equations of motion – Determination of natural frequencies of vibration and mode shapes – Orthogonal properties of normal mode

UNIT III MULTIPLE DEGREES OF FREEDOM SYSTEM 9

Mathematical models of multi-degree of freedom systems – orthogonality of normal modes – free and forced vibrations - Mode superposition method of obtaining response

UNIT IV CONTINUOUS SYSTEMS 9

Free and forced vibration of continuous systems, Rayleigh-Ritz method – formulation using conservation of energy , virtual work - applications

UNIT V DIRECT INTEGRATION METHODS FOR DYNAMIC RESPONSE 9

Damping in MDOF system – non linear MDOF, Wilson Theta method, Newmark beta method, step by step numerical integration method.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Analyse equations of motion for damped and un-damped vibrations for SDOF systems	3
CO2	Analyse equations of motion for two degrees of freedom systems and calculate the frequency & mode shapes	3

CO3	Analyse the MDOF systems and calculate the frequency & mode shapes	3
CO4	Analyse the continuous systems.	3
CO5	Analyse the system using direct integration methods for dynamic response	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Mario Paz, Structural Dynamics - Theory and Computations", 6th Edition, Pearson Education, 2005.

REFERENCES:

1. Chopra A.K., "Dynamics of Structures", 5th Edition, Pearson Education, Indian Branch,Delhi, 2007.
2. Clough &Penzien, "Dynamics of Structures", 4th Edition, McGraw Hill, International Edition, 2008.
3. Ashok K. Jain, "Dynamics of Structures with MATLAB application", 1st Edition, Pearson Education, 2016

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO5	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22027 **EARTHQUAKE RESISTANT DESIGN OF STRUCTURES**

L	T	P	C
3	0	0	3

OBJECTIVE:

To understand the behaviour of structures under dynamic, earthquake loading and design the structures as earthquake resistant as per codal provisions.

UNIT-I INTRODUCTION TO EARTHQUAKE 9

Seismology – Earthquake phenomenon – Causes and effects of earthquakes – Faults – Structure of earth – Plate Tectonics – Elastic Rebound Theory , Earthquake Hazard Map -Causes of Earthquakes - Classification of Earthquakes - Seismic waves -Energy release - Inertia forces, Natural period -Resonance.

UNIT-II EARTHQUAKE ENGINEERING AND MEASUREMENT 9

Earthquake Terminology – Source, Focus, Epicenter etc – Earthquake size – Magnitude and intensity of earthquakes –Seismic waves – Seismic zones – Seismic Zoning Map of India – Seismograms and Accelerograms, Transducers for velocity and acceleration measurements – Inductive Transducer LVDT- Cathode Ray Oscilloscope, frequency measuring instruments - XY Plotter Strip Chart recorder

UNIT-III EARTHQUAKE RESISTANT STRUCTURES 9

Performance of ground and buildings in past Earthquakes-Earthquake resistant measures in RC and Masonry buildings -Potential deficiencies of RC and Masonry buildings, ductile detailing-Design of non structural members-Problems on Torsional Provisions

UNIT-IV CODAL DESIGN PROVISIONS 9

Review of the latest Indian seismic code IS:1893 (Part-I) provisions for buildings – Earthquake design philosophy –Assumptions – Analysis by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion – Analysis of a multistoried building using Seismic Coefficient method. Codal Detailing Provisions: Review of the latest Indian codes IS: 4326 and IS: 13920 Provisions for ductile detailing of R.C buildings – Beam, column and joints.

UNIT-V ASEISMIC PLANNING 9

Plan Configurations – Torsion Irregularities – Re-entrant corners – Non-parallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings. Shear walls: Types – Design of Shear walls as per IS: 13920 – Detailing of reinforcements.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Write the equations of motion for damped and un-damped vibrations for SDOF systems	3
CO2	Analyse the MDOF systems and calculate the frequency & mode shapes	3
CO3	Associate with engineering seismology including causes and effects of earthquakes.	3
CO4	Analyze, design and detail a multi-storeyed structure using Seismic Coefficient and Response Spectrum methods	3
CO5	Explain the concept of aseismic planning, design and detail of Shear walls using I.S: 13920	3

TEXT BOOKS:

1. Mario Paz, Structural Dynamics - Theory and Computations”, 6th Edition, Pearson Education, 2005.
2. Pankaj Agarwal & Manish Shrikhande, Earthquake Resistant Design of Structures”, 5th Edition, Prentice Hall of India, New Delhi, 2009.
3. Jai Krishna A.R, Chandrasekharan A.R, Brijesh Chandra, Elements of Earthquake Engineering”, 2nd Edition, South Asian Publishers, New Delhi, 2001.

REFERENCES:

1. Chopra A.K., “Dynamics of Structures”, 5th Edition, Pearson Education, Indian Branch,Delhi, 2007.
2. Clough &Penzien, “Dynamics of Structures”, 4th Edition, McGraw Hill, International Edition, 2008.
3. S.K.Duggal, “Earth Quake Resistant Design of Structures”, Oxford university Press, 1st Edition, 2012.
4. Ashok K. Jain, “Dynamics of Structures with MATLAB application”, 1st Edition, Pearson Education, 2016

IS CODES:

1. IS 4326: 2013 Earthquake Resistant Design And Construction Of Buildings – Code of Practice
2. IS 1893: 2016 Criteria For Earthquake Resistant Design Of Structures – Part 1 General Provisions and Buildings.
3. IS 13920:2016 Ductile Design And Detailing Of Reinforced Concrete Structures Subjected to Seismic Forces – Code of Practice.

COURSE ARTICULATION MATRIX

COs	POs	PSOs

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	2	-	-	-	-	-	-	-	-	3	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	2	-	2	-	-	-	-	-	-	-	-	3	3
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	3
CO5	3	2	3	2	-	2	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22028 **SMART MATERIALS AND STRUCTURES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES :

This course is designed to give an insight into the latest developments regarding smart materials and their use in structures. Further, this also deals with structures which can self-adjust their stiffness with load.

UNIT I SMART MATERIALS FOR BUILDINGS 9

Introduction to Smart Materials and Structures – Instrumented structures functions and response – Sensing systems – Self diagnosis – Signal processing consideration – Actuation systems and effectors.

UNIT II MEASURING TECHNIQUES 9

Strain Measuring Techniques using Electrical strain gauges, Types – Resistance – Capacitance – Inductance – Wheatstone bridges – Pressure transducers – Load cells – Temperature Compensation – Strain Rosettes.

UNIT III SENSORS 9

Sensing Technology – Types of Sensors – Physical Measurement using Piezo Electric Strain measurement – Inductively Read Transducers – The LVOT – Fiber optic Techniques. Chemical and Bio-Chemical sensing in structural Assessment – Absorptive chemical sensors – Spectroscopes – Fibre Optic Chemical Sensing Systems and Distributed measurement.

UNIT IV ACTUATORS 9

Actuator Techniques – Actuator and actuator materials – Piezoelectric and Electrostrictive Material – Magnetorheological Material – Shape Memory Alloys – Electro-rheological Fluids– Electro-magnetic actuation – Role of actuators and Actuator Materials.

UNIT V SIGNAL PROCESSING AND CONTROL SYSTEMS 9

Data Acquisition and Processing – Signal Processing and Control for Smart Structures – Sensors as Geometrical Processors – Signal Processing – Control System – Linear and Nonlinear.

TOTAL PERIODS :45

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Describe the concept of smart materials and smart structures	2
CO2	Analyze the usage of strain measuring techniques	2
CO3	Analyze the various types of sensors and usage of sensing technology	2
CO4	Describe the types of actuators, actuator techniques and their applications	2
CO5	Explain the data acquisition processing systems in order to capture the data	2

TEXTBOOKS:

1. Mohsen shainpoor - Fundamentals of smart materials – Royal society of Chemistry - 2020
2. Brain Culshaw – Smart Structure and Materials - Artech House – Borton. London-2007.

REFERENCES:

1. L. S. Srinath – Experimental Stress Analysis – Tata McGraw-Hill, 1998.
2. J. W. Dally & W. F. Riley – Experimental Stress Analysis – Tata McGraw-Hill, 1998.
3. Ralph. C. Smith – Smart material systems model development- society for industrial and applied mathematics, Philadelphia, 2005

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	-	-	3	-	-	-	-	-	-	-	1	1
CO2	**2**	-	-	-	3	-	-	-	-	-	-	-	1	1
CO3	2	-	-	-	3	-	-	-	-	-	-	-	1	1
CO4	2	-	-	-	3	-	-	-	-	-	-	-	1	1
CO5	2	-	-	-	3	-	-	-	-	-	-	-	1	1

3-High, 2-Medium, 1-Low

CE22029 **DESIGN OF BRIDGES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To study the loads, forces on bridges and design of several types of bridges

UNIT I SHORT SPAN RC BRIDGES 9

Types of bridges and loading standards - Choice of type - I.R.C. specifications for road bridges – Design of RCC solid slab bridges -analysis and design of slab culverts , Tee beam and slab bridges.

UNIT II DESIGN PRINCIPLES OF LONG SPAN RC BRIDGES 9

Continuous girder bridges, box girder bridges, balanced cantilever bridges – Arch bridges – Box culverts.

UNIT III PRESTRESSED CONCRETE BRIDGES 9

Flexural and torsional parameters – Courbon's theory – Distribution co-efficient by exact analysis – Design of girder section – maximum and minimum prestressing forces – Eccentricity – Live load and dead load shear forces – Cable Zone in girder – check for stresses at various sections – check for diagonal tension – Diaphragms – End block – short term and long term deflections.

UNIT IV STEEL BRIDGES 9

General – Railway loadings – dynamic effect – Railway culvert with steel beams – Plate girder bridges – Box girder bridges – Truss bridges – Vertical and Horizontal stiffeners.

UNIT V BEARINGS AND SUBSTRUCTURES 9

Different types of bearings – Design of bearings – Design of piers and abutments of different types – Types of bridge foundations – Design of foundations.

TOTAL :45 PERIODS

OUTCOMES :

CO	**CO statements** After successful completion of this course, the students will be able to	**RBT level**
CO1	Design and analyse short span RC bridges	3
CO2	Design various long-span RC bridge types, including continuous girder, box girder, balanced cantilever, and arch bridges.	3
CO3	Utilize Courbon's theory, calculate distribution coefficients, and design girder sections for prestressed concrete bridges.	3
CO4	Design steel bridges under different loading conditions, including railway loads, and incorporate stiffeners for structural reinforcement.	3
CO5	Design bearings, piers, abutments, and foundations for bridges, ensuring stability and durability.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Jagadeesh.T.R. and Jayaram.M.A., "Design of Bridge Structures", Prentice Hall of India Pvt. Ltd. 2009.
2. Johnson Victor, D. "Essentials of Bridge Engineering", Oxford and IBH Publishing Co. New Delhi, 2019.

REFERENCES:

1. Sinha.N.C. And Roy.S.K. Fundamentals of Prestressed Concrete, S.Chand and Co. Ltd., 2011.
2. Ponnuswamy, S., "Bridge Engineering", Tata McGraw Hill, 2008.
3. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, fifth edition, 2012.
4. Pandit.G.S. And Gupta.S.P. Prestressed Concrete, CBS Publishers and Distributers Pvt. Ltd., Second edition, 2014.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	-	3	-	3	-	-	-	-	3	3
CO2	3	3	3	2	-	3	-	3	-	-	-	-	3	3
CO3	3	3	3	2	-	3	-	3	-	-	-	-	3	3
CO4	3	3	3	2	-	3	-	3	-	-	-	-	3	3
CO5	3	3	3	2	-	3	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22020 **MINI PROJECT**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The project work shall be carried out in the same domain of the specialized vertical for students registered for Honours with Specialisation and Minors by other department students.
The project topic for the students registered for Honours shall be finalized by the DCC.

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

PROFESSIONAL ELECTIVE

VERTICAL 3

CONSTRUCTION MANAGEMENT

CE22031 CONSTRUCTION MATERIALS AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge to classify the different types of construction materials and perform inventory and procurement management effectively in construction sites.

UNIT I CONSTRUCTION MATERIALS 9

Classification of construction materials – Cement, Sand, Aggregates, Steel, Aluminum, Glass, Bricks, Construction chemicals and admixtures, Water proofing materials and other Miscellaneous materials – Properties, applications, storage and handling

UNIT II MATERIAL MANAGEMENT 9

Introduction to Material Management and its role in construction industry – Functions - Scope and Importance in construction projects, Objectives of material management – Role of materials manager - Factors affecting material management in construction projects – Types of material costs – Direct and Indirect – Material schedule

UNIT III CLASSIFICATION AND CODIFICATION OF CONSTRUCTION MATERIALS 9

ABC, FSN, VED analysis - Procedure and its use, Standardization in materials and their management, Procurement, identification of sources of procurement, vendor analysis - Vendor analysis concept - Material requirement planning (MRP), planning, purchase procedure, legal aspects

UNIT IV INVENTORY MANAGEMENT 9

Need for Inventory – Inventory turnover ratio – Inventory related cost – functions of inventory – Inventory Model – EOQ Model – Factors affecting EOQ, Inventory Planning Process – Planning inventory of repetitive and non-repetitive materials – Lead time, safety stock, working stock – concept of (JIT) - Just in time management – Material Provisioning process

UNIT V STORE MANAGEMENT 9

Store Management - Receipt and inspection, care and safety in handling, loss on storage, wastage, Bulk purchasing, site layout and site organization, Materials Wastage standard – Quality control on construction materials - Check list

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the properties, applications, storage and handling of different construction materials	3
CO2	Identify the needs and functions of material management	3
CO3	Classify materials, identify sources of procurement and conduct vendor analysis	3
CO4	Perform effective inventory management in construction projects	3
CO5	Manage stores and exercise quality control on materials	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Kumar Neeraj Jha, Construction Project Management – Theory and Practice, Pearson Publications – Dorling Kindersley (India) Pvt. Ltd
2. Chitkara.K.K, (2014), Construction Project Management, 3rd Edition, McGraw-Hill Publishing Company, New Delhi.
3. Mamlouk. M.S. and Zaniewski. J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 2000.

REFERENCES:

1. Menon K.S., “Purchasing and Inventory Control”, Wheeler Publication, 1993
2. Ministry of Rural Development, GOI, “Procurement Manual”, National Rural Livelihoods Project, 2010
3. Chitale A.K. and R.C. Gupta, “Material Management – Text and Cases”, Prentice Hall of India Pvt. Ltd., 2007
4. "A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Fourth Edition, An American National Standard, ANSI/PMI 990001-2008"
5. Jhamb L.C., “Inventory Management”, Everest Publishing house, 2005

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	2	-	-	-	-	-	-	-	-	3	3
CO2	3	2	-	2	-	-	-	-	-	-	2	-	3	3
CO3	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO4	3	2	2	2	-	-	-	-	-	-	2	-	3	3
CO5	3	2	-	2	-	-	-	-	-	-	2	-	3	3

3-High, 2-Medium, 1-Low

CE22032 CONSTRUCTION EQUIPMENT AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

- To understand the importance and applications of various types of equipment's used for construction operations.

UNIT I EQUIPMENT FOR EARTHWORK 9

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers – Dozer, Excavators, Rippers, Loaders, trucks and hauling equipment, Compacting Equipment, Finishing equipment.

UNIT II OTHER CONSTRUCTION EQUIPMENTS 9

Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment – Cranes - Equipment for Dewatering and Grouting – Equipment for Demolition.

UNIT III CONCRETING EQUIPMENT 9

Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment

UNIT IV MATERIAL HANDLING EQUIPMENT 9

Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes – Tower crane, Mobile crane - Industrial Trucks.

UNIT V CONSTRUCTION EQUIPMENT MANAGEMENT 9

Identification – Planning and Selection of Equipment - Equipment Management in Projects - Construction Equipment - Choice of Equipment and Standard Production Rates - Estimation of Equipment Requirement - Depreciation – Replacement of Equipment

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment	3
CO2	Understand the importance of special construction equipment's and its applications	3
CO3	Apply the knowledge on concreting equipment's and its applications	3
CO4	Apply the knowledge and select the suitable material handling equipment for the construction project	3
CO5	Manage construction equipment effectively in the construction site	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Construction Equipment and Management, Sharma S.C. Khanna Publishers, New Delhi, 1988.
2. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2006.
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 2001.

REFERENCES:

1. Mahesh Varma, Construction Equipment and its Planning and Applications, Metropolitan Book Co. (P) Ltd., New Delhi, India.
2. Kumar Neeraj Jha, Construction Project Management – Theory and Practice, Pearson Publications – Dorling Kindersley (India) Pvt. Ltd.
3. Chitkara, K.K (2014), Construction Project Management, 3rd Edition, McGraw-Hill Publishing Company, New Delhi.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	2	-	-	-	-	-	-	2	-	3	3
CO2	3	2	-	2	-	-	-	-	-	-	2	-	3	3
CO3	3	2	-	2	-	-	-	-	-	-	2	-	3	3
CO4	3	2	-	2	-	-	-	-	-	-	2	-	3	3
CO5	3	2	2	2	-	-	-	-	-	-	2	-	3	3

3-High, 2-Medium, 1-Low

CE22033 FORMWORK SCAFFOLDING AND SHORING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To study and understand the various types of formworks, scaffolding and shoring methods and techniques

UNIT I FORMWORK MATERIALS AND ACCESSORIES 9

Introduction – Formwork as a temporary structure - Materials used for formwork, Requirements of good formwork – Economy in formwork – Timber, Plywood, Steel, Aluminium and Accessories - Horizontal and Vertical Formwork Supports - Types - Flying Formwork, Table Form, Tunnel Form, Formwork for Precast Concrete

UNIT II PLANNING AND DESIGN OF FORMWORK 9

Introduction - Forms for foundations, columns, beams, walls, slabs - Pressures on formwork - Examples - Vertical loads for design of slab forms - Uplift on shores - Laterals loads on slabs and walls – Design of Wall forms - Slab forms - Beam forms - Column forms - Examples in each

UNIT III FORMS FOR DOMES, TUNNELS AND SLIP FORMS 9

Formwork for domes - Hemispherical, Parabolic, Translational shells - Typical barrel vaults - Tunnel forming components - Curb forms invert forms - Arch forms - Concrete placement methods - Cut and cover construction, Slip Forms – Principles - Types - advantages - Functions of various components - Planning - Safety in slip forms

UNIT IV SCAFFOLDING SYSTEM 9

Types of scaffolds - Putlog and independent scaffold - Single pole scaffolds – Truss suspended - Gantry and system scaffolds – timber scaffolds, metal scaffolds and some proprietary scaffolds - Advantages and Limitations - possible causes for collapse of scaffold systems.

UNIT V SHORING SYSTEM 9

Shoring – Definition, Objectives – Materials used in the shoring system – Installation and Dismantling of shoring system – General requirements - Different types of shoring methods - Raking, flying and dead shores - Shoring System for Deep Excavation

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Select suitable materials and accessories for formwork connection	3
CO2	Develop a suitable planning and design of formwork system	3
CO3	Apply the knowledge of forms and their erection for domes, tunnels and slip forms	3
CO4	Identify appropriate scaffolding system for construction project.	3
CO5	Identify appropriate shoring system for construction project.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Robert L. Peurifoy and Garold D. Oberlender, Formwork for Concrete Structures, McGraw - Hill, 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996.
3. Kumar Neeraj Jha., Formwork for concrete structures, McGraw Hill Education (India) Private Limited, New Delhi,2017.

REFERENCES:

1. Michael P. Hurst, Construction Press, London & New York, 2003.
2. Austin, C.K., Formwork for Concrete, Cleaver - Hume Press Ltd., London, 1996
3. Tudor Dinescu and Constantin Radulescu, Slip Form Techniques, Abacus Press, Turn Bridge Wells, Kent, 2004.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	2	3	2	-	-	-	-	-	-	-	-	3	3
CO3	3	2	2	2	-	1	-	-	-	-	-	-	3	3
CO4	3	2	2	2	-	1	-	-	-	-	-	-	3	3
CO5	3	2	2	2	-	1	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22034	CONSTRUCTION QUALITY AND SAFETY MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of this course is

- To study the concepts of quality assurance and control techniques for the construction projects.
- To study the various causes of construction accidents and cost of construction injuries.
- To understand about the various safety programmes and laws related to safety to improve jobsite safety.

UNIT I QUALITY MANAGEMENT 9

Introduction – Definitions and objectives – Factors influencing construction quality – Responsibilities and authority – Quality plan – Quality Management Guidelines – Quality circle, Quality Policy, Objectives and methods in Construction industry – Taguchi's concept of quality – Codes and Standards – Inspection procedure – Total QA / QC programme and cost implication

UNIT II QUALITY ASSURANCE AND CONTROL 9

Owner, design, and construction-oriented objectives – Techniques and needs of QA/QC – Different aspects of quality – Quality checklist in sites - factors affecting site layout - Supervisor's responsibilities - storage and protection of construction materials and equipment - testing and quality - Purpose of inspection: Inspection of various components of construction; Statistical quality control - Control charts - Acceptance sampling

UNIT III CONSTRUCTION ACCIDENTS 9

Injury and Accidents – Causes, Investigations and Prevention of Accidents – Unsafe conditions and Unsafe acts - Hazards – Types, Nature, Causes and Control Measures - Human Factors in Construction Safety - Costs of Construction Injuries - Occupational and Safety Hazard Assessment - Legal Implications

UNIT IV SAFETY PROGRAMMES 9

Need - Safety provisions - Laws related to the Industrial Safety - Measurement of Safety Performance - Problem Areas in Construction Safety - Elements of an Effective Safety Programme – Job site Safety Assessment – Safety Meetings - Safety Incentives - Substance Abuse – Safety Record Keeping – Ergonomics in Construction

UNIT V SAFETY AND HEALTH MANAGEMENT 9

Safety Culture - Safe Workers - Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Safety Personnel - Safety Procedures - Occupational Health - Health Hazards in Construction Site - Disease Prone Environment in Construction Site - Precautionary Measures - Health Monitoring and Treatment - Safety Measures during Material Handling

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the importance of quality and quality management methods in construction	3
CO2	Apply the concepts of quality assurance and control techniques in construction	3
CO3	Identify the causes, investigations and prevention of accidents in the construction jobsite.	3
CO4	Apply the knowledge of safety programmes to improve the jobsite safety	3
CO5	Manage health and safety effectively in the construction site	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Dale H. Besterfield, Carol Besterfield -Michna, Glen H. Besterfield, Mary Besterfield - Sacre, Total Quality Management, Pearson Education, Prentice Hall
2. Jimmy W. Hinze, "Construction Safety", Prentice Hall Inc., 1997
3. James, J.o’ Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
4. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.

REFERENCES:

1. Juran Frank, J.M. and Gryna, F.M. "Quality Planning and Analysis", McGraw Hill, 2001.
2. Tamil Nadu Factory Act, Department of Inspectorate of factories, Tamil nadu.
3. BIS Code of Practice for Safety Management.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	3	-	-	-	-	1	-	3	3
CO2	3	2	2	2	-	3	-	-	-	-	-	-	3	3
CO3	3	2	3	2	-	3	-	-	-	-	-	-	3	3
CO4	3	2	3	2	-	3	-	-	-	-	-	-	3	3
CO5	3	2	3	2	-	3	-	-	-	-	1	-	3	3

3-High, 2-Medium, 1-Low

CE22035	RISK MANAGEMENT IN CONSTRUCTION PROJECTS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to develop the understanding of strategic and operational risk management in construction projects.

UNIT I RISK CONCEPTS 9

Definitions of risk - Importance and types of risk - Elements of risk management - Causes of risk - Principles of risk management - managing risk in the public and private sectors - Risk management process – Factors affecting risk management

UNIT II PLANNING FOR RISK 9

Components of risk management - Planning for risk management - Project charter - Risk management policies - roles and responsibilities - revisiting the work breakdown structure - risk management plan - risk registers - creating the risk management plan - risk analysis – tracking - Risk Management Framework

UNIT III RISK IDENTIFICATION 9

Identifying risk - preparing for risk identification - risk categories - referring to historical information - reviewing project documents - brainstorming - the Delphi technique - SWOT - diagrammatic techniques

UNIT IV RISK RESPONSE AND COMMUNICATION 9

Preparing for risk response - creating risk response - result of risk response planning - risk monitoring and control – risk communication - informing public about risk and responding to express concerns – risk evaluation process

UNIT V RISK MANGEMENT ASPECTS 9

Risk planning and management case studies - engineering contracts, project delivery - strategies and international project risk - management of risk in construction industry - dealing with uncertainties - risk mitigation techniques - Risk management in computer software

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Apply the knowledge of risk concepts and principles in the construction projects	3
CO2	Formulate an appropriate risk management plan for construction projects.	3
CO3	Identify the project risks using suitable methodologies and the ability to apply them in practice.	3
CO4	Understanding the need for risk response and communication	3

CO5	Apply the knowledge of risk management practices in the construction industry.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. PMP Project Management Professional Study Guide, Joseph Phillips, McGraw – Hill
2. Bruce Barkley, Project Risk Management (Project Management)
4. John R. Schuyler, Risk and Decision analysis in Projects (Cases in project and program management series)
7. Chris Chapman and Stephen Ward, Project Risk Management: Processes, Techniques and Insights.

REFERENCES:

1. Dale F. Cooper, Stephen Grey, Geoffrey Raymond, and Phil Walker, Project Risk Management Guidelines: Managing Risk in Large projects and Complex Procurements.
2. William G. Ramroth, Risk Management for Design Professionals.
3. James B. Atkins and Grant A. Simpson, Managing Project Risk: Best Practices for Architects and Related Professionals.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	2	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	2	-	-	-	-	-	-	3	3
CO3	3	3	2	2	-	2	-	-	-	-	-	-	3	3
CO4	3	3	2	2	-	2	-	-	-	-	-	-	3	3
CO5	3	3	2	2	-	2	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22036	CONTRACT MANAGEMENT AND DISPUTE RESOLUTION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

The objective of this course is

- To understand and interpret the various elements of contract documents, and properly administer the contracts clauses.
- To prepare and submit a tender for a construction project and to evaluate a tender document received for the award of a contract.
- To understand the arbitration process and its procedures.
- Apply the knowledge on various laws & labour regulations and their impact on managing contracts.

UNIT I CONSTRUCTION CONTRACTS 9

Indian Contracts Act – Elements of Contracts – Types of Contracts – Features – Suitability – Design of Contract Documents – International Contract Document – Standard Contract Document – Law of Torts

UNIT II TENDERS 9

Prequalification – Bidding – Accepting – Evaluation of Tender from Technical, Contractual and Commercial Points of View – Contract Formation and Interpretation – Potential Contractual Problems – World Bank Procedures and Guidelines – Tamil Nadu Transparency in Tenders Act

UNIT III ARBITRATION 9

Comparison of Actions and Laws – Agreements – Appointment of Arbitrators – Conditions of Arbitration – Arbitration Tribunals - Powers and Duties of Arbitrator – Enforcement of Award – Arbitration and Conciliation Act 1996

UNIT IV LEGAL REQUIREMENTS 9

Insurance and Bonding – Laws Governing Sale, Purchase and Use of Urban and Rural Land – Land Revenue Codes – Tax Laws – Income Tax, Sales Tax, Excise and Custom Duties and their Influence on Construction Costs – Legal Requirements for planning – Local Government Laws for Approval – Statutory Regulations

UNIT V LABOUR REGULATIONS 9

Social Security – Welfare Legislation – Laws relating to Wages and Bonus Disputes, Labour Administration – Insurance and Safety Regulations – Workmen’s Compensation Act – Indian Factory Act – Tamil Nadu Factory Act – Child Labour Act - Other Labour Laws.

TOTAL :45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Draft the construction contract as per the regulations	3
CO2	Apply the knowledge of bidding process and evaluate the tender document as per the procedure.	3
CO3	Understand the process of Arbitration and exercise the powers and duties of arbitrator	3
CO4	Explain the various legal requirements to be met in relation to land and construction	3
CO5	Identify and apply the provisions provided in the labour welfare schemes.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Gajaria G.T., Laws Relating to Building and Engineering Contracts in India, 2000.
2. Jimmie Hinze, Construction Contracts, McGraw Hill, 3rd Edition, 2013.
3. Ali D. Haidar, Handbook of Contract Management in Construction, Springer Cham, 1st Edition, 2021
4. Patil. B.S, Civil Engineering Contracts and Estimates, Universities Press (India) Private Limited, 4th Edition 2015.
5. Dharmendra Rautray, Principles of Law of Arbitration in India, Wolters Kluwer, 2018.

REFERENCES:

1. Joseph T. Bockrath, Contracts and the Legal Environment for Engineers and Architects, McGraw Hill, 2000.
2. Kwaku, A., Tenah, P.E. Jose M. Guevara, P.E., Fundamentals of Construction Management and Organisation, Printice Hall, 1985

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	1	-	3	-	3	-	-	-	-	3	3
CO2	3	2	-	2	-	3	-	3	-	-	-	-	3	3
CO3	3	2	-	2	-	3	-	3	-	-	-	-	3	3
CO4	3	2	-	2	-	3	-	3	-	-	-	-	3	3
CO5	3	2	-	1	-	3	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22037 SUSTAINABLE CONSTRUCTION

	L	T	P	C
	3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge about sustainable construction and to understand the concepts of sustainable materials, energy calculations, green buildings and environmental effects.

UNIT I OVERVIEW ON SUSTAINABILITY 9

Introduction and definition of Sustainability – Pillars of sustainability - Carbon cycle - role of construction material: concrete and steel, etc. – CO_2 contribution from cement and other construction materials – Carbon credit - Circular economy in the build environment - sustainable development goals

UNIT II MATERIALS USED IN SUSTAINABLE CONSTRUCTION 9

Sustainable materials - No/Low cement concrete - Recycled and manufactured aggregates, alternative cementitious material, Sustainability issues for concrete – Role of insulation and thermal properties of construction materials - Strategy in materials selection - Life cycle assessment for building materials

UNIT III ENERGY AND WATER EFFICIENCY ASPECTS 9

Thermal comfort inside the building – Factors - U value - Components of embodied energy - calculation of embodied energy for construction materials - Embodied energy and operational energy in conditioned building - Low Energy Building Strategies - Water efficiency techniques - 3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling

UNIT IV GREEN BUILDINGS 9

Concept of green building, Need of green building in present scenario, Importance of green building - Assessment methods - Global assessment and certification - Features of LEED – IGBC - GRIHA ratings - Control of energy use in building - ECBC code – OTTV concepts – Environmental Impact assessment

UNIT V ENVIRONMENTAL EFFECTS 9

Non-renewable sources of energy and Environmental aspects – energy norms, coal, oil, natural gas - nuclear energy - Global temperature, green house effects, global warming - Climate Change, Deforestation, Loss of Biodiversity – environmental, social and governance model in sustainable construction

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the concept of sustainability and its importance in construction industry.	3
CO2	Evaluate less carbon emission materials for construction.	3
CO3	Utilize and manage the energy and water efficiently for the building	3
CO4	Interpret the features of LEED, TERI and GRIHA ratings of buildings.	3
CO5	Explain the environmental effects of non-renewable energy sources.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Charles J Kibert, Sustainable Construction: Green Building Design & Delivery, 4th Edition, Wiley Publishers 2016.
2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell, UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011

REFERENCES:

1. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2012.
2. New Building Materials and Construction World magazine
3. Dr. Dinesh Kumar Gupta, Vaibhao K. Sonarkar, Enery Conservation and Building, Nirali Prakashan Publishers 2019.
4. Abe Kruger and Carl Seville, "Green building: principles and practices in residential construction", Cengage learning, 2012.
5. Sam Kubba, Handbook of green building and construction, Butterwort – Heineman, 2012

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	-	-	2	3	-	-	-	-	-	3	3
CO2	3	2	2	1	-	-	3	-	-	-	-	-	3	3
CO3	3	2	2	1	-	-	3	-	-	-	-	-	3	3
CO4	3	2	2	1	-	2	3	-	-	-	-	-	3	3
CO5	3	2	-	-	-	2	3	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22038	BUILDING SERVICES AND MAINTENANCE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to highlight the importance of different types of building services such as Electrical, Mechanical, Plumbing and fire protection systems and its applications in building and also to develop an appropriate maintenance information system for the building.

UNIT I BASICS OF BUILDING SERVICES 9

Basics of building services - Definitions - Objective - Applications - Classification of building services - selection of services - Natural and artificial lighting - principles and factors - Necessity of Ventilation Types – Natural and Mechanical - Factors to be considered in the design of Ventilation

UNIT II ELECTRICAL AND MECHANICAL SERVICES 9

Electrical services in the building - Technical terms and symbols for electrical installations and Accessories of wiring - Types of insulation – electrical layout for building - Introduction of mechanical services – Lift & Escalators - Definition, Types, Design Considerations, Location, Sizes, Components – HVAC - Air Conditioning - Terminologies, Principles, Guidelines - Types of Air Conditioners

UNIT III FIRE PROTECTION SYSTEM 9

Causes and Effects of fire - Standard for fire safety - Fire-Resisting Properties of Building Materials - General Requirements of Fire Resisting building as per NBC - Fire resistance/Firefighting and extinguishing systems - Means of escape, alarms, etc - Space requirements – Guidelines – Thermal Insulation – Principles, Purpose – Heat Insulation Materials

UNIT IV PLUMBING SERVICES 9

Water supply – Terminologies, Design principles, water supply requirements for building – Waste water systems– Layout, Design principles and recommendations for residential building – Gas supply – Installation and leakage check

UNIT V BUILDING MAINTENANCE 9

Building Maintenance – Maintenance of floorings, Doors & Windows, Paintwork, Brickwork – Cracks and Remedial measures in concrete – Checking building leakage - Types of maintenance – Scheduled and contingency maintenance – Maintenance strategy and inspection frequencies - MIS for building maintenance

TOTAL :45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the different building services based on the building type and the parameters to be considered.	3
CO2	Summarise the electrical and mechanical services in the building	3

CO3	Apply fire protection and fire resistance systems for multi-storied buildings as per regulations	3
CO4	Apply the knowledge of plumbing services in the building	3
CO5	Understand the scope of building services and be able to develop a suitable maintenance strategy for the building.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

3. David. V. Chadderton - Building Services Engineering, 5th edition (2007)
4. Barrie Chanter, Peter Swallow-Building Maintenance Management – Wiley - Blackwell (2007).
5. National Building Code of India - 2005, Bureau of Indian Standards, BIS, New Delhi
6. S. M. Patil, Building Services, Seema Publication, Mumbai Revised edition, 2014
7. William H. Severns and Julian R. Fellows, Air conditioning and refrigeration, John Wily and sons

REFERENCES:

1. SP 32 (1986) - Lighting and Ventilation
2. SP 30 (2011) - National Electrical Codes.
3. SP 35 - Handbook on water supply and Drainage.
4. IS 14665 (2000) - Part I, Part II, Part IV- Lifts.
5. IS 1172 (Reaffirmed 2002) -Code for basic Requirement for Water Supply, Drainage and Sanitation.
6. IS 2065 (Reaffirmed 1996) - Code of Practice for Water Supply in Buildings.
7. IS 1742 (Reaffirmed 2002) - Code of practice for building drainage.
8. IS 12183 (Reaffirmed 2004) - Code of Practice for Plumbing in Multi-Storied Buildings.
9. IS 15105 (2002) - Code of Practice for Fire Sprinklers.
10. IS 1641 to IS 1646 - Code of Practice for Fire Safety in Buildings
11. R. Udayakumar, A Text Book of Building Services, Eswar Press, Chennai
12. P. Purushothama Raj, Building Construction Materials and techniques, Pearson India Education Services Pvt. Ltd, 2017

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	2	3	2	-	-	-	2	-	-	-	-	3	3
CO3	3	2	3	2	-	-	-	2	-	-	-	-	3	3
CO4	3	2	3	2	-	-	-	2	-	-	-	-	3	3
CO5	3	2	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22030 **MINI PROJECT**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The project work shall be carried out in the same domain of the specialized vertical for students registered for Honours with Specialisation and Minors by other department students.
The project topic for the students registered for Honours shall be finalized by the DCC.

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

PROFESSIONAL ELECTIVE

VERTICAL 4

TRANSPORTATION ENGINEERING

CE22041	PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Student gains knowledge on latest I.R.C. guidelines for designing Rigid and Flexible Pavements.

UNIT I FUNDAMENTALS OF PAVEMENT DESIGN 9

Functions and desirable characteristics of pavement – Pavement Courses – Pavement Types – Comparison of rigid and flexible pavements – Factors affecting pavement design: Design life – Reliability – Traffic factors – Climatic factors – Road geometry – Sub-grade strength and drainage

UNIT II BASICS OF FLEXIBLE PAVEMENT DESIGN 9

Introduction to Guidelines for the design of flexible pavements (IRC:37-2018) – Design principles – Performance criteria: Sub-grade rutting criteria – Fatigue cracking criteria for bituminous layer – Fatigue performance models for Cement Treated Base (CTB) – Reliability – Analysis of Flexible Pavements – Computation design traffic

UNIT III ANALYSIS OF FLEXIBLE PAVEMENT LAYERS 9

Pavement composition – Sub-grade – Selection of dry density and moisture content for laboratory testing of sub-grade material – Resilient modulus of the sub-grade – Effective modulus/ CBR for design – Granular (unbound) sub-base layer – Cementitious (Cement Treated) sub-base (CTSB) Layer – Unbound base layer – Cementitious bases (CTB) – Bituminous layers – Resilient modulus of bituminous mixes

UNIT IV BASICS OF RIGID PAVEMENT DESIGN 9

Factors affecting design – Wheel load and its repetitions – Area of contact of wheel – Location of the load with reference to the slab – sub-grade strength and properties – sub-base provision or omission – strength of concrete – Modulus of elasticity – Poisson's ratio – Shrinkage properties of concrete – Fatigue behaviour of concrete – Temperature changes - Analysis of stresses (Westergaard's equation) – Temperature stresses – other stresses – Critical combination of stresses.

UNIT V RIGID PAVEMENT DESIGN USING IRC GUIDELINES 9

IRC Guidelines – Sample Problems – Reinforcement in Slab – Function – Reinforcement Design – Location of reinforcement – Design of joints – Need for joints – Types of joints – Requirements of joints – Expansion joints – Contraction joints – Warping joints – Construction joint – Longitudinal joints – Spacing of joints – Design of Dowel bars – Design of Tie bars

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Demonstrate the various factors influencing the pavement design	2
CO2	Summarize the factors considered for flexible pavement design using IRC:37-2018	2
CO3	Design the flexible pavement layers using IRC:37-2018	3
CO4	Summarize the factors considered for rigid pavement design	2
CO5	Design the rigid pavement using IRC:58-2011 & design the Dowel bar and tie bar for CC pavements	3

1-Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS:

1. L.R.Kadiyali and N.B. Lal, "Highway Engineering", Khanna Publishers, New Delhi, 2013.
2. Veeraragavan.A, Khanna.K and Justo C.E.G. Highway Engineering, Nem Chand and Brothers Publishers, 2016 (10th edition).

REFERENCES:

1. Yoder, R.J. and Witcak M.W. "Principles of Pavement Design", John-Wiley, 2000.
2. Guidelines for the Design of Flexible Pavements, IRC: 37-2018, The Indian Road Congress.
3. Guidelines for the Design of Rigid Pavements, IRC: 58-2011, The Indian Road Congress.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	3	2	-	-	-	-	2	-	-	-	-	-	3
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	3
CO5	3	3	2	-	-	-	-	2	-	-	-	-	-	3

3-High, 2-Medium, 1-Low

CE22042 DESIGN OF PEDESTRIAN AND BICYCLE TRACKS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to create awareness on safe design aspects of walkways and cycle tracks.

UNIT I DESIGN OF PEDESTRIAN TRACK 9

Glossary of terms – Introduction – Definition of pedestrian – Scope – General principles – Pedestrian Level of Service – Concept of Pedestrian Level of Service – Physical Characteristics: Footpath surface, Footpath width, Obstructions, Encroachment, Potential for vehicle conflict, Continuity – User Characteristics: Safety & Security, Comfort, and Walk environment.

UNIT II PEDESTRIAN FACILITIES DESIGN STANDARDS 9

Footpath – Clear walking zone – Clear height – Width – Frontage Zone – Surface quality – Cross falls – Service covers – Pedestrian guardrails – Design – Applications: Hazardous locations on straight stretches, at Junctions/intersections, schools/colleges, Bus stops, railway stations, etc., overpass, subway, etc. central reserves - Installation guidelines – Obstructions – Overhanging and other obstructions – Others – continuity and consistency – tactile pavers -

UNIT III PEDESTRIAN CROSSING 9

Principles of pedestrian crossings – Key guidelines – Components of pedestrian crossings – Zebra crossing – siting of zebra crossing – Width of zebra crossing – Guard-rails and lighting – Zebra crossing at signalized intersections – Refuge islands – Types of pedestrian crossings – At-grade pedestrian crossings – Grade separated pedestrian crossing facilities – Warrants – Layout of grade separated pedestrian facilities – requirements of pedestrian subway.

UNIT IV CYCLE TRACK DESIGN 9

Introduction – Definitions – Justification for the provision of cycle tracks and their capacity – Types – Horizontal curves – Vertical curves – Gradients – Sight distance – Lane width – Width of pavement – Clearance – Cycle tracks on bridges – Riding surface and lighting.

UNIT V SAFE & IDEAL CYCLE TRACK 9

Coherence: Coherence at Network level, Coherence at Road section level, Coherence at intersection level – Road Safety: at Network level, Road Safety at Road section level, Road Safety at intersection level, Road Safety at surface level – Comfort – Attractiveness: at Network level, Attractiveness at Road section level, Attractiveness at intersection level

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Explain the design standards for a good walkways (IRC)	2
CO2	Explain the design standards for location-specific pedestrian facilities (IRC)	2

CO3	Summarize the design standards for a pedestrian crossing	2
CO4	Explain the design standards for a good cycle track (IRC)	2
CO5	Demonstrate the design standards for a safe & ideal cycle track	2

1-Remember, 2- Understand, 3- Apply, 4- Analyze, 5- Evaluate, 6- Create

TEXT BOOKS:

1. L.R. Kadiyali, Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi, 2017.

REFERENCES:

1. Guidelines for Pedestrian Facilities, IRC: 103-2012, Indian Road Congress, New Delhi.
2. Recommended Practice for the Design and Layout of Cycle Track, IRC: 11-1962, Indian Road Congress, New Delhi.
3. Urban Cycling Design Guidelines, Pune Cycle Plan, Dec. 2017.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	3	-	-	3	-	3	-	-	-	-	-	3
CO2	-	-	3	-	-	3	-	3	-	-	-	-	-	3
CO3	-	-	3	-	-	3	-	3	-	-	-	-	-	3
CO4	-	-	3	-	-	3	-	3	-	-	-	-	-	3
CO5	-	-	3	-	-	3	-	3	-	-	-	-	-	3

3-High, 2-Medium, 1-Low

CE22043	AIRPORT AND HARBOUR ENGINEERING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to provide a brief introduction on design of an airport components and Harbour.

UNIT I TAXIWAY DESIGN 9

General – Layout of taxiways – Geometric standards for taxiways: length of taxiway, longitudinal gradient, rate of change of longitudinal gradient, sight distance, transverse gradient, turning radius (problem) – width of safety area – width of taxiway – Exit taxiways – design of exit taxiways - problem.

UNIT II PLANNING AND DESIGN OF TERMINAL AREA 9

General – Terminal building – Design objectives – facilities to be provided – Noise control – Planning considerations – Site selection – Space requirements – Passenger flow: arrival, check-in, waiting, security screening, departure, deplaning – Parking of vehicles – Size of apron – gate position – number of gates – problems – systems of aircraft parking – Apron turntable – Hangars.

UNIT III AIRPORT PAVEMENT DESIGN 9

General – Types of pavements – choice of the type of pavement – design factors – characteristics of construction materials – subgrade soil – wheel load – design of flexible pavements – design of rigid pavements – FAA method – method based on Westergaard's analysis – PCA method – LCN method of pavement design – problems.

UNIT IV MAINTENANCE DREDGING 9

General – disposal of the dredged material – types of dredging devices – Dipper dredge – Grapple dredge – operation – Continuous bucket elevator or ladder dredging – Hydraulic or suction dredge – operation – choice of dredger – execution of dredging work.

UNIT V NAVIGATIONAL AIDS 9

Necessity for signals – fixed and floating light stations – lighthouse – Lighthouse construction – Lights of Lighthouse – requirements of a signal – types of signals – light signals – Beacons – Buoys – mooring Buoys – fog signals – Audible signals – offshore moorings.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the design of taxiways	2
CO2	Explain the planning and design of a terminal building	2
CO3	Explain the design of runway pavement	2
CO4	Explain the maintenance dredging and its importance	2

CO5	Demonstrate the various navigational aids used in the sea transport	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Brothers, Roorkee, 2012.
2. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi, 2013

REFERENCES:

1. Subramanian K.P., Highways, Railways, Airport and Harbour Engineering, Scitech Publications (India), Chennai, 2010
2. C.Venkatramaiah, Transportation Engineering-Vol.2 Railways, Airports, Docks and Harbours, Bridges and Tunnels, Universities Press (India) Private Limited, Hyderabad, 2015.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	1	-	-	-	-	3	-	-	-	-	3	3
CO3	3	2	2	-	-	-	-	3	-	-	-	-	3	3
CO4	3	2	3	1	-	-	-	-	-	-	-	-	3	3
CO5	3	2	2	-	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22044	URBAN PLANNING AND DEVELOPMENT	L	T	P	C
		3	0	0	3

COURSE 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 provide the concepts of planning and design of 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, Development Control Rules, Transfer of Development Rights , Special Economic Zones.

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, DEVELOPMENT AND 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:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Classify urban areas for planning and development	2
CO2	Explain the content of Regional plan, Master plan etc on basis of development control rules	2
CO3	Design questionnaire for urban planning surveys	2
CO4	Plan and prepare lay out for urban development projects	2
CO5	Describe the various town and country planning acts	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Meera Mehta and Dinesh Mehta, Metropolitan Housing Markets, Sage Publications Pvt. Ltd., New Delhi, 1999.
2. Francis Cherunilam and Odeyar D Heggade, Housing in India, Himalaya Publishing House, Bombay, 1997.

REFERENCES:

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

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3													3
CO2	3													3
CO3	3					2								3
CO4	3		3								3			3
CO5								3				2		

3-High, 2-Medium, 1-Low

CE22045 TRAFFIC ENGINEERING AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To give an overview of Traffic engineering, various surveys to be conducted, traffic regulation, management and traffic safety.

UNIT I TRAFFIC CHARACTERISTICS 9

Brief introduction on codal provisions related to Traffic Engineering in India & abroad – Road Characteristics – Classification – Functions and standards – Road user characteristics – PIEV theory – Vehicle – Performance characteristics – Fundamentals of Traffic Flow – Urban Traffic problems in India.

UNIT II TRAFFIC SURVEYS 9

Traffic Surveys – Speed, journey time and delay surveys – Vehicle Volume Survey – Methods and interpretation – Origin Destination Survey – Methods and presentation– Parking Survey– Methods, interpretation and presentation – Statistical applications in traffic studies and traffic forecasting – level of service – Concept, application and significance.

UNIT III TRAFFIC ENGINEERING REGULATION AND CONTROL 9

Capacity of Rotary intersection and Design – Capacity of signalized intersections – Traffic signals, warrants, type – Design and coordination – Intersection channelisation – Grade separation - Traffic signs and road markings.

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, health effects and abatement measures.

UNIT V TRAFFIC MANAGEMENT 9

Area Traffic Management System – One way street system, exclusive traffic lanes, tidal flow operation, staggering of work hours and road pricing – Non road pricing options _ Parking charges, Public transport, Subsidies, Vehicle License fees, Road Building, Permit system, Physical Traffic Management Transport System Management (TSM) and Transport Demand Management (TDM)- - Introduction to Intelligent Transportation Systems (ITS)- ITS Applications in Traffic Management.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course,	RBT level
CO1	Students would have gained knowledge on characteristics of traffic elements, traffic survey, traffic regulation and traffic management measures.	2
CO2	Apply the knowledge of science and engineering fundamentals in conducting traffic surveys and analyze the problems.	2

CO3	Designing various types of control and regulatory measures to meet an efficient traffic network.	2
CO4	Understand various traffic management measures in addressing the demand, pricing and ITS applications.	2
CO5	Select appropriate methods to ensure the safety of the road users and analyze the environmental issues related to traffic network.	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi,2008.
2. Khanna .K and Justo C.E.G. and Veeraragavan, A Highway Engineering, Nem Chand Bros., Roorkee, Revised 10th Edition, 2014.
3. Salter. R.I and Hounsell N.B, Highway Traffic Analysis and design, Macmillan Press Ltd.1996.
4. Roger P.Roess, William R.Mcshane and Elena S.Prassas, Traffic Engineering-Second Edition, Prentice Hall Publishers,, Upper Saddle River, New Jersey 1998

REFERENCES:

1. Partha Chakroborty and Animesh Das Principles of Transportation Engineering , PHI Learning Pvt. Ltd., 2005
2. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management.
3. C. Jotin Khisty , Kent Lall , Transportation Engineering: An Introduction, Prentice Hall, 1998
4. Hobbs. F.D. Traffic Planning and Engineering,University of Brimingham, Peragamon Press 155 Ltd, 1994.
5. Taylor MAP and Young W, Traffic Analysis – New Technology and New Solutions, Hargreen Publishing Company , 1998.
6. Jason C.Yu Transportation Engineering, Introduction to Planning, Design and Operations, Elseevier, 1992.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3					2		3		1			2	1
CO2	3		3	3	2	2				1		2	3	2
CO3		3	3	2	3				3	2	2	3	3	
CO4	2	3	2	2	2			3	3	3	2	3	3	3
CO5		2	1	1	2		1	3	3	1	1	3	2	

3-High, 2-Medium, 1-Low

CE22046	TRAFFIC MANAGEMENT PLAN FOR CONSTRUCTION SITE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To give an exposure to students on the importance of traffic management plan during road work for smooth movement of traffic.

UNIT I PRINCIPLES OF WORK ZONES TRAFFIC MANAGEMENT PLANS 12

Background – Purpose of Work Zone Traffic Management Plans (WTMPs) – Who Should Prepare WTMPs? – What Can Make WTMPs Effective? – Judicious Application of WTMPs – Commonly used terms – Basic Principles of WTMP – Planning of WTMP – Temporary traffic control zone – Elements of temporary traffic control zones – typical layout.

UNIT II TRAFFIC CONTROL DEVICESS 10

Types of devices – Road signs - Retro reflective sheeting for road signs – Sign placement - Design of signs – Work zone related sign boards – Channelizing Devices – Temporary Pavement Markings & Road Studs – Lighting Devices & Variable Message Signs – Floodlights – Flashing warning beacons – Warning lights – Temporary traffic control signals – Portable variable message signs – Arrow boards.

UNIT III MEASURES FOR VULNERABLE ROAD USERS (VRUS) 5

Measures for VRUs – Guidance – Barriers for pedestrians and cyclist – Works on footpath: Alternative way for pedestrians – Speed reduction measures.

UNIT IV TRAFFIC MANAGEMENT PRACTICES AT WORKSITES 9

Introduction – Alternate one way operation – Traffic control by give and take system – Traffic control by priority signs - Traffic control by stop/go boards - Traffic control by portable traffic signals – Detours – Diversions – Full Road Closures – Intermittent Closures – Lane Closures - Lane Constrictions - Median Crossovers - Use of Shoulder as a Travel Lane - Night Construction - Advantages and Disadvantages of Work Zone Design Strategies.

UNIT V TYPICAL LAYOUTS 9

Following commonly occurring situations are presented in drawing format: (1) Two Lane to Four Lane (Shifting of Traffic from One Carriageway to Other) (2) Four lane to six lane concentric widening (3) Temporary diversion for reconstruction of CD works.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course,	RBT level
CO1	Students would have gained knowledge on the basic principle of Work Zone	2

	Traffic Management Plan.	
CO2	Explain on various types of traffic control devices used for managing traffic.	2
CO3	Understand the importance of vulnerable road users (pedestrians & cyclists) and their protection	2
CO4	Outline the various methods of traffic diversion plans at work site.	2
CO5	Prepare layouts using Auto CADD for selected work site locations.	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. Kadiyali. L.R. Traffic Engineering and Transport Planning, Khanna Publishers, Delhi, 2008.

REFERENCES:

1. IRC: SP: 55 – 2014, Guidelines on Traffic Management at Work Zones, Indian Road Congress, New Delhi.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1						3		3						3
CO2					3	3		3						3
CO3						3		3						3
CO4						3		3						3
CO5			3			3		3		3			3	3

3-High, 2-Medium, 1-Low

CE22047	INTELLIGENT TRANSPORTATION SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To learn the fundamentals of ITS
- To study the ITS functional areas
- To have an overview of ITS implementation in developing countries

UNIT I INTRODUCTION TO ITS 9

Fundamentals of ITS: Definition of ITS, Challenges in ITS Development-Purpose of ITS Deployment- Benefits of ITS- Overview of application of ITS in Transportation Planning.

UNIT II DATA COLLECTION THROUGH ITS 9

Sensors & its application in traffic data collection - Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – vehicle Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, RFID, video data collection, Internet of Things (IOT).

UNIT III ITS IN TRAFFIC MANAGEMENT 9

ITS User Needs and Services and Functional areas –Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveler Information systems (ATIS), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS)- Autonomous Vehicles- Autonomous Intersections.

UNIT IV ITS IN TRANSPORTATION PLANNING 9

ITS and safety, ITS and security- Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations – public transportation applications- Weight –in Motion.

UNIT V ITS APPLICATION IN LOGISTICS 9

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics-E commerce.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, students will be able to	RBT level
CO1	Understand the fundamentals of ITS and its benefits.	2
CO2	Gain knowledge on data collection using sensors and its applications.	2
CO3	Acquainted with the knowledge of ITS in Traffic Management	2
CO4	Application of ITS in Transportation Planning	2
CO5	Able to gain knowledge on application of ITS in Logistics	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. R. Srinivasa Kumar,”Intelligent Transportation Systems”, Universities Press P Ltd, Telangana, 2022.

REFERENCES:

1. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US, 2001.
2. Henry F.Korth, and Abraham Siberschatz, Data Base System Concepts, McGraw Hill, 1992.
3. TurbanE.,”Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.
4. Sitausu S. Mittra, "Decision Support Systems–Tools and Techniques", John Wiley, New York, 1986.
5. Cycle W.Halsapple and Andrew B.Winston, "Decision Support Systems–Theory and Application‟, Springer Verlog, New York, 1987
6. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1		2	3	2	2	1	3	1	2	2	3	
CO2	2	2	1	3	3	2	2	2	3	2	3	2	3	
CO3	2	1	2	2	3	2	1	1	3	2	1	1	3	
CO4	2	2	1	3	3	2	1	1	3	1	3	2	3	
CO5	3	2	1	3	3	2	1	2	3	2	3	2	3	

3-High, 2-Medium, 1-Low

CE22048 **SMART CITIES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

• To help the leaner's to understand the concepts of smart city and to introduce the students about application of technologies in smart cities

UNIT I INTRODUCTION 9

Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission.

UNIT II SMART PHYSICAL INFRASTRUCTURE 9

Infrastructure development in Smart Cities - Physical Infrastructure, Land Use - Compact/mixed-use development, Transit oriented development (TOD); Smart City Management-Transportation Unified governance structure (UMTA). Smart public transportation, Smart parking, Intelligent traffic management, Detour management; Low emission vehicles, Electric Mobility - Environmental projects etc.

UNIT III SUSTAINABILITY AND SMART PLANNING 9

Relationship between Sustainability and Smart planning - Place making project guidelines Surveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services

UNIT IV APPLICATION OF TECHNOLOGIES IN SMART CITIES 9

Role of Technologies in Smart Cities - Integrated Command and Control Center (ICCC), Data Analytics, Data driven strategies implementation in smart cities.

UNIT V SMART CITIES PROJECT MANAGEMENT 9

Need for project management, Philosophy and concepts; Project phasing and stages; Project organizational structuring: Planning and Scheduling: Project cost analysis; Procurement and Contracting: PPP: Project Monitoring and Evaluation: Risk Management; Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, students will be able to	RBT level
CO1	Understand the basics of Urbanisation and the role of smart cities.	2
CO2	Gain knowledge on implementation of smart physical infrastructure.	2
CO3	Understand the role of smart planning for sustainable development.	2
CO4	Comprehend the knowledge of Technologies in Smart City planning	2
CO5	Reviewing the case studies of smart city projects.	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES

1. P Sharma , "Sustainable Smart cities in India, Challenges and Future Perspectives", Springer Link, 2017
2. Sameer Sharma, "Smart Cities Unbounded- Ideas and Practice of Smart Cities in India", Bloomsbury India, 2018.
3. Binti Singh, Manoj Parmar, "Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019
4. https://smartcities.gov.in/guidelines#block-habikon-content
5. https://smartnet.niua.org/learn/library

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	2	1	3	2	3	1	1	2	2	1	3	3
CO2	3	3	3	2	1	3	3	2	3	1	3	1	3	3
CO3	3	1	3	2	1	1	3	3	2	2	3	2	3	3
CO4	3	2	2	2	3	2	3	2	3	1	3	2	3	3
CO5	2	2	3	3	2	2	2	2	3	3	2	2	3	3

3-High, 2-Medium, 1-Low

CE22040	MINI PROJECT	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The project work shall be carried out in the same domain of the specialized vertical for students registered for Honours with Specialisation and Minors by other department students.
The project topic for the students registered for Honours shall be finalized by the DCC.

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

PROFESSIONAL ELECTIVE

VERTICAL 5

ENVIRONMENTAL ENGINEERING

CH22051 INDUSTRIAL WASTE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To provide an understanding of solid waste classification, characteristics and its management, by following regulations and including environment risk assessment.

UNIT I FUNDAMENTALS 9

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health – ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and on to land for irrigation- Environmental legislations related to prevention and control of industrial effluents and hazardous wastes.

UNIT II CLEANER PRODUCTION 9

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Removal of Nitrogen and Phosphorus –Boiler water treatment methods and cooling water treatment methods Recycle, reuse and byproduct recovery – Applications.

UNIT III POLLUTION FROM MAJOR INDUSTRIES 9

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Cement, Steel plants, Refineries, fertilizer, thermal power plants – Wastewater reclamation concepts.

UNIT IV TREATMENT TECHNOLOGIES 9

Equalisation – Neutralisation – Flotation – Precipitation – Heavy metal Removal– Aerobic and anaerobic biological treatment – Sequencing batch reactors – High Rate reactors - Chemical oxidation – Ozonation – carbon adsorption - Photocatalysis – Wet Air Oxidation – Evaporation – Ion Exchange – Membrane Technologies – Nutrient removal.- Treatability studies.

UNIT V HAZARDOUS WASTE MANAGEMENT 9

Hazardous wastes - Physico chemical treatment – solidification – incineration – Secured landfills, Zero effluent discharge system.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements After successful completion of this course, the students will be able to	RBT level
CO1	Develop the knowledge on the sources and characteristics of pollutants.	3
CO2	Analyze the sources, types and composition of solid waste with methods of	4

	handling, sampling and storage of solid waste.	
CO3	Inspect the appropriate method for solid waste collection, transportation, redistribution and disposal.	4
CO4	Identify the methods of disposal of hazardous & radioactive solid waste.	3
CO5	Infer about the risk assessment and regulations of solid waste management.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. M.N.Rao & A.K.Dutta, "Wastewater Treatment", Oxford - IBH Publication, 1995.
2. W .W. Eckenfelder Jr., "Industrial Water Pollution Control", McGraw-Hill Book Company, New Delhi, 2000.

REFERENCES:

1. T.T.Shen, "Industrial Pollution Prevention", Springer, 1999.
2. R.L.Stephenson and J.B.Blackburn, Jr., "Industrial Wastewater Systems Hand book", Lewis Publisher, New Yark, 1998.
3. H.M.Freeman, "Industrial Pollution Prevention Hand Book", McGraw-Hill Inc., New Delhi, 1995.
4. Bishop, P.L., "Pollution Prevention: Fundamental & Practice", McGraw-Hill, 2000.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	3	2	2	3	2	3	3	2	2	2	2	2	2
CO2	2	3	2	2	2	2	2	2	2	2	2	2	2	2
CO3	2	2	2	2	2	2	3	3	2	2	2	2	2	3
CO4	2	2	2	2	2	2	3	3	2	2	2	2	2	2
CO5	2	2	1	2	2	2	2	3	3	2	2	2	1	1

3-High, 2-Medium, 1-Low

CH22052	AIR POLLUTION MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.

UNIT I SOURCES AND EFFECTS OF AIR POLLUTANTS 9

Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles-Impacts of Air pollution on building materials and structures.

UNIT II DISPERSION OF POLLUTANTS 9

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Air Quality Index-Dispersion of pollutants – Dispersion models – Applications.

UNIT III AIR POLLUTION CONTROL 9

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries- Air Pollution control devices.

UNIT IV AIR QUALITY MANAGEMENT 9

Air quality standards – Air quality monitoring – Sampling and Analysis of SO_2 and NO_2 in ambient air-Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality-Various models for checking Air Quality.

UNIT V AIR QUALITY SAMPLING AND MONITORING 9

Stack sampling - instrumentation and methods of analysis of SO_2, CO etc - legislation for control of air pollution and automobile pollution.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements After successful completion of this course, the students will be able to	RBT level
CO1	Interpret the sources and effects of air pollutants.	2

CO2	Inspect the various dispersion of pollutants.	4
CO3	Identifying the concepts involved in air pollution control.	3
CO4	Analyze the air quality standards and management policies.	4
CO5	Judge the monitoring levels of SO_2,CO etc.	5

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2002
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996.
3. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.

REFERENCES:

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark, 1997.
2. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company, New Delhi, 1991.
3. Peavy S.W., Rowe D.R. and Tchobanoglous G. Environmental Engineering, McGraw Hill, New Delhi, 1985.
4. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi.
5. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw-Hill, New Delhi, 1991

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	2	-	3	3	3	2	3	3	2	2	2
CO2	2	3	2	-	2	3	3	2	2	2	2	2	2	2
CO3	1	2	2	2	3	3	3	3	2	2	2	2	-	-
CO4	2	2	2	2	3	2	3	3	2	2	2	1	2	2
CO5	2	2	2	2	2	3	3	2	2	2	2	2	2	2

3-High, 2-Medium, 1-Low

CH22053	DISASTER MITIGATION AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge of causes of various disaster and its impact.
- To understand the concept of Disaster Management Cycle and Framework.
- To build skills to respond to disaster
- To explain the Applications of Science and Technology for Disaster Management & Mitigation

UNIT I INTRODUCTION 9

Understanding the Concepts and definitions of Disaster and its types, Hazard, Vulnerability, Risk, Capacity, Disaster and Development, and disaster management.

UNIT II DISASTER RISK REDUCTION (DRR) 9

10 Disaster Risk Reduction Strategies, Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems, Models in disaster preparedness, Components of Disaster Relief-(Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural nonstructural measures in DRR, Factors affecting Vulnerabilities, Mainstreaming disaster risk reduction in development, Undertaking risk and vulnerability assessments, Policies for Disaster Preparedness Programs, Preparedness Planning, Roles and Responsibilities, Public Awareness and Warnings, Rehabilitation measures and long term reconstruction.

UNIT III DISASTER MANAGEMENT CYCLE AND FRAMEWORK 9

Disaster Management Cycle, Paradigm Shift in Disaster Management Pre-Disaster Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development, Awareness During Disaster Evacuation, Disaster Communication, Search and Rescue, Emergency Operation Centre, Incident Command System, Relief and Rehabilitation, Damage and Needs Assessment, Restoration of Critical Infrastructure, Early Recovery, Reconstruction and Redevelopment, IDNDR, Yokohama Strategy, Hyogo Framework of Action

UNIT IV MITIGATION AND DISASTER MANAGEMENT 9

Disaster Profile of India, Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Intergovernmental Agencies. Early Warning Systems, Building design and construction in highly seismic zones, retrofitting of buildings.

UNIT V APPLICATIONS OF SCIENCE AND TECHNOLOGY FOR DISASTER MANAGEMENT & MITIGATION 9

Geo-informatics in Disaster Management, Disaster Communication System, Land Use

Planning and Development Regulations, Structural and Non Structural Mitigation of Disasters, S&T Institutions for Disaster Management in India.

TOTAL :45 PERIODS

OUTCOMES :

CO	**CO statements** After successful completion of this course, the students will be able to	**RBT level**
CO1	Classifying the various types of disasters, causes and their impact on environment and society.	2
CO2	Analyze and evaluate the measures adopted to mitigate the impacts.	4
CO3	Relate the skills in various stages of disaster preparedness, mitigation and management.	3
CO4	Explain about organizational and Administrative strategies for managing disasters.	2
CO5	Summarise the methodologies for disaster risk assessment with the help of latest tools like GPS, GIS, Remote sensing, information technologies, etc.	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Disaster Management by Dr. Mrinalini Pandey, Published by Wiley India, 2014 ISBN 10:8126549246/ISBN 13:9788126549245
3. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361

REFERENCES:

1. Disaster Management Act, Publisher by Govt. of India.
2. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management 6. NIDM Publications, GoI.
3. National Disaster Management Policy, GoI.
4. Roy, P.S. (2000): Space Technology for Disaster management: A Remote Sensing & GIS Perspective, Indian Institute of Remote Sensing (NRSA) Dehradun.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	2	2	3	2	3	3	2	2	2	1	2	2
CO2	2	3	2	2	2	2	3	3	2	3	2	2	1	1
CO3	-	3	2	2	3	2	3	2	2	2	3	2	2	2
CO4	2	2	2	2	2	2	3	2	2	2	3	1	1	1
CO5	2	2	2	2	2	2	3	3	2	2	2	1	-	1

3-High, 2-Medium, 1-Low

CH22054	GLOBAL CLIMATE CHANGE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To educate about Climate system and its changes and causes
- To impart knowledge about impacts, adaptation and mitigation of climate change
- To provide knowledge about clean technology and clean energy.

UNIT I INTRODUCTION TO CLIMATE CHANGE SCIENCE 9

Introduction- The basics of climate change science -Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

UNIT II OBSERVED CHANGES AND ITS CAUSES 9

Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – history of international climate change negotiations and introduces the United Nations Framework Convention on Climate Change (UNFCCC) – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modeling.

UNIT III IMPACTS OF CLIMATE CHANGE 9

Concept of climate change adaptation- Framework for assessing climate vulnerability -Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes. Introduction to linkages between climate change adaptation and development. Important international adaptation initiatives and programmes.

UNIT IV CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES 9

Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation

UNIT V CLEAN TECHNOLOGY & CLIMATE CHANGE FINANCE 9

Clean Development Mechanism – Carbon Trading - examples of future Clean Technology –

Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding. National financing and the centrality of the national budget in leveraging other sources of finance, including private sector finance. The major streams of international climate finance.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements After successful completion of this course, the students will be able to	RBT level
CO1	Outline about the basics of earth's climate system.	2
CO2	Identifying the changes in climate change and its causes.	3
CO3	Summarise the impacts of climate change	2
CO4	Discover the adaption and mitigation measures for climate change.	4
CO5	Analyzing clean technology and energy	4

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Jan C. van Dam, Impacts of Climate Change and Climate Variability on Hydrological Regimes, Cambridge University Press, 2003.
2. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd.

REFERENCE

1. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., 'Climate Change and Water'. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.
2. IPCC fourth assessment report - The AR4 synthesis report, 2007.
3. IPCC fourth assessment report –Working Group I Report, " The physical Science Basis", 2007.
4. IPCC fourth assessment report - Working Group II Report, "Impacts, Adaptation and Vulnerability", 2007.
5. IPCC fourth assessment report – Working Group III Report" Mitigation of Climate change", 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	2	2	2	2	2	3	2	2	2	2	2	-	2
CO2	2	2	2	2	2	2	3	3	2	2	2	2	2	2
CO3	-	2	2	2	1	2	3	2	2	2	1	2	2	2
CO4	2	2	2	2	2	3	3	3	2	2	2	2	1	1
CO5	2	2	1	2	1	2	3	3	2	2	2	2	2	2

3-High, 2-Medium, 1-Low

..CE22051 MUNICIPAL SOLID WASTE MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste

UNIT I SOURCES AND TYPES 9

Sources and types of municipal solid wastes-waste generation rates-factors affecting generation, characteristics-methods of sampling and characterization; Effects of improper disposal of solid wastes-Public health and environmental effects. Elements of solid waste management –Social and Financial aspects – Municipal solid waste handling and management rules – integrated management-Public awareness; Role of NGO‟s.

UNIT II ON-SITE STORAGE AND PROCESSING 9

On-site storage methods – Effect of storage, materials used for containers – segregation of solid wastes – Public health and economic aspects of open storage – waste segregation and storage – case studies under Indian conditions – source reduction of waste – Reduction, Reuse and Recycling.

UNIT III COLLECTION AND TRANSFER 9

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

UNIT IV OFF-SITE PROCESSING 9

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and bio-methanation; Thermal processing options – case studies under Indian conditions.

UNIT V 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.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the sources, types, generation rates, characteristics, sampling, effects of improper disposal of municipal solid wastes and the elements, regulatory requirements regarding municipal solid waste management.	3
CO2	Explain the onsite storage methods, processing and source reduction of	3

	municipal solid waste.	
CO3	Analyse the collection systems and explain the various collection methods, collection vehicles, transfer stations and manpower requirements.	3
CO4	Describe the physical and thermal processing of municipal solid waste and resource recovery from the municipal solid waste.	3
CO5	Determine the size of sanitary landfill and explain the operation and maintenance of sanitary landfill and dumpsite rehabilitation.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Tchobanoglous, G., Theisen, H. M., and Samuel A Vigil. "Integrated Solid Waste Management Engineering Principles and Management Issues". McGraw Hill, New York, 2015.
2. George Tchobanoglous and Frank Kreith"Handbook of Solidwaste Management", McGraw Hill, New York, 2002.

REFERENCES:

1. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2016.
2. Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 1993.
3. Vesilind, P.A. and Rimer, A.E., “Unit Operations in Resource Recovery Engineering”, Prentice Hall, Inc., 1981.
4. Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2005.
5. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	1	-	-	3	3	-	-	-	-	-	3	3
CO2	3	1	1	-	-	3	3	-	-	-	-	-	3	3
CO3	3	1	1	-	-	3	3	-	-	-	-	-	3	3
CO4	3	1	1	-	-	3	3	-	-	-	-	-	3	3
CO5	3	1	1	-	-	3	3	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

CE22052 ENVIRONMENTAL POLICY AND LEGISLATIONS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The course will analyze the legislative and judicial responses to environmental problems and the administrative system of environment related laws such as air, water, land, and hazardous substances etc. Environment advocacy and approaches for using litigation in environment protection will receive special attention.

UNIT I INTRODUCTION TO ENVIRONMENTAL LEGISLATIONS AND INTERNATIONAL SCENARIO 9

Significance of Environmental Law -International Environmental Law -Development of International Environmental Law -Source and General principals of International Environmental Law –General rights and obligations of States -General Issues of the international law related to environmental protection -Stockholm Declaration-Rio Declaration on Environment and Development-Basel Convention on the Control of Trans boundary Movement of Hazardous Wastes and their disposal - Convention of Biological Diversity - U.N Frame Work Convention on Climate Change-Montreal Protocol on Substances that deplete Ozone Layer-Kyoto Protocol.

UNIT II INDIAN CONSTITUTIONS AND ENVIRONMENTAL PROTECTION 9

Indian Constitution and Environmental Protection -Constitutional provisions concerning Environment Articles 14,15,(2) (b) 19 (e),21,31,32,38,39,42,47, 48-A,49,51,51-A: Indian Environmental Policy 2006 Administrative machinery for pollution control Common Law & Criminal Law Nuisance, Negligence, Strict liability and Absolute liability, Provisions of IPC relating to environmental problems (public nuisance u/s 268 and others (Sections 269,270,277,284,285,286,425 to 440) Section 133 of Cr.P.C.

UNIT III REMEDIES FOR ENVIRONMENTAL POLLUTION 9

Common Law Remedies/Remedies under Law of Tort – Penal Remedies – Indian Penal Code and Code of Criminal Procedure – Remedies under Constitutional Law – Writs – Public Interest Litigation - Public Liability Insurance Act, 1991 – The National Green Tribunal Act 2010.

UNIT IV MAJOR INDIAN LEGISLATIONS 9

Water Act (1974) Air Act (1981) Environmental Protection Act (1986) Major Notifications, The Municipal solid Wastes (Management and Handling) Rules 2000-Bio Medical Wastes (Management and Handling) Rules 1998- Hazardous Wastes (Management and Handling Rules 1989 - Environment Impact Assessment Notifications- Coastal Regulation Zone Notification-Public Hearing Notifications.

UNIT V ENVIRONMENT AND DEVELOPMENT CASE LAWS 9

Meaning and concept of development - Its impact on environment; conflict between environment and development, Concept of Sustainable Development., Polluter Pay Principle, Precautionary Principle, Public Trust Doctrine. Landmark Judgments - Olium gas leakage case, Rural Litigation and Entitlement Kendra, Dehradun, (1985) Supp SCC 487) Vellore Citizen Welfare Forum v. Union of India, (1996) 5SCC 647) Ganga Pollution case (1988) I SCC) S. Jagannath v. UOI (1997) SCC867) Vellore Citizens welfare forum case M.C. Mehta V. Kamalnath (1997) I SCC 388).

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe origins and sources of environmental laws, and understand how and by whom environmental laws are made and interpreted.	2
CO2	Describe Indian constitutions and environmental protection.	2
CO3	Explain the remedies for environmental pollution.	2
CO4	Explain the major Indian environmental management legislations.	2
CO5	Describe the environment and development case laws.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Leelakrishnan P., Environmental Law in India, Butterworths,1998
2. Leelakrishnan P., Environmental Case Book, Lexis Nexis, 2000

REFERENCES:

1. Shanthakumar S. , Environmental Law – An Introduction, Butterworths,2004
2. Shyam Diwan and Armin Rosencranz, Environmental Law and Policy in India, Oxford, 2001

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	2	-	-	3	3	3	-	2	-	-	3	3
CO2	3	1	2	-	-	3	3	3	-	2	-	-	3	3
CO3	3	1	2	-	-	3	3	3	-	2	-	-	3	3
CO4	3	1	2	-	-	3	3	3	-	2	-	-	3	3
CO5	3	1	2	-	-	3	3	3	-	2	-	-	3	3

3-High, 2-Medium, 1-Low

CE22053 ENVIRONMENTAL HEALTH AND SAFETY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To educate overview of EHS in industries and related Indian regulations, types of Health hazards, effect, assessment and control methods and EHS Management System.

UNIT I INTRODUCTION 9

Need for developing Environment, Health and Safety systems in work places- International initiatives, National Policy and Legislations on EHS in India - Regulations and Codes of Practice - Role of trade union safety representatives - Ergonomics.

UNIT II OCCUPATIONAL HEALTH AND HYGIENE 9

Definition of occupational health and hygiene - Categories of health hazards – Exposure pathways and human responses–Exposure Assessment-occupational exposure limits - Hierarchy of control measures - Role of personal protective equipment and the selection criteria.

UNIT III WORKPLACE SAFETY AND SAFETY SYSTEM 9

Features of Satisfactory and Safe design of work premises – good housekeeping - lighting and color, Ventilation and Heat Control, Noise, Chemical and Radiation Safety – Electrical Safety – Fire Safety – Safety at Construction sites, ETP – Machine guarding – Process Safety, Working at different levels.

UNIT IV HAZARDS AND RISK MANAGEMENT 9

Safety appraisal – Job Safety Analysis-Control techniques – plant safety inspection – Accident investigation - Analysis and Reporting – Hazard and Risk Management Techniques –Onsite and Offsite emergency Plans. Employee Participation- Education and Training- Case Studies.

UNIT V ENVIRONMENTAL HEALTH AND SAFETY MANAGEMENT 9

Concept of Environmental Health and Safety Management – Elements of Environmental Health and Safety Management Policy and implementation and review – ISO 45001-Strucure and Clauses-Case Studies.

TOTAL :45 PERIODS

OUTCOMES :

CO	**CO statements** After completion of this course, the students should be able to	**RBT level**
CO1	Summarise the need for EHS in industries and related Indian regulations	2
CO2	Describe various types of Health hazards, effect, assessment and control methods	2
CO3	Enumerate various safety systems in working environments	2
CO4	Explain the methodology for preparation of Emergency Plans and Accident investigation	2
CO5	Summarise EHS Management System and its elements	2

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Fundamentals of Industrial Safety and Health by Dr.K.U.Mistry, Siddharth Prakashan, 2012
2. The Facility Manager's Guide to Environmental Health and Safety by Brian Gallant, Government Inst Publ., 2007

REFERENCES:

1. Industrial Health and Safety Acts and Amendments, by Ministry of Labour and Employment, Government of India.
2. Effective Environmental, Health, and Safety Management Using the Team Approach by Bill Taylor, Culinary and Hospitality Industry Publications Services, 2005.
3. Environmental and Health and Safety Management by Nicholas P.Cheremisinoff and Madelyn L. Graffia, William Andrew Inc. NY, 1995.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	-	3	-	3	-	3	-	3	2	-	1	2	3	3
CO2	2	2	2	3	-	-	-	-	2	-	-	3	3	3
CO3	-	-	2	-	3	3	1	1	2	-	2	3	3	3
CO4	-	-	3	2	-	1	2	-	-	-	-	-	3	3
CO5	1	-	-	-	2	-	-	-	1	-	1	-	3	3

3-High, 2-Medium, 1-Low

CE22054 SUSTAINABILITY AND SOCIAL DEVELOPMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To impart knowledge on environmental, social and economic dimensions of sustainability and the principles evolved through landmark events so as to develop an action mind-set for Sustainable development.

UNIT I SUSTAINABILITY AND DEVELOPMENT CHALLEGES 9

Definition of sustainability – environmental, economic and social dimensions of sustainability - sustainable development models – strong and weak sustainability – defining development millennium development goals – mindsets for sustainability: earthly, analytical, precautionary, action and collaborative– syndromes of global change: utilisation syndromes, development syndromes, and sink syndromes – core problems and cross cutting Issues of the 21 century - global, regional and local environmental issues – social insecurity - resource degradation – climate change – desertification.

UNIT II PRINCIPLES AND FRAME WORK 9

History and emergence of the concept of sustainable development - our common future - Stockholm to Rio plus 20 – Rio Principles of sustainable development – Agenda 21 natural step peoples earth charter – business charter for sustainable development – UN Global Compact – Role of civil society, business and government – United Nations' 2030 Agenda for sustainable development – 17 sustainable development goals and targets, indicators and intervention areas.

UNIT III SUSTAINABLE DEVELOPMENT AND WELLBEING 9

The Unjust World and inequities - Quality of Life - Poverty, Population and Pollution – Combating Poverty - - Demographic dynamics of sustainability - Strategies to end Rural and Urban Poverty and Hunger – Sustainable Livelihood Framework- Health, Education and Empowerment of Women, Children, Youth, Indigenous People, Non-Governmental Organizations, Local Authorities and Industry for Prevention, Precaution , Preservation and Public participation.

UNIT IV SUSTAINABLE SOCIO-ECONOMIC SYSTEMS 9

Sustainable Development Goals and Linkage to Sustainable Consumption and Production Investing in Natural Capital- Agriculture, Forests, Fisheries - Food security and nutrition and sustainable agriculture- Water and sanitation - Biodiversity conservation and Ecosystem integrity – Ecotourism - Sustainable Cities – Sustainable Habitats- Green Buildings – Sustainable Transportation — Sustainable Mining - Sustainable Energy– Climate Change – Mitigation and Adaptation - Safeguarding Marine Resources - Financial Resources and Mechanisms.

UNIT V SUSTAINABILITY AT GLOBAL AND NATIONAL LEVEL 9

Nature of sustainable development strategies and current practice- Sustainability in global, regional and national context –Approaches to measuring and analysing sustainability– limitations of GDP- Ecological Footprint- Human Development Index- Human Development Report –

National initiatives for Sustainable Development - Hurdles to Sustainability - Science and Technology for sustainable development –Performance indicators of sustainability and Assessment mechanism – Inclusive Green Growth and Green Economy – National Sustainable Development Strategy Planning and National Status of Sustainable Development Goals

TOTAL :45 PERIODS

OUTCOMES :

CO	**CO statements** On completion of the course, the student is expected to	**RBT level**
CO1	Explain and evaluate current challenges to sustainability, including modern world social, environmental, and economic structures and crises.	2
CO2	Identify and critically analyze the social environmental and economic dimensions of sustainability in terms of UN Sustainable development goals.	3
CO3	Develop a fair understanding of the social, economic and ecological linkage o Human wellbeing, production and consumption.	3
CO4	Evaluate sustainability issues and solutions using a holistic approach that focuses on connections between complex human and natural systems.	3
CO5	Integrate knowledge from multiple sources and perspectives to understand environmental limits governing human societies and economies and social justice dimensions of sustainability.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Tom Theis and Jonathan Tomkin, Sustainability: A Comprehensive Foundation, Rice University, Houston, Texas, 2018.
2. A guide to SDG interactions:from science to implementation, International Council for Science, Paris, 2017.

REFERENCES:

1. Karel Mulder, Sustainable Development for Engineers - A Handbook and Resource Guide, Rouledge Taylor and Francis, 2017.
2. The New Global Frontier - Urbanization, Poverty and Environment in the 21st Century George Martine, Gordon McGranahan, Mark Montgomery and Rogelio Fernández-Castilla, IIED and UNFPA, Earthscan, UK, 2008.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	3	-	-	-	-	-	3	-	3	-	-	3	3
CO2	-	3	-	2	-	2	-	-	-	3	-	-	3	3
CO3	-	-	3	2	-	2	-	-	-	3	-	-	3	3
CO4	-	-	3	2	-	-	-	3	2	3	-	-	3	3
CO5	-	-	3	2	-	-	1	-	2	3	-	1	3	3

3-High, 2-Medium, 1-Low

CE22050 **MINI PROJECT**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The project work shall be carried out in the same domain of the specialized vertical for students registered for Honours with Specialisation and Minors by other department students.
The project topic for the students registered for Honours shall be finalized by the DCC.

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

PROFESSIONAL ELECTIVE

VERTICAL 6

GEO-INFORMATICS

CE22061 **TOTAL STATION AND GPS SURVEYING**

L	T	P	C
3	0	0	3

OBJECTIVE:
To understand the working of Total Station and GPS and solve the surveying problems.

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

UNIT II DISTANCE AND ATMOSPHERIC CORRECTION 9
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 and pressure transducers.

UNIT III ELECTRO OPTICAL AND MICRO WAVE 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. Care and maintenance of Total Station instruments — Traversing and Trilateration-COGO functions, offsets and stake out-land survey applications.

UNIT IV GPS 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 V 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 - applications- long baseline processing- use of different softwares.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Learn the fundamentals of Total station.	3
CO2	Apply the knowledge about electromagnetic waves and its usage in Total station and GPS.	3
CO3	Understand the measuring and working principle of electro optical and Microwave Total station and GPS	3
CO4	Apply the basic concepts of GPS	3
CO5	Summarise the basics concepts about Total station and GPS data downloading and processing	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 4th Edition,2012.
2. Satheesh Gopi, R Sathishkumar, N.Madhu, ― Advanced Surveying , Total Station GPS and Remote Sensing ― Pearson education , 2nd Edition,2017. ISBN: 978-81317 00679.

REFERENCES:

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, 1983.
3. Guocheng Xu, GPS Theory, Algorithms and Applications, Springer - Verlag, Berlin,3rd Edition,2016.
4. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 4th Edition, 2015.
5. Seeber G, Satellite Geodesy, Walter De Gruyter, Berlin,2nd Edition,2003.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO2	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO3	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO4	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO5	3	3	3	-	3	-	-	3	3	3	2	3	3	3

3-High, 2-Medium, 1-Low

CE22062	GEOINFORMATICS AND ITS APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVE:

To understand basics of geoinformatics and solve the Civil Engineering problems with the help of Geoinformatics technique

UNIT I MAP PRODUCTION CONCEPTS 9

Maps - uses –– Types of Maps – Map Scales – Map projections –– Map co-ordinate systems –Elements of a map - Map Layout principles — Map Design fundamentals — symbols and conventional signs - colours and patterns in symbolization – map lettering - map production – map printing– colours and visualization — map reproduction - Map generalization - geometric transformations – bilinear and affine transformations.

UNIT II GIS AND SPATIAL DATA 9

Data — Information — Primary and Secondary data sources — GIS - Components of a GIS — Hardware, Software, Data, People, Methods - Types of data – Spatial, Attribute data – scales/ levels of measurements - spatial data models - Raster vs Vector Models - Raster Data Structures - TIN and GRID data models.

UNIT III RASTER AND VECTOR DATA ANALYSIS 9

Raster Data analysis: Query Analysis – Local, Focal and Zonal Operations – Cost-Distance Analysis - Least Cost Path – Vector data analysis – attribute data analysis - query, calculations – Integrated data analysis - Reclassification, Aggregation, Overlay analysis: Point-in-polygon, Line- in-Polygon, Polygon-on-Polygon: Clip, Erase, Identity, Union, Intersection – Proximity Analysis: Buffering

UNIT IV NETWORK ANALYSIS 9

Network – Introduction - Network Data Model – Elements of Network - Building a Network database - Geocoding – Address Matching - Shortest Path in a Network – Time and Distance Based shortest path analysis – Driving Directions – Closest Facility Analysis – Catchment / Service Area Analysis-Location-Allocation Analysis.

UNIT IV MODELLING AND APPLICATIONS 9

Land Information studies - Building information system — Digital Infrastructure management - Watershed modelling for sustainable development - modelling of reservoir siltation — soil degradation assessment - Highway alignment studies – Intelligent transportation systems - Solid Waste management - Air quality monitoring - Disaster management.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the basic concepts of map making process.	3
CO2	Illustrate various components of spatial data and Geographic Information System	3
CO3	Analyze the spatial data which is useful for modelling the real-world problems	3
CO4	Analyze the spatial data which is useful for modelling the transportation networks and resource transport.	3
CO5	Illustrate the applicability of Geoinformatics technology on diverse Civil Engineering Problems	3

TEXT BOOKS:

1. C.P. Lo Albert K.W. Yeung, Concepts and Techniques of Geographic Information Systems, second edition, PHI Learning Private Limited, Delhi, 2014.
2. Jonathan E. Campbell, Michael Shin, Essential of Geographic Information System, Saylor Foundation, 2011.

REFER ENCES

1. Ian Heywood, Sarah Cornelius, Steve Carver, Srinivasa Raju, “An Introduction to Geographical Information Systems, Pearson Education, 2nd Edition, 2007.
2. Michael N. DeMers, Fundamentals of geographic information systems, Wiley,2009
3. John Peter Wilson, The handbook of geographic information science, Blackwell Pub.,2008
4. Harvey J.Miller, Shih-Lung Shaw, Geographic Information System for Transportation- Principle and Applications, Oxford University Press,2001.
5. Kang-Tsung Chang, "Introduction to Geographic Information Systems", McGraw Hill Publishing, 2nd Edition, 2011.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	3	-	-	3	3	3	-	3	3	3
CO2	3	3	3	2	3	-	-	3	3	3	2	3	3	3
CO3	3	3	3	2	3	-	-	3	3	3	-	3	3	3
CO4	3	3	3	2	3	-	-	3	3	3	-	3	3	3
CO5	3	3	3	2	3	3	3	3	3	3	2	3	3	3

3-High, 2-Medium, 1-Low

CE22063	GEOGRAPHIC INFORMATION SYSTEMS	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.

UNIT I INTRODUCTION TO MAPS AND GIS 9

Maps – Definition – Scale - Types of Maps – Elements of Map – Projection – purpose - types –Coordinate Systems: Geographic, Rectangular and Polar – Transformations - types and application – GIS: Introduction - History– Components – Applications of GIS - Popular GIS software — Opensource GIS software

UNIT II DBMS AND GIS DATA MODEL 9

Database Management system — function — types — advantages - Entity Relationship Model - Normalization - GIS Data Model - Introduction- Data Encoding - Vector Data Structure - RasterData structure — Network Data Structure - Comparison of Vector and Raster Data Structure – ODBC.

UNIT III GIS DATA INPUT 9

Sources for GIS Data - Vector Data Input – Georeferencing – Topology – Topological Relationship - Raster Data Input – Errors in input – Data Editing – Linking Attribute Data – Raster File Formats – Vector File Formats – Raster to Vector and Vector to Raster Conversion - OGC standards.

UNIT IV GIS DATA ANALYSIS 9

Introduction to spatial analysis - Raster Data Spatial Analysis: Local, Neighbourhood, Zonal Operations - Vector Operations and Analysis: Topological and Non-topological operations - Network Analysis – DEM – Surface Analysis.

UNIT V GIS OUTPUT DESIGN AND PRESENTATION 9

Introduction - Spatial and Non-spatial Data presentation - Map layout – Charts, Graphs and Multimedia output – Elements of Spatial Data Quality – Meta Data - Introduction to Web GIS – Applications in Civil Engineering

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Explain the fundamentals of maps, their characteristics and GIS, its components	3
CO2	Demonstrate the various spatial data models and their advantages	3
CO3	Demonstrate a error free GIS database for civil engineering applications	3
CO4	Apply the various spatial analysis tools for deriving GIS based outcome	3
CO5	Present the spatial information along with quality assessment for applications	3

TEXT BOOKS:

1. Ian Heywood, Sarah Cornelius, Steve Carver, An Introduction to Geographical Information Systems, 4th Edition, 2011, Prentice Hall, ISBN: 9780273722595
2. Longley, P. A., Goodchild, M. F., Maguire, D. J., and Rhind, D. W., Geographical Information Systems: Principles, Techniques, Management and Applications, 2nd Edition, 2015, John Wiley & Sons, ISBN: 9780471735458

REFERENCES

1. Jonathan Campbell and Michael Shin, Essentials of Geographic Information Systems, 2011, Saylor Foundation, ISBN: 9781453321966
2. Michael N. DeMers, Fundamentals of Geographic Information Systems, 4th Edition, 2009, Wiley, ISBN: 9780470129067
3. Kang-tsung Chang, "Introduction to Geographic Information Systems", 9th Edition, 2019, McGraw-Hill Book Company, ISBN: 9781259929649.
4. Paul A. Longley, Michael F. Goodchild, David J. Maguire, David W. Rhind, Geographic Information Science and Systems, 4th Edition, 2015, Wiley, ISBN: 9781118676950
5. David Smith, Understanding GIS - An ArcGIS Pro Project Workbook, 4th Edition, 2018, Environmental Systems Research, ISBN: 9781589485266

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO2	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO3	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO4	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO5	3	3	3	2	3	-	-	3	3	3	2	3	3	3

3-High, 2-Medium, 1-Low

CE22064	PHOTOGRAMMETRY	L	T	P	C
		3	0	0	3

OBJECTIVE:

the objective of the course is to familiarize the undergraduate students with the principles, tools and equipment, methodology for photogrammetric mapping work and the current trends in aerial based mapping techniques like UAV.

UNIT I PRINCIPLES AND PROPERTIES OF PHOTOGRAPHY 9

History - Definition, Applications - Types of Photographs, Classification - Photographic overlaps – Film-based Aerial Cameras – Construction - Camera accessories - Camera calibration - Digital Aerial cameras- CCD – Multiple frame and Line cameras - Linear array scanner - Flight Planning –Crab and Drift - Basic horizontal and vertical control - Pre pointing and Post pointing.

UNIT II GEOMETRIC PROPERTIES OF AERIAL PHOTOGRAPHS 9

Photo coordinate measurement - Refinement of photo coordinates - Vertical photographs - geometry, scale – Stereoscopes - parallax concept - parallax equation - Tilted photograph - Geometry, Scale, Coordinate system – Relief displacement –- Photo Interpretation.

UNIT III STEREO PLOTTERS& ORIENTATION 9

Projection system, Viewing, Measuring and Tracing system - Stereo plotters – Classification – Analog, semi analytical, Analytical and Digital plotting concepts – cross ratio- Two-dimensional coordinate transformations – ray tracing- Interior orientation - dependent and independent RO- – Collinearity condition and Coplanarity condition - Three-dimensional conformal coordinate transformation - Absolute orientation – GPS/INS based orientation

UNIT IV AEROTRIANGULATION, TERRAIN MODELING, ORTHOPHOTO 9

Neat model - blocks of photographs- – Aerotriangulation: – strip adjustment – independent model triangulation - Bundle block Adjustment– precision, accuracy and reliability- DTM, DEM and DSM, Orthophoto – mono plotting – stereo plotting - feature collection

UNIT V DIGITAL PHOTOGRAMMETRY 9

Photogrammetric Scanner – Digital Photogrammetry Work Station - requirement of functionalities Stereoscopic Viewing and Measuring System - Photogrammetry project Planning image properties- image matching: template matching , feature based matching - satellite photogrammery principles- UAS technology- regulatory – technical challenges – tools.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the importance of photography as means of mapping,functional and physical elements of photography.	3
CO2	Understand and reflect on the history and need of the photogrammetric mapping and the relevants of the accuracy standards and means to achieve them for precise large-scale maps with scientific methods.	3
CO3	Evaluate the standards of map based on the state-of-the-art tool, techniques and the production standards for photogrammetric map making.	3
CO4	Acquire knowledge on the current development, issues methods and solutions in map making and evaluate methods of production.	3
CO5	Analyze critically and evaluate methods by applying the knowledge so gained and to be a part of innovation and integration of mapping technology.	3

TEXTBOOKS:

1. Paul. R Wolf., Bon A.DeWitt, Elements of Photogrammetry with Application in GIS McGraw Hill International Book Co., 4th Edition, 2014.
2. E.M.Mikhail, J.S.Bethel, J.C.McGlone, Introduction to Modern Photogrammetry, Wiley Publisher, 2001

REFERENCES:

1. Gollfried Konecny, Geoinformation: Remote Sensing, Photogrammetry and Geographical Information Systems, CRC Press, 1st Edition, 2002.
2. Karl Kraus, Photogrammetry: Geometry from Images and Laser Scans, Walter de Gruyter GmbH & Co. 2nd Edition, 2007
3. Manual of Photogrammetry – American society of Photogrammetry & R.S by Albert.D, 1952.
4. Digital Photogrammetry – A practical course by Wilfried Linder, 3rd edition, Springer, 2009.
5. Digital Photogrammetry by – Y. Egels & Michel Kasser, Taylor & Francis group,2002

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO2	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO3	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO4	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO5	3	3	3	-	3	-	-	3	3	3	-	3	3	3

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3-High, 2-Medium, 1-Low

CE22065 **CARTOGRAPHY**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce Cartography as science and technology of Map Making
- The course also introduces its connections with Communication Science, Computer technology and IT.
- To outline the Cartography as a creative art.

UNIT I MAP – A SPECIAL GRAPHIC COMMUNICATOR 9

Maps, their functions and use – Definition of Cartography – Types of Maps – other cartographic products – map making steps – surveying and mapping - Concepts of sphere, ellipsoid and geoid - latitudes, longitudes and graticules - Map Scales and Contents – accuracy and errors- History of Cartography – Mapping organizations in India.

UNIT II ABSTRATION OF EARTH AND MAP PROJECTION 9

Map projections – shape, distance, area and direction properties - role of aspect, development surface, secant and light source / viewpoints – perspective and mathematical projections – Indian maps and projections – Map co-ordinate systems – UTM and UPS references – common projections and selections– projections for hemispheres and the world maps.

UNIT III MAP COMPILATION AND DESIGN 9

Base map concepts – scanning and digitization – planimetric, topographic and thematic information – sample and census surveys – attribute data tables – Elements of a map - Map Layout principles – Map Design fundamentals – symbols and conventional signs - graded and ungraded symbols - color theory - colours and patterns in symbolization – map lettering

UNIT IV MAP MAKING 9

Definition of chropleth , Dasymetric and isopleth maps – class interval selection and shading – isopleth maps and interpolation strategies – located symbol maps – flow maps – cadastral and engineering maps – demographic and statistical mapping –sequential maps – map production – map printing– colours and visualization – map reproduction – printing soft copies and standards.

UNIT V MAP TRANSFORMATIONS 9

Map generalization – attribute conversions and transforms – reduction and enlargement -fusions - geometric transformations – bilinear and affine transformations - hardware and software in map making – conversion to multimedia, internet and web objects - mobile maps–cartometry.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Demonstrate the basic concepts of Cartography	3

CO2	List out the concepts of map projections	3
CO3	Summarise the concepts about coordinate systems and their applications in map making	3
CO4	Explain the map compilation, design and map production processes	3
CO5	Apply the concepts of map transformation and web-based mapping	3

TEXTBOOKS:

1. Anson R.W. and Ormeling F.J. “Basic Cartography for students and Technicians”. Vol.I, II and III, Elsevier Applied Science Publishers, 3rd Edition, 2004.
2. Arthur, H. Robinson et al, “Elements of Cartography”, 7th Edition, John Wiley and Sons, 2004.

REFERNCES:

1. John Campbell, "introductory Cartography", Wm.C. Brown Publishers, 3rd Edition, 2004
2. Menno Jan Kraak & Ferjan Ormeling, Cartography Visualization of Geospatial Data, 2nd Edition, Pearson Education, 2004
3. Martin Dodge, Marrs Mcderby & Martin Turner, John wiley & srena"Geographic Visualization", west sin sex, England, 2008
4. Robert B McMaster, fritz C Kessler, Hugh H Howard "Thematic Cartography and Geovisualization 3rd edition by Terry A slocum, Prentice Hall, 2008.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO2	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO3	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO4	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO5	3	3	3	-	3	-	-	3	3	3	-	3	3	3

High, 2-Medium, 1-Low

CE22066 **AIRBORNE AND TERRESTRIAL LASER MAPPING**

L	T	P	C
3	0	0	3

OBJECTIVE:

To introduce the concepts of Space Borne, Air Borne, Terrestrial and Bathymetric LASER Scanners for Topographic and Bathymetric Mapping.

UNIT I SPACE BORNE RADAR AND LIDAR ALTIMETER 9

Principle and Properties of LASER- Production of Laser – Components of LASER – LiDAR – Types of LiDAR :Range Finder, DIAL and Doppler LiDAR - Platforms: Terrestrial, Airborne and Space borne LiDAR – Space Borne LiDAR Missions – Space Borne Radar Altimeter for mapping Sea Surface Topography , Moon Topography - Merits of ALS in comparison to Levelling, echo sounding, GPS leveling, Photogrammetry and Interferometry

UNIT II AIRBORNE LASER SCANNERS 9

Airborne Topographic Laser Scanner – Ranging Principle – Pulse Laser and Continuous Wave Laser – First Return and Last Return – Ellipsoidal and Geoidal Height - Typical parameters of a Airborne Laser Scanner (ALS) – Specifications of Commercial ALS –- Components of ALS - GPS, IMU, LASER Scanner, Imaging Device, Hardware and Software.

UNIT III DATA ACQUISITION AND PRE-PROCESSING 9

Various Scanning Mechanism – Synchronization of GPS, IMU and ALS Data - Reflectivity of terrain objects – Laser Classification – Class I to Class IV Laser – Eye Safety - Flight Planning – Determination of various data acquisition parameters – Swath Width, Point Density, No. of Strips, Area Covered, Point Spacing - Data Processing – Determination of flight trajectory

UNIT IV POST PROCESSING AND APPLICATIONS 9

Post Processing – Geo location of Laser Foot Prints – Various Co-ordinate Transformations involved - Filtering - Ground Point filtering – Digital Surface Model and Digital Elevation Model - LIDAR data formats Post Processing Software - Overview of LIDAR Applications in various domains - 3D city models – Corridor Mapping Applications – Forestry Applications.

UNIT V TERRESTRIAL AND BATHYMETRIC LASER SCANNERS 9

Terrestrial Laser Scanners (TLS) – Working Principle – Static TLS – Dynamic TLS – Vehicle Mounted TLS –- Commercial TLS Specifications – Bathymetric Laser Scanners (BLS) – Working Principle of BLS Depth of Penetration of BLS – Applications of TLS and BLS

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand the components of laser and various platforms of laser scanning	3

CO2	Summarize the components of Airborne Laser Scanner and ranging principles	3
CO3	Analyse the flight planning parameters and preprocessing of acquired data	3
CO4	Apply the data to derive DSM and DEM and its applications	3
CO5	Understand the components of TLS and ABS and its applications	3

TEXTBOOKS:

1. Jie Shan and Charles K. Toth, Topographic Laser Ranging and Scanning – Principles and Processing,Second Edition, CRC Press, Taylor & Francis Group, 2018
2. Pinliang Dong, Qi Chen, LiDAR Remote Sensing and Applications**,** 1st Edition, CRC Press 2018

REFERNCES:

1. George Vosselman and Hans-Gerd Maas, Airborne and Terrestrial Laser Scanning, Whittles Publishing, 2010.
2. Matti Maltamo, Erik Næsset, Jari Vauhkonen, Forestry Applications of Airborne Laser Scanning- Concepts and Case Studies, Springer, Dordrecht, 2016, Reprint Edition. ISBN 978- 94-017-8662-1
3. Michael Renslow, Manual of Airborne Topographic LiDAR, The American Society for Photogrammetry and Remote Sensing, 2013.
4. Zhilin Li, Qing Zhu, Chris Gold, Digital terrain modeling: principles and methodology, CRC Press, 2005.
5. Roger Read and Ron Graham, Manual of Aerial Survey: Primary Data Acquisition, Whittles Publishing, 2002.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO2	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO3	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO4	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO5	3	3	3	-	3	-	-	3	3	3	-	3	3	3

High, 2-Medium, 1-Low

CE22067 **SATELLITE IMAGE PROCESSING**

L	T	P	C
3	0	0	3

OBJECTIVE:

The objective of the course is to describe about the procedure of satellite data acquisition and analysis.

UNIT I - FUNDAMENTALS **9**

Satellite systems and data – acquisition - storage - orbits – Data formats –Data products – Image processing system – factors to be considered- Image display systems – Image sampling and quantization - Basic relationship between pixels.

UNIT II SENSOR AND DATA MODEL **9**

Sensor model – pixel characters - Image formation – Histogram -Types- Uni-variate & multi-variate image statistics – spatial statistics – Image registration and ortho rectification - Geometric and radiometric correction - noise models.

UNIT III IMAGE ENHANCEMENTS **9**

Spectral signatures – Image characteristics, feature space scatterogram- point, local and regional operation – contrast, spatial feature and multi-image manipulation techniques - Fourier transform - principle component analysis - Optimal Rotation Transformation – Scale-space transform, wavelet transform. multi-image fusion.

UNIT IV THEMATIC CLASSIFICATION **9**

Training sites - Supervised, Unsupervised and Hybrid classifiers -– Baye's Theorem – parametric classification - Decision tree – other non-parametric classifiers - sub-pixel and super-pixel classification - Hyper-spectral image analysis - Accuracy assessment.

UNIT V FEATURE EXTRACTION **9**

Pattern recognition - boundary detection and representation - textural and contextual analysis - decision concepts: Fuzzy sets - evidential reasoning - Expert system concepts - Artificial Neural Network – Object based methods - Case studies

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Gain knowledge about basic requirement of satellite image processing	3
CO2	Understand knowledge about Degradation in satellite image and also to restore it for further processing.	3
CO3	Perform various image Enhancement techniques to improve the visual Interpretability of the image.	3
CO4	Gain knowledge about classification of the satellite image using various method and also evaluate the accuracy of classification.	3
CO5	Implement the advanced image classification methods and conduct life long research in the field of image processing.	3

TEXTBOOKS:

1. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition, 2015.
2. Robert Shcowebgerdt, Remote sensing models & methods for image processing, Academic Press, 2012.

REFERENCES:

1. John A.Richards, Springer – Verlag, Remate Sensing Digital Image Analysis 5th Edition,2012..
2. Digital Image Processing (4th Edition) Rafael C. Gonzalez, Richard E. Woods Prentice Hall, 2018.
3. W.G. Rees - Physical Principles of Remote Sensing, Cambridge University Press, 2nd edition, 2001.
4. Fundamentals of Digital Image Processing by Annadurai Pearson Education (2006)
5. Digital Image Processing: PIKS Scientific Inside by William K. Pratt 4th Edition,Wiley Interscience,2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO2	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO3	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO4	3	3	3	-	3	-	-	3	3	3	2	3	3	3
CO5	3	3	3	-	3	-	-	3	3	3	2	3	3	3

High, 2-Medium, 1-Low

CE22068 CADASTRAL AND HYDROGRAPHIC SURVEYING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To educate the student about the various basic concepts of cadastral and hydrographic surveying.

UNIT I – INTRODUCTION TO CADASTRAL SURVEYING 9

Introduction to Cadastral survey - History of cadastral survey - Cadastral Survey Methods – survey of villages – Instruments used for cadastral survey – Orthogonal, Polar survey methods – Boundary survey – Rectangulation – town survey – Calculation of area - GPS and Total Station in Cadastral survey.

UNIT II - MAINTAINENCE AND MEASUREMENT 9

Cadastral survey maintenance – FMS: manual and digital – Resurveys – Measurement of subdivision – Measurement of obstructed lines – Survey of urban areas – Control requirement for Urban survey use of Satellite Imagery in boundary fixing- maintenance of accounts.

UNIT III - LAND INFORAMTION SYSTEM 9

land records in India – digital conversions of records – NLRMP – DILRMP – smart cities – current systems – international and nationals – digital solutions for land records – examples- Indian initiatives – Tamil nilam

UNIT IV - MODERN TECHNOLGY IN CADASTRAL SURVEYING 9

Current developments –- UAV- UAS –tools and techniques- Laser terrain mapping documentation - data maintenance – data bases – block chain technology – web technology.

UNIT V - HYDROGRAPHIC SURVEYING 9

Introduction - Shore Line Survey - Soundings - Making the Soundings - Methods of Locating Soundings - Reduction of Soundings - Plotting of Soundings - The Tides - Prediction of Tides - Tide Gauges - Mean Sea Level as datum - River Surveys - Measurement of Current and Discharge - Bathymetric Measurement.

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Apply various methods used for surveying, mapping and maintenance of cadastral records	3
CO2	Summarise the procedure of maintenance, documentation of land records and the current national developments in this regard.	3
CO3	Update with modern surveying technology and geospatial solutions for creation,	3
CO4	Demonstrate the methodology to create and maintain digital cadastre, LIS, etc.	3
CO5	Gain knowledge in computation of positions and levels of waterbodies.	3

TEXTBOOKS:

1. Land Information Management: An Introduction with Special Reference to Cadastral Problems in Third World Countries by Peter F.Dale, John D. McLaughlin,2010
2. Dr. B. C. Punmia, Ashok K. Jain and Arun K Jain, Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, Sixteenth Edition, 2019.

REFERNCES:

1. The Tamil Nadu survey and boundaries act, 1923, Tamil Nadu Act No.VIII.
2. Cadastral Survey Methodologies and Techniques in Developing Countries, Pertti ONKALO, 2006.
3. NLRMP - Guidelines, Technical Manuals and MIS,2009.
4. Land Tenure, Boundary Surveys, and Cadastral Systems by George M.Cole &Donald A Wilson,2016.
5. J. Uren and W.F. Price, Surveying for Engineers, Palgrave macmillan, Fifth Edition, 2010.
6. R. Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO2	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO3	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO4	3	3	3	-	3	-	-	3	3	3	-	3	3	3
CO5	3	3	3	-	3	-	-	3	3	3	-	3	3	3

High, 2-Medium, 1-Low

CE22060	MINI PROJECT	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The project work shall be carried out in the same domain of the specialized vertical for students registered for Honours with Specialisation and Minors by other department students.
The project topic for the students registered for Honours shall be finalized by the DCC.

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

PROFESSIONAL ELECTIVE

VERTICAL 7

GEOTECHNICAL ENGINEERING

CE22071	SUBSURFACE INVESTIGATION AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- Students are expected to understand the importance of site investigation, planning of sub soil investigation and interpretation of investigated data to design suitable foundation system.

UNIT I PLANNING OF EXPLORATION AND GEOPHYSICAL METHODS 9

Scope and objectives, planning an exploration program, methods of exploration, exploration for preliminary and detailed design, spacing and depth of bores, data presentation. Geophysical exploration and interpretation, seismic and electrical methods, cross bore hole, single bore hole – up hole -down hole methods

UNIT II EXPLORATION TECHNIQUES 9

Methods of boring and drilling, non-displacement and displacement methods, drilling in difficult subsoil conditions, limitations of various drilling techniques, stabilization of boreholes, bore logs.

UNIT III SOIL SAMPLING 9

Sampling Techniques – quality of samples – factors influencing sample quality - disturbed and undisturbed soil sampling advanced sampling techniques, offshore sampling, shallow penetration samplers, preservation and handling of samples

UNIT IV FIELD TESTING IN SOIL EXPLORATION 9

Field tests, Penetration tests, Field vane shear, Insitu shear and bore hole shear test, pressure meter test, dilatometer test - plate load test–monotonic and cyclic; field permeability tests – block vibration test. Procedure, limitations, correction and data interpretation of all methods.

UNIT V INSTRUMENTATION 9

Instrumentation in soil engineering, strain gauges, resistance and inductance type, load cells, earth pressure cells, settlement and heave gauges, pore pressure measurements – slope indicators, sensing units, case studies.

TOTAL :45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Plan the suitable exploration techniques based on the site conditions	3
CO2	Apply the knowledge of different methods of exploration to select appropriate method of boring for investigating real field condition.	3
CO3	Apply the knowledge of different sampling techniques to meet the needs and to characterize the soil.	3
CO4	Carryout appropriate field test to arrive the required soil parameters to design the geotechnical structures.	3
CO5	Plan the instrumentation program, execute the same in the field and monitor the performance of geostructures to ensure its stability during its life time.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Hunt, R.E., Geotechnical Engineering Investigation Manual, McGraw Hill, 1984.
2. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Hand Book, a Nostrand Reinhold, 1994.
3. Alam Singh and Chowdhary, G.R., Soil Engineering in Theory and Practice, Volume-2, Geotechnical Teating and Instrumentation, CBS Publishers and Distributors, New Delhi, 2006.

REFERENCES:

1. Nair, R.J. and Wood, P.M., Pressuremeter Testing Methods and Interpretation, Butterworths, 1987.
2. Dunnicliff, J., and Green, G.E., Geotechnical Instrumentation for Monitoring Field Performance, John Wiley, 1993.
3. Hanna, T.H., Field Instrumentation in Geotechnical Engineering, Trans Tech., 1985.
4. Day, R.N., Geotechnical and Foundation Engineering, Design and Construction, McGraw Hill, 1999.
5. Bowels, J.E., Foundation Analysis and Design, Fifth Edition, The McGraw-Hill Companies, New York, 1995
6. Clayton C.R.I., Matthews M.C. and Simons N.E., Site Investigation, Second Edition Halsted Press, 1982.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	1	-	1	-	2	-	-	3	3
CO2	3	2	2	2	-	1	-	1	-	2	-	-	3	3
CO3	3	2	2	2	-	1	-	1	-	2	-	-	3	3
CO4	3	2	2	2	-	1	-	1	-	2	-	-	3	3
CO5	3	2	2	2	-	1	-	1	-	2	-	-	3	3

3-High, 2-Medium, 1-Low

CE22072	EARTH PRESSURE AND EARTH RETAINING STRUCTURES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to impart knowledge to analyse and design rigid, flexible earth retaining structures, slurry supported trenches and deep cuts.

UNIT I EARTH PRESSURE THEORIES 9

State of stress in retained soil mass – Earth pressure theories – Classical and graphical techniques (Culmann's method) – Active and passive cases – Earth pressure due to external loads.

UNIT II STABILITY OF RETAINING STRUCTURES 9

Retaining structure – Selection of soil parameters - Lateral pressure due to compaction, strain softening, wall flexibility, drainage arrangements and its influence. – Stability analysis of retaining structure both for regular and earthquake forces

UNIT III SHEET PILE WALLS 9

Types of sheet piles - Analysis and design of cantilever and anchored sheet pile walls – free earth support method – fixed earth support method. Design of anchor systems - isolated and continuous.

UNIT IV SUPPORTED EXCAVATIONS 9

Lateral pressure on sheeting in braced excavation, stability against piping and bottom heaving. Earth pressure around tunnel lining, shaft and silos – Soil anchors – Soil pinning –Basic design concepts - Slurry Supported Trenches- Basic principles – Slurry characteristics – Specifications – Diaphragm walls – stability Analysis.

UNIT V STABILITY OF SLOPES 9

Stability of infinite and finite slopes, Limit Equilibrium method, Wedge analysis, Method of Slices, Bishop's method, Janbu's method etc. Special aspects of slope analysis, stability charts. Role of geosynthetics in stabilization of slopes.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Analyse the earth pressure acting on retaining structures	3
CO2	Apply the knowledge of engineering and earth pressure to analyse and design rigid retaining structures.	3
CO3	Apply knowledge of engineering and earth pressure to analysis and design the flexible earth retaining walls.	3
CO4	Apply knowledge on lateral earth pressure behind and around the excavation to analysis and design support structures for excavation.	3
CO5	Analyze the stability of infinite and finite slopes	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Clayton, C.R.I., Militisky, J, and Woods, R.I., Earth Pressure and Earth Retaining Structures, Second Edition, Survey University Press, 1993.
2. Das, B.M., Principles of Geotechnical Engineering, Fourth Edition, The PWS Series in Civil Engineering, 1988.
3. Militisky, J.and Woods, R., Earth and Earth Retaining Structures, Routledge, 1992.

REFERENCES:

1. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, Galgotia Book Source, 2000.
2. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
3. Koerner, R.M., Geotechnical and Foundation Engineering Design and Construction, McGraw Hill, 1999.
4. Day, R.W., Geotechnical and Foundation Engineering Design and Construction, McGrar Hill, 1999.
5. Mandal, J.N., Reinforced Soil and Geotextiles, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 1993.
6. Mccarthy, D.F., Essentials of Soil Mechanics and Foundations: Basic Geotechnics, Sixth Edition, Prentice Hall, 2002.
7. Muni Budhu, Soil Mechanics and Foundation, John Wiley and Sons, INC 2007.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	3	3	2	-	-	1	1	2	2	-	3	3
CO2	3	2	3	3	2	-	-	1	1	2	2	-	3	3
CO3	3	2	3	3	2	-	-	1	1	2	2	-	3	3
CO4	3	2	3	3	2	-	-	1	1	2	2	-	3	3
CO5	3	2	3	3	2	-	-	1	1	2	2	-	3	3

3-High, 2-Medium, 1-Low

CE22073	DEEP FOUNDATIONS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The student will be exposed to design of piles, pile groups and caissons with respect to vertical and lateral loads for various field conditions

UNIT I PILE CLASSIFICATIONS AND LOAD TRANSFER PRINCIPLE 9

Necessity of pile foundation – classification of piles – Factors governing choice of type of pile – Load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition – pile raft system – basic interactive analysis - criteria for pile socketing - responsibility of engineer and contractor

UNIT II AXIAL LOAD CAPACITY OF PILES AND PILE GROUPS 9

Allowable load of piles and pile groups – Static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – Wave equation application – evaluation of axial load capacity from field test results – pile integrity test - Settlement of piles and pile group – IS codal provisions and IRC guide lines.

UNIT III LATERAL AND UPLIFT CAPACITIES OF PILES 9

Piles sunder Lateral loads – Broms method, elastic, p-y curve analyses – Batter piles – response to moment – piles under uplift loads – under reamed piles – Drilled shaft – Lateral and pull out load tests – piled-raft design philosophy - IS codal provision – IRC and API guide lines – case studies

UNIT IV STRUCTURAL DESIGN OF PILE AND PILE GROUPS 9

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- Reinforcement details of pile and pile caps –– pile subjected to vibration – IS codal provision – IRC guide line.

UNIT V CAISSONS 9

Necessity of caisson – type and shape - Stability of caissons – principles of analysis and design – tilting of caisson – construction - seismic influences - IS codal provision.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the importance of pile foundation and various functions and responsibilities of geotechnical engineer and contractor	3
CO2	Determine the vertical load carrying capacity of pile and pile group- keeping the settlement of pile as an important criteria	3
CO3	Understand the different types of load acting on the pile and methods to calculate the pile capacity	3
CO4	Design and detailing the components of pile and pile groups	3
CO5	Design and check the stability of caisson foundation	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Das, B.M., Principles of Foundation Engineering, Design and Construction, Fourth Edition, PWS Publishing, 1999.
2. Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, NewYork, 1980.
3. Tomlinson, M.J. Foundation engineering, ELBS, Longman Group, U.K. Ltd., England 1995.

REFERENCES:

1. McCarthy, D.F., "Essentials of Soil Mechanics and Foundations". Prentice-Hall, 2006.
2. Michael Tomlinson and John Woodward, Pile design and construction practice, Taylor & Francis Group, London & New York, 2008.
3. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, McGraw Hill, New York, 1996.
4. Donald, P., Coduto, Foundation Design Principles and Practices, Prentice Hall, Inc. Englewood Cliffs, New Jersey, 1996.
5. Varghese P.C.," Foundation Engineering", PHI Learning Private Limited, New Delhi, 2005.
6. Reese,L.C., Isenhower,W.M. and Wang,S.T. Analysis and Design of Shallow and Deep Foundations, John Wiley and Sons, New York, 2005.
7. Varghese P.C.," Design of Reinforced Concrete Foundations", PHI Learning Private Limited, New Delhi, 2009.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO2	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO3	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO4	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO5	3	3	2	2	-	1	1	1	2	2	1	1	3	3

3-High, 2-Medium, 1-Low

CE22074	SOIL DYNAMICS AND MACHINE FOUNDATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The objective of this course is to understand the basics of dynamics, effects of dynamic loads and the various methods to design machine foundation

UNIT I THEORY OF VIBRATION 9

Nature of 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 – vibrations of multi degree freedom system.

UNIT II DYNAMIC SOIL PROPERTIES AND BEHAVIOR 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 III FOUNDATIONS FOR RECIPROCATING MACHINES 9

Machines and Foundations – General requirements – Modes of vibration of a rigid foundation, block method of analysis – Linear Elastic weightless spring method – Elastic half – space method – Analog models ; Design of Block foundation -- Codal Provisions.

UNIT IV FOUNDATION FOR IMPACT AND ROTARY MACHINCS 9

Dynamic analysis of impact type machines – Design of Hammer foundations – use of vibrator Absorbers – design – Codal recommendation. Special consideration for Rotary machines – Design criteria – Loads on Turbo Generator Foundation – method of analysis – Design; Dynamic soil – structure – Interaction, 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 :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Differentiate different type of dynamic loads and theory of vibration of different systems	3
CO2	Select different dynamic properties from different testing principles and applications	3
CO3	Perform analysis and design of foundation for reciprocating machines based on different methods.	3
CO4	Perform analysis and design of foundation for impact and rotary machines based on different methods	3
CO5	Assess influence of vibration from different dynamic source and to design suitable remediation	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Kameswara Rao, N.S.V., "Dynamics soil tests and applications", Wheeler Publishing, NewDelhi, 2000.
2. Moore, P.J., "Analysis & Design of Foundations for Vibrations", Oxford & IBH, 2006.
3. Krammer S.L., "Geotechnical Earthquake Engineering", Prentice hall, International Series, Pearson Education (Singapore) Pvt. Ltd., 2004.

REFERENCES:

1. Prakash, S and Puri, V.K., Foundations for machines, McGraw Hill, 1987.
2. Swami Saran, "Soil Dynamics and Machine Foundation", Galgotia publications Pvt. Ltd., New Delhi 1999.
3. Kameswara Rao, "Vibration Analysis and Foundation Dynamics", Wheeler Publishing, NewDelhi, 1998.
4. A.K.Chopra, Dynamics of Structures, Theory and Applications to Earthquake Engineering, 5th edition, Pearson Education, 2017.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	1	1	-	1	-	1	1	1	3	3
CO2	3	2	2	2	1	1	-	1	-	1	1	1	3	3
CO3	3	2	2	2	1	1	-	1	-	1	1	1	3	3
CO4	3	2	2	2	1	1	-	1	-	1	1	1	3	3
CO5	3	2	2	2	1	1	-	1	-	1	1	1	3	3

3-High, 2-Medium, 1-Low

CE22075	**TUNNELING**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- The students are expected to understand the behavior of underground structures with reference to various supporting systems under different loading conditions due to induced earth pressure on the underground structures.

UNIT I GROUND MOVEMENTS AND ITS EFFECTS 9

Understanding of the ground – Building response to ground movements – concept of limiting tensile strain – strains in simple rectangular beams – ground movement due to tunneling and excavation - lateral supporting systems – retaining walls – factors influencing on the selection of the retaining system – case history.

UNIT II ANALYSIS OF UNDERGROUND SUPPORTING SYSTEMS 9

Underground supporting system analysis - free and fixed earth support method – shear failure of strutted walls – push in – basal heave - upheaval – sand boiling - Stress and deformation analysis of excavation: simplified method – beam on elastic foundation method – finite element method.

UNIT III DESIGN OF UNDERGROUND SUPPORTING SYSTEMS 9

Principles of retaining wall design – types of wall support systems - design of structural elements – Permanent situations – bottom-up/top-down construction sequences – Props – Tied systems – Soil berms – Design of ground anchors – Retaining wall as part of complete underground structure – resistance to vertical and lateral actions.

UNIT IV DESIGN OF TUNNEL 9

Longitudinal and transverse profile of tunnel structure - tunnel protection against fire – advanced systems of anti-water insulation of underground structures - loading types of shallow and deep tunnels, rock mass classification - mining technologies of deep excavation - shield technology, execution technology of shallow underground structures, sewerage objects – trenchless technologies.

UNIT V PROTECTION OF ADJACENT BUILDINGS 9

Protection of building using the behaviour of excavation and tunneling induced deformation - building protection by auxiliary methods – construction defects and remedial measures - building rectification methods.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Understand various types of supporting systems used for excavations and analyse ground movement due to various activities like excavations.	3
CO2	Analyse underground supporting system using mathematical, analytical and numerical methods.	3
CO3	Design various underground supporting systems using mathematical and numerical approach.	3
CO4	Understand the concept of tunneling, analyse and design the tunnel in different ground.	3
CO5	Protect the adjacent building due to underground construction using various methods.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Chang – Yu Ou, Deep Excavation Theory and Practice, Taylor & Francis Group, London, UK, 2006.
2. Megaw T. M., and Bartlett, J.V., Tunnels: planning, design, construction. Ellis Horwood, 1983.
3. Kolymbas, D., Tunnelling and tunnel mechanics: A rational approach to tunnelling, 2nd corrected printing © 2008, Springer – Verlag Berlin Heidelberg, Italy, 2005.
4. Lunardi, P., Design and construction of tunnels, Springer – Verlag Berlin Heidelberg, Italy, 2008.

REFERENCES:

1. Holtz, R.D. and Kovaces, W.D., An Introduction to Geotechnical Engineering, Prentice Hall, Inc., Englewood Cliffs, NJ, 1981.
2. Terzaghi, K. and Peck, R. B, Soil Mechanics in Engineering Practice, John Wiley & Sons, New York, 1967.
3. Hausman, M. R., Engineering Principles of Ground Modification, McGraw – Hill Publishing Company, New York, 1990.
4. Bowles, J. E. Foundation Analysis and Design, 4th Ed. McGraw – Hill Book Company, NewYork, USA, 1988.
5. Hoek, E., Brown, E.T., Underground excavations in rock, The Institution of Mining and Metallurgy, London, SW7 2BP, England, 1980.
6. Goel, R.K. and Dwivedi, R.D., A Short-Term course on Underground Engineering, Central Institute of Mining and Fuel Research Regional Centre, Roorkee, 2010.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO2	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO3	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO4	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO5	3	3	2	2	-	1	1	1	2	2	1	1	3	3

3-High, 2-Medium, 1-Low

CE22076	ROCK MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The students are expected to classify, understand stress-strain characteristics, failure criteria, and influence of in-situ stress in the stability of various structures and various technique to improve the in-situ strength of rocks.

UNIT I CLASSIFICATION OF ROCKS 9

Types of Rocks - Index properties and classification of rock masses, competent and incompetent rock - value of RMR and ratings in field estimations

UNIT II STRENGTH CRITERIA OF ROCKS 9

Behaviour of rock under hydrostatic compression and deviatric loading - Modes of rock failure - planes of weakness and joint characteristics - joint testing, Mohr - Coulomb failure criterion and tension cut-off. Hoek and Brown Strength criteria for rocks with discontinuity sets.

UNIT III INSITU STRESSES IN ROCKS 9

Insitu stresses and their measurements, Hydraulic fracturing, flat jack, over coring and under coring methods - stress around underground excavations – Design aspects of openings in rocks - case studies.

UNIT IV SLOPE STABILITY AND BEARING CAPACITY OF ROCKS 9

Rock slopes - role of discontinuities in slop failure, slope analysis and factor of safety – remedial measures for critical slopes – Bearing capacity of foundations on rocks – case studies.

UNIT V ROCK REINFORCEMENT 9

Reinforcement of fractured and joined rocks - shotcreting, bolting, anchoring, installation methods - case studies..

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Classify the Rock mass and rate the quality of rock for tunneling and foundations work.	3
CO2	Apply the knowledge of the stress – strain characteristics and failure criteria of rock to arrive at the shear strength parameters of rocks	3
CO3	Apply the knowledge to assess the influence of insitu stress in the stability of various underground excavations.	3
CO4	Apply the knowledge to analyse the stability of rock slopes and arrive at the bearing capacity of shallow and deep foundations resting on rocks	3
CO5	Understand the various techniques such as rock reinforcement and rock support to improve the insitu strength of rocks	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Goodman, R.E., Introduction to rock mechanics, John Willey and Sons, 1989.
2. Hudson, A. and Harrison, P., Engineering Rock mechanics – An introduction to the principles, Pergamon publications, 1997.
3. Hoek, E and Bray, J., Rock slope Engineering, Institute of Mining and Metallurgy, U.K. 1981.

REFERENCES:

1. Hoek, E and Brown, E.T., Underground Excavations in Rock, Institute of Mining and Metallurgy, U.K. 1981.
2. Obvert, L. and Duvall, W., Rock Mechanics and the Design of structures in Rock, John Wiley, 1967.
3. Bazant, Z.P., Mechanics of Geomaterials Rocks, Concrete and Soil, John Wiley and Sons, Chichester, 1985.
4. Wittke, W., Rock Mechanics. Theory and Applications with case Histories, Springerverlag, Berlin, 1990.
5. Waltham, T, Foundations of Engineering Geology, Second Edition, Spon Press, Taylor & Francis Group, London and New York, 2002.
6. Ramamurthy T. , “Engineering in Rocks for Slopes Foundations and Tunnels”, PHI Learning Pvt. Ltd., 2007.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO2	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO3	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO4	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO5	3	3	2	2	-	1	1	1	2	2	1	1	3	3

3-High, 2-Medium, 1-Low

CE22077	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- The students are expected to understand the characteristics of existing ground and different methods to enhance the property of soil to satisfy the needs of different applications. The students will get detailed knowledge on dewatering, mechanical and chemical stabilization techniques

UNIT I PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 9

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

UNIT II DEWATERING 9

Dewatering Techniques - Well points - Vacuum and electro osmotic 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 COHESIVE SOILS 9

Insitu densification of cohesionless soils - 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 and Lime piles-Installation techniques - Simple design - Relative merits of above methods and their limitations

UNIT IV EARTH REINFORCEMENT 9

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

UNIT V GROUTING TECHNIQUES AND SOIL STABILIZATION 9

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring - Stabilization with cement, lime, chemicals and industrial wastes - Stabilization of expansive soil.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Identify various problems associated with soil deposits and selection of ground improvement methods	3
CO2	Understand dewatering techniques and design for simple cases as per needs and specifications.	3
CO3	Understand the concept involved for in-situ treatment of cohesive and cohesionless soils	3
CO4	Appreciate the concept of earth reinforcement and its applications and design for simple cases in various engineering structure.	3
CO5	Understand the soil grouting and stabilization techniques.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Purushothama Raj. P, "Ground Improvement Techniques", Firewall Media, 2005
2. Bikash Chandra chattopadhyay and Joyanta Maity, " Ground Improvement Techniques", PHI Learning Pvt. Ltd., 2017..

REFERENCES:

1. Koerner, R.M. "Construction and Geotechnical Methods in Foundation Engineering", McGraw Hill, 1994.
2. Moseley, M.P., "Ground Improvement", Blockie Academic and Professional, Chapman and Hall, Glasgow, 2004.
3. Winterkorn, H.F. and Fang, H.Y. "Foundation Engineering Hand Book". Van Nostrand Reinhold, 1994.
4. Koerner, R.M., "Designing with Geosynthetics" (Fourth Edition), Prentice Hall, Jersey, 2012

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO2	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO3	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO4	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO5	3	3	2	2	-	1	1	1	2	2	1	1	3	3

3-High, 2-Medium, 1-Low

CE22078 GEOSYNTHETICS DESIGN AND APPLICATIONS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The students are expected to understand the mechanism of the reinforcement, its influence in the shear strength and design concept for various applications in geotechnical engineering.

UNIT I PRINCIPLES AND MECHANISMS OF SOIL REINFORCEMENT 9

Historical Background – Principles - Concepts and Mechanisms of reinforced earth – Soil - Geosynthetics interaction mechanism – interface resistance – Factors influencing interaction - Strain compatibility

UNIT II REINFORCING MATERIALS AND THEIR PROPERTIES 9

Materials used in reinforced soil structures, fill materials, reinforcing materials metal strips, Geotextile, Geogrids, Geomembranes, Geocomposites and Geojutes, Geofoam, Natural fibers - facing elements – Influence of environmental factors on the performance of Geosynthetic materials – Physical – Mechanical – Hydraulic and Endurance properties testing.

UNIT III DESIGN FOR SOIL REINFORCEMENT AND SEPARATION 9

Reinforcing the soil - Geotextiles and Geogrids –Retaining wall – Embankments – Basal reinforcement – piled embankment – unpaved roads – paved roads – railway tracks – Shallow foundations – seismic aspects

UNIT IV DESIGN FOR FILTRATION, DRAINAGE AND CONTAINMENT 9

Geotextile filter – Filtration Mechanism – Factors affecting filter behaviour – Filtration design – Drains – Drainage in embankments – erosion control silt fences – Containment ponds - Reservoirs and Canals – Hydraulic tunnels – River bed and bank protection.

UNIT V DESIGN OF SLOPES 9

Type and orientation of Geosynthetics – Function of reinforcement against slope failure – Stability analysis – Design aspects – Seismic aspects – General construction aspects.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain various principles and mechanism of soil reinforcement.	3
CO2	Select different reinforcing materials based on functions to determine their properties.	3
CO3	Design geosynthetics as a reinforcement and/or a separator for different reinforced structures.	3
CO4	Design geosynthetics as a filter, drainer and as a containment for different reinforced.	3
CO5	Analyze and design reinforced slopes for static and seismic loading.	3

1-Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.
2. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.
3. Jones, C.J.F.P., Earth Reinforcement and Soil Structures, Earthworks, London, 1982.

REFERENCES:

1. Muller, W.W. HDPE Geomembranes in Geotechnics, Springer, New York 2007.
2. John, N.W.M., Geotextiles, John Blackie and Sons Ltd., London, 1987.
3. Sivakumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, University Press (India), Pvt. Ltd., Hyderabad, 2006.
4. Kerry Rowe.R., "Geotechnical and GeoEnvironmental Engineering handbook" Kluwer Academic Publishers, 2001
5. Sanjay Kumar Shukla., "Handbook of Geosynthetic Engineering" ICE publishing, London., Second edition., 2012

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO2	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO3	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO4	3	3	2	2	-	1	1	1	2	2	1	1	3	3
CO5	3	3	2	2	-	1	1	1	2	2	1	1	3	3

3-High, 2-Medium, 1-Low

CE22070	MINI PROJECT	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The project work shall be carried out in the same domain of the specialized vertical for students registered for Honours with Specialisation and Minors by other department students.
The project topic for the students registered for Honours shall be finalized by the DCC.

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

PROFESSIONAL ELECTIVE

VERTICAL 8

WATER RESOURCES ENGINEERING

CE22081 **GROUNDWATER ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

The objective of this course is to enable the student to understand the principles of Groundwater governing Equations, Characteristics of different aquifers and techniques of groundwater model development and management.

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 – Steady Radial Flow into a Well - round water table fluctuation and its interpretations – Groundwater development and Potential in India. Groundwater Estimation Committee (GEC) norms.

UNIT II WELL HYDRAULICS **9**

Objectives of Groundwater hydraulics – Darcy's Law - Groundwater equation – steady state flow – Dupuit Forchheimer assumption - Unsteady state flow – Theism's method Jacob method – Well losses - Partial penetrations of wells. – 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 - Environmental Regulatory requirements.

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:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Define the groundwater system basic, types of aquifers, aquifer parameters, movement and its potential for confined and unconfined aquifers	2

CO2	Apply the knowledge of groundwater flow in steady and unsteady flow characteristics of well hydraulics	2
CO3	Explain the concept of groundwater model development and data base management for groundwater management	2
CO4	Describe the importance of artificial recharge and groundwater quality concepts	2
CO5	Apply the creative and innovative technique on conservation of groundwater	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010.
2. Ashok Kumar Rastogi., Numerical Groundwater Hydrology, Penram Publication limited, 2012

REFERENCES

1. Fitts R Charles, "Groundwater Science". Elsevier, Academic Press, 2002.
2. Ramakrishnan, S, Ground Water, K.J. Graph arts, Chennai, 1998.
3. Chahar BR, Groundwater hydrology, McGraw Hill Education (India) Pvt Ltd, New Delhi, 2015.
4. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	-	1	1	-	3	-	-	1	2	3	3
CO2	3	3	3	-	2	2	-	3	-	-	2	2	3	3
CO3	2	2	3	-	3	2	-	2	-	3	3	3	3	3
CO4	2	2	2	-	3	3	-	3	-	3	2	3	3	3
CO5	2	3	2	3	3	3	-	3	3	3	2	3	3	3

3-High, 2-Medium, 1-Low

CE22082	PARTICIPATORY WATER RESOURCES MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

• To enable the students to understand the regional and global experiences of participatory ideology in irrigation water management

• To help students acquire knowledge on paradigms shifts and reorientations with regard to stakeholder participation in water management in general and in irrigation management in particular.

UNIT I FUNDAMENTALS OF SOCIOLOGY AND PARTICIPATORY APPROACH 9

Basic Sociological concepts and Definitions - Objectives - Perspectives- Social stratification - Sociological understanding - Irrigation as a Sociotechnical Process - paradigm shift and Participatory approach

UNIT II UNDERSTANDING FARMERS PARTICIPATION 9

Need of farmers participation -Benefits of farmers participation - Comparisons of cost and benefit - Water User Association - Membership - Kinds of participation - National and International Experiences -Activities on Water towards Organization and Structure - Context of participation- factors in the environment

UNIT III ROLE OF STAKEHOLDERS AND THE UNDERLYING ISSUES 9

Multiple use of water - Issues in sectoral Water Allocation - Domestic, Irrigation, Industrial sectors -Woman as a water user -Constraints and Opportunities. Role of Community Organisers - Constraints in Organising farmers Organisation

UNIT IV IMPROVING AGENCY RELATIONS AND INSTITUTIONAL REFORMS 9

Supporting farmer organization and participation -Decision Making- Leadership and responsibilities - Development strategy - Channels for implementation - Equity and Equality- Agency Incentives- Technical co-operation - Special roles -Agency Roles- Institutional Reforms

UNIT V POLICY CONSIDERATIONS AND EMERGING CHALLENGES 9

Water Policy- Irrigation Governance- Building from Below- Non-political Associations- Bureaucratic Reorientation- Policy options and Alternatives and Sustainability.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Capture to fundamental concepts and terms which are to be applied and understood all through the study.	2
CO2	Acquire a clear insight into the subject matter of participatory ideology with its rudiments under the light of both national and international illustrative cases.	2
CO3	Comprehend the roles of different players as stakeholders with the ground reality of the underlying issues in farm community.	2
CO4	Articulate as how reforms can help build up institutional and irrigation agencies with the support obtained from the existing farm network in irrigation Management	2
CO5	Gain an overarching understanding of recommendation for improved irrigation management with a vision to transform the existing governance and policies with the novel approach of sustainability.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Michael C.M., Putting people first, Sociology variables in Rural Development, Oxford University press, London 1985.
2. Uphoff. N., Improving International Irrigation management with Farmer Participation - Getting the process Right - Studies in water Policy and management, New West - View press, Boulder and London, 1986.

REFERENCES:

1. Sivasubramanium K., Water Management SIMRES Publication, Chennai 2009.
2. Desai A.R., Rural sociology in India, Popular Prakashan, Bombay, 1969
3. Chambers R., Managing canal irrigation, Oxford IBM publishing Co. Pvt. Ltd., New Delhi, 1998.
4. Korten F.F and Robert Y. Siy, Jr. Transforming a Bureaucracy - The experience of the Philippines National Irrigation Administration, Ateneo De Manila University Press, Manila, 1989.
5. http://irapindia.org/lMTlnlndia-Pa
6. http://mowr.gov.in/writereaddata/mainlinkFile/File421.pdf

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	1	-	-	-	-	-	-	-	-	-	-	2	2	2
CO2	2	-	-	-	-	-	-	3	-	-	-	2	2	2
CO3	2	2	-	-	1	2	3	3	3	-	-	2	3	3
CO4	2	-	3	2	1	1	2	3	2	-	-	3	3	3
CO5	1	-	3	2	1	2	2	1	2	1	1	3	3	2

3-High, 2-Medium, 1-Low

CE22083 URBAN WATER INFRASTRUCTURE **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To impart knowledge and skills relevant to water management in the context of urbanization and relate engineering principles to water supply, storm water and wastewater management, along with related regulations and best management practices from around the world.

UNIT I URBAN ECOSYSTEM 9

Cities as Ecological system – hybrid ecosystem – Resilience in urban ecosystem. Human components of Ecosystem – Urban pattern and Ecosystem function. Population and Community dynamics, functions of Urban Ecosystem.

UNIT II URBAN HYDROLOGY 9

The urban hydrological cycle – Function – Human induced changes in urban watershed – Hydrological calculation – Runoff – Infiltration – hydrograph.

UNIT III URBAN STORM WATER MANAGEMENT 9

Design of Drainage System – Roadway Drainage Analysis – Types of inlet – inlet design – Design of storm drain - Storm water management regulations - structural storm management systems – Newer trends in storm water management (Green infrastructure) – installation – operation and maintenance.

UNIT IV WATER CONSERVATION AND REUSE 9

Trends in supply and demand – indoor conservation – outdoor conservation – water reuse – Rainwater harvesting – public education.

UNIT V WATER GOVERNANCE 9

Challenges in water sector - Institutional setting, Supply Management, Demand Management, Waste water management – Private sector participation, urban service delivery, customer satisfaction, financial resource management – case studies of best practices in cities across the world.

TOTAL: 45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain various functional elements of urban ecosystem	2
CO2	Calculate urban runoff, compute supply and demand of water, draw hydrograph	2
CO3	Compare advantages of Newer techniques of green infrastructure and illustrate benefits	2
CO4	Assess the Operation and Maintenance needs of urban water systems	2
CO5	Propose best management practices for Indian context	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Anand Chiplunkar, K Seetharam and CheonKheong (ed) (2012), "Good Practices in urban water management" ADB, National University Singapore.
2. Mohammad Karamouz, Ali Moridi, Sara Nazif (2010), Urban Water Engineering and Management, 1st Edition, CRC Press

REFERENCES:

1. Marina Alberti (2008), "Advances in Urban Ecology", Springer, New York
2. Monzur A. Imteaz , (2019), Urban Water Resources, CRC Press
3. HormozPazwash (2016), "Urban storm water management", CRC Press
4. Larry W. Mays, (2004), Urban Stormwater Management Tools, McGraw-Hill Companies
5. J Parkinson, O Mark (2005) Urban Stormwater Management in Developing Countries, IWA Publishing

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	-	-	-	2	3	1	3	-	-	-	-
CO2	3	3	3	-	-	-	-	3	1	3	-	-	3	-
CO3	3	3	2	-	2	-	-	3	-	3	-	-	3	-
CO4	2	2	2	3	-	2	2	3	-	3	2	2	3	2
CO5	2	1	1	3	-	2	2	3	2	3	2	2	3	2

3-High, 2-Medium, 1-Low

CE22084 WATERSHED CONSERVATION AND MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To provide the technical and sociological understanding of a watershed.
- To provide a comprehensive discourse on the engineering practices of watershed management for realizing the higher benefits.

UNIT I WATERSHED CONCEPTS **9**

Watershed – Definition, Need and Elements – Principles - Influencing Factors: Geology – Soil – Morphological Characteristics - Toposheet - Delineation – Codification – Prioritization – Watershed Atlas.

UNIT II SOIL CONSERVATION MEASURES **9**

Types of Erosion – Water and Wind Erosion: Causes, Factors, Effects and Management – Soil Conservation Measures: Agronomical and Mechanical – Design of Terraces and Bunds - Estimation of Soil Loss – USLE Equation - Sedimentation.

UNIT III WATER HARVESTING AND CONSERVATION **9**

Yield from a Catchment - Traditional Water Harvesting Techniques – Micro-Catchments - Design of Small Water Harvesting Structures: Farm Ponds, Percolation Tanks, Check dams, Grassed Waterways.

UNIT IV GIS FOR WATERSHED MANAGEMENT **9**

Applications of Remote Sensing and Geographical Information System - Role of Decision Support System – Conceptual Models and Case Studies.

UNIT V WATERSHED MANAGEMENT **9**

Project Proposal Formulation - Watershed Development Plan – Entry Point Activities – Watershed Economics - Agroforestry – Grassland Management – Wasteland Management – Watershed Approach in Government Programmes – People's Participation – Evaluation of Watershed Management Programmes – Integrated Watershed Management – Case studies.

TOTAL: 45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Recognize and Interpret the morphological features of a watershed.	2
CO2	State, design and sketch the soil conservation structures.	2
CO3	Describe the micro catchment and apply the concepts to design the small water harvesting structures.	2
CO4	Illustrate the application of modern tools and technology in the management of watershed.	2
CO5	Classify the management activities and to develop an integrated watershed development plan.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. Ghanashyam Das, Hydrology and Soil Conservation Engineering, Prentice Hall of India Private Limited, New Delhi, Second Edition, 2009.
2. Suresh, R. Soil and Water Conservation Engineering, Standard Publishers and Distributors Private Limited, New Delhi, 2020.

REFERENCES:

1. Glenn O Schwab. etal, Soil and Water Conservation engineering, Wiley India Private Limited, 2009.
2. Heathcote, I. W. Integrated Watershed Management: Principles and Practice. John Wiley and Sons, Inc., New York, Second Edition 2009.
3. John G. Lyon, GIS for Water Resources and Watershed Management, CRC Press, 2002.
4. Vijay P. Singh, Donald K. Frevert, Watershed Models, CRC Press, 2005.
5. Vir Singh, Raj, Watershed Planning and Management, Bio- Green Publisher, 2016.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	1	1	-	1	-	3	2	-	2	2	2
CO2	3	2	2	2	1	2	2	1	1	2	1	2	2	2
CO3	3	2	2	2	1	2	2	1	1	2	1	2	2	2
CO4	-	-	-	-	3	-	-	-	3	2	2	2	2	2
CO5	-	2	2	2	-	2	2	3	3	3	2	2	2	2

3-High, 2-Medium, 1-Low

CE22085 **RIVER ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To understand theoretical concepts of water and sediment movements in rivers
- To inculcate the benefits of fluvial system to the society

UNIT I RIVER FUNCTIONS **9**

Primary function of a river – River uses and measures – Water and Sediment loads of river – Rivers in India, Himalaya and Peninsular.

UNIT II RIVER HYDRAULICS **9**

Physical Properties and Equations – Steady flow in rivers – uniform and non-uniform – Turbulence and velocity profiles – resistance coefficients – Boundary conditions and back waters – Transitions – Rating Curve – Unsteady flow in rivers : Propagative of surface waves – Characteristics, flood waves – kinematic and diffusion analogy – velocity of propagation of flood waves – Flood wave –Maximum

UNIT III RIVER MECHANICS **9**

River Equilibrium : Stability of Channel – regime relations – river bend equilibrium – hydraulic geometry of downstream - Bars and meandering - River dynamics – degradation and aggradations of river bed – Confluences and branches – River Data base.

UNIT IV RIVER SURVEYS AND MODEL **9**

Mapping – Stage and Discharge Measurements – Sediments – Bed and suspended load Physical hydraulic Similitude – Rigid and mobile bed – Mathematical – Finite one dimensional – multi – dimensional – Water Quality and ecological model

UNIT V RIVER MANAGEMENT **9**

River training works and river regulation works – Flood plain management – waves and tides in Estuaries - Interlinking of rivers – River Stabilization

TOTAL: 45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	analyse various functions and uses of Indian rivers	2
CO2	Develop equations for steady flow and unsteady flow conditions of river flow hydraulics	3
CO3	Exlain the concept of river mechanics	2
CO4	Conduct river surveys and develop various mathematical, water quality and ecological models	3
CO5	Develop river management skills for interlinking of rivers and their stabilization	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOK:

1. Santhosh kumar, River Engineering, Khanna Book Publishing Co. (P) Ltd, New Delhi, 2021
2. Pierre Y. Julien ., "River Mechanics" ,Cambridge University Press, 2002.

REFERENCES:

1. Janson PL.Ph., Lvan BendegamJvanden Berg, Mdevries A. Zanen (Editors), Principles of River Engineering – The non tidal alluvial rivers – Pitman, 1979.
2. K.L Rao , INDIA's WATER WEALTH – Orient Longman Ltd., 1979.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	-	-	-	-	-	-	-	1	-	2	2	2
CO2	3	3	3	-	-	-	-	-	1	1	-	2	2	2
CO3	3	2	2	2	-	2	-	-	1	1	-	2	2	2
CO4	3	3	3	2	-	2	2	2	1	1	1	2	2	2
CO5	3	2	3	2	-	3	3	3	1	1	3	2	2	2

3-High, 2-Medium, 1-Low

CE22086 WATER RESOURCES SYSTEMS ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVE:

- To introduce the student to the concept of Mathematical approaches for managing the water resources system and apply to operate a water resource system optimally.

UNITI SYSTEM APPROACH **9**

Definition, classification, and characteristics of systems - Philosophy of modelling – Goals and Objectives – Basics of system analysis concept – steps in systems engineering.

UNITII LINEARPROGRAMMING **9**

Introduction to Operation research - Linear programming Problem Formulation-graphical solution Simplex method –Sensitivity analysis - application to operation of single purpose reservoir

UNITIII DYNAMICPROGRAMMING **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

UNITIV SIMULATION **9**

Basic principles and concepts – Monte Carlo techniques – Model development – Inputs and outputs – Single and multipurpose reservoir simulation models – Deterministic simulation – Rule Curve development for reservoir

UNITV ADVANCEDOPTIMIZATIONTECHNIQUES **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 :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.	3
CO2	Apply the concept of linear programming for optimisation of water resources problems.	3
CO3	Explain the concept of dynamic programming and apply in water resource system.	3
CO4	Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy	3
CO5	Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS

1. Vedula, S., and Majumdar, P.P. Water Resources Systems – Modeling Techniques and Analysis Tata McGraw Hill, New Delhi, Fifth reprint,2010.
2. Bhave PR, Water Resources Systems, Narosa Publishers,2011

REFERENCES:

2. Gupta, P.K., and Man Mohan, “Problems in Operations Research”, (Methods and Solutions), Sultan Chand and Sons, New Delhi,1995.
3. Chaturvedi, M.C., “Water Resources Systems Planning and Management”, Tata McGraw Hill, New Delhi,1997.
4. Taha, H.A., “Operations Research”, McMillan Publication Co., New York,1995.
5. Hiller, F.S., and Liebermann, G.J., “Operations Research”, CBS Publications and Distributions, New Delhi,1992.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	-	-	-	-	-	-	2	-	3	2	2
CO2	3	2	-	-	-	3	-	-	3	-	2	2	2	3
CO3	3	3	2	-	2	2	-	-	2	-	3	2	1	3
CO4	3	3	3	-	3	3	2	-	3	-	2	3	3	3
CO5	3	3	3	3	3	3	-	2	3	-	3	3	3	3

3-High, 2-Medium, 1-Low

CE22087 INTEGRATED WATER RESOURCES MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVE

Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I CONTEXT FOR IWRM **9**

Water as a global issue: Key challenges – Definition of IWRM within the broader context of development – Key elements of IWRM - Principles – Paradigm shift in water management - Complexity of the IWRM process – UN World Water Assessment - SDGs.

UNIT II WATER ECONOMICS **9**

Economic view of water issues: Economic characteristics of water good and services – Non-market monetary valuation – Water economic instruments – Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies.

UNIT IIILEGAL ANDREGULATORYSETTINGS **9**

Basic notion of law and governance: Principles of International and National law in the area of water management - Understanding UN law on non-navigable uses of International water courses - International law for groundwater management – World Water Forums – Global Water Partnerships - Development of IWRM in line with legal and regulatory framework: Case Studies.

UNIT IVWATER AND HEALTH WITHIN THE IWRMCONTEXT **9**

Links between water and health: Options to include water management interventions for health – Health protection and promotion in the context of IWRM – Global burden of Diseases - Health impact assessment of water resources development projects – Case studies.

UNIT VAGRICULTURE IN THE CONCEPT OF IWRM **9**

Water for food production: ‘blue’ versus ‘green’ water debate – Water foot print - Virtual water trade for achieving global water and food security - Climate Smart Agriculture - Current water pricing policy– Scope to relook pricing.

TOTAL: 45 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management	2
CO2	Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.	2
CO3	Apply law and governance in the context of IWRM.	2
CO4	Discuss the linkages between water-health; develop a HIA framework	2
CO5	Analyse how the virtual water concept pave way to alternate policy options.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. Cech Thomas V., Principles of water resources: history, development, management and policy. John Wiley and Sons Inc., New York. Fourth Edition 2018.
2. Mollinga.P. etal "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.

REFERENCES:

1. Technical Advisory Committee, Dublin principles for water as reflected in comparative assessment of institutional and legal arrangements for Integrated Water Resources Management, Technical Advisory Committee Background Paper No: 3. Global water partnership, Stockholm, Sweden. 1999.
2. Technical Advisory Committee, Integrated Water Resources management, Technical Advisory Committee Background Paper No: 4. Global water partnership, Stockholm, Sweden. 2002.
3. Technical Advisory Committee, Effective Water Governance". Technical Advisory Committee Background Paper No: 7. Global water partnership, Stockholm, Sweden, 2003.
4. Tony Allan, Virtual Water: Tackling the Threat to Our Planet's Most Precious Resource, I. B. Taurus, 2011.Vonvention on the Law of the Non-navigational Uses of International Watercourses. https://legal.un.org/ilc/texts/instruments/english/conventions/8_3_1997.pdf

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	1	-	2	3	-	2	2	3	3	2	2
CO2	2	2	2	2	2	2	3	2	3	3	3	3	2	3
CO3	2	-	2	2	-	3	3	2	3	3	3	3	2	2
CO4	2	2	2	2	-	3	3	2	3	3	3	3	2	2
CO5	2	2	2	2	1	3	3	2	3	3	3	3	2	2

3-High, 2-Medium, 1-Low

CE22088 **ENVIRONMENTAL HYDRAULICS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To apply the knowledge of fluid mechanics to analyze and predict mixing in natural bodies of water.
- To study the hydrodynamic aspects of water quality management in natural bodies of water.

UNIT I INTRODUCTION TO ENVIRONMENTAL TRANSPORT PROCESSES 9

Concentration and units of measure – Conservation laws – Systems and Control Volume approach – Differential element approach – Sources, Sinks and box-models – Mixing. Advection-Diffusion equation. Analytical and numerical solution to Advection-Diffusion equation.

UNIT II GROUNDWATER FLOW AND QUALITY MODELING 9

Dupuit‟s approximation – Basic contaminant transport equation – Application of boundary layer approximations – Saltwater intrusion into aquifers – Non-aqueous phase liquid (NAPL) in groundwater – numerical modeling.

UNIT III TRANSPORT PROCESSES IN RIVERS 9

Mixing in Rivers – Continuous point discharges – Two rivers mixing – Dispersion in rivers.

UNIT IV TRANSPORT PROCESSES IN LAKES AND RESERVOIRS 9

Reservoir classification – External energy sources – Surface layer – mixing in the hypolimnion – inflows and outflows.

UNIT V TRANSPORT PROCESSES IN THE ESTUARIES 9

Classification – Forces – wind, tides, rivers – Trapping and pumping – Estuarine Circulation.

TOTAL :45 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Analyse analytical and numerical solutions for environmental transport processes	3
CO2	Apply boundary layer approximations and develop quality ground water numerical modeling	3
CO3	Discuss the transport processes in rivers	2
CO4	Explain the transport processes in lakes and reservoirs.	2
CO5	Discuss the transport processes in Estuaries	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Rubin H. and Atkinson J. "Environmental Fluid Mechanics" Marcel Dekker, Inc. New York. 2001
2. Vijay P Singh and Willi H. Hager, " Envirinmental Hydraulics" Springer Dordrecht, 1996

REFERENCES:

1. Fischer, H.B., List, E.G., Koh, R.C.Y., Imberger, J and Brooks, N.H. "Mixing in Inland and Coastal Waters" Academic Press, New York, 1979.
2. Clark, M.M., "Transport Modeling for Environmental Engineers and Scientists" John Wiley and Sons, New York. 1996.
3. Martin J.L. and McCutcheon S.C. "Hydrodynamics and Transport for Water Quality Modeling" CRC Press, Inc. ISBN:0-87371-612-4, 1999.
4. Chapra, S.C. "Surface Water Quality Modeling" McGraw Hill Book Co. Singapore, 1997.
5. M.Thomann, R.V. and Mueller, J.A. "Principles of Surface Water Quality Modeling and Control" Harper and Row, New York, 1987.
6. Csanady, G.T., "Turbulent Diffusion in the Environmen"t D.Reidel Publishing Co. Holland, 1973.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	2	2	3	2	1	1	1	2	2	2
CO2	3	3	3	2	2	2	3	2	1	1	1	2	2	3
CO3	2	2	2	1	-	2	3	2	1	1	1	2	2	2
CO4	2	2	2	1	-	2	3	2	1	1	1	2	2	2
CO5	2	2	2	1	-	2	3	2	1	1	1	2	2	2

3-High, 2-Medium, 1-Low

CE22080 **MINI PROJECT**

L	T	P	C
0	0	4	2

COURSE OBJECTIVES:

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

The project work shall be carried out in the same domain of the specialized vertical for students registered for Honours with Specialisation and Minors by other department students.
The project topic for the students registered for Honours shall be finalized by the DCC.

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Design/Develop sustainable solutions for societal issues with environmental considerations applying the basic engineering knowledge.	6
CO2	Analyze and review research literature to synthesize research methods including design of experiments to provide valid conclusion.	4
CO3	Utilize the new tools, algorithms, techniques to provide valid conclusion following the norms of engineering practice.	4
CO4	Test and Evaluate the performance of the developed solution using appropriate techniques and tools.	5
CO5	Apply management principles to function effectively in the project team for project execution.	3
CO6	Engage in learning for effective project implementation in the broadest context of technological change with consideration for public health, safety, cultural and societal needs.	3
CO7	Write effective reports and make clear presentation to the engineering community and society.	3

1- Remember, 2- Understand, 3- Apply, 4-Analyse, 5- Evaluate, 6- Create

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	3	-	-	-	3	-	-	-	-	-	3	3
CO2	-	3	-	3	-	-	-	-	-	-	-	-	3	3
CO3	-	-	-	-	3	-	-	3	-	-	-	-	3	3
CO4	-	3	-	-	3	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	-	-	-	-	3	-	3	-	3	3
CO6	-	-	-	-	-	3	3	-	-	-	-	3	3	3
CO7	-	-	-	-	-	-	-	-	-	3	-	-	3	3

3-High, 2-Medium, 1-Low

VALUED ADDED COURSES

OFFERED BY CIVIL ENGINEERING

VD22401 **APPLICATION OF PLANNING TOOL IN CONSTRUCTION PROJECTS**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand the significance of project planning in construction projects and give hands on experience to prepare project schedules using computer software which enables the project manager to execute the projects effectively.

COURSE CONTENT :

Introduction – Phases of construction project – Project Stakeholders – Types of Construction projects - Project Planning and Management - Purpose and Objective, Applications of Computer in Project Management - Role of Construction Management - Planning of Manpower, construction Materials, equipment - Planning engineer skills & responsibilities – Cost Control - Schedule Control - Project Planning using a computer tool - Creating new project with Planned Start Date, Defining Calendars, Organizing Work Breakdown Structure - Define WBS structure, Adding Activities, Estimate the activity duration, Assigning Relationship to the Activities, Assigning Predecessors and Successors, Scheduling the Project, Assigning Resources and Costs to Activities, Cost Forecast, Roles assignment, Budgeted Cost - Updating the project, Budgeted and Actual Cost Comparison based on S-Curve.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Apply the concepts of planning and scheduling of a construction project using the computer tools.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Jongpil Nam, "Construction Scheduling with Primavera P6" Author House UK Ltd. 2016
2. Vinayagam.P, Vimala.A., "Planning and Managing Projects with Primavera P6 Project Planner" I.K. International Publishing House Pvt. Ltd. 2017.
3. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, McGraw-Hill Publishing Company, New Delhi, 1998.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	3	-	3	3

3-High, 2-Medium, 1-Low

VD22402 **GIS TOOLS IN CIVIL ENGINEERING**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To give practical exposure to the students to data input, data storage, data analyses and data output capabilities of a standard GIS software (proprietary and open software's)
- It also adds skills in mapping techniques and map outputs.

COURSE CONTENT :

Fundamentals of GIS - Georeferencing of toposheet and creating vector layers, attribute tables and layout Preparation – Rectification and Spatial Referencing of Digital Map - Onscreen Digitization and Database Creation - Data Conversion - Vector to Raster, Raster to Vector - Analysis of data and creation of maps using Google earth maps - Open-source GIS (Preferably QGIS) Demo – Mini Project: Development of Digital Map of a City using QGIS software.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Adopt the software skills to collect, process and analyse data using in digital image processing, Global positioning system in real time.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Ian Heywood, Sarah Cornelius, Steve Carver, An Introduction to Geographical Information
   Systems, Pearson Education, 4th Edition, 2012.
2. Michael N. DeMers, Fundamentals of geographic information systems, Wiley, 2009.
3. QGIS Training Manual (https://docs.qgis.org/3.28/en/docs/training_manual/index.html)

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	3	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22403	**FINITE ELEMENT ANALYSIS USING COMPUTER TOOLS**	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To impart knowledge on the basics of Finite element analysis using software

COURSE CONTENT :

Overview of Finite Element Analysis – Basics of Statics and Strength of Materials, Introduction to Finite Element software – Applications - computer tools - Programming mode and GUI software, Preprocessing - Basic geometry creation methods in Workbench- Meshing methods – refinement, Solving the problem – Post processing of results, types of analysis – static structural analysis, buckling analysis and non linear analysis, thermal analysis and dynamic analysis

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Apply the basics of Finite Element Analysis and its application using Computer Tools.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Ansys Workbench 14.0 for Engineers and Designers (MISL-DT) – 2013
2. Introduction to ANSYS 16.0 (English, Paperback, Choudary R. B.) - 2016

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	3	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22404 **WATER CONSERVATION TECHNIQUES**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To emphasis the importance of ground water conservation

COURSE CONTENT :

Hydrology cycle - Rainfall- Run off relation – Importance of water conservation - Need of planned utilization of water resources – Traditional water harvesting techniques - Indoor water conservation – Outdoor water conservation - Check dams ,Farm Pond and other water storage works – Percolation pond- Evaporation suppression - Seepage reduction- Groundwater recharge - Water reuse – Rainwater harvesting- Water conservation practices in irrigated lands – Public education about water conservation techniques.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Enumerate the different water conservation techniques.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Santhosh Kumar Garg, Hydrology and Water Resources Engineering, Khanna Publishers, Delhi.
2. G.L.Asawa, Irrigation and Water Resources Engineering ,New age international(p) ltd. publishers, New Delhi.

REFERENCES:

1. A Manual on "Rainwater Harvesting and Conservation": Government of India, Consultancy Service Organization Central Public Works Department, New Delhi.
2. Pietro Laureano, Water Conservation Techniques in Traditional Human Settlements COPAL publishing
3. Madireddi V. Subba Rao Water Conservation, Management and Analysis Read worthy Publications Pvt Ltd.
4. Traditional Water Harvesting Systems of India" C.P.R. Environmental Education Centre, Chennai, India (2004).
5. "A Water Harvesting Manual for Urban Areas" issued by Centre for Science and Environment.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

L	**T**	**P**	**C**
2	**0**	**0**	**2**

VD22405 **VASTU IN CONSTRUCTION**

COURSE OBJECTIVES:

- To impart knowledge on the Vastu concepts in Civil Engineering

COURSE CONTENT :

Introduction to Vastu concepts, importance of Vastu, advantages of Vastu, disadvantages of Vastu, Basic Principles of Vastu Shastra: The Ten Directions– site selection and sub soil exploration - Open Space planning and Building design - Floor level Height factors – Verandas-Balconies -Porch Basements- Water flow - Mezzanine floors - Plants and Greenery - Vastu rules for rooms.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the applications of Vastu concepts in Civil Engineering practices.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Vaibhav Chawadre, Indian Vastu Shastra, Create space Independent Publishers, December 2015.
2. B. B. Puri, Applied Vastu Shastra Vaibhavam in modern architecture, Vastu Gyan Publication, 1997.

REFERENCES:

1. Ranjeet. P , D.V.S. Narshima Rao and Md. Akram Ullah Khan, Vastu in construction in civil Engineering point of view, International Journal of Research in Engineering and Technology (IJRET), Volume: 05 (04), 102-106, 2016.
2. Subodha Jalote, R. K. Pandey, C. B. Gupta, C. S. Mishra, Vikas Shrivastav, Application of Vastu in Construction, International Journal of Engineering and Advanced Technology (IJEAT), Volume-4 (6), 30-32, 2015.
3. Prabhu, Balagopal,T.S and Achyuthan,A, A text Book of Vastuvidya, Vastuvidya pratisthanam, 2011.
4. D. N. Shukla and Vastu-Sastra: Hindu Science of Architecture, Munshiram Manoharial Publishers, 1993.

1. V. Chakra borty, Indian Architectural Theory: Contemporary Uses of Vastu Vidya at Google Books.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22406 **BUILDING VALUATION**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand the terminologies and concepts behind the valuation of buildings

COURSE CONTENT :

Principles of valuation, definition of value, price and cost. Attributes of value, Different types of values - Essential characteristics of market value. Valuer and his duties, purpose of valuation and its function. Factors affecting the valuation of properties-tangible and intangible properties, Landed properties- free hold and leasehold properties, different types of lease, Rental method of valuation – Rent control act - Value of land, belting method of valuation, Valuation based on land and building- item wise, cubic content basis. Valuation from yield Depreciation, different methods of calculating depreciation – Depreciated cost, Valuation of residential building, commercial industrial buildings.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Assess the value of buildings considering various influencing factors.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Jagannathan .G, "Getting More at Less Cost", - The Value Engineering Way, Tata McGraw Hill, New Delhi, 1992.
2. Rangwala .S.C, "Valuation of Real Properties", Charotar Publishing House,Anand, 2015.

REFERENCES:

1. V N Vazirani, S P Chandola, Civil Engineering Estimating, Costing and Valuation, Kanna Publishers.
2. B N Dutta, Estimation and Costing in Civil Engineering, 28th revision, 2016.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	3	-	3	3

3-High, 2-Medium, 1-Low

VD22407 **DESIGN OF MULTISTOREY BUILDING**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To impart principles of analysis and design of multi storey buildings subjected to gravity loads and lateral loads

COURSE CONTENT :

Multi storied buildings - Determination of dead load, live load, wind load and earthquake load on various components of the buildings - Analysis and design for gravity and lateral forces like wind load, earthquake loads. Detailing of reinforcement and bar bending schedule - Requirement of ductility in Multistoried Building- Ductile detailing of beams, columns and foundation – Design of transverse reinforcement in columns and shear stirrups in beams- confining reinforcement

TOTAL : 30 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Analyse and design multi storey buildings subjected to gravity loads and lateral loads	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Unnikrishna Pillai, S., DevdasMenon, “Reinforced Concrete Design”, Tata McGraw-Hill Publishing Company Ltd., New Delhi 2003.
2. Dr.S.R.Karve and Dr.V.L.Shah, “Illustrated Design of Reinforced Concrete Buildings”, Nineth Edition, Structures Publications.

REFERENCES:

1. U.H. Varyani, “Structural Design of Multi Storeyed Building”, Second Edition, Standard Publishers Distributors.
2. Krishna Raju, N., “Design of Reinforced Concrete Structures”, CBS Publishers & Distributors, New Delhi, 2003.
3. W. Schueller, High Rise Building Structures: John Wiley & Sons, 1977.
4. B S Smith & A Coull, Tall Building Structures: - John Wiley & Sons, 1991.
5. http://ethesis.nitrkl.ac.in/4250/1/Computer_Aided_Analysis_and_Design_of_Multi-Storeyed_Buildings.pdf
6. http://www.iitk.ac.in/nicee/IITK-GSDMA/EQ26.pdf

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22408	CORRESION OF STEEL IN CONCRETE AND PREVENTIVE MEASURES	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To introduce the principles of corrosion and corrosion control techniques

COURSE CONTENT :

Corrosion of steel in concrete - Causes and mechanisms of corrosion – Carbonation - Chloride attack - Corrosion damage - Vertical cracks and horizontal cracks - Condition evaluation - Quantification of corrosion damage - Half cell potential measurements - Carbonated depth measurement - Chloride determination - Resistivity measurement - Corrosion rate measurement - Corrosion protection techniques - Cathodic protection - Sacrificial anode – Corrosion inhibitors - Concrete coatings - Corrosion resistant steels - Coatings to reinforcement - Indian standard codal requirements for enhancing durability of R.C.C. structures.

TOTAL : 30 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the various corrosion testing methods and the types of corrosion control techniques in field.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Broomfield John P, Corrosion of Steel in Concrete , Taylor & Francis, 2023.
2. Amir Poursaee, Corrosion of Steel in Concrete Structures, Woodhead Publishing, 2023
3. B.Vidivelli, Rehabilitation of Concrete Structures Standard Publishes Distribution 2009.

REFERENCES:

1. Luca Bertolini PhD, Dr. sc. tech. Bernhard Elsener PhD, Pietro Pedeferri Rob B. Polder PhD, Wiley, Corrosion of Steel in Concrete: Prevention, Diagnosis, Repair, Wiley-VCH, 2004
2. Dodge Woodson, Concrete Structures, Protection, Repair and Rehabilitation, Butterworth Heinemann, Elsevier, New Delhi 2012.
3. Mars G. Fontana, Corrosion Engineering Mc-Graw Hill Publishers, New Delhi, 2001.
4. Ravishankar.K., Krishnamoorthy. T.S, Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures, Allied Publishers, 2004.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22409	WASTEWATER TREATMENT TECHNIQUES	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To give sound knowledge with understanding of wastewater treatment technologies to the students

COURSE CONTENT :

Domestic wastewater treatment - Wastewater characteristics - Primary, secondary and tertiary treatment - Unit operations and processes - Physical unit operations - Biological unit processes: Aerobic and anaerobic processes, suspended and attached growth systems, batch and continuous systems - Aerobic treatment; Suspended growth aerobic treatment processes; Activated sludge process and its modifications; Attached growth aerobic processes; Tricking filters, Bio-towers and Rotating biological contactors - Anaerobic treatment; Suspended growth, Attached growth, Fluidized bed and Sludge blanket systems; DEWATS systems - Industrial wastewater treatment- Nitrification, Denitrification; Phosphorus removal, – Heavy metal removal – Membrane separation process – Air stripping and Absorption processes - Sludge treatment - Aerobic sludge stabilization - Anaerobic sludge stabilization and Sludge composting - Operations and maintenance of treatment plants, Troubleshooting – Eco toilets -Tertiary treatment techniques, Plant layout - Filtration, Softening process, Defluoridation, Removal of Odors -Treated municipal wastewater discharge systems, Post treatment techniques - Visit to a municipal wastewater treatment plant.

TOTAL : 30 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Design wastewater treatment plant units based on the characteristics of wastewater.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Garg, S.K., “Environmental Engineering I & II”, Khanna Publishers, New Delhi, 2013.
2. Modi, P.N., “Environmental Engineering I & II”, Standard Book House, Delhi, 2012.
3. Manual on Water Supply and Treatment, CPHEEO, Government of India, New Delhi, 1999.
4. Manual on Sewerage and Sewage Treatment, CPHEEO, Government of India, New Delhi, 1993.
5. Hand book on Water Supply and Drainage, SP35, B.I.S., New Delhi, 1987.
6. Metcalf and Eddy, M.C., “Wastewater Engineering – Treatment & Reuse”, Tata McGraw-Hill Publications, New Delhi, 2003.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	3	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22410 **AUTOMATION IN CONSTRUCTION**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To introduce the students the concepts of automation in construction

COURSE CONTENT :

Introduction- Present Scenario of automation in construction – Areas of automation in construction –Advantages of automation - Photogrammetric mapping for construction - LiDAR mapping and 3D point clouds - Unmanned Aerial Vehicle (UAV) / Unmanned Aircraft System (UAS) applications in construction - Simultaneous localization and mapping (SLAM) - Machine automation for civil engineering applications - Sensing technology for construction and maintenance - Field robotics - Augmented and virtual reality - Advanced computing in construction - Building information modelling (BIM)- Computer-aided construction and management

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the scope of automation principles in construction.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Robotics and Automation in Construction, Edited by Carlos Balaguer and Mohamed Abderrahim, ISBN 978-953-7619-13-8, 404 pages, Publisher: InTech,2008.
2. Javad Majrouhi Sadroud, Automation in Construction Management – Automated Management of Construction Materials using RFID Technology, Scholar’s Press, 2014.

REFERENCES:

1. Thomas Book, Thomas Linner, Robot – Oriented Design – Design and Management Tools for the Deployment of Automation and Robotics in Construction, Cambridge Handbook on Construction Robotics.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22411 **BIOMIMICRY IN CIVIL ENGINEERING**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- Understand the principles of biomimetics and how to adopt biomimicry in civil engineering.

COURSE CONTENT :

Introduction to biomimetics, evolution and approach towards biomimicry, biomimicry – a sustainable design, applications in construction materials, paint (lotus concept), architectural design of buildings and bridges, water harvesting, passive cooling systems, self-healing buildings, examples of buildings inspired by nature. Applications of Biomimicry in Construction and Architecture

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Summarise the concepts and applications of biomimicry in civil engineering.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Pacheo Torgal,F., Labrincha, J.A., Diamanti, M.V., Yu, C.P., Lee, H.K., “Biotechnologies and biomimetics for Civil Engineering”, Springer, 2015.
2. Akhlesh Lakhtakia ,Raúl José Martín-Palma , “Engineered Biomimicry”, Elsevier , 1st Edition, 2013.

REFERENCES:

1. Peter Forbes, “The Gecko's Foot: Bio-inspiration: Engineering New Materials from Nature”, W. W. Norton & Company , May 17, 2006.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22412	BUILDING ACOUSTICS

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand basic concepts of acoustics and human hearing, behavior of sound in enclosed spaces, the theories on architectural acoustics, and the basic principles of noise control and acoustic comfort in buildings.

COURSE CONTENT :

Introduction to acoustics, effects of noise, basic principles of sound – Acoustical dry wall systems and panels – Room acoustics – absorption, reflection, refraction and diffusion – Building acoustics – noise control applications – hearing and perception – non-acoustic spaces – auditorium acoustics – acoustical measurement, analyses and modeling – Regulations and guidelines, Green materials with acoustic applications

TOTAL : 30 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the principles of acoustical design of buildings	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Marshall Long, "Architectural Acoustics", Academic Press, 2nd Edition, March 2014.
2. Tor Erik Vigran, "Building Acoustics", CRC Press, 1st Edition, July 2008.

REFERENCES:

1. M.D. Egan, "Architectural Acoustics,', Mc Grawhill Inc., 1988.
2. John Edwin Moore, "Design for Good Acoustics and Noise Control", Macmillan Education, 1988.
3. M. D. Egan, "Concepts in Architectural Acoustics", Tulane University, School of Architecture, 1972.
4. J. Flynn, J. A. Kremers, A. W. Segil, G. Steffy, Van Nostrand Reinhold, "Architectural Interior Systems, Lighting, Acoustics, Air Conditioning", Van Nostrand Reinhold , 1992.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22413 **FORENSIC CIVIL ENGINEERING**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

To introduce the various aspects of investigation involved in Failure of structures

COURSE CONTENT :

Testing of failures - Various methods of testing of failed structures - Laser scanning, microscope, Radio graphic evaluation, Load Testing of shoring systems and repair technology. Structural Failures - Failure of construction materials steel, concrete - Joints by Bolt and weld. Failure of compression members and tension members by reversal of loads – Failure aspects of post tensioned concrete systems, space frame, plane frame, precast buildings, failure of bridges. Geo Technical Failures - Soil liquefaction, failure of foundation systems – Causes and prevention. Designing Against Failure - Quality control – Material selection, workmanship, design and detailing. Case Studies And Professional Practice - Case Studies on famous failures – Reasons and lessons learnt – Aspects of professional practice.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarize the different failures encountered in civil engineering practice and explain how to investigate them.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Robert Ratay, "Forensic Structural Engineering Handbook", McGraw-Hill Education, 2nd Edition, 2010.
2. Stephen E. Petty, "Forensic Engineering – Damage Assessments for Residential and Commercial Structures", CRC Press, 1st Edition, 2013.

REFERENCES:

1. "Forensic Engineering – 2012", proceedings of sixth ASCE Conference of Forensic Engineering held in San Francisco, California, Oct 31- Nov 03, 2013.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22414 **OPTIMIZATION TECHNIQUES**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To introduce the various optimization techniques.

COURSE CONTENT :

Introduction – Phases of construction project – Project Stakeholders – Types of Construction Introduction to Optimization -Design Variables -Objective function – Constraints -Problem Formulation– Linear Programming Problem - Simplex method – Big-M Method- Two - phase method – Duality Problem – Unconstrained Single and Multi - Variable Optimization - Optimality Criterion -Constrained Optimization Technique -Lagrange multipliers and Kuhn-Tucker conditions -Solution of Optimization Problems using Excel and MATLAB -Applications of Genetic Algoritmh, Particle Swam Optimization, Firefly algorithm in Civil Engineering

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Apply the basic concepts of mathematics to formulate an Optimization problem.	3
CO2	Solve Optimization problems using MATLAB and MS Excel Platform.	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Singiresu S Rao, "Engineering Optimization – Theory and Practice", New Age International Publishers, 2013.
2. A.K. Malik, S.K. Yadav and S.R. Yadav, "Optimization Techniques", IK Publishers, 2013.

REFERENCES:

1. J.C. Pant, Introduction to Optimization, Jain Brothers, 2008.
2. S.S. Rao, Optimization Theory and Applications, Wiley Eastern, 2004.
3. K.V. Mittal, Optimization Methods, Wiley Eastern, 2003.
4. H.A. Taha, Operations Research, Pearson, 2007.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22415 IN-SITU SOIL TESTING AND INSTRUMENTATION

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand the various parameters to be arrived from field test
- To interpret the required properties of soil for designing structural elements

COURSE CONTENT :

Procedure, limitations, correction and data interpretation of following methods - Field index property tests - Penetration tests - Field vane shear test (In-situ shear and borehole shear test) – Pressure meter test – Dilatometer test – Plate load test (Monotonic and cyclic) – Field permeability tests – Block vibration test

Instrumentation in soil engineering –Data acquisition system – Strain gauges – Load cells – Earth pressure cells – Settlement and heave gauges – Pore pressure measurements - Slope indicators

TOTAL : 30 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the different in situ soil testing and instrumentation methods.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Alam Singh and Chowdhary, G.R., Soil Engineering in Theory and Practice, Volume-2, Geotechnical testing and instrumentation, CBS Publishers and Distributors, New Delhi,2006.
2. Nair, R.J. and Wood, P.M., Pressuremeter Testing Methods and Interpretation, Butterworths, 1987.

REFERENCES:

1. Dunnicliff, J., and Green, G.E., Geotechnical Instrumentation for Monitoring Field Performance, John Wiley, 1993.
2. Hunt, R.E., Geotechnical Engineering Investigation Manual, McGraw Hill,1984.
3. Hanna, T.H., Field Instrumentation in Geotechnical Engineering, Trans Tech., 1985.
4. Day, R.N., Geotechnical and Foundation Engineering, Design and Construction, McGraw-Hill, 1999.
5. Bowles, J.E., Foundation Analysis and Design, Fifth Edition, The McGraw-Hill companies, Inc., New York, 1995.
6. Clayton C. R. I., Matthews M. C. and Simons N. E., Site Investigation, Second Edition Halsted Press, 1982.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22416 **NON DESTRUCTIVE TESTING TECHNIQUES**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

To introduce the various non-destructive testing (NDT) techniques currently employed for evaluation and condition monitoring of civil structures and construction materials.

COURSE CONTENT :

Introduction to Non-Destructive evaluation – Methods of Non-Destructive evaluation – Visual Inspection -Principles – Manual, Automated or Machine Vision Inspection - Liquid Penetrant Testing - Penetrant Materials , Considerations and Procedure - Ultrasonic Testing - Basic Principles of sound generation - Pulse echo and through transmission testing - RADAR and microwaves - Principle of the measurement - Magnetic Particle - Magnetism and Ferromagnetic Materials -Basic Procedure and Important Considerations - Radiology - Electromagnetic Radiation - General Principles of Radiography - Sources of Radiation - Thermography - Theory and applications - Acoustic Emission Testing - Applications of NDT in Civil Engineering - **Case studies** :NDT for detection of cracks voids in concrete bridges, NDT for steel bridges, NDT on masonry bridges

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Describe the basic principles and the method of application of the common Non - destructive Evaluation techniques	2
CO2	Discuss the applications and limitations of each of the techniques.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Malhotra, V.M. and Carino, N.J., Handbook on Non-Destructive Testing of Concrete, 2nd Ed., Taylor and Francis, London.
2. Bungey, S., Lillard, G. and Grantham, M.G. Testing of Concrete in Structures, 4th Ed. Taylor and Francis, London

REFERENCES:

1. Peter J. Shull and Marcel Dekker. “Nondestructive Evaluation – Theory, Techniques, and applications”, ed., 2002.
2. Paul E. Mix, “Introduction to Nondestructive Testing: a Training Guide”, 2nd ed., John Wiley & Sons, 2005.
3. Handbook on Nondestructive Testing of Concrete: Second Edition, V.M. Malhotra and N.J. Carino http://www.ndt-ed.org

4. Charles J. Hellier, “Handbook of Nondestructive Evaluation”, McGraw-Hill, 2001.
5. Krautkramer, H., “Ultrasonic Testing of Materials”, Springer-Verlag, 1969.
6. Novgoresky, M.A., “Testing of Building Materials and Structures”, Mir Publishers, 1973.
7. American Society of Metals: Handbook, Vol. II, Destructive Inspection and Quality Control, 1976

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	3	-	-	-	-	-	-	-	3	3
CO2	3	3	2	2	3	-	-	-	-	-	-	-	3	3
CO3	3	3	2	2	3	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22417 **BASE ISOLATION AND DAMPING TECHNIQUES IN ASEISMIC DESIGN**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- This course is designed to give an insight into the conventional techniques and latest developments regarding base isolation and damping techniques in aseismic design of civil engineering structures.

COURSE CONTENT :

Base isolation Techniques – Need – Mechanism – Types – Laminated Rubber bearing – Lead core rubber bearing – Roller Pendulum system (RPS) – Seismic dampers – Types – Metallic dampers- friction dampers – viscous fluid dampers – Semi-active dampers - Magneto-rheological Fluid dampers for vibration control - RPS augmented with Magneto-rheological fluid dampers for seismic isolation – Magneto-rheological elastomers and gels for seismic isolation – Shape memory alloys for vibration control – Design guidelines for base isolation – Isolation system – Building example – Bridge example

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Analyze the conventional and smart techniques for seismic isolation and damping of structures	3

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Anil K. Chopra, "Dynamics of Structures – Theory and applications to Earthquake Engineering", Pearson Education, 2019
2. Kelly T.E., "Bas Isolation of Structures – Design guidelines", Holmes consulting Group ltd., 2001.
3. Kelly T.E., "In-Structure Damping and energy dissipation", Holmes consulting group ltd., 2001.
4. S.R. Damodarasamy & S. Kavitha, " Basics of structural Dynamics and Aseismic design", PHI Learing private Limited, New Delhi, 2012.
5. A.V. Srinivasan & D. Michael McFarland, " Smart Structures –Analysis and Design",
6. Cambridge University Press, 2001
7. Farzad Naiem and James M. Kelly, "Design of Seismic Isolated structures", John Wiley and Sons, 1999
8. Gian Paolo Cimellaro, "Seismic Isolation, Energy Dissipation and Active Vibration Control of Structures", 17th World Conference on Seismic Isolation, conference Proceedings, Springer, 2023

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22418 **INTERIOR DESIGNING**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand the basics of interior designing

COURSE CONTENT :

Theory of interior design - Fundamentals of design - Fundamentals of structure - Introduction to computers - Analytical drawing - Anthropometry and Ergonomics - History of crafts and interior design, Research strategy and design process - Building services, Residential space design, Applications of AutoCAD and SketchUp software for interior designing.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Summarise the concepts of interior designing.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Chris Grimley, Mimi Love, “The Interior Design Reference & Specification Book updated & revised: Everything Interior Designers Need to Know Every Day”, January 2018
2. Frida Ramstedt, “The Interior Design Handbook: Furnish, Decorate, and Style Your Space” – 27 October 2020.

REFERENCES:

1. Lawrence Bauer, Michael, Mösle, Peter, Schwarz, Michael Green building, Springer-Verlag Ahmed Kasu, Interior Design, TWAIN Pub. Bombay
2. Sudhir Diwan, Sanskruti a manual of Interior DesignVol-1, Interior Affairs, Mumbai
3. Karlen Mark, Space planning Basics, Van Nostrand Reinhold, New York, 1992.
4. Joseph D Chiara, Julius Panero, & Martin Zelnick, Time Saver standards for Interior Design & space planning, 2nd edition, Mc-Graw Hill professional, 2001.
5. Francis.D. Ching & Corky Bingelli, Interior Design Illustrared, 2nd edition, Wiley publishers, 2004.
6. Julius Panero & Martin Zelnick, Human Dimension & Interior Space : A source book of Design Reference standards, Watson – Guptill, 1979. Karlen
7. Barner, R.M., (1980), Motion and Time Study, Design and Measurement of work, John Wiley, New York

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	2	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22419 LANDSCAPING ARCHITECTURE

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand the necessity of planning landscaping.

COURSE CONTENT :

Site analysis, synthesis, suitability, landscape zoning and planning with landscape land uses for medium to large scale projects - visualising landforms - Understanding contours and their characteristics, graphical representation, - Surface Drainage: Site planning for efficient drainage; understanding drainage pattern and watershed area - Landscape Construction - Circulation: Roads and Parking, paths and plazas - Level Change: Wall, steps and ramps - Planting: Planters, beds, edges and terraces - Water elements: Pools and water bodies - Landscape simulation and site utilities: Basic planning and understanding of principles for: - External lighting; types of fixtures and their use in varying situations - Irrigation: broad systems and their utility as per plantation typology - Street furniture / site furnishings

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Summarise the methodology for planning exterior landscaping.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Simonds. J. O. (1961). Landscape Architecture, The Shaping of Man's Natural Environment.London: F.W. Dodge Cooperation.
2. Harris.C.W and Dine.N.T ; (1997) Time Saver Standards For Landscape Architecture, Mcgraw – Hill International Edition, Arch. Series
3. Starke .B and Simonds. J. O. (2013) Landscape Architecture: A Manual of Site Planning and Design. 5 editions. McGraw-Hill Professional
4. Baker.B.H (1987) A Dictionary of Landscape Architecture.Albu : University of New MexicoPress
5. Reid G. W: (1987) Landscape Graphics: Watson-Guptill
6. Shaheer .M, Dua G.W and Pal.A .(2012) Landscape Architecture in India: a reader .India: La, Journal of Landscape Architecture
7. Reid G. W: (1993)From Concept to Form: In Landscape Design. John Wiley & Sons

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	-	2	3	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22420 **GREEN BUILDING CONCEPTS**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand the necessity of adopting the basic green building concepts

COURSE CONTENT :

Introduction to Global Warming - Sources of global warming, Carbon footprint - Green buildings: Concepts, sun path, orientation of rooms and buildings - Rating – Rating by various agencies - Materials used and their Efficiency - Comparison of conventional & green buildings - Environment friendly and cost effective building technologies - Buildings with cost and energy efficient roofing systems - Building in different climatic regions, Energy audit

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the green building concepts in buildings and explain how to rate a green building.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Jerry Yudelson,"The green building revolution", Island press, 2010.
2. Abe Kruger and Carl Seville, "Green building: principles and practices in residential construction", Cengage learning, 2012.

REFERENCES:

1. Lawrence Bauer, Michael, Mösle, Peter, Schwarz, Michael Green building, Springer-Verlag Berlin Heidelberg 2010
2. Hisham galal Elshimy, Green Building as Concept of Sustainability Sustainable Strategy to Design Office Building, pharos university 2015.
3. Sam kubba Handbook of Green Building Design and Construction, 2nd Edition, Butterworth-Heinemann 2016

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	2	2	-	-	3	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22421	BASICS OF STEEL CONCRETE COMPOSITE CONSTRUCTION	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To introduce the principles and concepts of steel concrete composite construction.

COURSE CONTENT :

Introduction to steel - concrete composite construction – Cambering -Theory of composite structures Types of Composite construction – Concepts of Composite slabs and Beams, Composite Columns, Composite Trusses and Composite Box Girder Bridges -Shear connectors and their types – Partial and full shear connection - Design of composite beams as per IS 11384 and Eurocode - Case studies on Steel - Concrete Composite construction in buildings.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the theory and principles of Steel – Concrete Composite construction	2
CO2	Design composite beams and shear connectors	3
CO3	Elaborate case studies on steel - concrete composite construction in buildings.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Johnson R.P. and Yong C. Wang “Composite Structures of Steel and Concrete”, Blackwell Scientific Publications, UK, 2018.
2. Oehlers D.J. and Bradford M.A., “Composite Steel and Concrete Structural Members, Fundamental behaviour”, Pergamon press, Oxford, 1995.

REFERENCES:

1. BS 5950-1: 2000 Structural use of steel work in building. Code of practice for design – Rolled and welded sections.
2. EN 1994-1-1 (2004) (English): Eurocode 4: Design of composite steel and concrete structures – Part 1-1: General rules and rules for buildings
3. EN 1994-1-2 (2005) (English): Eurocode 4: Design of composite steel and concrete structures – Part 1-2: General rules - Structural fire design
4. IS 11384 – 2022 :Code of practice for composite construction in structural steel and concrete.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	-	-	-	3	-	-	-	-	3	3
CO2	3	3	3	2	-	-	-	3	-	-	-	-	3	3
CO3	3	3	3	2	-	-	-	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22422 **BIM FOR CIVIL ENGINEERS**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To understand the necessity of adopting the Building Information Modelling as an engineer.

COURSE CONTENT :

Fundamentals of BIM Knowledge and BIM Models - Definition of BIM - From CAD to BIM - Necessity of BIM - BIM Benefits - LOD (Level of Development) in BIM, View & Retrieve Information from BIM Models – Computer tools and basic commands - Section a 3D view - Retrieve information from schedules - Measure distance in BIM models , Modeling of a Building - Introduction to Model Integration and Clash Detection - Introduction to quantity take-off for construction - create quantity schedules - customize settings for schedules - create material take-off schedules - export and compile schedules

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Summarise the necessity of BIM, the different stages involved and adopt the concept of BIM using computer tools to perform the model integration and scheduling of construction project.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Peter Barnes, Nigel Davies, BIM in Principle and in Practice, ICE Publishing, 2015.
2. Rafael Sacks, BIM Handbook – A Guide to Building Information Modelling for Owners Designers, Engineers, Contractors and Facility Managers, 3rd edition, John Wiley Publishers, 2018.
3. Brad Hardin, Dave Mccool, BIM and Construction Management, 2nd edition, Wiley Publications, 2015.
4. Ph.D. Raja R. A. Issa, Ph.D., J.D., P.E. and Svetlana Olbina, Building Information Modelling : Applications and Practices, ASCE, 2015.

COURSE ARTICULATION MATRIX :

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	2	3	-	-	-	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22423	PLUMBING FOR WATER AND SANITATION	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To understand the terminologies and concepts behind the water and sanitation plumbing systems.

COURSE CONTENT :

Importance of codes, architectural and structural coordination - plumbing terminologies - plumbing fixtures and fittings - traps, interceptors, indirect waste and vents – Plumbing system for sanitary sewage, storm drain, rainwater harvesting, water supply, gray and reclaimed water - pumping systems - pump heads - types of pumps – pump selection - Storm Water and Drainage pumps - introduction to starters and control panels.

TOTAL : 30 PERIODS

OUTCOMES :

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Interpret plumbing codes and good engineering practices, select proper plumbing materials and systems, and supervise code-based plumbing installations.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXTBOOKS:

1. A Guide to Good Plumbing Practices', a book published by IPA., 2016.
2. William Paton Buchan "Plumbing: A Text-Book to the Practice of the Art or Craft of the Plumber" Forgotten Books, 2018.

REFERENCES:

1. Uniform Illustrated Plumbing Code-India (UIPC-I) published by IPA and IAPMO(India).
2. National Building Code (NBC) of India.
3. IS 17650 Part 1 and Part 2 for Water Efficient Plumbing Products.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	2	-	-	3	3	-	-	-	-	3	3

3-High, 2-Medium, 1-Low

VD22424 **DATA ANALYTICS FOR CIVIL ENGINEERS**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES:

- To introduce the basic concepts of data analytics and the applications in various fields of civil engineering.

COURSE CONTENT :

Introduction – Data and knowledge, assessment of the knowledge, statistics, data analytics, process models, methods, Data understanding – significance, data quality, data visualization, correlation analysis, data analytic models – types, steps, classes, algorithms for model selection, errors and validation, Data preparation – data selection, cleaning data, constructing data, data integration, Pattern recognition through clustering – types of clustering, similarity measures, applications in civil engineering – applications in transportation engineering and construction management

TOTAL : 30 PERIODS

OUTCOMES :

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the concepts and applications of data analytics in civil engineering.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

REFERENCES:

1. Big Data & Hadoop, V.K. Jain, Khanna Publishing House, 2017.
2. Data Science for Civil Engineering: A Beginner's Guide, Rakesh K. Jain, Prashant Shantaram Dhotre, Deepak Tatyasaheb Mane, Parikshit Narendra Mahalle, CRC Press, 1st Edition, May 2023.
3. Data Analytics for Engineering and Construction Project Risk Management, Ivan Damnjanovic, Kenneth Reinschmidt, Springer, 2020.
4. Big Data Black Book, DT Editorial Services, Wiley India, 1st edition, 2016.
5. Data Science & Analytics, V.K. Jain, Khanna Publishing House, 1st edition, 2018.

COURSE ARTICULATION MATRIX :

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	2	3	-	-	-	-	-	-	-	1	1

3-High, 2-Medium, 1-Low

OPEN ELECTIVES

OFFERED BY CIVIL ENGINEERING

OE22401 **BASIC CIVIL ENGINEERING**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To get exposed to the glimpses of Civil Engineering topics that is essential for an Engineer.

UNIT I PLANNING, FIELD SURVEY AND INVESTIGATION 9

Introduction, Branches, Scope, Impact, Role of Civil Engineer, Units of measurement, Unit conversion (Length, Area, Volume). Basic of surveying- Fundamental principles, Classification. Linear measurement: Instruments used, Ranging- Angular measurement: Compass-Meridian, Bearing, and Local attraction. Leveling: Instrument used, Terminology, Types of leveling- Modern surveying tools: Introduction to Theodolite, Total Station, Introduction to GPS, GIS & RS

UNIT II BUILDING COMPONENTS 9

Foundations : Types of foundation, Bearing capacity of soil – Requirement of good foundations Superstructure: Brick masonry – stone masonry –framed structures- roofing – flooring – plastering – types of Bridges and Dams.
Definition and concept of plan of a simple residential building, Low cost housing, FSI.
Overview on Indian Standard code books- Basics of Estimation and costing

UNIT III TRANSPORTATION ENGINEERING 9

Basics of Highway construction materials, properties- Bituminous and Concrete road construction -traffic signals & Intersections-Basic of Railway engineering- Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings- Basics of Airport engineering- Air transport characteristics - airport classification – ICAO- Basics of Harbor engineering- Definition of Terms- Harbour, Port, Satellite Port, Docks, Waves and Tides

UNIT IV ENVIRONMENTAL ENGINEERING 9

Water supply engineering – Sources of water and their characteristics – Drinking Water quality standards- water treatment- – Principles, functions, and design of water treatment plant units- Disinfection - wastewater engineering- Characteristics and composition of sewage - primary treatment of sewage- secondary treatment of sewage- disposal of sewage- sludge treatment and disposal-Municipal and Industrial solid waste .

UNIT V RECENT DEVELOPMENT IN CIVIL ENGINEERING 9

Smart city and it's features, Solid waste management systems, Mass Rapid Transportation systems-MRTS, Metro, Rain water harvesting systems, Watershed Management, Green building, Repair and rehabilitation of Heritage structures, Features of Earthquake resistant structure.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the principles and the different methods of surveying.	2

CO2	Elaborate the functions and purpose of substructure and different superstructure components.	2
CO3	Describe the design principles involved in transportation engineering.	2
CO4	Explain the characteristics of water and wastewater and their treatment techniques.	2
CO5	Summarise the recent developments in civil engineering.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Raju .K.V.B, Ravichandran .P.T, “Basics of Civil Engineering”, Ayyappa Publications, Chennai, 2012.
2. Rangwala .S.C,” Engineering Material”s, Charotar Publishing House, Anand, 2012.

REFERENCES:

1. Ramesh Babu, “Civil Engineering”, VRB Publishers, Chennai, 2000.
2. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, (2005).
3. National Building Code of India, Part V, “Building Materials”, 2005
4. Surendra Singh, “Building Materials”, Vikas Publishing Company, New Delhi, 1996.
5. Ramamrutham S., “Basic Civil Engineering”, DhanpatRai Publishing Co. (P) Ltd. (1999).
6. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010
7. Punmia.B.C., Ashok K.Jain and Arun K Jain , Surveying Vol. I & II, Lakshmi Publications Pvt Ltd, New Delhi, 2005
8. Garg, S.K. Environmental Engineering, Vol.I and II Khanna Publishers, New Delhi, 2010.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	-	-	-	-	3	-	3	-	-	-	-	1	1
CO2	3	-	-	-	-	3	-	3	-	-	-	-	1	1
CO3	3	-	-	-	-	3	-	3	-	-	-	-	1	1
CO4	3	-	-	-	-	3	-	3	-	-	-	-	1	1
CO5	3	-	-	-	-	3	-	3	-	-	-	-	1	1

3-High, 2-Medium, 1-Low

OE22402 FUNDAMENTALS OF REMOTE SENSING AND GIS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To introduce the students to the basic concepts and principles of various components of remote sensing.
- To provide an exposure to GIS and its practical applications in Engineering fields

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION 9

Definition – components of RS – History of Remote Sensing – Merits and demerits of data collation between conventional and remote sensing methods - Electromagnetic Spectrum – wave theory, particle theory, Stefan – Boltzmann Law and Wien's Law – visible and non visible spectrum – Radiation sources: active & passive; Radiation Quantities

UNIT II EMR INTERACTION WITH ATMOSPHERE 9

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere - Scattering (Rayleigh, Mie, non-selective scattering) absorption and refraction – Atmospheric effects on visible, infrared, thermal and microwave spectrum – Atmospheric windows.

UNIT III PLATFORMS AND SENSORS 9

Ground based platforms –Airborne platforms – Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Resolution concepts – Scanners - Along and across track scanners – Orbital and sensor characteristics of different satellites – Airborne and Space borne TIR sensors – Calibration – S/N ratio – Passive/Active microwave sensing – Airborne and satellite borne RADAR –SAR –LIDAR , UAV – High Resolution Sensors

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:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the concepts and laws related to remote sensing	2
CO2	Discuss the interaction of electromagnetic radiation with atmosphere and earth material	2
CO3	Differentiate the different types of remote sensors	2
CO4	Summarise the fundamentals of maps, their characteristics and GIS, its components	2

CO5	Describe various spatial data models, their analysis and their advantages	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. George Joseph and Jeganathan. C, Fundamentals of Remote Sensing, Universities Press, 3 rd edition, 2018
2. Anji Reddy, M. "Textbook of Remote Sensing and Geographical Information System" 2nd edition. BS Publications, Hyderabad, 2001.

REFERENCES:

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. Lo. C.P.andA.K.W.Yeung, "Concepts and Techniques of Geographic Information
3. Systems",Prentice Hall of India Pvt. Ltd., New Delhi, 2002
4. Peter A.Burrough, Rachael A. McDonnell, " Principles of GIS", Oxford University Press, 2000
5. Paul Curran P.J. Principles of Remote Sensing. Longman, RLBS, 2003.
6. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press, 1995
7. Janza, F.Z., Blue H.M. and Johnson,J.E. Manual of Remote Sensing. Vol.I, American Society of Photogrametry, Virginia, USA, 2002.
8. Ian Heywood "An Introduction to GIS", Pearson Education Asia, 2000

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	3	3	-	-	-	-	-	-	1	1
CO2	-	-	-	-	3	3	-	-	-	-	-	-	1	1
CO3	-	-	-	-	3	3	-	-	-	-	-	-	1	1
CO4	-	-	-	-	3	3	-	-	-	-	-	-	1	1
CO5	-	-	-	-	3	3	-	-	-	-	-	-	1	1

3-High, 2-Medium, 1-Low

OE22403 **ELECTRONIC WASTE MANAGEMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To give an overview of electronic waste and the methods to dispose and manage.

UNIT I BASICS OF E – WASTE **9**

Introduction to electronic waste (E-waste), classification of E-waste, legislative influences on electronic recycling, WEEE (Waste Electrical and Electronic Equipment)and ROHS (Restriction of Hazardous Substances Directive) directive, treatment options for WEEE, material composition of WEEE, health and safety implication

UNIT II MATERIALS USED IN MANUFACTURING ELECTRICAL AND ELECTRONIC PRODUCTS **9**

Overview, ROHS directive and prescribed materials – lead, brominated flame retardants, soldering and move to lead free assembly, printed circuit board materials, encapsulant of electronic components, indium tin oxide and LCD screens, polymeric materials in enclosures, casing and panels, material composition of mobile phones, computers, televisions, washing machines and other electronic components, useful components and hazardous components in electronic waste.

UNIT III DUMPING, BURNING AND LANDFILL **9**

Introduction, landfills, pollutions from landfill, landfill site construction, burning, incineration, thermal processing, current practices in India, case studies and projects.

UNIT IV INTEGRATED APPROACH TO ELECTRONIC WASTE RECYCLING **9**

Separation and sorting, treatment, emerging technologies like separation, thermal treatment, sensing technologies, plastics to liquid fuels, sorting, crushing, automated disassembly, design for recycling and inverse manufacturing. Design methodology and resource efficiency, environmentally sound treatment technology for E-waste, eco- design guidelines for manufacturing, case studies and project.

UNIT V ELECTRONIC WASTE MANAGEMENT **9**

Methods for electronic waste management, national and international efforts, corporate social responsibility, extended producer responsibility(EPR), current practices in India, case studies and project.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	**RBT level**
CO1	Illustrate the classification of e-waste, health and safety implications and thereby choose appropriate treatment method.	2
CO2	Summarise the materials involved in manufacturing of electrical and electronic products.	2
CO3	Describe about the disposal of waste	2
CO4	Describe the integrated approach to e waste recycling	2

CO5	Describe the suitable waste management method based on case studies and practices in India.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Rakesh Johri, E-waste: Implications, Regulations and Management in India and Current Global Best Practices, The Energy and Resources Institute, New Delhi
2. R E Hester, R M Harrison, Electronic Waste Management, RCS Publishing.

REFERENCES:

1. Electronic Waste Management Rules 2016, Govt. of India, available online at CPCB website.
2. MSW Management Rules 2016, Govt. of India, available online at CPCB website.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO2	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO3	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO4	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO5	-	-	-	-	-	3	3	2	-	-	-	-	-	1

3-High, 2-Medium, 1-Low

OE22404 BASICS AND PRINCIPLES OF GREEN BUILDING DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To impart knowledge on the principle and design of green buildings considering all energy saving concepts.

UNIT I BASICS OF GREEN BUILDING AND ASSESSMENT METHODS 9

Introduction of green building, Concept of green building, History of green building, Need of green building in present scenario, Importance of green building Merits and demerits, Classification of green building, Assessment methods Global assessment and certification, Local assessment, LEED India GRIHA (Green Rating for Integrated Habitat Assessment)

UNIT II PRINCIPLES AND ELEMENTS OF DESIGN OF GREEN BUILDING 9

Principles and elements of design of green building; Sustainability: concept and reality - Climate responsive process of design: Climatic zones, design sequence, shelter or form, land form, vegetation, water bodies, street widths, open spaces, ground character, plan form, orientation, roof form Shading devices and their effect

UNIT III THERMAL PERFORMANCE OF BUILDING SECTIONS 9

Thermal comfort inside the building: Factors affecting, indices, cooling and heating requirement, Heat transmission through building sections, thermal performance of building sections, simple calculation for U value and insulation thickness, Day lighting and Ventilation

UNIT IV WATER CONSERVATION AND OTHER GREEN BUILDING ASPECTS 9

Water conservation: 3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling Material conservation: concept of embodied energy, low energy materials, sustainable materials, alternative materials Concept of carbon emission and its reduction.

UNIT V BUREAU OF ENERGY EFFICIENCY 9

Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings - Introduction to Energy efficiency softwares, carbon calculators

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the basics of green buildings and the assessment methods.	2
CO2	Enumerate the principles and elements of design of green buildings.	2
CO3	Describe about the thermal performance of building sections, lighting and ventilation in buildings.	2
CO4	Describe the water conservation techniques and sustainable materials.	2
CO5	Enumerate the guidelines of the energy conservation building code, model tools used to calculate energy efficiency.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Dr. Dinesh Kumar Gupta , Vaibhao K. Sonarkar , Enery Conservation and Building, Nirali Prakashan publishers 2019.
2. Abe Kruger and Carl Seville, “Green building: principles and practices in residential construction”, Cengage learning, 2012.

REFERENCES:

1. Sam Kubba , Hand book of green building and construction, Butterwort –heineman,2012
2. Green Building A-Z , Jerry Yudelson,New Society Pub, 2007
3. R.S. Means, Green Building:: Project Planning & Cost Estimating, Third Edition , 2010
4. Jerry Yudelson, “The green building revolution”, Island press, 2010
5. Abe Kruger and Carl Seville ,Green Building: Principles and Practices in Residential Construction (Go Green with Renewable Energy Resources) , Hardcover –Import , 2012

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO2	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO3	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO4	-	-	-	-	-	3	3	2	-	-	-	-	-	1
CO5	-	-	-	-	-	3	3	2	-	-	-	-	-	1

3-High, 2-Medium, 1-Low

OE22405 PRINCIPLES OF VASTU IN INTERIOR DESIGN

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the basics, importance of vastu and applications.

UNIT I OVERVIEW OF VASTUSHASTRA AND ITS HISTORY 9

Introduction of Vastushastra, Definition of Vastu, Importance of Vastu, Scientific Explanation about Vastushastra, Role of Vastushastra in today's life, Overview of the history of Vastushastra its origins to present with reference to vedic Vastushastra, Skandpuran, Agnipuran, Vayupuran, Gurudpuran, Mastya puran, Changes of vastu from old places, temples, residential and old wada concepts To modern luxurious flats, bunglows and commercial multiplexes.

UNIT II PRINCIPLES OF VASTU 9

Principles of Vastushastra, five elements: earth (geomagnetic energy), water(gravitational energy), fire(solar energy), air (wind energy) and space(cosmic energy) and their influence on the environment and people, Arrangement of man-made environments aligned with the forces of nature, Importance of directions and its scientific applications, Importance of Vastu in selection of size and shapes of open plots, residential, commercial and industrial places, planning correct placements of various rooms like study rooms, living rooms, kitchen, bed room dining rooms, W.C. bath rooms, store rooms, landscaping, Positive and negative effects of placements according to the energy field.

UNIT III SITE SELECTION AND BUILDING DESIGN 9

Type, shape and selection of land, Layouts and design of various Commercial and Residential Plots, Assessment of specific environmental elements to determine beneficial influences, Building orientation, Earth acupuncture, physiological and emotional effects of geopathic stress, Landscape design. Building design - placement of rooms and interior elements based on planetary influences using the blueprint of the Vastu Pursha mandala, Construction sequencing – specific guidelines from groundbreaking to completion.

UNIT IV EFFECTS OF VASTU ON HUMAN BEING AND REMEDIAL VASTU 9

Effects of Vastu on human being – Glands, Chakras (Energy Receiving Centers of body), Bioenergy field, Human Aura Concepts, Scientific Remedial Vastu - Rectification with co-ordination of vastu with modern interior designing and planning concepts, Introduction to Rectification of Vastu in Existing Building, rectification with corrective majors for defective vastu which includes no dismantling and structural alterations and by other cost effective methods, Rectification with Crystal Therapy, Rectification with colors Therapy, Rectification with Vastu Yantras, Rectification with use and effects of Pyramids in Vastu. Rectification with Tree plantations for positive energy creation, Rectification with balancing the electromagnetic field, Rectification with changing the placements of Furniture, Rectification with natural resources.

UNIT V INTERIOR DESIGNING 9

The ten directions, ruling planets, cold and hot directions, dark and light directions, light and heavy directions, slope of directions, Interior design as per basic vastu, Colors therapy, Space planning – standard human body dimensions, minimum space requirement for movement, procedure for design, interior layout of a residence layout, elements and principles of interior designing, Introduction of Pyra – Vaastu, Plants and greenery, Interior Layout Including-Furniture, Fixtures.

TOTAL: 45 PERIODS

OUTCOMES:

CO	CO statements Upon successful completion of the course, the students should be able to	RBT level
CO1	Ennumerate the overview and history of vastu.	2
CO2	Describe the principles and importance of vastu.	2
CO3	Summarise the methods for site selection and building design.	2
CO4	Summarise the effects of vastu on human being and remedial vastu.	2
CO5	Describe the different factors to be considered for interior designing.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. D. N. Shukla, "Vastu-Sastra – Volume 1 – Hindu Science of Architecture", Vastu Vanmaya Prakasana Sala, Shukla Kuti,
2. Anand Bhardwaj, "Vastu Shastra in Modern Context", Om Publications, 2019.

COURSE ARTICULATION MATRIX

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	3	-	-	-	-	-	-	-	-

3-High, 2-Medium, 1-Low

OE22406 INTEGRATED SOLID WASTE MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To make the students conversant with the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste, construction and demolition waste and electronic waste.

UNIT I SOURCES AND CHARACTERISTICS 9

Sources and types of municipal solid wastes- Public health and environmental impacts of improper disposal of solid wastes- sampling and characterization of wastes - factors affecting waste generation rate and characteristics - Elements of integrated solid waste management – Requirements and salient features of Solid waste management rules (2016) –- Role of public and NGOs- Public Private participation – Elements of Municipal Solid Waste Management Plan.

UNIT II SOURCE REDUCTION, COLLECTION AND TRANSFER OF WASTES 9

Waste Management Hierarchy - Reduction, Reuse and Recycling - source reduction of waste – Methods of Residential and commercial waste collection – Collection vehicles – Manpower – Collection routes – Analysis of waste collection systems; Transfer stations –location, operation and maintenance; options under Indian conditions – Field problems- solving.

UNIT III PROCESSING OF WASTES 9

Objectives of waste processing – Physical Processing techniques and Equipment; Resource recovery from solid waste composting and biomethanation; Thermal processing options – case studies under Indian conditions.

UNIT IV 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.

UNIT V CONSTRUCTION, DEMOLITION AND E-WASTE MANAGEMENT 9

Construction and Demolition (C&D) Waste Management – Overview, Regulation, Beneficial Reuse of C&D Waste Materials- Electronic Waste (E-Waste) Management – Issues and Status in India and Globally, E-Waste Management Rules 2016 and Management Challenges

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Explain the nature and characteristics of municipal solid wastes and the regulatory requirements regarding municipal solid waste management.	2
CO2	Summarise the concepts on reduction, reuse and recycling of waste.	2
CO3	Design the systems for storage, collection, transport, processing and disposal of municipal solid waste.	2
CO4	Determine the size of sanitary landfill and explain the operation of sanitary landfill.	2
CO5	Explain the management of construction, demolition and electronic waste.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Tchobanoglous, G., Theisen, H. M., and Samuel A Vigil. "Integrated Solid Waste Management Engineering Principles And Management Issues". McGraw Hill, New York, 2015.
2. Tchobanoglous, G., Theisen, H. M., and Eliassen, R. "Solid. Wastes: Engineering Principles and Management Issues". McGraw Hill, New York, 1993.

REFERENCES:

1. Vesilind, P.A. and Rimer, A.E., "Unit Operations in Resource Recovery Engineering", Prentice Hall, Inc., 1981
2. Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2000
3. Government of India, "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, New Delhi, 2014.
4. Bhide A.D. and Sundaresan, B.B. "Solid Waste Management Collection", Processing and Disposal, 2001
5. Manser A.G.R. and Keeling A.A.," Practical Handbook of Processing and Recycling of Municipal solid Wastes", Lewis Publishers, CRC Press, 1996
6. George Tchobanoglous and Frank Kreith, "Handbook of Solidwaste Management", McGraw Hill, New York, 2002

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	3	3	3	-	-	-	-	-	1
CO2	-	-	-	-	-	3	3	1	-	-	-	-	-	1
CO3	-	-	-	-	-	3	3	1	-	-	-	-	-	1
CO4	-	-	-	-	-	3	3	1	-	-	-	-	-	1
CO5	-	-	-	-	-	3	3	3	-	-	-	-	-	1

3-High, 2-Medium, 1-Low

OE22407 **LIFE CYCLE ASSESSMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- The overall learning objective of this course is for students to be able to know about the management benefits, strengths, and weaknesses of LCA, when to apply this tool, knowing the basic steps and processes of how to conduct one

UNIT I BASICS OF SUSTAINABILITY CONCEPTS AND LIFE CYCLE ANALYSIS 9

Introduction – basics of Sustainability Concepts and Life Cycle Analysis - Material flow and waste management - Water energy and food nexus - Risk and Life Cycle Framework for Sustainability - Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems.

UNIT II ENVIRONMENTAL DATA COLLECTION AND LCA METHODOLOGY 9

Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology – Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools.

UNIT III LIFE CYCLE ASSESSMENT – DETAILED METHODOLOGY 9

Detailed Methodology and ISO Framework of Life Cycle Assessment- Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework

UNIT IV DESIGN FOR SUSTAINABILITY 9

Design for Sustainability : Environmental Design for Sustainability: Economic, Environmental Indicators, Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis

UNIT V FACTORS FOR GOOD LCA STUDY 9

Factors for Good LCA Study : ISO Terminologies, LCA Steps Recap, Chemical Release and Fate and Transport, and Green Sustainable Materials. Case Studies (e.g., Odour Removal for Organics Treatment Plant, Comparison of Hand Drying Methods, Biofuels for Transportation, Solar Lamp, Bioplastic etc.).

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Summarise the basics of sustainability and life cycle analysis.	2
CO2	Describe how environmental data is collected and LCA process is done.	2
CO3	Discuss in detail the steps in methodology of LCA.	2
CO4	Enumerate the design principles for sustainability.	2
CO5	Summarise the factors for a good LCA study.	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Sustainable Engineering Concepts and Life Cycle Analysis by David T. Allen, David R. Shonnard, Prentice Hall, ISBN-10: 0132756544, ISBN-13: 978-0132756549.
2. “Life Cycle Assessment: Principles and Practice” Downloadable from: http://www.epa.gov/ORD/NRMRL/std/sab/LCA.html.

REFERENCES:

1. Life Cycle Assessment (LCA): A Guide to Approaches, Experiences and Information Sources by Allan A.Jensen. Downloadable from https://www.eea.europa.eu/publications/GH-07-97-595-EN-C/Issue-report-No-6.pdf/

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	3	3	1	-	-	-	-	-	1
CO2	-	-	-	-	-	3	3	1	-	-	-	-	-	1
CO3	-	-	-	-	-	3	3	1	-	-	-	-	-	1
CO4	-	-	-	-	-	3	3	1	-	-	-	-	-	1
CO5	-	-	-	-	-	3	3	1	-	-	-	-	-	1

3-High, 2-Medium, 1-Low

OE22408 **WATER POLLUTION AND ITS MANAGEMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

- To know the basics, importance of Water Pollution
- To study the various Effects of Water pollution
- To learn the importance of methods of control of Water Pollution
- To understand the various Water Pollution control Act

UNIT I SOURCES & CHARACTERISTICS OF WATER POLLUTION 9

Water pollution-Sources & types of water pollution –Physical, chemical & biological –Effect of water pollution. Drinking water quality standards waste Water treatment –Primary, secondary, tertiary-water pollution prevention & control act – 1974.

UNIT II WATER QUALITY AND STANDARDS 9

Quality of surface waters, Water quality in flowing waters, Water quality in impounded waters, Groundwater quality, Water quality standard Microbiological quality of drinking water, and Chemical quality of drinking water.

UNIT III INDUSTRIAL ACTIVITY & MITIGATION MEASURES 9

Role of water in different industries-Effluent discharge characteristics-Discharge Standards for Rivers and Streams-Role of stakeholders, Public NGOS, Government in Protection of Water bodies-Control Measures-Mitigation Measures for Industrial Water Contamination due to industries.

UNIT IV WATER POLLUTION REGULATIONS 9

Administrative regulation under recent legislations in water pollution control. Water (Prevention & control of pollution) Act 1974 as amended by Amendment Act 1988. Water (Prevention & control of pollution) Rules 1975 Water (Prevention & control of pollution) Cess Act. 1977 as amended by Amendment Act 1991.

UNIT V ROLE OF REGULATORY BOARDS 9

Sustainable Development, Rain Water Harvesting-Methods-Water Pollution-Causes and Effects-Role of Regulatory bodies and Local bodies-CPCB-TWAD Board – CMWSSB – Case studies related to Effective Water Management.

TOTAL: 45 PERIODS

OUTCOMES:

CO	**CO statements** Upon successful completion of the course, the students should be able to	RBT level
CO1	Ennumerate the sources and characteristics of water pollution.	2
CO2	Describe the water quality standards	2
CO3	Summarise the industrial activity and mitigation measures	2
CO4	Summarise the water pollution regulations	2
CO5	Describe the role of regulatory bodies	2

1- Remember, 2- Understand, 3- Apply, 4- Analyse, 5- Evaluate, 6- Create

TEXT BOOKS:

1. Fair.G.M, "Water and Waste water engineering Vol.I & II" .John Wiley and sons, Newyork. 2010.
2. P.C. Bansil, "Water Management In India, "Concept Publishing Company", New Delhi, 2004.

REFERENCES:

1. Metcalf & Eddy, "Wastewater engineering, Treatment and Reuse", Tata Mac Grawhill publications, 2008.
2. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 2009.
3. Arceivala.S.J, "Wastewater Treatment for Pollution Control", Tata McGraw- Hill, 2008.
4. Aruna Venkat, "Environmental Law and Policy", PHI learning private limited New Delhi, 2011.

COURSE ARTICULATION MATRIX

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	-	-	-	-	-	3	3	3	-	-	-	-	-	-
CO2	-	-	-	-	-	3	3	3	-	-	-	-	-	-
CO3	-	-	-	-	-	3	3	3	-	-	-	-	-	-
CO4	-	-	-	-	-	3	3	3	-	-	-	-	-	-
CO5	-	-	-	-	-	3	3	3	-	-	-	-	-	-

3-High, 2-Medium, 1-Low