VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

Thindal, Erode - 638 012

(Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai)
(Accredited by NAAC with 'A+' grade)

REGULATIONS 2022
(Incorporating Relative grading system)

CURRICULUM AND SYLLABUS

BE - CIVIL ENGINEERING

Choice Based Credit System (CBCS)

	VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)
Department	Civil Engineering
Programme	BE- Civil Engineering
Regulations	2022

SUMMARY OF CREDITS

S.No	Course Category	Credits per Semester								Total Credits	Credits in %	Credits as per AICTE Model Curriculum
		1	2	3	4	5	6	7	8			
1	HS	4	4					6		14	9	12
2	BS	11	8	4	4					27	17	25
3	ES	8	9							17	10	24
4	PC			15	18	13	13	5		64	39	48
5	PE					6	6	6		18	11	18
6	OE					3	3	3		9	5	18
7	EC							2	12	14	9	15
8	MC	✓	✓	✓	✓	✓	✓	✓	-	-	-	-
9	VC	✓								-	-	-
10	OC, SC, AC	✓								-	-	-
Total Credits / Sem		23	21	19	22	22	22	22	12	163	100	160

HS - Humanities and Social Science
BS - Basic Science
ES - Engineering Science
PC - Professional Core
PE - Professional Elective
OE - Open Elective
EC - Employability Enhancement Course (Project, Seminar, Internship, etc.)
MC - Mandatory Course
VC - Value added course (If three or more credits earned, then one elective course may be exempted)
OC - Online Course (If six or more credits earned, then two elective courses may be exempted)
SC - Self Study course
AC - Audit Course

	VELALAR COLLEGE OF ENGINEERING AND TECHNOLOGY (Autonomous)	CURRICULUM
		UG
		R - 2022
Department	Civil Engineering	
Programme	BE- Civil Engineering	

SEMESTER 1											
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
	22MCT01	Induction Programme	MC	0	0	0	0	100	0	100
THEORY										
1	22ENT11	Communicative English (For the students admitted in AY 2022-23 only)	HS	3	0	0	3	40	60	100
1a	22ENT11	Communicative English (For the students admitted from AY 2023-24 onwards)	HS	3	0	0	3	40	60	100
2	22MAT13	Matrices and Calculus	BS	3	1	0	4	40	60	100
3	22PHT11	Engineering Physics	BS	3	0	0	3	40	60	100
4	22CYT11	Engineering Chemistry	BS	3	0	0	3	40	60	100
5	22MET11	Engineering Graphics	ES	2	0	4	4	40	60	100
6	22EET11	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	40	60	100
7	22HST11	தமிழர் மரபு / Heritage of Tamils (For the students admitted from the AY 2023-24 onwards)	HS	1	0	0	1	40	60	100
PRACTICALS										
8	22PHL11	Physics And Chemistry Laboratory I	BS	0	0	2	1	60	40	100
9	22MEL11	Workshop Practices Laboratory	ES	0	0	2	1	60	40	100
MANDATORY COURSE										
10	22MCT02	Universal Human Values	MC	0	0	2	0	100	0	100
Total Credits							22			

SEMESTER 2										
S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
THEORY										
1	22ENT21	Professional English (For the students admitted in AY 2022-23 only)	HS	3	0	0	3	40	60	100
1a	22ENT21	Professional English (For the students admitted from AY 2023-24 onwards)	HS	3	0	0	3	40	60	100
2	22MAT23	Vector Calculus and Complex Analysis	BS	3	1	0	4	40	60	100
3	22PHT21	Materials Science	BS	3	0	0	3	40	60	100
4	22CST11	Python Programming	ES	3	0	0	3	40	60	100
5	22MET21	Engineering Mechanics	ES	3	1	0	4	40	60	100
6	22HST21	தமிழரும் தொழில் நுட்பமும் /	HS	1	0	0	1	40	60	100

		Tamils and Technology (For the students admitted from the AY 2023-24 onwards)								
6a	22HST11	தமிழர் மரபு / Heritage of Tamils (For the students admitted in the AY 2022-23 only)	HS	1	0	0	1	40	60	100
PRACTICALS										
7	22PHL21	Physics And Chemistry Laboratory II	BS	0	0	2	1	60	40	100
8	22CSL11	Python Programming Laboratory (For the students admitted in AY 2022 - 23 only)	ES	0	0	2	1	60	40	100
8a	22CSL11	Python Programming Laboratory (For the students admitted in AY 2024 - 25 onwards)	ES	0	0	3	1	60	40	100
9	22MEL21	Computer Aided Drafting and Modeling Laboratory	ES	0	0	2	1	60	40	100
MANDATORY COURSE										
10	22MCT03	Environmental Science and Engineering	MC	2	0	0	0	100	0	100
						Total Credits	21			

SEMESTER 3

S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
THEORY										
1	22MAT35	Differential Equations and Transforms	BS	3	1	0	4	40	60	100
2	22CET31	Construction Materials and practices	PC	3	0	0	3	40	60	100
3	22CEC32	Solid Mechanics	PC	3	0	2	4	50	50	100
4	22CET33	Fluid Mechanics	PC	3	0	0	3	40	60	100
5	22CET34	Surveying	PC	3	0	0	3	40	60	100
6	22HST21	தமிழரும் தொழில் நுட்பமும் / Tamils and Technology (For the students admitted in the AY 2022-23 only)	HS	1	0	0	1	100	0	100
PRACTICALS										
7	22CEL31	Surveying Laboratory	PC	0	0	2	1	60	40	100
8	22CEL32	Computer Aided Building Drawing	PC	0	0	2	1	60	40	100
MANDATORY COURSE										
9	22MCL04	English for Professionals	MC	0	0	2	0	100	0	100
						Total Credits	19			

SEMESTER 4

S. No	Course Code	Course Title	Category	Periods / Week			Credits	Max. Marks		
				L	T	P		CA	SE	Tot.
THEORY										
1	22MAT43	Numerical Methods	BS	3	1	0	4	40	60	100

2	22CET41	Strength of Materials	PC	3	1	0	4	40	60	100
3	22CET42	Hydraulic Engineering	PC	3	0	0	3	40	60	100
4	22CET43	Soil Mechanics	PC	3	0	0	3	40	60	100
5	22CET44	Highway and Pavement Engineering	PC	3	0	0	3	40	60	100
6	22CET45	Water supply and Waste water Engineering	PC	3	0	0	3	40	60	100
PRACTICALS										
7	22CEL41	Hydraulic Engineering Laboratory	PC	0	0	2	1	60	40	100
8	22CEL42	Soil Mechanics and Highway Engineering Laboratory	PC	0	0	2	1	60	40	100
MANDATORY COURSE										
9	22MCT05	Aptitude and Logical Reasoning	MC	2	0	0	0	100	0	100
Total Credits							22			

SEMESTER 5										
S. No	**Course Code**	**Course Title**	**Category**	**Periods / Week**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CA**	**SE**	**Tot.**
THEORY										
1	22CET51	Design of Reinforced Concrete structural Elements	PC	3	1	0	4	40	60	100
2	22CET52	Structural Analysis-I	PC	3	1	0	4	40	60	100
3	22CET53	Foundation Engineering	PC	3	0	0	3	40	60	100
4	22CEEXX	Professional Elective - 1	PE	3	0	0	3	40	60	100
5	22CEEXX	Professional Elective - 2	PE	3	0	0	3	40	60	100
6		Open Elective - 1	OE	3	0	0	3	40	60	100
PRACTICALS										
7	22CEL51	Environmental Engineering Laboratory	PC	0	0	2	1	60	40	100
8	22CEL52	Survey Camp	PC	0	0	2	1	100	0	100
MANDATORY COURSE										
9	22MCL06	Communication Skills Laboratory	MC	0	0	2	0	100	0	100
Total Credits							22			

SEMESTER 6										
S. No	**Course Code**	**Course Title**	**Category**	**Periods / Week**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CA**	**SE**	**Tot.**
THEORY										
1	22CET61	Concrete Technology	PC	3	0	0	3	40	60	100
2	22CET62	Structural Analysis-II	PC	3	1	0	4	40	60	100
3	22CET63	Design of Steel Structures	PC	3	1	0	4	40	60	100

4	22CEEXX	Professional Elective - 3	PE	3	0	0	3	40	60	100
5	22CEEXX	Professional Elective - 4	PE	3	0	0	3	40	60	100
6		Open Elective - 2	OE	3	0	0	3	40	60	100
PRACTICALS										
7	22CEL61	Concrete Technology Laboratory	PC	0	0	2	1	60	40	100
8	22CEL62	Environmental and Irrigation Engineering – Design and Drawing	PC	0	0	2	1	60	40	100
Total Credits							22			

SEMESTER 7										
S. No	**Course Code**	**Course Title**	**Category**	**Periods / Week**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CA**	**SE**	**Tot.**
THEORY										
1	22CET71	Engineering Economics and cost analysis	HS	3	0	0	3	40	60	100
2	22CET72	Estimation and Quantity surveying	PC	3	1	0	4	40	60	100
3	22CEEXX	Professional Elective - 5	PE	3	0	0	3	40	60	100
4	22CEEXX	Professional Elective - 6	PE	3	0	0	3	40	60	100
5		Open Elective - 3	OE	3	0	0	3	40	60	100
6	22HST71	Human Values and Professional Ethics	HS	1	0	0	1	40	60	100
PRACTICALS										
7	22CEL71	Structural Analysis and Design Laboratory	PC	0	0	2	1	60	40	100
8	22CEL72	Design Project	EC	0	0	3	2	40	60	100
MANDATORY COURSE										
9	22MCT07	Indian Constitution and Traditional Knowledge	MC	2	0	0	0	100	0	100
Total Credits							22			

SEMESTER 8										
S. No	**Course Code**	**Course Title**	**Category**	**Periods / Week**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CA**	**SE**	**Tot.**
Practical										
1	22CEL81	Internship	EC	0	0	0	2	100	0	100
2	22CEL82	Project Work	EC	0	0	20	10	40	60	100
Total Credits							12			
Total Programme Credits - 163										

L - Lecture Period T - Tutorial Period P - Practical Period	CA - Continuous Assessment SE - Semester Examination Tot.- Total

VALUE ADDED COURSES										
S. No	**Course Code**	**Course Title**	**Category**	**Periods / Week**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CA**	**SE**	**Tot.**
1	22CEV01	Introduction to Revit Architecture	VC	0	0	2	1	100	0	100
2	22CEV02	Civil Engineering Drawing and Bar Bending Schedule	VC	0	0	2	1	100	0	100
3	22CEV03	Vaastu Shastra – Design Application	VC	0	0	2	1	100	0	100
4	22CEV04	Building Information Modelling	VC	0	0	2	1	100	0	100
5	22CEV05	Structural analysis and design using Softwares	VC	0	0	2	1	100	0	100
MANDATORY COURSES										
S. No	**Course Code**	**Course Title**	**Category**	**Periods / Week**			**Credits**	**Max. Marks**		
				L	**T**	**P**		**CA**	**SE**	**Tot.**
1	22MCT01	Induction Programme	MC	-	-	-	-	-	-	-
2	22MCT02	Universal Human Values	MC	1	0	1	0	100	0	100
3	22MCT03	Environmental Science and Engineering	MC	2	0	0	0	100	0	100
4	22MCL04	English for Professionals	MC	0	0	2	0	100	0	100
5	22MCT05	Aptitude and Logical Reasoning	MC	0	0	2	0	100	0	100
6	22MCL06	Communication Skills Laboratory	MC	2	0	0	0	100	0	100
7	22MCT07	Indian Constitution and Traditional Knowledge	MC	2	0	0	0	100	0	100
Other Courses										
8	22HST11	தமிழர் மரபு / Heritage of Tamils	HS	3	0	0	1	40	60	100
9	22HST21	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HS	3	0	0	1	40	60	100
10	22HST71	Human Values and Professional ethics	HS	3	0	0	3	40	60	100

PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I (Water Resources)	VERTICAL II (Structures)	VERTICAL III (Environmental and Construction Management)	VERTICAL IV (Construction Techniques and Practices)	VERTICAL V (Transportation Engineering)	VERTICAL VI (Diversified Course)
Irrigation Engineering	Finite Element Method	Solid & Hazardous waste Management	Construction Equipment and Machinery	Traffic Engineering and Management	Advanced Surveying
Hydrology	Bridge Engineering	Municipal Solid waste Management	Formwork Engineering	Railways, Airports, Docks & Harbour	Ground Improvement Techniques
Water Resources systems Engineering	Structural Dynamics and Earthquake Engineering	Public Health Engineering	Construction Planning, scheduling and control	Infrastructure planning and Design	Remote sensing
Ground Water Engineering	Advanced design of RC Structures	Construction Project Management	Safety in construction	Urban Transportation planning	Structural Geology
Watershed conservation and Management	Prefabricated Structures	Housing planning and Management	Energy Efficient Buildings	Smart Cities	Rainwater Harvesting
Water Quality and Management	Prestressed concrete Structures	Building construction and services	Advanced Construction Techniques	Transportation planning process	Climate Change Adaptation and Mitigation
Urban Water Infrastructure	Advanced Steel structures	Contract Laws and regulations	Repair and Rehabilitation of structures	Intelligent Transport system	Steel concrete Composite structures

Registration of Professional Elective Courses from Verticals:

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

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

Sl. No	Category	Course Code	Course Title	Hours / Week			Credit	Max. Marks		
				L	T	P		CA	SE	Tot.
VERTICAL 1: WATER RESOURCES										
1	PE	22CEE11	Irrigation Engineering	3	0	0	3	40	60	100
2	PE	22CEE12	Hydrology	3	0	0	3	40	60	100
3	PE	22CEE13	Water Resources systems Engineering	3	0	0	3	40	60	100
4	PE	22CEE14	Ground Water Engineering	3	0	0	3	40	60	100
5	PE	22CEE15	Watershed conservation and Management	3	0	0	3	40	60	100
6	PE	22CEE16	Water Quality and Management	3	0	0	3	40	60	100
7	PE	22CEE17	Urban Water Infrastructure	3	0	0	3	40	60	100
VERTICAL 2: STRUCTURES										
8	PE	22CEE21	Finite Element Method	3	0	0	3	40	60	100
9	PE	22CEE22	Bridge Engineering	3	0	0	3	40	60	100
10	PE	22CEE23	Structural Dynamics and Earthquake Engineering	3	0	0	3	40	60	100
11	PE	22CEE24	Advanced design of RC Structures	3	0	0	3	40	60	100
12	PE	22CEE25	Prefabricated Structures	3	0	0	3	40	60	100
13	PE	22CEE26	Prestressed concrete Structures	3	0	0	3	40	60	100
14	PE	22CEE27	Advanced Steel structures	3	0	0	3	40	60	100
VERTICAL 3: ENVIRONMENTAL AND CONSTRUCTION MANAGEMENT										
15	PE	22CEE31	Solid & Hazardous waste Management	3	0	0	3	40	60	100
16	PE	22CEE32	Municipal Solid waste Management	3	0	0	3	40	60	100
17	PE	22CEE33	Public Health Engineering	3	0	0	3	40	60	100
18	PE	22CEE34	Construction Project Management	3	0	0	3	40	60	100
19	PE	22CEE35	Housing planning and Management	3	0	0	3	40	60	100
20	PE	22CEE36	Building construction and services	3	0	0	3	40	60	100
21	PE	22CEE37	Contract Laws and regulations	3	0	0	3	40	60	100
VERTICAL 4: CONSTRUCTION TECHNIQUES AND PRACTICES										
22	PE	22CEE41	Construction Equipment and Machinery	3	0	0	3	40	60	100
23	PE	22CEE42	Formwork Engineering	3	0	0	3	40	60	100
24	PE	22CEE43	Construction Planning, scheduling and control	3	0	0	3	40	60	100
25	PE	22CEE44	Safety in construction	3	0	0	3	40	60	100
26	PE	22CEE45	Energy Efficient Buildings	3	0	0	3	40	60	100
27	PE	22CEE46	Advanced Construction Techniques	3	0	0	3	40	60	100
28	PE	22CEE47	Repair and Rehabilitation of structures	3	0	0	3	40	60	100

VERTICAL 5: TRANSPORTATION ENGINEERING										
29	PE	22CEE51	Traffic Engineering and Management	3	0	0	3	40	60	100
30	PE	22CEE52	Railways, Airports, Docks & Harbour	3	0	0	3	40	60	100
31	PE	22CEE53	Infrastructure planning and Design	3	0	0	3	40	60	100
32	PE	22CEE54	Urban Transportation planning	3	0	0	3	40	60	100
33	PE	22CEE55	Smart Cities	3	0	0	3	40	60	100
34	PE	22CEE56	Transportation planning process	3	0	0	3	40	60	100
35	PE	22CEE57	Intelligent Transport system	3	0	0	3	40	60	100
VERTICAL 6: DIVERSIFIED COURSE										
36	PE	22CEE61	Advanced Surveying	3	0	0	3	40	60	100
37	PE	22CEE62	Ground Improvement Techniques	3	0	0	3	40	60	100
38	PE	22CEE63	Remote sensing	3	0	0	3	40	60	100
39	PE	22CEE64	Structural Geology	3	0	0	3	40	60	100
40	PE	22CEE65	Rainwater Harvesting	3	0	0	3	40	60	100
41	PE	22CEE66	Climate Change Adaptation and Mitigation	3	0	0	3	40	60	100
42	PE	22CEE67	Steel concrete Composite structures	3	0	0	3	40	60	100

OPEN ELECTIVES										
Sl.No	Category	**Course Code**	**Course Title**	**Hours / Week**			**Credit**	**Max. Marks**		
				L	**T**	**P**		**CA**	**SE**	**Tot.**
OFFERED BY DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE										
1	OE	22ADO01	Fundamentals of Database	3	0	0	3	40	60	100
2	OE	22ADO02	Data Science for Engineers	3	0	0	3	40	60	100
3	OE	22ADO03	Cyber Security	3	0	0	3	40	60	100
4	OE	22ADO04	Data Visualization	3	0	0	3	40	60	100
5	OE	22ADO05	Business Analytics	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF BIO MEDICAL ENGINEERING										
1	OE	22BMO01	Biometric systems and their applications	3	0	0	3	40	60	100
2	OE	22BMO02	Healthcare Management Systems	3	0	0	3	40	60	100
3	OE	22BMO03	Basics of Bioinformatics	3	0	0	3	40	60	100
4	OE	22BMO04	Biology for Engineers	3	0	0	3	40	60	100
5	OE	22BMO05	Regulatory requirements in Pharmaceutical Industries	3	0	0	3	40	60	100
6	OE	22BMO06	Rapid Prototyping	3	0	0	3	40	60	100
7	OE	22BMO07	Radiotheraphy basics and Applications	3	0	0	3	40	60	100
8	OE	22BMO08	Nanotechnology and Applications	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF CIVIL ENGINEERING										
1	OE	22CEO01	Civil and Infrastructure Engineering	3	0	0	3	40	60	100
2	OE	22CEO02	Environmental Pollution and Waste management	3	0	0	3	40	60	100
3	OE	22CEO03	Disaster Management and Mitigation	3	0	0	3	40	60	100
4	OE	22CEO04	Building Services	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING										
1	OE	22CSO01	Foundation of AR/VR	4	0	0	3	40	60	100
2	OE	22CSO02	Web Designing	4	0	0	3	40	60	100
3	OE	22CSO03	Block Chain fundamentals	4	0	0	3	40	60	100
4	OE	22CSO04	Knowledge Management	4	0	0	3	40	60	100
5	OE	22CSO05	Cloud Computing Essentials	4	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING										
1	OE	22ECO01	Consumer Electronics	3	0	0	3	40	60	100
2	OE	22ECO02	Advanced Mobile Communication	3	0	0	3	40	60	100
3	OE	22ECO03	Optoelectronics	3	0	0	3	40	60	100
4	OE	22ECO04	IOT System Design and Applications	3	0	0	3	40	60	100
5	OE	22ECO05	5G Technologies	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING										
1	OE	22EEO01	Domestic and Industrial Electrical Installations	3	0	0	3	40	60	100
2	OE	22EEO02	Renewable Energy Sources	3	0	0	3	40	60	100
3	OE	22EEO03	Electric Vehicles	3	0	0	3	40	60	100
4	OE	22EEO04	Energy Auditing and Conservation	3	0	0	3	40	60	100

OFFERED BY DEPARTMENT OF MECHANICAL ENGINEERING										
1	OE	22MEO01	Industrial Instrumentation	3	0	0	3	40	60	100
2	OE	22MEO02	Product Design and Development	3	0	0	3	40	60	100
3	OE	22MEO03	Sustainable Manufacturing	3	0	0	3	40	60	100
4	OE	22MEO04	Entrepreneurship Development	3	0	0	3	40	60	100
5	OE	22MEO05	Fundamentals of Ergonomics	3	0	0	3	40	60	100
6	OE	22MEO06	Principals of Management and Industrial Psychology	3	0	0	3	40	60	100
7	OE	22MEO07	Safety Measures for Engineers	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF MEDICAL ELECTRONICS										
1	OE	22MDO01	Introduction to Medical Electronics	3	0	0	3	40	60	100
2	OE	22MDO02	Hospital Waste Management	3	0	0	3	40	60	100
3	OE	22MDO03	Hospital Information System	3	0	0	3	40	60	100
4	OE	22MDO04	IoT Applications in Healthcare	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF INFORMATION TECHNOLOGY										
1	OE	22ITO01	Basics of Java Programming	3	0	0	3	40	60	100
2	OE	22ITO02	Ethical Hacking	3	0	0	3	40	60	100
3	OE	22ITO03	E-Commerce and Applications	3	0	0	3	40	60	100
4	OE	22ITO04	Basics of Android Application Development	3	0	0	3	40	60	100
5	OE	22ITO05	Web Essentials	3	0	0	3	40	60	100
6	OE	22ITO006	Digital Video Editing	3	0	0	3	40	60	100
OFFERED BY DEPARTMENT OF SCIENCE AND HUMANITIES										
1	OE	22GEO01	National Cadet Corps Studies – I	3	0	0	3	40	60	100
2	OE	22GEO02	National Cadet Corps Studies – II	3	0	0	3	40	60	100

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

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

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

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

VERTICALS FOR MINOR DEGREE

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V	Vertical VI
Fintech and Block chain	**Entrepreneurship**	**Public Administration**	**Business Data Analytics**	**Environment and Sustainability**	**Artificial Intelligence**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development	Introduction to Data Science
Fundamentals of Investment	Team Building and Leadership Management for Business	Constitution of India	Datamining for Business Intelligence	Sustainable Agriculture and Environmental Management	Principles of Artificial Intelligence
Banking, Financial Services and Insurance	Creativity and Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials	Data Warehousing and Data Mining
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Digital Marketing and Social Network Analytics	Materials for Energy Sustainability	Machine Learning Techniques
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Supply Chain Analytics	Green Technology	Expert Systems
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis	Cognitive Science
-	-	-	-	Integrated Energy Planning for Sustainable Development	Gamification
-	-	-	-	Energy Efficiency for Sustainable Development	-

Sl. No	Course Code	Course Title	Hours / Week			Credit	Max. Marks		
			L	T	P		CA	SE	Tot.
VERTICAL 1: FINTECH AND BLOCK CHAIN									
1	22ITM11	Financial Management	3	0	0	3	40	60	100
2	22ITM12	Fundamentals of Investment	3	0	0	3	40	60	100
3	22ITM13	Banking, Financial Services and Insurance	3	0	0	3	40	60	100
4	22ITM14	Introduction to Blockchain and its Applications	3	0	0	3	40	60	100
5	22ITM15	Fintech Personal Finance and Payments	3	0	0	3	40	60	100
6	22ITM16	Introduction to Fintech	3	0	0	3	40	60	100
VERTICAL 2: ENTREPRENEURSHIP									
7	22MEM21	Foundations of Entrepreneurship	3	0	0	3	40	60	100
8	22MEM22	Team Building and Leadership Management for Business	3	0	0	3	40	60	100
9	22MEM23	Creativity and Innovation in Entrepreneurship	3	0	0	3	40	60	100
10	22MEM24	Principles of Marketing Management for Business	3	0	0	3	40	60	100
11	22MEM25	Human Resource Management for	3	0	0	3	40	60	100
12	22MEM26	Financing New Business Ventures	3	0	0	3	40	60	100
VERTICAL 3: PUBLIC ADMINISTRATION									
13	22ECM31	Principles of Public Administration	3	0	0	3	40	60	100
14	22ECM32	Constitution of India	3	0	0	3	40	60	100
15	22ECM33	Public Personnel Administration	3	0	0	3	40	60	100
16	22ECM34	Administrative Theories	3	0	0	3	40	60	100
17	22ECM35	Indian Administrative System	3	0	0	3	40	60	100
18	22ECM36	Public Policy Administration	3	0	0	3	40	60	100
VERTICAL 4: BUSINESS DATA ANALYTICS									
19	22CSM41	Statistics for Management	3	0	0	3	40	60	100
20	22CSM42	Datamining for Business Intelligence	3	0	0	3	40	60	100
21	22CSM43	Human Resource Analytics	3	0	0	3	40	60	100
22	22CSM44	Digital Marketing and Social Network Analytics	3	0	0	3	40	60	100
23	22CSM45	Supply Chain Analytics	3	0	0	3	40	60	100
24	22CSM46	Financial Analytics	3	0	0	3	40	60	100

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY									
25	22CEM51	Sustainable infrastructure Development	3	0	0	3	40	60	100
26	22CEM52	Sustainable Agriculture and Environmental Management	3	0	0	3	40	60	100
27	22CEM53	Sustainable Bio Materials	3	0	0	3	40	60	100
28	22CEM54	Materials for Energy Sustainability	3	0	0	3	40	60	100
29	22CEM55	Green Technology	3	0	0	3	40	60	100
30	22CEM56	Environmental Quality Monitoring and Analysis	3	0	0	3	40	60	100
31	22CEM57	Integrated Energy Planning for Sustainable Development	3	0	0	3	40	60	100
32	22CEM58	Energy Efficiency for Sustainable Development	3	0	0	3	40	60	100
VERTICAL 6: ARTIFICIAL INTELLIGENCE									
33	22ADM61	Introduction to Data Science	3	0	0	3	40	60	100
34	22ADM62	Principles of Artificial Intelligence	3	0	0	3	40	60	100
35	22ADM63	Data Warehousing and Data Mining	3	0	0	3	40	60	100
36	22ADM64	Machine Learning Techniques	3	0	0	3	40	60	100
37	22ADM65	Expert Systems	3	0	0	3	40	60	100
38	22ADM66	Cognitive Science	3	0	0	3	40	60	100
39	22ADM67	Gamification	3	0	0	3	40	60	100

22MCT01	**INDUCTION PROGRAMME** (Common to all B.E /B. Tech Programmes)	**L**	**T**	**P**	**C**
		0	**0**	**0**	**0**

Preamble:

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:
"Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed."

"One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. " Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program:

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it every day for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering /Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:

- Guide to Induction program from AICTE

22ENT11 **COMMUNICATIVE ENGLISH** **L T P C**

(Common to all B.E./B. Tech Programmes) **4 0 0 3**

(Students admitted during 2022- 23 only)

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English aims at developing Communication Skills in English which is essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with LSRW skills.

UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION **9**

Listening: Listening for General Information - Specific Details – Conversations - Telephone Conversation - Listening to Voicemail and Messages - Listening and Filling a form **Speaking**: Self Introduction - Introducing a Friend - Politeness Strategies - Telephone Conversation - Leave a Message with Another Person - Asking for Information to Fill Details in a form **Reading:** Reading Brochures - Telephone Messages - Social Media Messages relevant to Technical Contexts **Writing:** Writing Reviews - Book/Movie – Writing about Oneself **Grammar & Vocabulary:** Tenses - Types of Questions - Parts of Speech - Contextual Meaning of Words - Abbreviations and Acronyms.

UNIT 2 EXPRESSING CASUAL CONVERSATIONS **9**

Listening: Information about Hotels and Accommodation - Recipes and Food Items - Listening to Conversations Asking for and Giving Directions – Making an Enquiry **Speaking:** Life Style Changes and Making Comparisons - Talking about Food - Making Conversation using Asking for Directions - Making an Enquiry - Role Plays - Dialogues **Reading**: Habit Formation and Changing Habits - International Cuisine - Reading a Print Interview and Answering Comprehension Questions **Writing**: E-Mail to Friend – E-Mails about Food and Recipes, Inviting Dignitaries, Accepting and Declining Invitations **Grammar & Vocabulary**: Evaluations and Comparisons with Adjectives – Prepositions - Modifiers.

UNIT 3 CLARIFICATIONS AND RECOMMENDATIONS **9**

Listening: Listening to Short Talks and Fill a table – Gap Filling Exercises - Note Taking **Speaking:** Group Discussion - Agreeing and Disagreeing - Tips and Strategies for GD **Reading:** Reading Problems and Solutions – Articles - Essays drawn from various sources **Writing:** Making Recommendations - Giving Instructions - Note Making - Itinerary- Process Description **Grammar & Vocabulary**: Word Formation - Compound Nouns - Phrasal Verbs.

UNIT 4 PUBLIC SPEAKING AND BUSINESS COMMUNICATION **9**

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech - Answering Multiple Choice Questions **Speaking**: Welcome Address - Vote of Thanks - Special Address on Specific Topic **Reading**: Life and Achievements of a Famous Personality - Reading Motivational Essays on Famous Engineers and Technologists **Writing:** Checklists - Business Communication - Quotations, Placing Orders, Complaints **Grammar & Vocabulary**: Modal Verbs and Probability - Collocations – Fixed Expressions - Semi-Fixed Expressions.

UNIT 5 WRITING DEFINITIONS AND PRODUCT DESCRIPTIONS **9**

Listening: Listening to Product Description - Labeling and Gap Filling Exercises - Seeking help with Office Equipment - Job Details **Speaking:** Describe a Product - Compare and Contrast with other Products - Buying a Product - Selling a Product - Cancelling and Fixing Appointments - Hotel Accommodation - Training Facilities - Conference Facilities **Reading:** Reading Graphical Material for Comparison (advertisements) - Clarifying an Error in the Bill **Writing:** Writing Definitions – Single Line Definition and Extended Definition - Compare and Contrast Paragraphs - Designing a Website **Grammar & Vocabulary**: Use of Discourse Markers – One Word Substitution.

TOTAL: 45

TEXT BOOKS:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level 1, Student's Book) Cambridge University Press, New Delhi: 2017.

REFERENCES:

1. M Ashraf Rizvi, "Effective Technical Communication", McGraw-Hill, 2nd Edition, New Delhi, 2018.
2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.
3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

eRESOURCES :

1. https://learnenglish.britishcouncil.org/intermediate-vocabulary
2. http://www.usingenglish.com
3. https://learnenglish.britishcouncil.org/intermediate-grammar
4. https://learnenglish.britishcouncil.org/speaking

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

CO1 Converse and read fluently using basic grammar components.
CO2 Communicate through writing without any grammatical errors.
CO3 Write clear, coherent and organized passages adhering to instructions.
CO4 Speak effectively in real-time and business situations.
CO5 Enhance vocabulary through listening and reading.

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

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

22ENT11 **COMMUNICATIVE ENGLISH** **L T P C**

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

(Students admitted during 2023- 24 onwards)

Preamble :

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Communicative English aims at developing Communication Skills in English which is essential for the learner to handle English language for a variety of everyday purposes through acquisition of basic grammar and vocabulary along with LSRW skills.

UNIT 1 INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 9

Listening: Listening for General Information - Specific Details – Conversations - Telephone Conversation - Listening to Voicemail and Messages – Gap Filling **Speaking**: Self Introduction – Expressing Opinions - Introducing a Friend - Telephone Conversation - Leave a Message - **Reading:** Reading Brochures and Pamphlets **Writing:** Writing Reviews - Book/Movie – Writing about Oneself **Grammar & Vocabulary:** Parts of Speech - Tenses - Contextual Meaning of Words - Abbreviations and Acronyms.

UNIT 2 EXPRESSING CASUAL CONVERSATIONS 9

Listening: Information about Hotels and Accommodation - Recipes and Food Items - Listening to Conversations Asking for and Giving Directions – Making an Enquiry **Speaking:** Talking about Daily Routine - Talking about Food - Making Conversation using Asking for and Giving Directions - Making an Enquiry - Role Plays - Dialogues **Reading**: International Recipes - Reading a Print Interview and Answering Comprehension Questions **Writing**: E- Mail to a Friend – E-Mails about Food and Recipes, Inviting Dignitaries, Accepting and Declining Invitations **Grammar & Vocabulary**: Evaluations and Comparisons with Adjectives - Word Formation.

UNIT 3 CLARIFICATIONS AND RECOMMENDATIONS 9

Listening: Listening to Short Talks and Fill a table – Gap Filling Exercises - Note Taking **Speaking:** Group Discussion - Agreeing and Disagreeing - Tips and Strategies for GD **Reading:** Articles - Essays drawn from various sources - Note Making **Writing:** Writing Recommendations - Giving Instructions – Itinerary - Process Description **Grammar & Vocabulary**: Prepositions - Modifiers - Phrasal Verbs.

UNIT 4 PUBLIC SPEAKING AND BUSINESS COMMUNICATION 9

Listening: Listening to Speeches by Famous People and Identifying the Central Message of the Speech - Answering Multiple Choice Questions **Speaking**: Welcome Address - Vote of Thanks - Special Address on Specific Topic **Reading**: Life and Achievements of Famous People **Writing:** Checklists – Personal Letters **Grammar & Vocabulary**: Modal Verbs and Probability - Collocations – Fixed Expressions - Semi-Fixed Expressions.

UNIT 5 WRITING DEFINITIONS AND PRODUCT DESCRIPTIONS 9

Listening: Listening to Product Description - Labeling and Gap Filling Exercises - Seeking help with Office Equipment - Job Details **Speaking:** Describe a Product - Compare and Contrast with other Products - Buying a Product - Selling a Product - Cancelling and Fixing Appointments - Hotel Accommodation **Reading:** Reading Graphical Material for Comparison - Tables - Pie Charts **Writing:** Writing Definitions – Single Line Definition and Extended Definition - Compare and Contrast Paragraphs - Clarifying an Error in the Bill **Grammar & Vocabulary**: Types of Questions - Use of Discourse Markers – One Word Substitution.

TOTAL: 45

TEXT BOOK:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level 1, Student's Book) Cambridge University Press, New Delhi: 2017.

REFERENCES:

1. M Ashraf Rizvi, "Effective Technical Communication", McGraw-Hill, 2nd Edition, New Delhi, 2018.
2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook, Oxford University Press, 2020.
3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

eRESOURCES :

1. https://learnenglish.britishcouncil.org
2. https://www.usingenglish.com

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

CO1 Converse and read fluently using basic grammar components.
CO2 Communicate through writing without any grammatical errors.
CO3 Write clear, coherent and organized passages adhering to instructions.
CO4 Speak effectively in real-time and business situations.
CO5 Enhance vocabulary through listening and reading.

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

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

22MAT13	MATRICES AND CALCULUS (Common to B.E CE and ME Programmes)	L	T	P	C
		3	1	0	4

Preamble

The course aims at achieving conceptual understanding of topics such as Matrix Algebra and Calculus. The syllabus is designed to provide the skills for modeling engineering problems and understand the role of single variable and multivariables in the discipline of engineering and computer science.

UNIT 1 MATRICES **9+3**

Characteristic equation – Eigen values and Eigenvectors of a real matrix – Properties of Eigenvalues and Eigenvectors – Statement and application of Cayley Hamilton Theorem – Orthogonal transformation of a symmetric matrix to diagonal form – Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT 2 DIFFERENTIAL CALCULUS **9+3**

Representation of functions Limit of a function Continuity Derivatives Differentiation rules (sum, product, quotient, chain rules) Implicit differentiation Logarithmic differentiation Applications : Maxima and Minima of functions of one variable.

UNIT 3 APPLICATIONS OF DIFFERENTIAL CALCULUS **9+3**

Curvature – Radius, Centre and Circle of curvature in Cartesian form Evolute – Envelope of family of curves with one and two parameters**.**

UNIT 4 MULTIVARIABLE CALCULUS **9+3**

Partial derivatives – Differentiation of implicit functions – JacobianProperties – Taylor's series expansion for functions of two variables – constrained Maxima and Minima – Lagrange's multipliers with single constraint.

UNIT 5 INTEGRAL CALCULUS **9+3**

Definite and Indefinite integrals Substitution rule Integration by parts, Integration of rational functions by partial fraction, Area as a double integral in Cartesian and Polar forms – Volume as triple integral in Cartesian coordinates

(Lecture: 45 & Tutorial: 15) TOTAL : 60

TEXT BOOKS:

1. Kreyszig Erwin, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 26thReprint, New Delhi, 2016
2. Anton.H,Bivens.IandDavis.S,"Calculus",Wiley,10th Edition,2016

eResources:

1. https://nptel.ac.in/courses/111106146. A course on Basic Calculus –I by Prof.Arindama Singh, Departmentb of Mathematics , IIT Madras.
2. https://nptel.ac.in/courses/111106051. A Course on Linear algebra ,byProf.K.C.Sivakumar ,IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Determine eigenvalues and eigenvectors of real symmetric matrices and reduce the quadratic form to canonical form by orthogonal transformation.
CO2	Apply differential calculus tools in solving various application problems.
CO3	Determine evolute and envelope of curves using curvature.
CO4	Calculate partial derivatives of a function and identify the extrema on an interval.
CO5	Apply different integration methods and multiple integral ideas in solving areas, volumes and other practical problems.

Mapping of COs with POs and PSOs

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

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

22PHT11	ENGINEERING PHYSICS	L	T	P	C
	(Common to all B.E/B.Tech Programmes)	3	0	0	3

Preamble

This course aims to impart the essential concepts of laser, fibre optics, ultrasonics, quantum physics and crystal structure and crystal defects. It also describes the physical phenomena related to the above mentioned concepts and their applications in engineering and provides motivation towards innovations.

UNIT 1 LASER **9**

Introduction –spontaneous emission and stimulated emission, population inversion, pumping. Einstein's coefficients - derivation. Types of lasers- Nd-YAG-CO_2, Semiconductor lasers (homojunction-&-heterojunction) – Industrial applications - lasers in welding, heat treatment, cutting- medical applications holography-construction and reconstruction-Safety classes of laser.

UNIT 2 FIBRE OPTICS **9**

Principle and propagation of light in optical fibres – numerical aperture and acceptance angle types of optical fibres (material, refractive index, mode) – double crucible technique of fibre drawing splicing, losses in optical fibre, dispersion fibre optical communication system (Block diagram) light sources detectors fibre optic sensors – temperature & displacement endoscope.

UNIT 3 ULTRASONICS **9**

Introduction – Production – magnetostriction effect – piezoelectric effect - piezoelectric generator detection of ultrasonic waves properties – cavitations -velocity measurement – acoustic grating Industrial applications – drilling, welding, soldering and cleaning – SONAR non destructive testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays, medical applications - sonograms.

UNIT 4 QUANTUM PHYSICS **9**

Black body radiation – Planck's theory (derivation) – deduction of Wien's displacement law and Rayleigh – Jeans' law from Planck's theory – Compton effect theory and experimental verification – matter waves – Schrödinger's wave equation – time independent and time dependent equations – physical significance of wave function – particle in a one dimensional box.

UNIT 5 CRYSTAL PHYSICS **9**

Lattice – unit cell – Bravais lattice – lattice planes – Miller indices – d spacing in cubic lattice – calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC and HCP structures – NaCl, ZnS, diamond and graphite structures – polymorphism and allotropy crystal defects – point, line and surface defects.

TOTAL : 45

TEXT BOOKS:

1 Gaur R.K. and Gupta S.L., "Engineering Physics", 8th Edition, Dhanpat Rai publishers, 2009.
2 Mani Naidu S., "Engineering Physics", 2nd Edition, Pearson Publishing, 2011.

REFERENCES:

1. Serway and Jewett, "Physics for Scientists and Engineers with Modern Physics", 9th Edition, Thomson Brooks Cole, 2013
2. Palanisamy P.K., "Engineering Physics", 2nd Edition, Scitech Publications, 2011

3. Chitra Shadrach and SivakumarVadivelu, "Engineering Physics", 1st Edition, Pearson Education, 2007.

eResources :

1. http://oupinheonline.com/book/bhattacharyatandonengineeringphysics/ 9780199452811.
2. https://www.khanacademy.org/science/physics/quantumphysics.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Compare NdYAG, CO_2 and Semiconductor lasers for welding, heat treatment, cutting, medical applications and holography using Stimulated Emission.

CO2 Demonstrate the knowledge of wave optics using light waves for communication system.

CO3 Describe the production and applications of ultrasonics.

CO4 Examine the dual nature of light waves using quantum theory for Black body radiation and Schrodinger's wave equations in particle in a one and three dimensional box.

CO5 Explain the description of a crystal structure in terms of atom positions, unit cells, and crystal symmetry; and to relate the crystal symmetry to the symmetry observed in a diffraction experiment.

Mapping of COs with POs and PSOs

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

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

22CYT11	ENGINEERING CHEMISTRY (Common to all B.E/B.Tech Programmes)	L	T	P	C
		3	0	0	3

Preamble

The study of water technology enables engineers to acquire skills to choose the appropriate method of water treatment for industrial and domestic purposes. Electrochemistry and corrosion explain the fundamentals, identification and corrosion prevention for solving electrochemical and corrosion problems. The study of energy storage devices exposes some of the most commonly used energy storage devices. Nanochemistry empowers engineers to acquire knowledge about nanomaterials and their applications in various fields. Polymeric materials aim to equip the engineering students to realize the importance of chemistry in composites and conducting polymers.

UNIT 1 WATER TECHNOLOGY 9

Hardness – types and its units – Boiler troubles – scale and sludge, boiler corrosion, caustic embrittlement, priming and foaming – Internal conditioning – carbonate and calgon conditioning External conditioning – demineralization process – Desalination – electrodialysis, reverse osmosis Treatment of water for municipal water supply (Removal of suspended particles and disinfection methods – Ozonisation).

UNIT 2 ELECTROCHEMISTRY AND CORROSION 9

Electrochemistry – Emf Series and its applications. Metal Finishing – Manufacture of Printed Circuit Board.Corrosion – mechanism – Galvanic, atmospheric (O_2) and Pitting corrosion. Protective coating – electroplating of nickel and electroless copper plating on printed circuit board.

UNIT 3 ENERGY STORAGE DEVICES 9

Batteries – types – Construction and working of Primary battery – Zinc-Air/carbon, Secondary batteries – Lead-acid battery and Lithium -ion battery, Fuel cells – H_2-O_2 fuel cell and Microbial fuel cell.

UNIT 4 NANOCHEMISTRY 9

Nanomaterials –Types – Synthesis – sol-gel and laser ablation – Characterization – Scanning Electron Microscope and Transmission Electron Microscope – Principle and instrumentation (block diagram) – Properties – optical, electrical, mechanical and magnetic and Applications of nanomaterials – medicine, agriculture, electronics and catalysis.

UNIT 5 POLYMERS 9

Polymers – thermoplastics and thermosetting plastics – polymerization – types (definition only) – Compounding of plastics – fabrication – compression and injection – Composites – polymer matrix composites (Fibre reinforced composites) and metal matrix composites – Conduction polymers – General mechanism of conduction in polymers.

TOTAL : 45

TEXT BOOKS:

1. Engineering chemistry, 17th Edition. P. C. Jain & Monica Jain, DhanpatRai Publishing Company, 2022.
2. Applied chemistry, 2nd Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, McGraw Hill Education (India) Private Limited, 2019.

REFERENCES:

1. Wiley Engineering Chemistry, 2nd Edition, Wiley,Wiley India Pvt. Ltd, New Delhi, 2014.
2. Engineering chemistry, 2nd Edition. O. G. Palanna, McGraw Hill Education (India) Private Limited, New Delhi, 2017.
3. A Textbook of NanoScience, 2nd Edition, Dr. Rakesh Kumar, Dr. Kamala Pati Tiwary, S. K. Kataria & Sons, New Delhi, 2013.

eResources:

1. http://nptel.ac.in/courses/113105028/,"Science and Technology of Polymers" Prof. Basudam Adhikari, Materials Science Centre, IIT Kharagpur
2. https://archive.nptel.ac.in/courses/118/102/118102003/ , "Nano structured materials Synthesis, Properties, Self Assembly and Applications" Prof. Ashok K Ganguli, Department of Chemistry, IIT Delhi

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Evaluate the process to purify hard water using internal and external treatment.
CO2 Apply the principle of electrochemistry in PCB etching and surface coating to prevent corrosion.
CO3 Compare and contrast the performance of primary, secondary and flow battery.
CO4 Analyze the characteristics of nanomaterials synthesized by top down and bottomup process with the aid of SEM and TEM.
CO5 Categorize the types of polymeric materials and fabrication of plastic by injection and compression molding for engineering applications.

Mapping of COs with POs and PSOs

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

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

22MET11	ENGINEERING GRAPHICS	L	T	P	C
	(Common to all B.E/B.Tech Programmes)	2	0	4	4

Prerequisites: Basic Geometry

Preamble

The knowledge of Engineering graphics is essential for the Engineering graduates in proposing new product designs through drawings and interpreting data from existing drawings. Engineering Design inculcates into an Engineer the creativity and knowledge on various aspects to be considered while designing and realizing the functional products and processes. This course deals with Engineering curves, orthographic and pictorial projections, sectional views and development of surfaces.

UNIT 1 INTRODUCTION AND PLANE CURVES 9+3

Importance of graphics in Engineering applications – Use of drafting instruments – BIS conventions and specifications –Size, layout and folding of drawing sheets – Diagonal scales and vernier scales Lines, lettering and dimensioning Basic geometrical constructions (circular and polygonal surfaces). (PRACTICE ONLY AND NOT FOR EXAMINATIONS).

Curves used in Engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

UNIT 2 PROJECTION OF POINTS, LINES AND PLANE SURFACES 9+3

Orthographic projection principles- Principal Planes First angle projection - Projection of points in four quadrants – End point projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and trapezoidal method.

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT 3 PROJECTION OF SOLIDS 9+3

Projection of simple solids - Cube, prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane and parallel to the other by rotating object method.

UNIT 4 SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 9+3

Sectioning of above solids in simple vertical position when cut by a cutting plane which is inclined to one of the reference planes and perpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids in simple vertical position – Cube, prisms, pyramids, cylinder and cone.

UNIT 5 ISOMETRIC AND FREE HAND SKETCHING 9+3

Principles of isometric projection – Isometric scale –Isometric projections of simple solids Prisms, pyramids, cylinder and cone Combination of two solid objects in simple vertical position.

Visualization concepts Free hand sketching – Conversion of Isometric view to orthographic views. Perspective projection of simple solids (Qualitative only).

Introduction to CAD software (Not for Examinations)

(Lecture: 45 & Tutorial: 15) TOTAL : 60

TEXT BOOKS:

1. Venugopal K and Prabhu Raja V., "Engineering Graphics", New Age International (P) Ltd, 13th Edition, 2015.
2. Jeyapoovan T. , "Engineering Graphics with AUTOCAD", Vikas Publishing House Pvt., Ltd., 7th Edition, 2015.

REFERENCES:

1. Bhatt N.D., Panchal, V.M. and Ingle P.R., "Engineering Drawing", Charotar Publishing House Pvt. Ltd., 53rd Edition, 2014.
2. Parthasarathy N.S. and Vela Murali, "Engineering Drawing", Oxford University Press, 1st Edition, Second Impression 2015.
3. LuzzaderW..J. and Duff J.M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production", Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Draw the various conic sections and Engineering curves
CO2 Sketch projections of lines and planes with vertical and inclined positions
CO3 Draw the projections of solids kept in various positions.
CO4 Sketch sectioned views of solids and development of surfaces.
CO5 Draw the isometric and orthographic views from given pictorial views.

Mapping of COs with POs and PSOs

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

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

22EET11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING

L	T	P	C
3	0	0	3

Preamble

The course covers the fundamentals of basic electrical circuit parameters of both ac and dc circuits and the characteristics of motors and generators. The basics of semiconductor devices and logic gates provides the necessary initiative for the students to acquire the knowledge in basic electronics.

UNIT 1 DC CIRCUITS AND AC CIRCUITS **9**

DC Circuits: Basic Definitions - Resistance: Resistors in Series and Parallel - Ohm's Law - Method of solving a circuit by Kirchoff's laws. AC Circuits: Basic Definitions - Alternating Voltage and Current, R.M.S and Average Value, Power Factor, Form Factor and Peak Factor - Analysis of AC Circuit: R, L, C, Series RL, RC & RLC Circuits.

UNIT 2 POWER SYSTEMS **9**

Structure of Power System - Generation: Introduction to Conventional and Non Conventional Energy Sources Transmission: Overhead and Underground Systems - Distribution: Single phase and three phase system Basic principles of Earthing.

UNIT 3 ELECTRICAL MACHINES **9**

Laws of Electromagnetic Induction – Fleming's Right and Left hand rules – Lenz's law. DC Generator: Construction and working principle - DC Motor: Construction and working principle Single Phase Induction Motor: Split Phase and Capacitor Start Induction Motor.

UNIT 4 ELECTRONICS DEVICES **9**

PN junction Diode and its Characteristics - Zener Diode and its Characteristics - Half and Full wave Rectifiers - Bipolar Junction Transistor - CE configuration and its characteristics.

UNIT 5 DIGITAL ELECTRONICS **9**

Boolean Algebra - Theorems and Laws - DeMorgan's theorem - Logic Gates - Universal Gates - Implementation of Boolean functions. Binary Arithmetic: Addition – Subtraction - Multiplication - Division - Half adder and Full adder circuits.

TOTAL : 45

TEXT BOOKS:

1. Muthusubramanian R and Salivahanan S, "Basic Electrical and Electronics Engineering", McGraw Hill Education, 1st Edition, 2014.
2. Mittle V N and Aravind Mittal, "Basic Electrical engineering", McGraw Hill Education, 2nd Edition, 2006.

REFERENCES:

1. V.K.Mehta and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S.Chand & Company Ltd, 2015.
2. SedhaR.S.,"Applied Electronics",S.Chand & Company Ltd,2006.
3. Thomas L.Floyd.,"Digital Fundamentals",Pearson Education,PrenticeHall,Tenth Edition,2010.

eResources:

1. NPTEL, http://nptel.ac.in/courses/117106101/ , "Basic Electrical Circuits", Prof. Nagendra Krishnapura, IIT, Madras.
2. NPTEL, http://nptel.ac.in/downloads/108105053/ , "Basic Electrical Technology", Prof. Dr. L. Umanand, IIS, Bangalore.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Analyze the various DC and AC circuits and find the circuit parameters.
CO2 Describe the principles of power system engineering.
CO3 Illustrate the construction and working principle of electrical machines.
CO4 Explain the basics of semiconductor devices and its applications.
CO5 Describe the basics of Number systems and Logic gates.

Mapping of COs with POs and PSOs

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

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

22HST11	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

UNIT 1 LANGUAGE AND LITERATURE **3**

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT 2 HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE **3**

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT 3 FOLK AND MARTIAL ARTS **3**

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT 4 THINAI CONCEPT OF TAMILS **3**

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT 5 CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE **3**

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

TOTAL : 15

TEXT-CUM-REFERENCE BOOKS

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

7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).

8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)

9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22PHL11	PHYSICS AND CHEMISTRY LABORATORY I	L	T	P	C
	(Common to all B.E/B.Tech Programmes)	0	0	2	1

Preamble

This course aims to impart knowledge in the determination of the physical parameters such as wavelength of laser and mercury spectrum, Numerical aperture and acceptance angle of an optical fiber, velocity of ultrasonic waves and thermal conductivity of bad conductor and additionally necessitate the practical skills in determination of rate of corrosion in mild steel, water quality parameters and amount of iron in the given sample.

PHYSICS LABORATORY I

LIST OF EXPERIMENTS

1. Determination of Optical property of Laser and Particle size of Lycopodium powder.
2. Determination of Numerical aperture and acceptance angle of an optical fiber.
3. Determination of velocity of ultrasonic waves Ultrasonic Interferometer.
4. Determination of wavelength of mercury spectrum Spectrometer grating.
5. Determination of Thermal conductivity of Bad conductor.

CHEMISTRY LABORATORY I

LIST OF EXPERIMENTS

1. Determination of alkalinity in water sample
2. Determination of Calcium and Magnesium hardness in water by EDTA method.
3. Determination of rate of corrosion in Mild steel by weight loss method.
4. Determination of iron content of the water sample using spectrophotometer (1,10phenanthroline / thiocyanate method).
5. Determination of iron content of the given solution using a potentiometer

TOTAL : 45

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Experiment and determine the optical property of light sources and acceptance angle of optical fiber using Laser and Spectrometer.
CO2	Experiment and determine the velocity of ultrasonic waves and thermal conductivity of a given bad conductor using ultrasonic interferometer and Lee's disc.
CO3	Experiment and estimate type and amount of alkalinity, Calcium and Magnesium hardness in water sample using titrimetry.
CO4	Experiment and determine the rate of corrosion in mild steel by weight loss method.
CO5	Experiment and determine the amount of iron content present in the given sample using potentiometer and spectrophotometer.

Mapping of COs with POs and PSOs

COs\POs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO 12	PSO 1	PSO 2
CO1	2	1		3		1	1		1	1	1	1		
CO2	2	1		3		1	1		1	1	1	1		
CO3	2	1		3		1	1		1	1	1	1		
CO4	2	1		3		1	1		1	1	1	1		
CO5	2	1		3		1	1		1	1	1	1		

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

22MEL11	WORKSHOP PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

Preamble

Workshop practices give hands-on training practice to Engineering students. This course includes carpentry, plumbing, welding, sheet metal forming and welding exercises. Also, this course will inculcate in the students the habit of selecting right tools, planning the job and its execution

GROUP A

CIVIL **9**

Plumbing Works:

Study of plumbing tools, pipeline joints, its location, functions and safety aspects.

1. a. Distribution of water from sump to overhead tank and return to home tap with bye pass connection.

b. Distribution of water in mixed pipes.

Carpentry using Power Tools only:

Study of the carpentry tools, joints and processes in roofs, doors, windows and furniture and safety precautions.

Hands-on-exercise:

a. Tee Lap joint

b. Dove tail joint

MECHANICAL **15**

Welding:

1. Arc welding - Lap joint
2. Arc welding - Tee joint

Basic Machining:

3. Simple Turning and Facing
4. Drilling and Tapping

Sheet Metal Work Forming & Bending:

5. Model making - Tray / Funnel

Study Experiments:

(a) Study of centrifugal pump

(b) Study of air conditioner

Demonstration:

Gas welding practice

GROUP B

ELECTRICAL **12**

1. Residential house wiring using switches, fuse, indicator and lamps.
2. Fluorescent lamp wiring.
3. Staircase wiring.
4. Reading of voltage, current, power, energy and other parameters with 1 phase digital energy meter.
5. Measurement of earth resistance.

ELECTRONICS **9**

1. Identification and Study of Electronic components and equipments – Resistors, capacitors, inductors, colour coding and measurement.
2. Measurement of AC signal parameters (peak-peak, RMS value, period, frequency) using CRO.
3. Verification of the truth tables of logic gates: AND, OR, XOR and NOT.
4. Construction of Half Wave and Full Wave Rectifiers and study their output waveforms.
5. Soldering practice – Using general purpose PCB.

TOTAL : 45

REFERENCES:

1. Manual prepared by the faculty of Mechanical Engineering Department, VCET.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Fabricate various joints by carpentry and to prepare plumbing line assemblies.
CO2 Fabricate various joints through arc welding and gas welding processes.
CO3 Perform metal forming and basic machining operations.
CO4 Construct various types of domestic wiring and measure the various electrical parameters.
CO5 Develop and test circuits with active elements and verify truth table of logic gates.

Mapping of COs with POs and PSOs

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

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

22MCT02	UNIVERSAL HUMAN VALUES	L	T	P	C
	(Common to all B.E/B.Tech Programmes)	0	0	2	0

Preamble:

Universal Human Values is a life skill necessary for all to develop physical health and factors for strengthening life force. This course aims to expose the students in the areas of mediation and impart the knowledge on social virtues and morals

UNIT 1 Physical Health **6**

SKY – Introduction – Education as a means for youth empowerment – Greatness of Education – Yoga for Youth Empowerment – Simplified Physical Exercises: Explanation – Hand, Leg, Breathing and Eye exercises – Kapalabathi, Makarasanam, Massaging, Acupressure and Relaxation practices –Yogasanas Explanation – Benefits

UNIT 2 Strengthening Life Forces **6**

Reasons for Diseases: Natural Reasons (Hereditary, Planetary Position, Natural Calamities and Climatic changes) – Artificial Reasons (Food, Thought, Deed). Philosophy of Kayakalpa: Physical Body –Life Force – Biomagnetism – Mind. Maintaining Youthfulness – Postponing Aging – Transformation of Food into seven Body constituents.

UNIT 3 Wellness of Mind **6**

Classification of Mind Waves – Beta, Alpha, Theeta, Delta – Agna Meditation – Benefits. Shanthi Mediation – Benefits. Thuriya Meditation – Benefits. Blessing and its Benefits: Auto Suggestion – Blessing the family and others – Blessings the World – Divine Protection.

UNIT 4 Virtues **6**

Individual Virtues: Self Control – Self Confidence – Speaking Truth – Contentment – Humility – Mind Control. Tolerance – Adjustment – Sacrifice – Forgiveness. Cleanliness (Body, Dress, Surrounding) External, Mental, Inner Cleanliness. **Societal Virtues :**Ahimsa – Services, Patriotism – Equality, Respecting the parents and elders – Caring for them – Respecting Teachers. Punctuality – Time Management.

UNIT 5 Morals **6**

Importance of introspection: I and Mine (Ego, Possessiveness), Six Temperaments: Greed – Anger – Miserliness – Immoral Sexual Passion – Inferior Superior complex – Vengeance. Maneuvering the Six Temperaments: Contentment – Tolerance – Charity – Chastity – Parity – Forgiveness. Five important Benefits of Meditation: Perspicacity – Magnanimity – Adaptability – Receptivity – Creativity. (Enhancing memory) (Effective Examination Preparation)

TOTAL : 30

TEXT BOOKS:

1. "Yoga for Youth Empowerment" compiled by Vethathiri Maharishi Institute for Spiritual and Institutional Education, Aliyar, Pollachi, 1st Edition 2016.
2. "Yoga for Human Excellence", compiled by Vethathiri Maharishi Institute for Spiritual and Institutional Education, Aliyar, Pollachi 1st Edition 2009.

eRESOURCE:

1. www.online.vethathiri.edu.in "online in (Virtual) Programme on Yoga and Human Excellence".

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

1. Demonstrate the knowledge on physical health
2. Discuss the factors for strengthening life force
3. Classify mind waves and explain the benefits of meditation
4. Explain individual and social virtues
5. Identify and explain the importance of morals.

Mapping of COs with POs and PSOs

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

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

22ENT21 **PROFESSIONAL ENGLISH** **L T P C**

(Common to all B.E./B. Tech Programmes) **4 0 0 3**

(Students admitted during 2022- 23 only)

Preamble:

The course Professional English aims at developing LSRW skills which are essential for the learners to communicative effectively and appropriately in professional contexts through acquisition of grammar and vocabulary.

UNIT 1 ANALYTICAL READING 9

Listening: Listening to Podcasts - Anecdotes - Stories - Event Narration - Documentaries and Interviews with Celebrities - Evaluative Listening - Advertisements - Listening and Filling a Graphic Organizer **Speaking**: Conversation Skills – Opening - Turn Taking - Closing - Explaining how something works - Marketing a Product - Persuasive Speech Techniques **Reading:** Reading Advertisements - User Manuals - Analytical Reading - Deductive and Inductive Reasoning **Writing**: Professional E-mails – E-mail Etiquette - Compare and Contrast Essays **Grammar & Vocabulary**: Prepositional Phrases - Impersonal Passive Voice - Product Description.

UNIT 2 SUMMARISING 9

Listening: Listening to Lectures - Talks and Completing Gap Filling Exercises on Science and Technology - Listening Technical Information from Podcasts **Speaking**: Summarizing - Oral Reporting - Narrating Personal Experiences – Events - Interviewing a Celebrity **Reading:** Reading Scientific and Technical Articles - Texts **Writing:** Lab Reports - Summary Writing **Grammar & Vocabulary**: Purpose Expressions - Same Word used as Different Parts of Speech.

UNIT 3 DESCRIBING VISUAL MATERIALS 9

Listening: Listening to the Panel Discussion **Speaking**: Speaking at Formal Situations - Mini Presentation and Making Recommendations **Reading:** Reading Journal Articles - Speed Reading - Interpretation of Graphics – Tables - Pie Chart - Flow Chart - Bar Chart **Writing**: Data Commentaries - Describing Visual Materials - Mechanics of Writing - Writing Complaints to Editorial Columns **Grammar & Vocabulary:** Subject-Verb Agreement - Pronouns - Relative Pronouns.

UNIT 4 WRITING E-MAILS AND JOB APPLICATION LETTERS 9

Listening: Listening to Model Interviews **Speaking**: Speaking at Different Types of Interviews - Role Play Practice **Reading:** Reading Job Advertisements and Company Profile - Statement of Purpose (SOP) **Writing:** Filling up the Job Application Letter – Cover Letter – Résumé Preparation - Internship Application **Grammar & Vocabulary:** Error Correction – 'If' Conditionals - Infinitives - Gerunds.

UNIT 5 REPORT WRITING 9

Listening: Viewing a Model Group Discussion **Speaking**: Participating in a Group Presentation - Presentation **Reading:** Cause and Effect Essays – Letters and E-mails of Complaint **Writing:** Types of Reports - Report Format - Industrial Accident Report - Industrial Visit Report - Feasibility Report - Designing and Reporting Surveys - Writing Discursive Essays **Grammar & Vocabulary:** Reported Speech - Numerical Adjectives - Idioms and Phrases.

TOTAL: 45

TEXT BOOK:

1. 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited .2019.

REFERENCES:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level2, Student's Book) Cambridge University Press, New Delhi: 2017.

2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook , Oxford University Press, 2020.
3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

eRESOURCES :

1. www.eslgold.com
2. www.usingenglish.com
3. https://learnenglish.britishcouncil.org/intermediate-grammar
4. https://learnenglish.britishcouncil.org/speaking

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

CO1 Read for gathering and understanding information using narrative techniques.
CO2 Develop and demonstrate listening skills for academic and professional purposes.
CO3 Apply apt vocabulary and construct grammatically correct sentences in professional situations.
CO4 Face interviews with communicative competence and confidence with a good knowledge of career skills.
CO5 Enhance writing skills for essays and for preparing reports.

Mapping of COs with POs and PSOs

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

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

22ENT21 **PROFESSIONAL ENGLISH** **L T P C**

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

(Students admitted during 2023- 24 onwards)

Preamble:

The course Professional English aims at developing LSRW skills which are essential for the learners to communicative effectively and appropriately in professional contexts through acquisition of grammar and vocabulary.

UNIT 1 ANALYTICAL READING 9

Listening: Listening to Anecdotes - Stories - Event Narration – Documentaries and Interviews with Celebrities - Advertisements - Listening and Gap Filling Exercises **Speaking**: Conversation Skills – Initiating - Turn Taking - Closing – Explaining how something works - Persuasive Speech Techniques **Reading:** Reading Advertisements - User Manuals - Analytical Reading - Deductive and Inductive Reasoning **Writing**: Professional E-mails – E-mail Etiquette – Compare and Contrast Essays **Grammar & Vocabulary**: Prepositional Phrases –Same Word used as Different Parts of Speech.

UNIT 2 SUMMARISING 9

Listening: Listening to Lectures - Talks and Completing Gap Filling Exercises on Science and Technology – Listening Technical Information from Podcasts **Speaking**: Summarizing - Oral Reporting – Narrating Personal Experiences – Events – Interviewing a Celebrity **Reading:** Reading Scientific and Technical Articles - Texts **Writing:** Lab Reports - Summary Writing. **Grammar & Vocabulary**: Impersonal Passive Voice - Purpose Expressions.

UNIT 3 DESCRIBING VISUAL MATERIALS 9

Listening: Listening to the Panel Discussion **Speaking**: Speaking at Formal Situations –Mini Presentation and Making Recommendations **Reading:** Reading Journal Articles - Speed Reading - Interpretation of Graphics – Flow Chart - Bar Chart **Writing**: Data Commentaries - Describing Visual Materials – Mechanics of Writing - Writing Complaints to Editorial Columns **Grammar & Vocabulary:** Subject-Verb Agreement – Pronouns - Relative Pronouns - Numerical Adjectives.

UNIT 4 WRITING E-MAILS AND JOB APPLICATION LETTERS 9

Listening: Listening to Model Interviews **Speaking**: Speaking at Interviews – Role Play Practice **Reading:** Reading Job Advertisements and Company Profile - Statement of Purpose (SOP) **Writing:** Filling up the Job Application – Cover Letter – Résumé Preparation – Internship Application **Grammar & Vocabulary:** 'If' Conditionals – Infinitives – Gerunds - Compound Nouns.

UNIT 5 REPORT WRITING 9

Listening: Viewing a Model Group Discussion **Speaking**: Participating in a Group Talk –

Reading: Cause and Effect Essays – Business Letters **Writing:** Types of Reports - Report Format - Industrial Accident Report - Industrial Visit Report – Feasibility Report - Designing and Reporting Surveys – Writing Discursive Essays **Grammar & Vocabulary:** Reported Speech – Idioms and Phrases.

TOTAL: 45

TEXT BOOK:

1. 'English for Engineers and Technologists' Volume 1 published by Orient Black Swan Limited .2019.

REFERENCES:

1. Richards, Jack. C with Jonathan Hull and Susan Proctor New Interchange: English for International Communication. (Level2, Student's Book) Cambridge University Press, New Delhi: 2017.
2. Sanjay Kumar and Pushp Lata, "Communication Skills: A Workbook , Oxford University Press, 2020.
3. J K Gangal, "A Practical course in Spoken English", PHI Learning Pvt. Ltd., 1st Edition, Delhi, 2014.

eRESOURCES :

1. www.eslgold.com
2. www.usingenglish.com

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

CO1 Read for gathering and understanding information using narrative techniques.
CO2 Develop and demonstrate listening skills for academic and professional purposes.
CO3 Apply apt vocabulary and construct grammatically correct sentences in professional situations.
CO4 Face interviews with communicative competence and confidence with a good knowledge of career skills.
CO5 Enhance writing skills for essays and for preparing reports.

Mapping of COs with POs and PSOs

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

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

22MAT23	VECTOR CALCULUS AND COMPLEX ANALYSIS (Common to B.E – CE and ME Programmes)	L	T	P	C
		3	1	0	4

Prerequisites : 22MAT13 - MATRICES AND CALCULUS

Preamble

Vector calculus is a form of mathematics that is focused on the integration of vector fields. An Engineer should know the Transformations of the Integrals, as Transformation of Line Integral to surface and then to volume integrals. Complex Integration approach is very useful to evaluate many improper integrals of a real variable.

UNIT 1 DIFFERENTIATION OF VECTORS 9+3

Scalar and vector valued functions – gradient, tangent plane – directional derivative – divergence and curl – scalar and vector potentials – Statement of vector identities – Simple problems.

UNIT 2 INTEGRATION OF VECTORS 9+3

Line, surface and volume integrals – Statement of Green's, Stoke's and Gauss divergence theorems – Simple applications involving squares, rectangles, cubes and rectangular parallelepipeds.

UNIT 3 ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic functions: Necessary conditions – CauchyRiemann equations and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions by Milne's method – Conformal mapping: w = z+k, kz, 1/z and bilinear transformation

UNIT 4 TAYLOR'S SERIES AND LAURENT'S SERIES 9+3

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula(excluding proof) – Zeros, Singularities Taylor's and Laurent's series expansions.

UNIT 5 RESIDUES 9+3

Residues – Calculation of residues Cauchy's residue theorem(excluding proof) – Application of residue theorem to evaluate real definite integrals.

(Lecture: 45 & Tutorial: 15) TOTAL : 60

TEXT BOOKS:

1. Kreyszig Erwin, "Advanced Engineering Mathematics ", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 26th Reprint, New Delhi, 2016

REFERENCES:

1. Grewal B.S., "Higher Engineering Mathematics" 43rd Edition,Khanna Publishers, New Delhi, 2014
2. Veerarajan T., "Engineering Mathematics (I Year)", 3 rd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2012.

eResources:

1. https://nptel.ac.in/courses/111105122. A course on Integral and vector calculus by Prof.Hari Shankar Mahato,IIT,Kharagpur.
2. https://nptel.ac.in/courses/111103070. A course on Complex Analysis, by Prof.P.A.S.SreeKrishna, IIT,Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Compute gradient, directional derivative by vector differentiation.
CO2 Determine line integrals, surface integrals and volume integrals by vector integration.
CO3 Construct analytic functions and transform the analytic functions from one domain to another using conformal mapping.
CO4 Classify singularities, obtain Taylor's series and Laurent's series for analytic functions.
CO5 Compute complex integrals using Cauchy's Residue theorem.

Mapping of COs with POs and PSOs

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

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

22PHT21	MATERIALS SCIENCE	L	T	P	C
	(Common to B.E – CE and ME Programmes)	3	0	0	3

Prerequisites : Engineering Physics

Preamble

Materials Science is a significant research area that involves in search of novel materials with the required qualities, and to understand the concept of acoustics, thermal Physics, elasticity, superconducting and new engineering materials.

UNIT 1 ACOUSTICS **9**

Introduction-Classification of Sound-Characteristics of Sound-Loudness Weber Fechner law-units of loudness-Decibel-Acoustics of buildings-Reverberation-Reverberation time-Sabine's formula for Reverberation time-Growth and Decay Method-Absorption Coefficient-Determination of Absorption - affecting Acoustics of Buildings.

UNIT 2 THERMAL PHYSICS **9**

Introduction-Modes of Heat transfer-Thermal Conductivity-Newton's law of Cooling-Determination of Thermal conductivity-Searle's method-Lee's Disc method-Radial flow of Heat-Rubber tube method-Thermal conductivity of a rubber tube-Heat conduction through a compound media(Series and parallel).

UNIT 3 ELASTICITY **9**

Elasticity-Stress-Strain diagram and its uses-Factors affecting elastic modulus and tensile strength-Torsional stress and Deformations-twisting couple-torsion pendulum: theory and Experiment-Bending of beam-Bending moment-Cantilever, Young's Modulus by Uniform and non-Uniform bending: theory and Experiment-I-shaped girders.

UNIT 4 SUPERCONDUCTING MATERIALS **9**

Superconductivity : Properties – Type I and type II superconductors –BCS theory of superconductivity(qualitative)GMR – High Tc superconductors –Josephson Effect Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT 5 NEW ENGINEERING MATERIALS **9**

Metallic glasses: Preparation, properties and applications – Shape memory alloys (SMA): Characteristics, properties of Ni-Ti alloy, applications – Nanomaterials – Preparation – Pulsed laser deposition – Sol-Gel technique– Applications.

TOTAL : 45

TEXT BOOKS:

1. Kasap S.O., "Principles of Electronic Materials and Devices", 3rd Edition, Tata McGrawHill 2007.
2. Palanisamy P.K, "Materials Science", 2nd Edition, Scitech publications (India) Pvt. Ltd., Chennai, 2007.

REFERENCES:

1. Balasubramaniam R, "Callister's Materials Science and Engineering", 2nd Edition, WileyIndia 2014.
2. Charles P. Poole and Frank J.Owens, "Introduction to Nanotechnology", 1st Edition, Wiley, New Delhi, 2007.
3. Bhattacharya D.K. and PoonamTandon "Engineering Physics",2nd Edition,Oxford University press.
4. Senthilkumar.G, "Engineering PhysicsI" New Edition VRB Publishers Pvt.Ltd,20132014.

eResources :

1. http://nptel.ac.in/courses/122202008 , "Materials Science" – Dr. S. K. Gupta, IIT Delhi
2. https://www.khanacademy.org/science/physics/magneticforcesandmagneticfields

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Understand the principles of acoustics and the factors involved in construction of buildings.
CO2	Demonstrate the thermal conductivity of a material by Lee's Disc and Searle's method, and thermal conduction through compound media.
CO3	Discuss the basics of elasticity and the methods of measuring its parameters.
CO4	Describe the concept of Superconductivity by BCS theory along with their Applications.
CO5	Explain the preparation and properties of metallic glasses, Shape memory alloys and Nanomaterial using PLD, Sol- Gel methods.

Mapping of COs with POs and PSOs

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

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

22CST11	PYTHON PROGRAMMING	L	T	P	C
	(Common to all B.E /B.Tech Programmes)	3	0	0	3

Preamble

Python is easy to use, powerful, and versatile, making it a great choice for beginners and experts alike. Python's readability makes it a great first programming language - it allows you to think like a programmer and not waste time understanding the mysterious syntax that other programming languages can require. The syntax in Python helps the programmers to do coding in fewer steps**.** Python is widely used in bigger organizations because of its multiple programming paradigms.

UNIT 1 COMPUTING FUNDAMENTALS 9

Fundamentals of Computing – Identification of Computational Problems Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

UNIT 2 INTRODUCTION TO PYTHON 9

Python interpreter, data types: int, float, boolean, string, and list; variables, expressions, statements, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT 3 CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals: Boolean values and operators, conditional (if), alternative (ifelse), chained conditional (ifelifelse); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT 4 LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT 5 FILES, MODULES AND PACKAGES 9

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages, Introduction to Pygame tool; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0100).

TOTAL : 45

TEXT BOOKS:

1. ReemaThareja, "Python Programming using Problem Solving Approach", Oxford University Press, 2017.
2. Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.

REFERENCES:

1. E Balagurusamy," Problem Solving and Python Programming", McGraw Hill Education, 2018
2. G Venkatesh and MadhavanMukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1stEdition, Notion Press, 2022.

eRESOURCES:

1. https://swayam.gov.in/course/4178spokentutorialpythonenglish, "Introduction to Python", Prof. PrabhuRamachandran, IIT Bombay.
2. https://onlinecourses.nptel.ac.in/noc18_cs22, "Programming, Data Structures and Algorithms Using Python", Prof.MadhavanMukund, IITBombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Use the basics of algorithmic problem solving techniques (pseudo code, flow chart, language basics) for a given problem.
CO2	Apply suitable python conditional and looping statements to solve a given problem.
CO3	Define Python functions and use function calls to solve problems.
CO4	Use Python data structures (lists, tuples, and dictionaries) to represent complex data.
CO5	Create python packages, modules and files for a given scenario.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1						1	1		
CO2	3	2	2	2	1						1	1		
CO3	3	2	2	2	1						1	1		
CO4	3	2	2	2	1						1	1		
CO5	3	2	2	2	1						1	1		

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

22MET21	ENGINEERING MECHANICS (Common to B.E – CE and ME Programmes)	L	T	P	C
		3	1	0	4

Prerequisites : 22PHT11- Engineering physics

Preamble

Engineering Mechanics deals with the state of rest or motion of the bodies subjected to the action of forces. This course is mainly concerned about the rigid body mechanics, which forms the basis for the design and analysis of the various structural and mechanical devices encountered in Engineering. This course is subdivided into Statics and Dynamics. Statics deals with the study of bodies under rest or uniform motion while Dynamics deals with the bodies under accelerated motion.

UNIT 1 BASICS AND STATICS OF PARTICLES 9+3

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and Triangular laws 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 2 EQUILIBRIUM OF RIGID BODIES 9+3

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 – Scalar components of a moment – Varignon's theorem – Single equivalent force Equilibrium of Rigid bodies in two dimensions – Analysis of trusses using method of joints Equilibrium of Rigid bodies in three dimensions.

UNIT 3 PROPERTIES OF SURFACES AND SOLIDS 9+3

Centroids and centre of mass– Centroids of lines and areas Rectangular, circular, triangular areas, T section, I section, Angle section, Hollow section by using standard formulae – Theorems of Pappus Area moments of inertia of plane areas – Rectangular, circular, triangular areas, T section, I section, Angle section, Hollow section by using standard formulae. Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia – Polar moment of inertia – Radius of gyration Mass moment of inertia – Mass moment of inertia for prismatic, cylindrical and spherical solids from first principle.

UNIT 4 FRICTION 9+3

Friction force – Types of friction - Laws of sliding friction –Applications of friction in machines Wedge friction, Ladder friction, Screw friction, Belt friction.

UNIT 5 DYNAMICS OF PARTICLES AND RIGID BODIES 9+3

Displacements, Velocity and acceleration, their relationship – Relative motion –Work Energy Equation– Impulse and Momentum Translation and Rotation of rigid bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

(Lecture: 45 ; Tutorial: 15) TOTAL : 60

TEXT BOOKS:

1. Beer F.P et.al., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 10th Edition, Tata McGraw Hill Education India Pvt. Ltd., New Delhi, 2014.
2. Kumaravelan R. and Yugananth P., "Engineering Mechanics", 2nd Edition, Scitech Publications, 2015.

REFERENCES:

1. Vela Murali, "Engineering Mechanics", 1st Edition 11th Impression, Oxford University Press, 2016.
2. Meriam J. L., Kraige L. G. and Bolton J. N., "Engineering Mechanics SI Version (Volume 1 and 2)", 8th Edition, Wiley, 2017.

3. Kottiswaran N., "Engineering Mechanics Statics and Dynamics", 10th Edition, Sri Balaji Publications Pvt. Ltd., 2013.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Analyze the static equilibrium of particles under the influence of forces.
CO2 Draw free body diagrams and to solve problems related to the static equilibrium of rigid bodies.
CO3 Locate the centroid of plane areas and centre of mass of solids and to compute moment of inertia.
CO4 Analyze the influence of friction on the equilibrium of bodies.
CO5 Analyze the equilibrium of particles subjected to dynamic forces and to solve problems related to the general plane motion of rigid bodies.

Mapping of COs with POs and PSOs

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

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

22HST21	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

UNIT 1 WEAVING AND CERAMIC TECHNOLOGY **3**

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

UNIT 2 DESIGN AND CONSTRUCTION TECHNOLOGY **3**

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

UNIT 3 MANUFACTURING TECHNOLOGY **3**

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold Coins as source of history - Minting of Coins – Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in ilappathikaram.

UNIT 4 AGRICULTURE AND IRRIGATION TECHNOLOGY **3**

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT 5 SCIENTIFIC TAMIL & TAMIL COMPUTING **3**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries Sorkuvai Project.

TOTAL : 15

TEXT-CUM-REFERENCE BOOKS

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

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

22PHL21	PHYSICS AND CHEMISTRY LABORATORY II	L	T	P	C
	(Common to all B.E/B.Tech Programmes)	0	0	2	1

Preamble

This course aims to impart knowledge in the determination of the physical parameters such as young's modulus, band gap, Coefficient of viscosity, thickness of thin wire and Rigidity modulus of wire. This course also aims to impart the significance and estimation of DO and Cl content in water sample by titrimetric method. Amount of Na^+, $Ba^{2+}$and acid with electroanalytical techniques such as flame photometry, conductometry and pH metry in the aqueous solutions has been quantitatively analyzed.

PHYSICS LABORATORY II
LIST OF EXPERIMENTS

1. Determination of Young's modulus by Uniform bending method.
2. Determination of bandgap of semiconductors.
3. Determination of coefficient of viscosity by Poiseuille's method.
4. Determination of thickness of thin wire by Air wedge method.
5. Determination of rigidity modulus-torsion pendulum.

CHEMISTRY LABORATORY II
LIST OF EXPERIMENTS

1. Determination of Dissolved Oxygen content of waste water sample by Winkler's method.
2. Determination of chloride content of wastewater sample by Argentometric method.
3. Estimation of dissolved metal ions present in wastewater using flame photometer.
4. Conductometric precipitation titration of $BaCl_2$ vs Na_2SO_4 using conductivity meter.
5. Determination of acid strength in waste water using pH meter.

TOTAL : 45

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Experiment and determine the physical characteristics of given solid materials using Young's modulus-Uniform bending method, Air wedge and Torsion Pendulum

CO2 Experiment and determine the band gap energy of a given semiconducting material using Zener diode.

CO3 Experiment and determine the physical characteristics of a given liquid using Poiseuille's method.

CO4 Experiment and estimate the amount of dissolved oxygen by Winkler's method and Chloride content by Mohr's method.

CO5 Analyse the concentration of metal ions and acid present in the wastewater with the aid of Flame photometer, Conductivity meter and pH meter.

Mapping of COs with POs and PSOs

COs\POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO2
CO1	2	1		3		1	1		1	1	1	1		
CO2	2	1		3		1	1		1	1	1	1		
CO3	2	1		3		1	1		1	1	1	1		
CO4	2	1		3		1	1		1	1	1	1		
CO5	2	1		3		1	1		1	1	1	1		

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

22CSL11 **PYTHON PROGRAMMING LABORATORY** **L T P C**
(Common to all B.E/B.Tech Programmes) **0 0 2 1**
(Students admitted during 2022- 23 only)

Preamble:
Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
   (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions
   (exchange the values of two variables, circulate the values of n variables, distance between two points)
3. Scientific problems using Conditionals and Iterative loops.
   (Number series, Number Patterns, pyramid pattern)
4. Implementing realtime/technical applications using Lists, Tuples.
   (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing realtime/technical applications using Sets, Dictionaries.
   (Language, components of an automobile, Elements of a civil structure, etc. operations of Sets & Dictionaries)
6. Implementing programs using Functions.
   (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings.
   (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries
   Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing realtime/technical applications using File handling
10. Developing a game activity using Pygame like bouncing ball, car race

SOFTWARE

Python 3 interpreter / open source IDE
Raptor Tool
Libre Office Packages

TOTAL: 45

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

CO1 Design flowcharts using Raptor.

CO2 Develop programs using expressions and Control statements in Python.

CO3 Develop programs using functions, packages for a given problem..

CO4 Process compound data using Python data structures

CO5 Utilize Python packages in developing software applications.

Mapping of COs with POs and PSOs

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

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

22CSL11 **PYTHON PROGRAMMING LABORATORY** **L T P C**

(Common to all B.E, B.Tech Programmes) **0 0 3 1**

(Students admitted during 2024- 25 onwards)

Preamble:

Python is a dynamic and powerful programming language that focuses on code readability. The Python language has diversified application in the software development companies such as in gaming, web frameworks and applications, language development, prototyping, graphic design applications, etc. This provides the language a higher plethora over other programming languages used in the industry.

LIST OF EXPERIMENTS

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
   (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions
   (exchange the values of two variables, circulate the values of n variables, distance between two points)
3. Scientific problems using Conditionals and Iterative loops.
   (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples.
   (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries.
   (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions.
   (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings.
   (reverse, palindrome, character count, replacing characters)
8. Implementation of searching algorithms using linear and binary search technique.
9. Implementation of sorting algorithms using selection sort and insertion sort method.
10. Implementing programs using written modules and Python Standard Libraries
    Libraries (pandas, numpy. Matplotlib, scipy)
11. Implementing real-time/technical applications using File handling.
12. Developing a game activity using Pygame like bouncing ball, car race.

SOFTWARE

- Python 3 interpreter / open source IDE
- Raptor Tool
- Libre Office Packages

TOTAL: 45

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

CO1	Design flowcharts using Raptor.
CO2	Develop programs using expressions and Control statements in Python.
CO3	Develop programs using functions, packages for a given problem..
CO4	Process compound data using Python data structures
CO5	Utilize Python packages in developing software applications.

Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	3					1			1		
CO2	2	2	2	3					1			1		
CO3	2	2	2	3					1			1		
CO4	2	2	2	3					1			1		
CO5	2	2	2	3					1			1		

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

22MEL21	COMPUTER AIDED DRAFTING AND MODELING LABORATORY	L	T	P	C
		0	0	2	1

(Common to B.E – CE and ME Programmes)

Prerequisites: 22MET11 - Engineering Graphics

Preamble

Computer Aided Drafting and Modeling Laboratory course provides the students with the knowledge on the use of software and its various features and tools for drafting and modeling the Engineering components with different geometries and morphological features, dimensioning, mentioning tolerances and for creating architectural drawings. This course includes drafting orthographic views of Engineering curves, simple solids and sectioned solids, 3D models of simple mechanical or electrical devices and drawing residential plans.

LIST OF EXERCISES USING DRAFTING SOFTWARE (AUTOCAD OR EQUIVALENT)

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative and polar) – Creation of simple figures like polygon and general multiline figures and Title Block with necessary text and projection symbol.
2. Drawing a Projection of Straight lines inclined to both the principal planes.
3. Drawing curves – Ellipse, parabola, spiral, involute using spline or cubic spline.
4. Drawing front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views.
6. Creation of 3D models of simple objects and obtaining 2D multiview drawings from 3D model. (Eg. Vblock, Base of a mixer, Simple stool, Objects with hole and curves).
7. Drawing isometric projection of simple objects.
8. Drawing a simple steel truss.
9. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
10. Drawing a plan of residential building (Two bedrooms, kitchen, hall, etc.)

TOTAL : 45

REFERENCES:

1. Gowri, S. and Jeyapoovan, T., "Computer Aided Drafting and Modeling Laboratory", Vikas Publishing House Pvt., Ltd., 1st Edition, 2011.
2. Manual prepared by the faculty of Mechanical Engineering Department, VCET.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Develop the 2D sketches for the given conditions using drafting packages.
CO2 Sketch the orthographic views for the given isometric view of solids.
CO3 Create 3D models of simple engineering components.
CO4 Develop multiple views from the solid modeled.
CO5 Draw the plan and elevation of residential buildings.

Mapping of COs with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	1	1				3	3		2		
CO 2	3	2	1	1	1				3	3		2		
CO 3	3	2	1	1	1				3	3		2		
CO 4	3	2	1	1	1				3	3		2		
CO 5	3	2	1	1	1				3	3		2		

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

22MCT03	ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to all B.E/B.Tech Programmes)	L	T	P	C
		2	0	0	0

Preamble

The study of biodiversity reflects the level of national interest in natural resources and heritage, which is considered as an important part of a country's wealth. As India is one of the world's 12 giant diversity hubs, we need to focus on understanding, preserving and utilizing the biodiversity of our biological resources. Environmental protection is an important issue for today's society, as scientific research provides evidence of increased global warming, ozone depletion and increased pollution. Engineers need to learn the importance of green synthesis in the design, development and evaluation of structures, devices and systems to provide practical solutions to the problems caused by the pollution and depletion of natural resources.

UNIT 1 NATURAL RESOURCES, ECOSYSTEM AND BIODIVERSITY 6

Forest Resources – use and over exploitation – Water Resources – use and over utilization – Dams – benefits and problems – Ecosystem – structure and function – Biodiversity – types – threats to biodiversity – Biodiversity conservation–Insitu and Exsitu – Role of an individual in conservation of natural resources.

UNIT 2 ENVIRONMENTAL POLLUTION 6

Definition – causes, effects and control measures – Air Pollution, Water Pollution, Soil Pollution – Solid waste – methods of disposal – sanitary landfill, incineration and composting – Environmental Impact Assessment and ISO 14000.

UNIT 3 EWASTE AND ITS MANAGEMENT 6

EWaste – sources of ewaste – hazardous substances in ewaste – effects of ewaste on environment and human health – need for ewaste management – disposal treatment methods of ewaste – Global scenario of ewaste – ewaste in India case studies.

UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT 6

Social issues – Sustainable development – Water conservation – rain water harvesting. Disaster Management – floods, earthquake, cyclone and landslides. Role of IT in environment and human health.

UNIT 5 GREEN CHEMISTRY 6

Green Chemistry – twelve principles of green chemistry – Importance of green synthesis – Green synthesis – dimethyl carbonate – Biocatalysts – extraction of gold – Applications of green synthesis.

TOTAL : 30

TEXT BOOKS:

1. Environmental Science, 5th Edition. P. N. Palanisamy, P. Manikandan, A. Geetha, K. Manjula Rani, V. N. Kowshalya, Pearson India Education services Private Limited, 2020.
2. Environmental Science and Engineering, 2nd edition, Dr.T. ArunLuiz , V K publications, 2018.

REFERENCES:

1. Environmental Science and Engineering, 3rd reprint, Benny Joseph, McGraw Hill Education (India) Private Limited, New Delhi, 2015.
2. Engineering Chemistry, 1st Impression, K. SeshaMaheswaramma, MridulaChugh, Pearson India Education Services Private Limited, 2016.
3. Introduction to Environmental Engineering and Science, 2nd edition, Gilbert M. Masters, Prentice Hall of India Private Limited, 2015.

eResources:

1. https://www.digimat.in/nptel/courses/video/105105169/L01.html , "Electronic waste management issues and challenges" Prof. B Rajesh Kumar Dubey, Department of Civil Engineering, IIT Kharagpur.

2. https://archive.nptel.ac.in/courses/105/103/105103205/, "Municipal solid waste management" Prof. Ajay Kalamdhad, Department of Civil Engineering, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Recognize the biodiversity threats, overexploitation of forest and overutilization of water to conserve biodiversity.
CO2 Analyze sources, impacts, air and water pollution control measures and solid waste management to maintain a green environment.
CO3 Identify the Environmental impacts of ewaste and its management.
CO4 Explain human health, environment and disaster management through information technology.
CO5 Apply the principles of green chemistry to green synthesis for a sustainable environment.

Mapping of COs with POs and PSOs

COs\ POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO1 2	PSO 1	PS O2
CO1	3	2	1	1	1	2	3	2	1	1	1	2		
CO2	3	2	1	1	1	2	3	2	1	1	1	2		
CO3	3	2	1	1	1	2	3	2	1	1	1	2		
CO4	3	2	1	1	1	2	3	2	1	1	1	2		
CO5	3	2	1	1	1	2	3	2	1	1	1	2		

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

22MAT35	DIFFERENTIAL EQUATIONS AND TRANSFORMS	L	T	P	C
		3	1	0	4

Pre-requisites :

22MAT13-MATRICES AND CALCULUS
22MAT23-VECTOR CALCULUS AND COMPLEX ANALYSIS

Preamble: The laws of nature are expressed as differential equations. Scientists and Engineers must know how to model the real world phenomena in terms of differential equations, to solve those equations and interpret the solutions. This course focuses on differential equations which are significantly used in Engineering problems.

UNIT 1 ORDINARY DIFFERENTIAL EQUATIONS 9+3

Linear higher order differential equations with constant coefficients – Particular Integrals for the types: e^{ax}, cosax or sinax, $x^n e^{ax}$, cosax or sinax, $x^n - e^{ax}$, cosax or sinax, $x^n e^{ax}$, cosax or sinax, x^n, Method of variation of parameters – Applications of differential equations: Simple harmonic motion – bending of beams (Differential equations and associated conditions need to be given).

UNIT 2 LAPLACE TRANSFORMS 9+3

Laplace transform: Sufficient conditions – Transform of elementary functions – Basic Properties— Transform of periodic functions. Inverse Laplace transform: Standard results –Partial fraction method-Statement of Convolution theorem and its applications – Solution of linear second order ODE with constant coefficients using Laplace transformation techniques.

UNIT 3 PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations – Solving partial differential equations of first order: Clairaut's form, Lagrange's linear equation – Solving Linear partial differential equations of second and higher order with constant coefficients of homogeneous type - Particular Integrals for the types:
$e^{ax+by}, x^m y^n, \sin(ax+by)\ or\ \cos(ax+by) e^{ax+by}, x^m y^n, \sin(ax+by)\ or\ \cos(ax+by)$.

UNIT 4 FOURIER SERIES 9+3

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

UNIT 5 SOLUTION OF BOUNDARY VALUE PROBLEMS USING FOURIER SERIES 9+3

One dimensional wave equation –Transverse vibrations of a string – One dimensional equation of heat conduction –Steady state temperature distribution in a rod. Two dimensional steady state temperature distributions in a finite plate.

(Lecture: 45 & Tutorial: 15) TOTAL: 60

TEXT BOOKS:

1. Kreyszig Erwin,"Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal B.S., "Higher Engineering Mathematics" 44rd Edition, Khanna Publishers, New Delhi, 12th reprint, 2021.

REFERENCES:

1. Ramana B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 26th Reprint, New Delhi, 2016
2. N.P.Bali, ManishGoyal, "Engineering Mathematics",Lakshmi Publications(PVT) Ltd,5th edition.

eResources :

1. https://nptel/courses/video/111106111/L02.html, Lecture on Transform techniques for Engineers, Fourier series examples, by Dr.Srinivasa Rao Manam, Department of Mathematics, IIT, Madras.
2. https://archive.nptel.ac.in/courses/122/107/122107037/ Lecture on one dimensional wave equation, by Prof.P.N.Agarwal, Department of Mathematics, IIT,Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Solve linear differential equations with constant coefficients and apply them in solving real world problems.

CO2 Solve linear second order ordinary differential equations with constant coefficients using the properties of Laplace transform.

CO3 Compute the solution for the standard forms of linear partial differential equations of first order and solve homogeneous partial differential equations of first and higher order with constant coefficients.

CO4 Compute the trigonometric form of the Fourier series for periodic waveforms satisfying the Dirichlet's conditions and using them to evaluate infinite series.

CO5 Compute the analytical solution for the given physical model under the specified initial and boundary conditions in one dimensional and two dimensional distributions using Fourier series.

Mapping of COs with POs and PSOs

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

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

22CET31 **CONSTRUCTION MATERIALS AND PRACTICES**

L	T	P	C
3	0	0	3

Preamble

The primary objective of the course is to familiarize with the basic building materials, properties and their applications. This course aims to provide sufficient knowledge on the different types of masonries with their applications and various construction technologies involved in the substructure and superstructure construction.

UNIT 1 CONSTRUCTION MATERIALS **9**

Stone as building material – Criteria for selection – Tests on stones – Dressing and quarrying of stone – Bricks: Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Lime: Preparation of lime mortar – Cement: Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time.

UNIT 2 MASONRY **9**

Stone masonry – Classification – Materials used – Dressing of stones – Supervision of stone masonry – Brick masonry – Bond in brickwork – Supervision of brick masonry – Defects in brick masonry– Comparison of brick and stone masonry – Hollow block masonry – Load bearing wall – Partition wall – Cavity wall construction – Arches and Lintels – Flooring – Requirements of good floor Types of flooring.

UNIT 3 CONSTRUCTION PRACTICES **9**

Formwork - Types of Formwork, types of materials used in formwork – Scaffoldings Types of Scaffoldings, Scaffolding Erection & dismantling, Scaffolding Inspection – Fire protection in structures Classification of fire, general causes of fire, detection of fire and methods for fire control - Damp Proof Course - Causes of dampness, effects of dampness and methods of damp proofing - Type of joints in concrete Construction, Expansion, Contraction and Isolation joints.

UNIT 4 SUB STRUCTURE CONSTRUCTION **9**

Box and Pipe Jacking - Under water construction of diaphragm walls and basement - Tunneling techniques – Piling techniques – Well and caisson – Sinking cofferdam - Driving diaphragm walls, sheet piles – Shoring for deep cutting – Well points – Dewatering and stand by plant equipment for underground open excavation.

UNIT 5 SUPER STRUCTURE CONSTRUCTION **9**

Launching girders, bridge decks, offshore platforms – Special forms for shells – Techniques for heavy decks – Material handling – Tall structures – Lightweight materials – Erection of light weight components – Support structure for heavy equipment and conveyors – Erection of articulated structures, braced domes and space decks.

TOTAL : 45

TEXT BOOKS:

1. Varghese, P.C. “Building Construction”, Prentice Hall of India Pvt. Ltd, New Delhi, 2016.
2. Bindra.S.P and Arora.S.P, “Building Construction”, Dhanpat Rai Publication Pvt, Ltd, 2010.

REFERENCES:

1. V.N. Vazirani, and S.P. Chandola, “Engineering Materials”, Khanna Publishers, 2009.
2. M.S.Shetty, “Concrete Technology”, S.Chand Publishers, 2019.

eRESOURCES:

1. http://nptel.ac.in/courses/105102088/, “Building Materials and Construction”, Prof. Dr. B. Bhattacharjee, IIT Delhi.
2. http://nptel.ac.in/courses/105106053/, “Modern Construction Materials”, Prof. RavindraGettu, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Describe the basic construction materials.
CO2 Apply the various construction practices in the field.
CO3 Explain construction of various formworks and scaffoldings.
CO4 Discuss the substructure construction practices.
CO5 Discuss the superstructure practices.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1				1					1	1	
CO2	3	2	1				1					1	2	
CO3	3	2	1				1					1	1	
CO4	3	2	1				1					1	1	
CO5	3	2	1				1					1	2	

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

22CEC32	SOLID MECHANICS	L	T	P	C
		3	0	2	4

Prerequisites : 22MET21 - ENGINEERING MECHANICS

Preamble:

The primary objective of the course is to familiarise with the fundamental concepts of stress, strain and deformation of bars and beams. It deals with analyse of plane trusses, mechanism of load transfer in beams, the induced stress resultants and deformations.

UNIT 1 STRESS AND STRAIN **9**

Stress and Strain due to axial load - Elastic limit - Hooke‘s law - Stress and Strain relationship (Mild and TOR steel) Stress and Strain in Composite sections - Thermal Stresses and Strains - Poisson‘s ratio - Relation between elastic constants (derivation) - Volumetric strain - Bulk Modulus - Basics of shear stress and shear strain.

UNIT 2 SHEAR FORCE AND BENDING MOMENT **9**

Introduction - Types of beams, load and reactions - Shear force and bending moment - Relationships between load, shear force and bending moment - Shear force and bending moment diagrams for statically determinate beams. Theory of simple bending - Analysis of beams for stresses.

UNIT 3 DEFLECTION OF BEAMS **9**

Double integration method - Macaulay's method - Moment area method - Conjugate beam method for computation of slopes and deflections of determinate beams.

UNIT 4 TORSION OF SHAFTS AND SPRINGS **9**

Torsion of circular solid 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 - Power transmitted by the shaft - Shaft in series and parallel - Closed and Open Coiled helical springs – Leaf Springs – Springs in series and parallel.

UNIT 5 TRUSSES **9**

Analysis of plane trusses - Method of joints - Method of sections - Method of tension coefficient.

PRACTICAL COMPONENT **15**

1. Tension test on steel rods in U.T.M.
2. Impact tests on metal specimen (Izod & Charpy)
3. Torsion test on steel rod.
4. Deflection test on rectangular cross section beam for point load.
5. Hardness tests on metals (Brinell and Rockwell).

(Lecture: 45 & Practical: 15) TOTAL : 60

TEXT BOOKS:

1. Bansal R.K., “Strength of Materials”, Laxmi Publications (P) Ltd., 2022.
2. Bhavikatti.S., “Solid Mechanics”, Vikas publishing house Pvt. Ltd, New Delhi, 2018.

REFERENCES:

1. Gambhir. M.L., “Fundamentals of Solid Mechanics”, PHI Learning Private Limited, New Delhi, 2022.
2. Vazirani.V.N and Ratwani.M.M, “Analysis of Structures”, Vol I Khanna Publishers, New Delhi, 2015.

eRESOURCES:

1. http://nptel.ac.in/courses/105105108, “Strength of Materials”, Prof. S.K. Bhattacharyya, IIT kharagpur.
2. http://nptel.ac.in/courses/112207147, “Strength of Materials”, Dr. S. P. Harsha, IIT Roorkee.
3. http://nptel.ac.in/courses/112206141, ―Strength of Materials, Prof. M.S. Sivakumar, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Solve stress and strain relationship, thermal stress and strain for Mild and TOR steel.
CO2	Draw the shear force and bending moment diagram for statically determinate beams.
CO3	Calculate the deflection of beams by Double integration, Macaulay's, Moment area and Conjugate beam methods.
CO4	Analyse behavior of shafts subjected to torsion, closed, open and leaf springs.
CO5	Analyse plane trusses by using method of joints, sections and tension coefficient method.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1	2							1	1	
CO2	3	2	2	1	1							1	1	1
CO3	3	2	2	1	2							1	1	
CO4	3	2	2	1	1							1	1	
CO5	3	2	2	1	2							1	1	1

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

22CET33	FLUID MECHANICS	L	T	P	C
		3	0	0	3

Prerequisites : 22PHT11 - Engineering Physics

Preamble

This course provides the fundamental knowledge on properties of fluids and characteristics of fluids in rest and motion. It deals with the pipe flow, pipe networks, boundary layers and advancement of practical applications and understanding the concept of model and prototype. It introduces dimensional analysis and develops knowledge in complexities involved in solving fluid flow problems.

UNIT 1 FLUID PROPERTIES AND FLUID STATICS **9**

Fluid definition, distinction between solid and fluid - Properties of fluids - density, specific weight, specific volume, specific gravity, temperature, viscosity, compressibility, capillarity and surface tension. Fluid statics- Pressure at a point - Pascal's law - Hydrostatic law - absolute and gauge pressures - pressure measurements by manometers - centre of pressure - buoyancy - stability of floating body.

UNIT 2 FLUID KINEMATICS AND DYNAMICS **9**

Fluid Kinematics - types of flow - velocity field and acceleration - continuity equation (one and three dimensional differential forms) - Equation of streamline - stream function - velocity potential function. Fluid dynamics equations of motion - Euler's equation along streamline - Bernoulli's equation - applications - Venturimeter, Orifice meter. Linear momentum equation and its application.

UNIT 3 FLOW THROUGH PIPES **9**

Flow through pipes - Loss of Energy in pipes - Major loss and minor loss - Hydraulic gradient and total energy line - Pipes in series and parallel Pipe network.

UNIT 4 BOUNDARY LAYER **9**

Boundary layer definition - boundary layer on a flat plate - thickness and classification - displacement, energy and momentum thickness - Boundary layer separation and control - drag in flat plate - drag and lift coefficients

UNIT 5 DIMENSIONAL ANALYSIS AND MODEL STUDIES **9**

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

TOTAL : 45

TEXT BOOKS:

1. Modi P.N and Seth "Hydraulics and Fluid Mechanics including Hydraulic Machines", Standard Book House, New Delhi. 2015.
2. R.K. Bansal, "A textbook of Fluid mechanics and hydraulic machines", 9th Edition, Laxmi Publications (P) Ltd., New Delhi, 2017.

REFERENCES:

1. Ramamrutham, S., "Hydraulic Fluid Mechanics and Fluid Machines", DhanpatRai and Sons, Delhi, 2014.
2. R. K Rajput, "A Text book of Fluid Mechanics and Hydraulic Machines", S. Chand Limited, 2016.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/112/105/112105269/, "Introduction to Fluid Mechanics", Prof.Suman Chakraborty, IIT Kharagpur.
2. https://archive.nptel.ac.in/courses/112/105/112105171/, "Fluid mechanics", Prof.S.K.Som, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Identify and explain the importance, application and interrelationship of various properties of fluid.
CO2	Describe the behavior of fluids in motion with and without applying the forces.
CO3	Estimate the major and minor losses in pipe flow and calculate the flow through pipes connected in series and in parallels.

CO4 Classify the boundary layer thickness and explain layer separation and methods to control separation.
CO5 Analyse the dependent and independent parameters for a model of fluid flow.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1								1	1	
CO2	3	2	2	1								1	1	
CO3	3	2	2	1								1	1	1
CO4	3	2	2	1								1	1	
CO5	3	2	2	1								1	1	1

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

22CET34	SURVEYING	L	T	P	C
		3	0	0	3

Preamble:
Surveying is the process of determining by measurement, the relative positions of points on or near the earth surface. The data collected from a survey is used in the preparation of plans, maps, profiles, charts and diagrams. The course also emphasizes the importance of modern surveying using total station and GPS.

UNIT 1 FUNDAMENTALS OF CONVENTIONAL SURVEYING 9

Definition, Principles, Classification – Field and Office work – Scales – Conventional Signs. Chain Survey Instruments – Ranging – Types Obstacles in Chaining – Chain and Tape corrections Setting out Perpendiculars. Prismatic Compass – Surveyor's Compass – Working and use of compass Bearing – Systems and Conversions – Computation of angles from bearing Local Attraction Magnetic Declination – Dip – Traversing – Adjustment of error.

UNIT 2 LEVELLING AND CONTOURING 9

Basic Terms Types of Level – Fundamental Axes Levelling staff – Bench Marks – Temporary and Permanent Adjustments – Types of Levelling Curvature and Refraction correction Reciprocal Levelling – Calculation of Areas and Volumes. Contouring – Characteristics and Uses of Contours – Methods of contouring.

UNIT 3 THEODOLITE SURVEYING AND TACHEOMETRIC SURVEYING 9

Theodolite – types – Terms - Temporary and Permanent Adjustments – Measurement of Horizontal Angles by Repetition and Reiteration – Closing Error and Distribution – Omitted Measurements Tacheometric surveying – Methods. Determination of constants of the tacheometer use of anallactic lens distance and elevation formula for inclined sights with vertical and normal holding staff – movable hair method principles of tangential tacheometry subtense bar method.

UNIT 4 CURVES AND HYDROGRAPHIC SURVEYING 9

Curves-Classifications-Elements of curves-Designation of curves-Setting out of simple curves: Linear and instrument method. Hydrographic surveying – Tides - MSL - Sounding methods.

UNIT 5 MODERN SURVEYING 9

Total Station – Principle - classification - working. - GPS - Developments - Basic Concepts - Segments - Receivers and methods Applications. Remote sensing: Classification – principles – Resolution – Sensors - Methods of remote sensing - Image interpretation -Application.

TOTAL : 45

TEXT BOOKS:

1. Dr. B.C. Punmia, Ashok Kumar Jain, Ashok Kr. Jain, Arun Kr. Jain, Surveying (Volume –I and II), Lakshmi Publications, 17th Edition, 2016.

2. Basak N.N, "Surveying and Levelling", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2nd Edition, 2014.

REFERENCES:

1. Kanetkar .T.P, and Kulkarni .S.V, "Surveying and Levelling, Vol. I & II", 24th Edition, Pune VidyarthiGrihaPrakashan, 2014.
2. James M. Anderson and Edward M. Mikhail, ―Surveying, Theory and Practice, 7th Edition, McGraw Hill, 2014.
3. Satheesh Gopi, R.Sathishkumar, N. Madhu, ―Advanced Surveying, Total Station, GPS and Remote Sensing, 2nd Edition, Pearson education, 2018.

eRESOURCES:

1. http://nptel.ac.in/courses/105107122/, ―Surveying, Prof. J.K. Ghosh, IIT Roorkee.
2. http://nptel.ac.in/courses/105104101/, ―Surveying, Prof.BharatLohani, IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Conduct linear and angular measurement survey with the help of chain, tape and compass.
CO2	Apply the knowledge of levelling in different operations in civil engineering projects.
CO3	Determine the horizontal and vertical distance by traversing using theodolite and measure difference in elevation and produce reduced level of the given points.
CO4	Illustrate the setting out of a simple curve in road alignment and application of hydrographic surveying.
CO5	Handle total station instrument for making the horizontal and vertical measurements.Conduct the global positioning system for determining geographical location of the site.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2							1				1	
CO2	2	2							1				1	1
CO3	2	2							1				1	
CO4	2	2							1				1	1
CO5	2	2			2				1				1	1

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

22CEL31	SURVEYING LABORATORY	L	T	P	C
		0	0	2	1

Co-requisites: 22CET34 SURVEYING

Preamble

The primary objective is to impart the knowledge on suitable surveying methods and instruments for a given problem. To familiarize the handling of a Dumpy level and theodolite and to train the students about the handling of Total Station.

LIST OF EXPERIMENTS

Chain Survey

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

Compass Survey

3. Compass Traversing – Measuring Bearings & arriving included angles

Levelling Study of levels and levelling staff

4. Fly levelling using Dumpy level

Theodolite Study of Theodolite

5. Measurements of horizontal angles by reiteration and repetition and vertical angles
6. Determination of elevation of an object using single plane method when base is Accessible/inaccessible.

Tacheometry – Tangential system – Stadia system

7. Determination of Tacheometric Constants
8. Heights and distances by stadia Tacheometry
9. Heights and distances by Tangential Tacheometry

Total Station Study of Total Station Measuring Horizontal and vertical angles

10. Measurement of area using Total station
11. Setting out of curve using Total station

TOTAL : 45

REFERENCES:

1. Kanetkar .T.P, and Kulkarni .S.V, "Surveying and Levelling, Vol. I & II", 24th Edition, Pune VidyarthiGrihaPrakashan ,2014.
2. James M. Anderson and Edward M. Mikhail, ―Surveying, Theory and Practice, 7thEdition, McGraw Hill, 2014.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Take accurate measurements, field booking, plotting and adjustment of errors.
CO2	Setting out the foundation and simple curve using chain, tape and total station.
CO3	Determine the horizontal and vertical angles by reiteration and repetition method.
CO4	Determine the horizontal and vertical distances by tachometry.
CO5	Determine the area of the given location using Total station

Mapping of COs with POs and PSOs

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

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

22CEL32	COMPUTER AIDED BUILDING DRAWING	L	T	P	C
		0	0	2	1

Prerequisites: 22MEL22 - Computer Aided Drafting and Modeling Laboratory

Preamble

The primary objective is to impart fundamental knowledge on AutoCAD or QCAD to make the students draw the plan, elevation and sectional view of a building and truss. To make the students to understand and learn various elements of Residential / Institutional / Workshop buildings and to develop its model.

LIST OF EXPERIMENTS

1. Prepare a plan, elevation and cross section of fully paneled wooden double door
   Draw the plan, elevation and cross section for the following given structures
2. Single floor office building.
3. Single bed room house with R.C.C roof
4. Double bed room house with R.C.C roof
5. Residential building with tiled roofing
6. Industrial Building North Light Roof Truss.
7. RCC Framed single storey library building
8. RCC Framed Structure Double Storey Building
9. Prepare a building layout with site plan as per scale for approval work
10. Develop a 3 Dimensional model of a single storey single bay residential building.

TOTAL : 45

REFERENCES:

1. M. V. Chitawadagi, S.S. Bhavikatti, "Building Planning and drawing", Dream tech Press, 2014
2. V.B.Sikka, "A course in Civil Engineering Drawing" S.K.Kataria & Sons Publishers, Seventh Edition, 2015.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Plan, orient and complete joinery details of paneled door.
CO2 Draw a building plan for the given area.
CO3 Prepare an elevation for the given plan.
CO4 Prepare a sectional view for the given plan.
CO5 Develop a 3 Dimensional model of a single storey single bay residential building.

Mapping of COs with POs and PSOs

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

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

22MCL04	ENGLISH FOR PROFESSIONALS	L	T	P	C
	(Students admitted during 2023-2024 onwards)	0	0	2	0

Preamble:

Communicative English is a life skill necessary for all students of Engineering and Technology. The course Essential English for Professionals aims at enabling the learners to communicate effectively and appropriately in professional contexts by exposing them to LSRW tasks.

UNIT 1 LISTENING **5**

Listening to Casual Conversation- Note-Taking on TED Talks – Summarizing

UNIT 2 READING **7**

Reading for gist - Biographies of Famous Personalities - Reading and Note Making on News Articles

UNIT 3 WRITING **5**

Letter Writing - Seeking Permission- Seeking Apology - Letters Requesting Certificates – Analytical Writing and Issue based writing

UNIT 4 SPEAKING **9**

Presentation Techniques - Presentation with visual aids – Extempore and Impromptu talk

UNIT 5 VERBAL ABILITY **4**

Parajumbles - Sentence Completion - Identifying Common Errors

TOTAL: 30

REFERENCES:

1. M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.
2. Meenakshi Raman and Sangeetha Sharma., "Technical Communication: English Skills for Engineers" Oxford University Press, 1st Edition, New Delhi, 2008.

eRESOURCES:

1. https://agendaweb.org/listening/audio-books-mp3.html
2. https://www.ndtv.com/world-news
3. http://learnenglishteens.britishcouncil.org/skills/reading
4. https://www.bbc.com/

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Analyze the given listening material and answer the questions correctly employing listening techniques.
CO2	Analyze the given reading material and answer the questions correctly employing reading techniques.
CO3	Write within the stipulated time syntactically and semantically correct sentences to present ideas in the form of essays and letters.
CO4	Take part effectively in group discussion, conforming to professional norms and to give extemporaneous presentation.
CO5	Identify within the stipulated time syntactically and semantically correct sentences for a variety of language exercises.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1					3					3				
CO2										3				
CO3									3	3		1		
CO4									3	3		1		
CO5										3		1		

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

22MAT43 **NUMERICAL METHODS** **L T P C**
3 1 0 4

Pre-requisites:

22MAT13 – Matrices and Calculus,
22MAT23 – Vector Calculus and Complex Analysis,
22MAT35 - Differential Equations and transforms

Preamble: The primary objective of the course is to develop the basic understanding of numerical techniques. Numerical analysis is concerned with finding numerical solutions to solve algebraic, transcendental, and differential equations, and to calculate derivatives and integral problems.

UNIT 1 SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS **9+3**

Solution of algebraic and transcendental equations -Newton Raphson method – Solution of linear system of equations- Gauss elimination –Pivoting- Gauss Jordon method - Iterative methods of Gauss Jacobi and Gauss-Seidel methods – Eigen value of a matrix by power method.

UNIT 2 INTERPOLATION AND APPROXIMATION **9+3**

Interpolation with unequal intervals-Lagrangian's interpolation – Newton's divided difference interpolation –Interpolation with equal intervals -Newton's forward and backward difference formulas.

UNIT 3 NUMERICAL DIFFERENTIATION AND INTEGRATION **9+3**

Approximation of derivatives using interpolation polynomials –Numerical integration using Trapezoidal and Simpson's 1/3 rules –Evaluation of double integrals by Trapezoidal and Simpsons's 1/3 rules.

UNIT 4 NUMERICAL SOLUTION TO ORDINARY DIFFERENTIAL EQUATIONS **9+3**

Single step methods: Euler's methods-Modified Euler's method- Fourth order Runge – Kutta method for solving first order equations – Multistep methods- Milne's predictor and corrector methods for solving first order equations.

UNIT 5 NUMERICAL SOLUTION TO PARTIAL DIFFERENTIAL EQUATIONS **9+3**

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

(Lecture : 45; Tutorial : 15) TOTAL : 60

TEXT BOOKS:

1. Chapra. S.C., and Canale. R.P, "Numerical Methods for Engineers", 7th Edition, McGraw Hill Education India Private Limited,2016.
2. Gerald. C.F and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 7th Edition, New Delhi, 2013.

REFERENCES:

1. Grewal. B.S., and Grewal. J.S.,"Numerical methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2014.
1. http://nptel.ac.in/courses/111105038/2, "Numerical Solution of Ordinary and Partial differential Equations", Prof. G. P. Raja Shekhar, Department of Mathematics, Indian Institute of Technology, Kharagpur
2. http://nptel.ac.in/courses/122102009/16, "Numerical Methods and Computation", Prof. S.R.K Iyengar , Department of Mathematics, Indian Institute of Technology ,New Delhi.

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

CO1 Compute the real root of the algebraic and transcendental equations and solve the system of linear equations numerically.

CO2 Construct an Interpolation polynomial that approximates the given data table to determine the intermediate values.

CO3 Perform differentiation and integration for the functions using numerical techniques.

CO4 Compute the numerical solutions for the Initial value problems involving ordinary differential equations using single step and multi step methods.

CO5 Compute the numerical solution for the Boundary value problems involving partial differential equations using implicit and explicit methods.

Mapping of COs with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2								1		
CO2	3	3	2	2								1		
CO3	3	3	2	2								1		
CO4	3	3	2	2								1		
CO5	3	3	2	2								1		

1 – Slight (Low), 2 – Moderate (Medium), 3 – Substantial (High)

22CET41 **STRENGTH OF MATERIALS**

L	T	P	C
3	1	0	4

Prerequisites : 22CEC32 - SOLID MECHANICS

Preamble

The primary objective of the course is to impart knowledge on deflection of statically determinate beams, ideal columns and real columns. Strength of materials is concerned the estimation of load carrying capacity of columns, stresses due to unsymmetrical bending and analysis of members under two dimensional state of stress.

UNIT 1 ENERGY PRINCIPLES **9+3**

Strain energy due to axial force, suddenly applied load and impact load - strain energy due to shear, flexure and torsion – Castigliano's theorems – Maxwell's reciprocal theorems - Principle of virtual work - application of energy theorems for computing deflections in beams.

UNIT 2 INDETERMINATE BEAMS **9+3**

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

UNIT 3 COLUMNS AND CYLINDER **9+3**

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 – Thin cylinders -Thick cylinders - Compound cylinders..

-

UNIT 4 STATE OF STRESS IN TWO DIMENSIONS **9+3**

2D State of stress - 2D normal and shear stress on any plane - Principal stresses and principal planes Mohr's circle - Theories of failure basics only.

UNIT 5 UNSYMMETRICAL BENDING OF BEAMS AND CURVED BEAMS **9+3**

Stresses due to unsymmetrical bending - Deflection of beam due to unsymmetrical bending - Shear Centre - Curved beams (Winkler Bach formula).

(Lecture : 45; Tutorial : 15) TOTAL : 60

TEXT BOOKS:

1. Bansal.R.K., Strength of Materials, Laxmi Publication, New Delhi, 2022.
2. Rajput R.K. Strength of Materials (Mechanics of Solids), S.Chand & company Ltd., New Delhi, 2022.

REFERENCES:

1. Egor P Popov, Engineering Mechanics of Solids, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
2. Kazimi S.M.A, Solid Mechanics, Tata McGrawHill Publishing Co., New Delhi, 2003.
3. Rattan.S.S., Strength of Materials, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.

eRESOURCES:

1. http://nptel.ac.in/courses/112207146/, ―Strength of Materials, Dr. Satish C Sharma, IIT Roorkee.
2. http://nptel.ac.in/courses/105101085/, ―Structural Analysis I, Dr. R.S. Jangid, Dr. Siddhartha Ghosh, IIT Bombay.
3. http://nptel.ac.in/courses/112201095/,―Advanced Strength of Materials, Prof. S.K. Maiti, IIT Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Compute deflection in beams using Castiglano‘s, Maxwell‘s and Virtual work methods.
CO2	Draw the shear force and bending moment diagram for indeterminate beams.
CO3	Solve the problems of short and long column subjected to axial, eccentric loads by using Eular‘s and Rankine Gordon formula.
CO4	Analyse plane members subjected to two dimensional state of stress.
CO5	Analyse beams subjected to unsymmetrical bending and curved bars using Winkler Bach formula.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	3	2	3		2	2	3	1	2	2	1
CO2	3	2	2	3	2	3		2	2	3	1	2	2	1
CO3	3	2	2	2	1	3		2	2	3	1	2	2	1
CO4	3	2	2	3	2	3		2	2	3	1	2	2	2
CO5	3	2	2	3	2	3		2	2	3	1	2	2	2

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

22CET42	HYDRAULIC ENGINEERING	L	T	P	C
		3	0	0	3

Prerequisites : 22CET33 - FLUID MECHANICS

Preamble

This course deals with characteristics of open channel under uniform and non-uniform flow classifications and conditions. It provides basic knowledge in physical mechanisms of hydraulic jumps, surges and force exerted by the jet on vanes. It inculcates basic knowledge on the working principles and design of hydraulic machines.

UNIT 1 UNIFORM FLOW **9**

Definition and differences between pipe flow and open channel flow - Types of Flow - Discharge through open channel by Chezy's Formula - Empirical Formulae for Chezy's constant - Best hydraulic sections for uniform flow (Rectangular, Trapezoidal, Circular Section only) Specific energy and specific energy curve - Critical depth and critical velocity.

UNIT 2 NON - UNIFORM FLOW **9**

Dynamic equations of gradually varied flow - Back water curve and Afflux -Water surface flow profile classifications: Hydraulic Slope, Hydraulic Curve - Profile determination by Direct step method - Hydraulic jumps - Types Surges.

UNIT 3 IMPACT OF JET ON VANES **9**

Force exerted by the jet – stationary and moving vertical plate, Inclined flat plate, curved plate - unsymmetrical moving curved plate - series of vanes - Jet propulsion.

UNIT 4 PUMPS **9**

Centrifugal pumps - Minimum speed to start the pump - Multistage pumps - Cavitations in pumps - characteristics curve - Reciprocating pumps - Negative slip - Air vessels - Savings in work done comparison between centrifugal pumps and reciprocating pumps – Submersible pump – working principle

UNIT 5 TURBINES **9**

.Turbines - Classification - Pelton Wheel turbines, Francis turbine, Kaplan turbine - draft tube - Performance of turbine - Specific speed - Unit Quantities - Characteristic curves.

TOTAL : 45

TEXT BOOKS:

1. Modi P.N. and Seth S.M., "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2009.
2. Bansal R K, "Fluid Mechanics and Hydraulic Machines", Laxmi Publications, New Delhi, 2017.

REFERENCES:

1. Subramanya K., "Flow in open channels", Tata McGraw Hill, New Delhi, 2008.
2. VenTe Chow, "Open Channel Hydraulics", McGraw Hill, New York, 2009.
3. R. K Rajput, "A Textbook of Fluid Mechanics and Hydraulic Machines", S. Chand Limited, 2016.

eRESOURCES:

1. http://nptel.ac.in/courses/105107059, "Advanced Hydraulics", Dr. C. S. P. Ojha, IIT Roorkee.
2. http://nptel.ac.in/courses/105103022, "Advanced Hydraulics", Dr. Suresh A Kartha, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Design of most economical section for an open channel flow.

CO2 Describe the varied flow profiles under non-uniform flow.

CO3 Analyse and compute the force exerted by the jet on the vanes under stationary and moving conditions.

CO4 Design appropriate type and working proportions of turbines for the given conditions.

CO5 Identify and explain the type of pumps required for specific purpose.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	1								1	1	1
CO2	3	2	2	1								1	1	
CO3	3	2	2	1								1	1	
CO4	3	2	2	1								1	1	1
CO5	3	2	2	1								1	1	1

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

22CET43	SOIL MECHANICS	L	T	P	C
		3	0	0	3

Preamble

Soil Mechanics is a discipline of Civil Engineering involving the study of soil, its behaviour and application as an engineering material. This course introduces the types of rock and engineering properties of the rock. It provides basic knowledge on the physical and engineering behavior and compaction characteristics of soils. This course focuses on the mechanism of stresses, consolidation, shear strength and stability analysis of slopes.

UNIT 1 SOIL CLASSIFICATION AND COMPACTION 9

Nature of soil formation and deposition-Basic definition and relationship - Physical properties of soil - Phase relationships - Index properties of soils – Atterberg's limits and indices – BIS and Unified soil classification system - Field identification simple tests.

Soil compaction – Standard and Modified Proctor compaction Field compaction methods - Factors influencing compaction behaviour of soils.

UNIT 2 STRESS IN SOILS 9

Soil water Statics - Effective stress and neutral stress concepts – Effect of water table - Capillary phenomenon - Effective stress under hydrostatic , steady seepage and Surcharge conditions.

Vertical Stress distribution in soil –Boussinesq theory -Stress Isobar - Line load - Uniformly distributed load – circular and rectangular area - Newmark's Chart construction and use - Approximate methods Wester-guard Theory.

UNIT 3 PERMEABILITY AND CONSOLIDATION 9

One dimensional flow through soils – Darcy's law, Permeability measurement in the laboratory, field pumping in and pumping out tests, Factors influencing permeability of soils.

Consolidation Components of Consolidation - Immediate and consolidation settlement, e-log p relationship, Terzaghi's one dimensional consolidation theory – Determination of Cv by $\sqrt{t}$ and log t methods, Computation of consolidation settlement.

UNIT 4 SHEAR STRENGTH 9

Mohr circle - characteristics - Mohr Coulomb failure theory - Measurement of shear strength - direct shear, triaxial compression, unconfined compression test and Vane shear tests – Factors affecting shear strength.

UNIT 5 STABILITY OF SLOPES 9

Slope failure mechanisms - Types - Infinite slopes - Finite slopes - Method of Slices - Friction circle method - Fellenius method for Critical Slip Circle - Use of Taylor's stability number – Slope protection measures

TOTAL : 45

TEXT BOOKS:

1. Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2005.
2. T N Ramamurthy, T G.Sitharam, "Geotechnical Engineering(Soil Mechanics)", S Chand & Co Ltd, New Delhi, 2005,

REFERENCES:

1. Murthy, V.N.S., "Geotechnical Engineering", S.Chand& Company Pvt. Ltd., New Delhi. 2011.
2. Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi, 2005.

e RESOURCES:

1. http://nptel.ac.in/courses/105103097, "Soil Mechanics", Prof. Baleshwar Singh, Civil Engineering, IIT Guwahati.

2. http://nptel.ac.in/courses/105101084, "Soil Mechanics", Dr. B.V.S. Viswanadham, Civil Engineering, IIT Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	To impart knowledge on the basic, engineering properties and compaction of soil.
CO2	To get exposure on the stress distribution due to self-weight with fluctuation of underground water and due to external loads
CO3	Demonstrate the knowledge on flow of water, below ground level and consolidation of soil.
CO4	To acquire knowledge on the shear strength of soil.
CO5	To acquire knowledge on the finite and infinite stability of slope.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	1	3	1			2	1	2	3	3	3
CO2	3	2	3	1	3	1	1	1	2	1	2	3	2	2
CO3	3	2	3	1	2	2	1	1	2		2	3	2	2
CO4	3	3	3	1	2	1	1	1	1	1	2	3	2	2
CO5	3	3	2	1	2			1	1			3	2	3

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

22CET44	HIGHWAY AND PAVEMENT ENGINEERING	L	T	P	C
		3	0	0	3

Preamble

The course aims to make the students learn the principles of highways, their components and design of flexible and rigid pavements. Further, students will get acquainted with treatment for failures and remedial measures during maintenance of pavements.

UNIT 1 HIGHWAY PLANNING AND ALIGNMENT 9

Significance of highway plans - Modal limitations towards sustainability - History of road development in India - Classification of highways - Locations and functions - Factors influencing highway alignment - Engineering surveys for alignment, objectives, conventional and modern methods.

UNIT 2 GEOMETRIC DESIGN OF HIGHWAYS 9

Typical cross sections of Urban and Rural roads - Cross sectional elements - Sight distances Horizontal curves, Super elevation, transition curves, widening at curves Vertical curves - Gradients - Lateral and vertical clearance at underpasses – Express ways.

UNIT 3 DESIGN OF FLEXIBLE AND RIGID PAVEMENTS 9

Design principles - Pavement components and their role - Design of flexible pavement (IRC 37) - Design of rigid Pavements (Determination of stresses through IRC 58).

UNIT 4 HIGHWAY CONSTRUCTION MATERIALS AND PRACTICE 9

Highway construction materials, properties, testing methods - CBR Test for subgrade - Tests on aggregate – Tests on bitumen - Bituminous and Concrete road construction, Polymer modified bitumen, Recycling, Different materials Glass, Fiber, Geo-synthetics – Geo-Textiles, Geo-Membrane (problem not included) Highway drainage - Construction machineries.

UNIT 5 EVALUATION AND MAINTENANCE OF PAVEMENTS 9

Pavement distress in flexible and rigid pavements - Pavement evaluation, Present Serviceability Index, skid resistance, structural evaluation, and evaluation by deflection measurements - Types of maintenance - Strengthening of pavements - Rigid and Flexible overlay.

TOTAL : 45

TEXT BOOKS:

1. Khanna.S. K., Justo.C.E.G and Veeraragavan A. "Highway Engineering", Nem chand Publishers, 2014.
2. Subramanian K.P., "Highways, Railways, Airport and Harbour Engineering", Scitech Publications (India), Chennai, 2010.

REFERENCES:

1. IRC standards 37- 2012 (Guidelines for the design of flexible pavements) and IRC standards 58-2014 (Guidelines for the design of plain jointed rigid pavements).
2. Kadiyali.L.R. “Principles and Practice of Highway Engineering”, Khanna Technical Publications, 8th edition Delhi, 2013.

eRESOURCES:

1. http://nptel.ac.in/courses/105101087/ “Transportation Engineering I”, Dr. Tom V Mathew, IIT Bombay.
2. https://books.google.co.in/books?isbn=9382609857/ Dr. L.R. Kadiyali.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Conduct surveys involved in planning of highway alignment.
CO2	Design cross section elements, sight distance, horizontal and vertical alignments.
CO3	Identify pavement materials based on characteristics and design flexible and rigid pavements as per IRC.
CO4	Discuss construction methodology based on the pavement type.
CO5	Develop drainage patterns and evaluate distresses in pavements and suggest remedial measures.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1		2			2				1	3	2
CO2	2	2	1		2			1				1	3	3
CO3	3	3	1		2			2				1	3	3
CO4	2	2	1		2			2				1	3	2
CO5	3	2	1		2			1				1	3	3

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

22CET45	WATER SUPPLY AND WASTE WATER ENGINEERING	L	T	P	C
		3	0	0	3

Preamble

To introduce students to various components and design of water supply scheme, water and wastewater treatment methods and sewage disposal.

UNIT 1 SOURCES AND QUALITY OF WATER **9**

Public water supply system - Planning Objectives - Design period - Population forecasting - Water demand - Sources of water Surface and Groundwater - Characteristics of water - Water quality standards - Impact of climate change.

UNIT 2 CONVEYANCE SYSTEM **9**

Water supply Factors - Intake structures - Types of conduits for water - Pipe materials - Hydraulics of flow in pipes - Transmission main design - Laying, jointing and testing of pipes - Types of Pipe appurtenances - Selection of pumps and pipe materials.

UNIT 3 WATER TREATMENT **9**

Objectives - Unit operations and processes - Principles, functions of flash mixers, flocculators and Sedimentation tanks - Slow sand and rapid sand filters (Comparison only) - Aeration - Iron and manganese removal - Defluoridation - Construction, operation and maintenance aspects of water treatment plants.

UNIT 4 PRIMARY AND SECONDARY WASTE WATER TREATMENT **9**

Objective - Grey water harvesting - Primary treatment Principles, functions and design of screen, grit chamber and septic tank - Secondary treatment - Working principles - Activated sludge process - Trickling filter - Oxidation ditches - Upflow anaerobic sludge blanket - Waste stabilization ponds.

UNIT 5 DISPOSAL OF SEWAGE **9**

Standards for disposal - Methods dilution Self- purification of surface water bodies - Oxygen sag curve . Land disposal - Characteristics of sludge - Thickening - Conditioning and Dewatering - Sludge digestion - Biogas recovery.

TOTAL : 45

TEXT BOOKS:

1. Garg, S.K., Environmental Engineering, Vol I &Vol II, Khanna Publishers, New Delhi, 2014.
2. Punmia, B.C , Ashok K Jain and Arun K Jain., Water Supply Engineering, Laxmi Publications Pvt. Ltd., New Delhi, 2013.

REFERENCES:

1. Birde G.S and Birde J.S., Water Supply and Sanitary Engineering, Dhanpat Rai Publishing Co., New Delhi, 2015.
2. Metcalf & Eddy., Wastewater Engineering, Treatment and Reuse, Tata McGraw Hill Company, New Delhi, 2015.

eRESOURCES:

1. http://nptel.ac.in/courses/105104102/ “Water and wastewater Engineering” Dr. P. Bose, IIT Kanpur.
2. http://nptel.ac.in/courses/105104102/2, “Water and Waste water Engineering”, Prof. C. Venkobachar, Prof. Ligy Philip, Prof. B.S. Murty, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Recognize the water supply system, water sources and water quality characteristics and standards.
CO2 Design the conduits for transportation of water from the source to treatment plant and to the city.
CO3 Design various water treatment units.
CO4 Design the various primary and secondary treatment units for wastewater.
CO5 Select suitable treatment units for disposal of sewage and sludge.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3		2				1	1				1	
CO2	2	3		2				1	1				1	
CO3	3	3	3			3	2	2	2		2		2	1
CO4	3	3	3		2	3	3	2	3		2		2	1
CO5	3	3	3	2	2					2	2	3	1	

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

22CEL41 HYDRAULIC ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Prerequisites: 22CET33 - FLUID MECHANICS

Preamble

To provide hands on experience in calibration of flow meters, performance characteristics of pumps and turbines.

LIST OF EXPERIMENTS

1. Flow through Orificemeter
2. Flow through Venturimeter
3. Flow through orifice
4. Flow through Notches
5. Determination of friction factor in pipes.
6. Determination of minor losses
7. Characteristics of Centrifugal pumps
8. Characteristics of Gear pump
9. Characteristics of Reciprocating pump
10. Study on impact jet on flat plate
11. Characteristics of Pelton wheel turbine
12. Characteristics of Francis turbine

TOTAL : 45

REFERENCES:

1. Bansal R K, “Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi, 2017.
2. https://eerc03-iiith.vlabs.ac.in “Hydraulics and Fluid Mechanics Lab”

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Determine various flow problems and fluid characteristics.
CO2 Determine the losses of flow through various mediums like pipes.
CO3 Determine the performance characteristics of rotodynamic pumps.
CO4 Determine the performance characteristics of positive displacement pumps.
CO5 Determine the performance characteristics of turbines.

Mapping of COs with POs and PSOs

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

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

22CEL42	SOIL MECHANICS AND HIGHWAY ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

Co-requisites: 22CET43 - SOIL MECHANICS

Preamble

This course deals with the determination of various physical and engineering properties of soil. With the knowledge of these properties, students will be able to identify, classify and appreciate the use of soil as a suitable construction material and design appropriate foundations for the structure. This course also imparts knowledge on testing of coarse aggregates thus enabling students to identify the coarse aggregates as an appropriate material for pavements.

LIST OF EXPERIMENTS

1. Specific gravity of soil solids (soil and coarse aggregates).
2. Grain size distribution Sieve analysis (soil and coarse aggregates).
3. Atterberg limits.
4. Field density test (Sand replacement method and Core cutter method).
5. Determination of moisture density relationship using Standard Proctor Compaction test.
6. Permeability determination (constant head and falling head methods).
7. Direct shear test on cohesionless soil.
8. Unconfined compression test in cohesive soil.
9. Determination of binder content.
10. Penetration resistance of bitumen.
11. Viscosity and Softening point of bitumen.
12. California Bearing Ratio (Demonstration only).
13. Ductility of bitumen (Demonstration only).

TOTAL : 45

REFERENCES:

1. https://nptel.ac.in/courses/105101160, “Geotechnical engineering laboratory”, Prof. J. N. Mandal, IIT Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Determine engineering properties of soil.
CO2 Determine index, compaction and flow of water through soil media.
CO3 Determine the shear strength parameters.
CO4 Examine the quality of bitumen.
CO5 Determine the strength of subgrade soil.

Mapping of COs with POs and PSOs

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

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

22MCT05	APTITUDE AND LOGICAL REASONING	L	T	P	C
		2	0	0	0

Preamble:

Aptitude tests are used to determine an individual's ability/potential to succeed in a certain task, with no prior knowledge or training and are frequently used as part of a pre-employment assessment. Aptitude tests are a proven tool used to identify those who are best equipped to carry out any given role.

A logical reasoning test is a form of testing that is widely used by corporate employers to help assess candidates during their recruitment process.

UNIT 1 UNITARY METHODS **6**

Number System, Time and Work, Pipes And Cisterns

UNIT 2 NUMERICAL COMPUTATION **6**

Ratio and Proportion, Problems on Ages

UNIT 3 NUMERICAL ESTIMATION I **6**

Time and Distance, Problems on Trains, Boats and Streams

UNIT 4 NUMERICAL ESTIMATION II **6**

Percentage, Profit and Loss, Simple Interest and Compound Interest

UNIT 5 LOGICAL REASONING **6**

Direction Sense, Seating Arrangements, Coding and Decoding

TOTAL : 30

REFERENCES:

1 Dr.R.S.Aggarwal, “Quantitative Aptitude for Competitive Examination”, S.Chand Publications, 2022.

2 Dr.R.S.Aggarwal, “A Modern Approach to Verbal & Non-Verbal Reasoning”, S.Chand Publications, 2022.

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

CO1	Solve the given equation using appropriate simplification methods and compute time, work, capacity and identify the pattern by analyzing the given problem/scenario
CO2	Apply aptitude method of ratio and proportion to solve the given scenario.
CO3	Calculate time, speed, distance by applying suitable aptitude method for the given problem statement.
CO4	Calculate percentage and profit & loss for the given problem statement and Compute simple interest, compound interest for the given problem/scenario.
CO5	Use their logical thinking abilities to solve given problem involving direction sense, seating arrangement and coding & decoding.

22CET51	DESIGN OF REINFORCED CONCRETE STRUCTURAL ELEMENTS	L	T	P	C
		3	1	0	4

Prerequisites: 22CET41 – STRENGTH OF MATERIALS

Preamble

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 1 LIMIT STATE METHOD **9+3**

Objective of structural design - Stress-strain behavior of steel and concrete - Type of Loads on Structures and Load combinations - Concept of Working Stress Method, Ultimate Load Design and Limit State Design Methods for RCC - Analysis and design of singly and doubly reinforced rectangular beams by Limit State Method - Analysis and design of Flanged (T beam and L beam) and Continuous beam.

UNIT 2 DESIGN OF BEAMS **9+3**

Behaviour of RC members in Shear, Bond and Anchorage. Design for Bond - bond failure and strength - splicing of reinforcement – Codal recommendations. Design for Shear - Behaviour of reinforced concrete under shear - design shear strength with and without shear reinforcement. Design for Torsion - general behavior in torsion - Design of RC members for combined Bending, Shear and Torsion.

UNIT 3 DESIGN OF SLABS AND STAIRCASE **9+3**

Design of slab - one way and two-way slabs for simply supported and different edge conditions - Design of continuous slabs and Cantilever slab using IS code coefficients. Staircases - Types - Design of Straight and dog-legged Staircase.

UNIT 4 DESIGN OF COLUMNS **9+3**

Design of compression members – Columns - Effective length - Axially loaded and eccentrically loaded columns Interaction diagrams - Biaxial bending - Slender columns.

UNIT 5 DESIGN OF FOOTINGS **9+3**

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

(Lecture : 45; Tutorial : 15) TOTAL : 60

TEXT BOOKS:

1. Krishna Raju, N., Reinforced Concrete Design: IS:456-2000 Principles and Practice, New Age International Publishers, 2018.
2. Varghese, P.C., “Limit State Design of Reinforced Concrete”, 2nd Edition, Prentice Hall of India, Pvt. Ltd., New Delhi, 2008.

REFERENCES:

1. Krishnaraju.N, “Design of Reinforced Concrete Structures”,3rd edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2015.
2. Subramanian,N., “Design of Reinforced Concrete Structures”, Oxford University Press, New Delhi, 2013.
3. Shah V L Karve S R., "Limit State Theory and Design of Reinforced Concrete", Structures Publilcations, Pune, 2013.
4. Punmia. B.C., Ashok Kumar Jain, Arun Kumar Jain, “Limit State Design of Reinforced Concrete”, Laxmi Publication Pvt. Ltd., New Delhi, 2007.
5. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.

6. SP16, IS456:1978 “Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105105, “Design of Reinforced Concrete Structures”, Prof. NirjharDhang, IIT Kharagpur.
2. http://nptel.ac.in/105102088/ “Building materials and Construction”, Dr. B. Bhattacharjee, IIT Delhi.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the various design methodologies for the design of RC elements
CO2 Know the analysis and design of flanged beams by limit state method and design of beams for shear, bond and torsion.
CO3 Design the various types of slabs and staircase by limit state method.
CO4 Design columns for axial, uniaxial and biaxial eccentric loadings.
CO5 Design of footing by limit state method.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3		1				1			1	3	3
CO2	3	1	3		1				1			1	3	3
CO3	3	1	3		1				1			1	3	3
CO4	3	1	3		1				1			1	3	3
CO5	3	1	3	1	1				1			1	3	3

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

22CET52 **STRUCTURAL ANALYSIS I**

L	T	P	C
3	1	0	4

Prerequisites: 22CET41 – STRENGTH OF MATERIALS

Preamble

To analyse indeterminate structures using force method. It aims at determination of end moments and constructing shear force, bending moment diagrams for the beams and frames using slope deflection method and moment distribution method. Analyse beams and frames using matrix flexibility method and matrix stiffness method.

UNIT 1 CONSISTENT DEFORMATION METHOD **9 + 3**

Introduction – Static and kinematic indeterminacy - Choices of redundant – Method of consistent deformation – Applications – Statically indeterminate beams – Pin jointed plane frames – Statically indeterminate rigid jointed plane frames. Principal of virtual work- Pin jointed plane frames only.

UNIT 2 SLOPE DEFLECTION METHOD **9 + 3**

Introduction – Slope deflection equations – Continuous beams – Sinking of supports – Analysis of portal frames with and without side sway (single storey and single bay).

UNIT 3 MOMENT DISTRIBUTION METHOD **9 + 3**

Stiffness – carry over factor – distribution factor - Analysis of continuous beams – Analysis of portal frames with and without side sway (single storey and single bay).

UNIT 4 FLEXIBILITY MATRIX METHOD **9 + 3**

Introduction – Equilibrium and compatibility conditions – Primary structure – Element and global flexibility matrix – Applications – Analysis of indeterminate beams, frames and trusses (redundancy restricted to two).

UNIT 5 STIFFNESS MATRIX METHOD **9 + 3**

Introduction – Displacement and force transformation matrices – Element and global stiffness matrix – Applications – Analysis of indeterminate beams, frames and trusses (redundancy restricted to two).

(Lecture : 45; Tutorial : 15) TOTAL : 60

TEXT BOOKS:

1. Vaidyanadhan R and Perumal, P, “Comprehensive Structural Analysis-Vol.1 &Vol.2”, Laxmi Publications Pvt. Ltd, New Delhi,4th Edition 2018.
2. Hibbeler R.C., “Structural Analysis”, 10th Edition, Pearson India, Bengaluru, 2018.

REFERENCES:

1. Bhavikatti S.S., "Matrix Methods of Structural Analysis", 1st Edition, I.K. International Publishing House, New Delhi, 2011.
2. Devdas Menon, "Structural Analysis", 2nd Edition, Narosa Publishing House, New Delhi, 2018.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105166/, “Structural Analysis-I”, Prof.Amit Shaw, IIT Kharagpur.
2. https://archive.nptel.ac.in/courses/105/105/105105109/ “Structural Analysis-II”, Module, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Evaluate the behavior of structural elements using force method.
CO2 Analyse the continuous beams and rigid frames using slope defection method
CO3 Examine the concept of moment distribution for the analysis of continuous beams and rigid frames with and without sway
CO4 Derive bending moments of continuous beams, pin jointed trusses and rigid plane frames using flexibility matrix method
CO5 Evaluate bending moments of continuous beams, pin jointed trusses and rigid plane frames using stiffness matrix method

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2			3				1		2	3	3
CO2	3	3	2			3				1		2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			3				1		2	3	3

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

22CET53 **FOUNDATION ENGINEERING**

L	T	P	C
3	0	0	3

Prerequisites : 22CET43 - Soil mechanics

Preamble

This course deals with the investigation of soil condition and to select the suitable type of foundation. It provides knowledge on the design of shallow, deep foundation and earth retaining walls.

UNIT 1 SITE INVESTIGATION AND SELECTION OF FOUNDATION **9**

Methods of explorati on - auger, wash boring and rotary drilling - Depth of boring - Spacing of bore hole - Sampling techniques - Disturbed and undisturbed sampling methods - Split spoon, Thin wall, Stationery and piston sampler - Penetration tests (SPT and SCPT) and plate load test - Bore log report - Data interpretation.

UNIT 2 SHALLOW FOUNDATION **9**

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

UNIT 3 FOOTINGS AND RAFTS **9**

Types of footings - Contact pressure distribution - Types of loading and proportioning - Analysis of Isolated footing, Combined footings, Raft foundation and Eccentric footings.

UNIT 4 PILE FOUNDATION **9**

Types of piles and their function - Factors influencing the selection of pile - Carrying capacity of single pile in granular and cohesive soil - Static formula - Dynamic formulae (Engineering news and Hileys) - Capacity from in-situ tests (SPT and SCPT) - Negative skin friction - Uplift capacity- Group capacity - efficiency of pile groups(Feld‘s rule, Converse - Labarra formula).

UNIT 5 RETAINING WALLS **9**

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 - Rebhanns and Culmann Graphical method - Pressure on the wall due to line load.

TOTAL : 45

TEXT BOOKS:

1. Arora K.R. - Soil Mechanics and Foundation Engineering, Standard Publishers and Distributors, New Delhi, 2005.
2. Gopal Ranjan and Rao A.S.R. - Basic and Applied soil mechanics, New Age International Pvt. Ltd, New Delhi, 2016.

REFERENCES:

1. Punmia, B.C. - Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd., New Delhi, 2005.
2. Venkatramaiah, C. - Geotechnical Engineering, New Age International Publishers, New Delhi, 2007.
3. IS 6403:1981 (Reaffirmed 1997) - Bearing capacity of shallow foundation‖, BIS, New Delhi, 1998.
4. IS 2192:1979 - Code of practice for - Subsurface Investigations for foundations, BIS, New Delhi,1979

5. IS 8009 (Part2):1980 (Reaffirmed 1995) - Deep foundations subjected to symmetrical static vertical loading, BIS, New Delhi, 1992.
6. IS 2911 (Part1):1979 (Reaffirmed 1997) - Concrete Piles, BIS, New Delhi, 1994.
7. IS 2911 (Part 4):1979 (Reaffirmed 1997) - Load Test on Piles, BIS, New Delhi, 1997.

eRESOURCES:

1. http://nptel.ac.in/courses/105107120, - Foundation Engineering, Prof. Mahendra Singh, Prof. Priti Maheswari, Prof. N.K. Samadhiya, IIT Roorkee.
2. http://nptel.ac.in/courses/105101083, - Foundation Engineering, Dr. DeepankarChoudhury, IIT Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify and explain the methods of soil investigation and report preparation.
CO2 Analyse the shallow foundation considering shear failure and settlement criteria.
CO3 Analyse footings and rafts.
CO4 Explain the load carrying capacity of pile foundation.
CO5 Analyse the retaining structures.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1				2	1					2	2	
CO2	3		1			2	1					2	3	1
CO3	3		1			2	1					2	3	1
CO4	2	1	2			2	1					2	2	
CO5	3		1			2	1					2	3	1

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

22CEL51 ENVIRONMENTAL ENGINEERING LABORATORY

L	T	P	C
0	0	2	1

Pre-requisites: 22CET45 - Water Supply and Waste Water Engineering

Preamble

The objective of this laboratory course is to obtain characteristics of potable water and wastewater.

LIST OF EXPERIMENTS

1. Determination of (i) pH (ii) Turbidity.
2. Determination of hardness.
3. Estimation of acidity and alkalinity.
4. Determination of solids.
5. Determination of residual chlorides.
6. Determination of dissolved oxygen.
7. Determination of available chlorine in bleaching powder.
8. Determination of chemical oxygen demand.
9. Determination of (i) Nitrate (ii) Phosphate (iii) Ammonium nitrogen.
10. Determination of sulphates.
11. Biochemical oxygen demand (Demonstration).

TOTAL : 45

REFERENCES:

1. APHA, "Standard Methods for the Examination of Water and Waste water", 22nd Ed. Washington, 2012.
2. H.H. and Krist,H, "Laboratory Manual for the Examination of water, wastewater soil Rump", Second Edition, VCH, Germany, 3rd Edition, 1999.
3. James P.Lodge Jr, "Methods of air sampling & analysis", , Lewis publishers,Inc,USA,1989.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Determine the physical and chemical impurities present in the water.
CO2 Determine the amount of oxygen required for self-purification of a stream.
CO3 Estimate the amount of coagulant required for water treatment.
CO4 Determine the degree of treatment required for water and wastewater treatment.
CO5 Determine the type of chlorination required for water treatment.

Mapping of COs with POs and PSOs

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

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

22CEL52 **SURVEY CAMP**

L	T	P	C
0	0	2	1

Pre-requisites:

22CET34 - SURVEYING

22CEL31 - SURVEYING LABORATORY

Preamble

The survey camp is to enable the students to get practical training in the fieldwork. Groups of not more than six members will carry out each exercise during survey camp. At the end of the camp, each student will independently complete the calculation & drawings for the data collected from the field. The survey camp report shall include all original field observations, calculation and plots.

LIST OF EXPERIMENTS

One week Survey Camp will be conducted during summer vacation in the following activities:

1. Block Level/ By squares of size at least 100 Meter x 100 Meter atleast 20 Meter interval.
2. L.S & C.S - Road alignment for a Length of not less than 1 KM atleast L.S at Every 30M and C.S at every 90 M.
3. Radial tachometric contouring - Radial Line at Every 45 Degree and Length not less than 60 Meter on each Radial Line
4. Use of GPS to determine latitude and longitude and locate the survey camp location.
5. Total station surveying to plot a boundary.
6. Column marking using total station.

REFERENCES:

1. Punmia.B.C, Ashok K Jain and Arun K Jain, "Surveying" Vol. I & II, Laxmi Publication, 16th Edition, New Delhi, 2005.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Prepare contour map for the given area
CO2 Plot LS and CS of the given terrain
CO3 Understand the surveying techniques in field to establish vertical control
CO4 Prepare topographical survey using total station
CO5 Carry out different setting out works in the field

Mapping of COs with POs and PSOs

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

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

22MCL06 **COMMUNICATION SKILLS LABORATORY** **L T P C**
0 0 2 0

Preamble :
Communication Skill is a life skill necessary for all students of Engineering and Technology. The course Communicative Skills Laboratory aims at developing effective oral and written communication to facilitate their success in competitive examinations, and recruitment screening thereby ensuring professional success and progress.

UNIT 1 RECEPTIVE SKILLS **6**
LISTENING & READING – Developing Listening & Reading Skills - Comprehension and Analysis – Listening & Reading for Main Idea - Specific Information - Cloze Test- Rearranging words and sentences

UNIT 2 PRODUCTIVE SKILLS **8**
SPEAKING & WRITING - Group Discussion and Practice – Mock GD - Structure – Types - Techniques - Keywords -Vital qualities - Attitude and Opinion - Expository and Persuasive Paragraphs – Picture Description

UNIT 3 ENGLISH FOR NATIONAL AND INTERNATIONAL EXAMINATIONS **4**
Orientation to International English Language Testing System (IELTS) and other Competitive Examinations – MCQs

UNIT 4 CAREER SKILLS **6**
Types of Interviews - FAQ's - Mock Interviews - Body Language - Team Work - Managing Time - Managing Stress - Negotiation Skills - Networking – Profile Creation (Linked in, Portfolio)

UNIT 5 VERBAL ABILITY **6**
Synonyms and Antonyms - Idioms and Phrases - Sentence Construction and Improvement- Paraphrasing - Contextual Vocabulary - Verbal Analogy

TOTAL: 30

REFERENCES:

1. M Ashraf Rizvi "Effective Technical Communication", Tata McGraw-Hill, 2st Edition, New Delhi, 2018.
2. Koneru Aruna 'Professional Communication' MC Graw Hill Education, Chennai, 2008.
3. Upadhyay Meenakshi & Arun Sharma 'Comprehension Interpersonal & Communication Skills for General Studies Civil Services Preliminary Examination' MC Graw Hill Education, New Delhi, 2012.

e.RESOURCES :
1. https://www.teachingenglish.org.uk/article/email-writing
2. http://www.oxforddictionaries.com/words/writing-job-applications
3. https://www.fresherslive.com/online-test/verbal-ability-test/questions-and-answers
4. www.cambridgeenglish.org

Course Outcomes: Upon completion of the course, students will be able to:
- **CO1** Respond quickly and correctly to questions from different types of scripts, exhibiting good comprehension and analyzing skills
- **CO2** Participate effectively in formal group discussions and prepare professional e mails, persuasive and expository paragraphs to establish and meet organizational needs and goals.
- **CO3** Fare well in IELTS and other English language assessment segments of competitive examinations within the stipulated time.
- **CO4** Write effective résumés, and face interviews with communicative competence and confidence, with a good knowledge of career skills .
- **CO5** Select appropriate vocabulary and idiomatic expressions, identify errors in syntax, and arrange sentences to make meaningful paragraphs, without any aid.

Mapping of COs with POs and PSOs

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1					3					3				
CO 2									3	3				
CO 3										3		1		
CO 4									3	3		1		
CO 5										3		1		
Mapping Average					3				3	3		1		

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

22CET61 **CONCRETE TECHNOLOGY**

L	T	P	C
3	0	0	3

Prerequisites : 22CET31 - Construction Materials and Practices

Preamble

This course deals about the properties of raw materials to make the concrete. It helps to provide the behaviour of concrete at its fresh and hardened state. It deals with the concrete mix design and understands special concrete and their uses.

UNIT 1 CONSTITUENT MATERIALS **9**

Cement – Chemical composition and Properties - Tests on cement - BIS Specifications – Aggregates - Classification - Mechanical properties and tests as per BIS standards - Water - Quality of water for use in concrete.

UNIT 2 CHEMICAL AND MINERAL ADMIXTURES **9**

Accelerators - Retarders - Plasticizers - Super plasticizers - Water proofers - Mineral Admixtures like Fly Ash, Silica Fume, Ground Granulated Blast Furnace Slag (GGBS) and Metakaolin - Their effects on concrete properties (fresh and hardened state).

UNIT 3 PROPORTIONING OF CONCRETE MIX **9**

Concept of mix design - Properties of concrete related to mix design - Physical properties of materials required for mix design - Design mix and conventional Mix - BIS method of mix design and problems - ACI mix design procedure only.

UNIT 4 FRESH AND HARDENED PROPERTIES OF CONCRETE **9**

Workability - Tests for workability of concrete - Slump Test and Compacting factor Test - Segregation and Bleeding - Properties of Hardened concrete - Determination of Compressive, Split tensile and Flexural strength as per BIS - Stress-strain curve for concrete - Determination of Young‘s Modulus.

UNIT 5 SPECIAL CONCRETES **9**

Light weight concrete - Fibre reinforced concrete - Ferrocement - Ready mix concrete - SIMCON and SIFCON - Shotcrete - High performance concrete - Geopolymer Concrete - Self compacting concrete - Nano concrete – 3D printed concrete.

TOTAL : 45

TEXT BOOKS:

1. M.S.Shetty, “Concrete Technology”, 8th Edition, Chand Publication, 2019.
2. A.M.Neville, J.J.Brookes, “Concrete Technology”, 5th Edition, Pearson Education, 2009.

REFERENCES:

1. A.R. Shanta Kumar, “Concrete Technology”, 1st Edition, Oxford University Press, New Delhi, 2010.
2. M.L. Gambhir, “Concrete Technology”, 3rd Edition, Tata Mc-Graw hill Publishers, New Delhi, 2013.
3. A.M. Neville, “Properties of Concrete”, 2nd Edition, Pearson Education, 2012.

eRESOURCES:

1. http://nptel.ac.in/courses/105102012/, “Concrete Technology”, Dr. B. Bhattacharjee, IIT Delhi
2. https://nptel.ac.in/courses/105/106/105106176/# , “Advanced Concrete Technology”, Dr Manu santhanam, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify and explain the characteristics of basic ingredients and properties of concrete.
CO2 Apply the effect of the admixtures on proportion and workability of concrete.
CO3 Design the concrete mix using BIS code.
CO4 Distinguish the properties of fresh and hardened concrete.
CO5 Justify the significance of special concretes viz., Light weight, fibre reinforced, polymer, self-compacting concrete.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3		2				1	1					
CO2	2	3		2				1	1					
CO3	3	3	3			3	2	2	2		2			
CO4	3	3	3		2	3	3	2	3		2			
CO5	3	3	3	2	2					2	2	3		

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

22CET62 **STRUCTURAL ANALYSIS II**

L	T	P	C
3	1	0	4

Prerequisites : 22CET52 - STRUCTURAL ANALYSIS I

Preamble

To employ plastic and elastic methods for the analysis of determinate and indeterminate structures. It also aims at determination of member forces in arches and suspension bridges. It also gives an idea of analysing beams for moving loads.

UNIT 1 PLASTIC ANALYSIS OF STRUCTURES **9 + 3**

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 2 MOVING LOADS AND INFLUENCE LINES **9 + 3**

Influence lines for reactions in statically determinate structures – Influence lines for member forces in pin jointed frames – Influence lines for shear force and bending moment in beam sections – Muller Breslau principle – Influence lines for continuous beams (2-degree redundant structures).

UNIT 3 ARCHES **9 + 3**

Arches as structural forms – Arch structures – Arch action – Types of arches – Parabolic and circular arches – Analysis of three hinged and two hinged arches – Settlement and temperature effects.

UNIT 4 SUSPENSION BRIDGES AND CABLES **9 + 3**

Analysis of suspension bridges – Unstiffened cables and cables with two and three hinged stiffening girders - Influence lines for three hinged stiffening girders.

UNIT 5 INTRODUCTION TO FEM **9 + 3**

Introduction to Finite Element Method (FEM) - Discretization of a structure - Displacement functions – Bar element, truss element and beam element – Plane stress and plane strain - Triangular elements.

(Lecture : 45; Tutorial : 15) TOTAL : 60

TEXT BOOKS:

1. Vaidyanadhan R and Perumal, P, “Comprehensive Structural Analysis - Vol.1 &Vol.2”, Laxmi Publications Pvt. Ltd, New Delhi, 4th Edition 2018.
2. Hibbeler R.C., "Structural Analysis", 10th Edition, Pearson India, Bengaluru, 2018.

REFERENCES:

1. Bhavikatti S.S., "Matrix Methods of Structural Analysis", 1st Edition, I.K. International Publishing House, New Delhi, 2011.
2. Devdas Menon, "Structural Analysis", 2nd Edition, Narosa Publishing House, New Delhi, 2018.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105166/, “Structural Analysis-I”, Prof.Amit Shaw, IIT Kharagpur.
2. https://archive.nptel.ac.in/courses/105/105/105105109/ “Structural Analysis-II (web)”, Module, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Determine the plastic moment capacity of structures.
CO2 Evaluate the shear force and bending moment of simply supported beams carrying moving loads.
CO3 Analyse the various types of arches

CO4 Analyse the suspension bridges with stiffening girders.
CO5 Analyse rigid frames by approximate methods for gravity and horizontal loads.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2			3				1		2	3	3
CO2	3	3	2			3				1		2	3	3
CO3	3	3	2			3				1		2	3	3
CO4	3	3	2			3				1		2	3	3
CO5	3	3	2			3				1		2	3	3

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

22CET63	DESIGN OF STEEL STRUCTURES	L	T	P	C
		3	1	0	4

Preamble

To introduce limit state design of structural steel members subjected to tensile, compressive and transverse loads. This course deals with design of structural steel elements such as tension members, columns, beams, plate girders, purlin including its connection and design procedure of gantry girder.

UNIT 1 CONNECTIONS **9 + 3**

Properties of steel – Structural steel sections – Limit state design concepts – Loads on structures – Basics of riveted connection - connections using bolting, welding – Design of bolted and welded joints – Eccentric connections - Efficiency of joints.

UNIT 2 TENSION MEMBERS **9 + 3**

Types of tension members and sections - Mode of failure - Net area - Net effective sections for plates and angles in tension - Concept of shear lag - Design of plate and angle tension members - Connections in tension members – Design of lug angles and tension splice.

UNIT 3 COMPRESSION MEMBERS **9 + 3**

Types of compression members and sections - Mode of failure - Effective length - Slenderness ratio - Design of axially loaded single and compound section compression members – Design of built up laced and battened type columns - Design slab and gusseted base for axially loaded columns.

UNIT 4 BEAMS **9 + 3**

Design of laterally supported and unsupported beams - Built up beams - Beams subjected to uniaxial and biaxial bending - Design procedure of welded plate girder.

UNIT 5 ROOF TRUSSES AND INDUSTRIAL STRUCTURES **9 + 3**

Roof trusses - Roof and side coverings - Design of channel and I section purlins - Design procedure of gantry girder.

(Lecture : 45; Tutorial : 15) TOTAL : 60

TEXT BOOKS:

1. Subramanian N, "Design of Steel Structures", Oxford University Press, New Delhi, 2016.
2. Duggal S K, “Limit State design of steel Structures”, Mc. Graw Hill Education (India) Private Limited, New Delhi, 2019.

REFERENCES:

1. Jayagopal L S and Tensing D, ‘Design of steel structures”, 1st edition, Vikas Publishing House private Ltd., 2016.
2. Bhavikatti S S, "Design of steel structures" By Limit state method as per IS:800 - 2007, IK International Publishing House Pvt. Ltd., 2009
3. Shiyekar M R, "Limit state design in structural steel", PHI Learning private limited, Delhi, 2nd Edition, 2013.
4. IS 800:2007, General construction in steel-code of practice, (Third revision), Bureau of Indian Standards, New Delhi, 2007.
5. IS 875:2015(Part 3), Code of practice for design loads for buildings and structures (Third revision), Bureau of Indian Standards, New Delhi, 2015.

eRESOURCES:

1. https://nptel.ac.in/courses/105105162 “Design of steel structures”, Prof. Damodar Maity, Indian Institute of Technology, Kharagpur.
2. https://www.steel-insdag.org/teaching-resource-materials

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Design of structural steel connections.
CO2 Design of tension members.
CO3 Design of compression members.
CO4 Design of structural steel beam and plate girder.
CO5 Design of industrial building components and gantry girder.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3			1			1	1			3	2
CO2	3	3	3			1			1	1			3	2
CO3	3	3	3			1			1	1			3	2
CO4	3	3	3			1			1	1			2	2
CO5	3	3	3	1		1			1	1			2	2

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

22CEL61	CONCRETE TECHNOLOGY LABORATORY	L	T	P	C
		0	0	2	1

Pre-requisites: 22CET31- CONSTRUCTION MATERIALS AND PRACTICES
Co-requisites: 22CET61- CONCRETE TECHNOLOGY

Preamble

This laboratory course involves experiments on physical test on cement, aggregate, fresh concrete and hardened concrete.

LIST OF EXPERIMENTS

1.PHYSICAL TESTS ON CEMENT:

i. Specific Gravity.
ii. Consistency.
iii. Initial and Final setting time.
iv. Soundness.
v. Compressive strength of cement.

2.TESTS ON AGGREGATE:

i. Gradation of Aggregates.
ii. Specific gravity and Water absorption.
iii. Bulking of Sand and bulk density.
iv. Abrasion Test.
v. Crushing strength and impact test.

3.TESTS ON FRESH CONCRETE:

i. Slump cone.
ii. Flow table.
iii. Compaction factor.
iv. Vee Bee.

4.TESTS ON HARDENED CONCRETE:

i. Compressive strength.
ii. Split tensile strength.
iii. Flexural strength.
iv. Modulus of Elasticity

TOTAL : 45

REFERENCES:

1. M.S.Shetty, “Concrete Technology”, 8th Edition, Chand Publication, 2019.
2. http://nptel.ac.in/courses/105102012/, “Concrete Technology”, Dr. B. Bhattacharjee, IIT Delhi

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Determine the physical properties and strength of cement.
CO2 Determine the properties of Fine aggregates.
CO3 Determine the properties of coarse aggregates.
CO4 Determine the properties of fresh concrete.
CO5 Determine the properties of hardened concrete.

Mapping of COs with POs and PSOs

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

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

22CEL62	ENVIRONMENTAL AND IRRIGATION ENGINEERING – DESIGN AND DRAWING	L	T	P	C
		0	0	2	1

Preamble

The objective of this laboratory course is to design and drawing with a suitable scale of public health and irrigation structures.

LIST OF EXPERIMENTS

Design and Drawing of

1. Flow diagram - Water and wastewater.
2. Screen and Grit chamber.
3. Slow sand filter.
4. Rapid sand filter.
5. Clariflocculator.
6. Septic tank.
7. Activated sludge process.
8. Direct Sluice - Tower head and Wing wall types.
9. Aqueduct.
10. Surplus weir.
11. Canal drop.

TOTAL : 45

REFERENCES:

1. Garg S.K., "Irrigation Engineering and Hydraulic Structures," KH Publications, New Delhi, 2006.
2. Punmia B.C., "Irrigation and Water Power Engineering", Laxmi Publishers, New Delhi, 2021.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Design and draw the components of rapid sand filter.
CO2 Design and draw the settling and flocculation tank.
CO3 Design and draw the primary and secondary treatment of sewage plant.
CO4 Design and draw the various canal structures.
CO5 Design and draw the components of septic tank.

Mapping of COs with POs and PSOs

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

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

22CET71	ENGINEERING ECONOMICS AND COST ANALYSIS	L	T	P	C
		3	0	0	3

Preamble

The main objective of this course is to make the student know the basic law of economics, how to organise a business, the financial aspects related to business, different methods of appraisal of projects and pricing techniques.

UNIT 1 BASIC ECONOMICS **9**

Definition of economics - nature and scope of economic science - nature and scope of managerial economics - basic terms and concepts - goods, utility, value, wealth - factors of production, land, its peculiarities - labour - economies of large and small scale - consumption - Requirements - its characteristics and classification - law of diminishing marginal utility – relation between economic decision and technical decision.

UNIT 2 DEMAND AND SCHEDULE **9**

Demand : Demand schedule, demand curve, law of demand, elasticity of demand - types of elasticity - factors determining elasticity - measurement - its significance.

Supply : Supply schedule , supply curve, law of supply, elasticity of supply - time element in the determination of value - market price and normal price - perfect competition - monopoly – monopolistic competition.

UNIT 3 ORGANISATION **9**

Forms of business, proprietorship, partnership, joint stock company, cooperative organization, state enterprise - mixed economy - money and banking - banking - commercial banks -central banking functions - control of credit - monetary policy – credit instrument.

UNIT 4 FINANCING **9**

Types of financing - Short term borrowing, Long term borrowing, Internal generation of funds, External commercial borrowings, Assistance from government budgeting support and international finance corporations - analysis of financial statement – Balance Sheet - Profit and Loss account - Funds flow statement.

UNIT 5 COST AND BREAK EVEN ANALYSIS **9**

Types of costing – cost output relationship in the short run and in long run – pricing practice, full cost pricing, marginal cost pricing, going rate pricing, bid pricing, pricing for a rate of return – appraising project profitability – cost benefit analysis – feasibility reports, appraisal process, technical feasibility, economic feasibility, financial feasibility - break even analysis – basic assumptions – breakeven chart – managerial uses of break-even analysis.

TOTAL : 45

TEXT BOOKS:

1. Dewett K.K. &Varma J.D., “Elementary Economic Theory”, S Chand & Co., 2nd edition, 2006.
2. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2nd edition, 2013.

REFERENCES:

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 5th edition, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis”, Engg. Press, Texas, 3rd edition, 2012.
3. Samuelson P.A., “Economics - An Introductory Analysis”, McGraw-Hill, 2019.

eRESOURCES:

1. https://nptel.ac.in/courses/112107209/ "Engineering Economic Analysis", Dr. Pradeep K. Jha, IIT Roorkee.
2. https://nptel.ac.in/courses/105103023/ "Construction Economics & Finance", Dr. BuluPradhan, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the basics on economics, its characteristics and classification.
CO2 Discuss the demand and supply schedule.
CO3 Summarize the different forms of business and its banking.
CO4 Explain the financing, its types and flow of funds.
CO5 Describe the costing types and breakeven analysis.

Mapping of COs with POs and PSOs

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

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

22CET72	ESTIMATION AND QUANTITY SURVEYING	L	T	P	C
		3	1	0	4

Pre-requisites:

22CET51- DESIGN OF REINFORCED CONCRETE ELEMENTS
22CET63- DESIGN OF STEEL STRUCTURES

Preamble

To acquire knowledge in estimation of different building components, rate analysis, tender practices, contract procedures, valuation of land & building and preparation of reports.

UNIT 1 ESTIMATION OF BUILDINGS 9 + 3

Types of estimates - Units of measurements - Methods of estimates - Load bearing and framed structures - Calculation of quantities of earthwork, brick work, RCC, PCC, plastering, white washing, and painting / varnishing for doors and windows, residential building with flat roof.

UNIT 2 ESTIMATION OF MISCELLANEOUS STRUCTURES 9 + 3

Types of arches - Calculation of brick work and RCC works in arches - septic tank with soak pit– Road estimating - bituminous and cement concrete roads - retaining wall – culverts - Steel requirement – R.C.C roof slab, beam, column and foundation, staircase - G.I sheet roof over steel truss.

UNIT 3 SPECIFICATIONS AND RATE ANALYSIS 9 + 3

Bar bending schedule - Standard data - Observed data - Standard Schedule of rates - Standard data for man hours and machineries - Specifications - Sources - Preparation of detailed and general specifications - Rate analysis.

UNIT 4 TENDER AND CONTRACT 9 + 3

Tenders - Tamil Nadu Transparency in Tenders act 2000 - Tender notices - types - Tender procedures - Drafting model tenders, E-tendering - Digital signature certificates. Contract - Types, formation and contract conditions - Contract for labour, material, design, construction - Drafting of contract documents based on IBRD / MORTH standard bidding documents - Construction contracts - Contract problems - Arbitration and legal requirements.

UNIT 5 VALUATION AND REPORT 9 + 3

Definitions - types and methods of valuation - Necessity - Capitalised value - Depreciation - Escalation - Valuation of land and Buildings - Calculation of Standard rent - Mortgage – Lease - Principles for report preparation - Report on estimate of residential building and roads.

(Lecture : 45; Tutorial : 15) TOTAL : 60

TEXT BOOKS:

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

REFERENCES:

1. Kanagasabapathy B., “Practical Valuation Engineering”, 1st Edition, Volume. I, II & III, K. Ehilaalarasi Kanagasabapathy Publications, 2006.
2. Hand Book of Consolidated Data – 8/2000, Vol.1, PWD Tamil Nadu.
3. Standard Schedule of Rates - PWD, Government of Tamil Nadu, Chennai
4. Tamil Nadu Transparencies in Tenders Act, 2000.
5. Arbitration and Conciliation Act, 1996

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Estimate of the building elements.
CO2 Prepare abstract bill of quantities.
CO3 Execute rate analysis for the materials and labour.
CO4 Discuss the types of contracts.
CO5 Carry out valuation of land, buildings and prepare report.

Mapping of COs with POs and PSOs

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

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

22HST71	HUMAN VALUES AND PROFESSIONAL ETHICS	L	T	P	C
		1	0	0	1

Pre-requisites: Universal Human Values

Preamble

Universal Human Values is a life skill necessary for all students of Engineering and Technology. The course aims to identify the values and skills, and to realize the need, basic guidelines, content and process of value education. Professional Ethics For Engineers deals with the human values, integrity and work ethics in the common world. This course is mainly concerned about the theories of ethics, which form the basis for the understanding and responsibility of the various groups encountered in Engineering.

UNIT 1 INTRODUCTION TO UNIVERSAL HUMAN VALUES 3

Understanding the need, basic guidelines, content and process for Value Education. Self Exploration– Mechanism for self-exploration. Continuous Happiness and Prosperity- Basic Human Aspirations and its requirements for fulfillment of Human Aspirations understanding and living in harmony at various levels.

UNIT 2 HARMONY IN ONESELF, FAMILY AND SOCIETY 3

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationships. Trust and Respect- values of relationship. Difference between intention and competence. Difference between respect and differentiation

UNIT 3 HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 3

Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in Professional Ethics. Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models.

UNIT 4 ENGINEERING ETHICS 3

Senses of Engineering Ethics– Variety of moral issues – Types of inquiry – Moral dilemmas – Moral autonomy – Kohlberg's theory – Gilligan's theory – Consensus and controversy – Models of professional roles –Professional responsibility - Moral reasoning - Theories about right action – Self-interest – Self respect – Duty ethics – Customs and religion.

UNIT 5 ENGINEERING AS SOCIAL EXPERIMENTATION 3

Engineering as experimentation – Engineers as responsible experimenters – Role of codes- Codes of Ethics – Sample code of Ethics like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers (IETE) – A balanced outlook on law - Safe exits -The Bhopal gas tragedy and Challenger case study.

Lecture: 15, Total: 15

TEXT BOOKS:

1. Gaur R R, Sangal R, Bagaria G P, "A Foundation Course in Human Values and Professional Ethics". 3rd Revised Edition, 2023
2. Govindarajan M, Natarajan S and Senthil Kumar V. S, "Engineering Ethics", PHI Learning Pvt. Ltd, New Delhi, 2017.

REFERENCES:

1. Banerjee B P, "Foundations of Ethics and Management", Excel Books. 2005.
2. Bajpai B L, "Indian Ethos and Modern Management", New Royal Book Co., Lucknow. Reprinted 2008.
3. Subramanian R, "Professional Ethics", Oxford university press, 2017.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Relate the significance of value inputs in a classroom and start applying them in their life and profession.

CO2 Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual.

CO3 Interpret the value of harmonious relationships based on the trust and respect in their life and profession.

CO4 Discuss the ethical issues related to Engineering.

CO5 Discuss Engineer's work in the context of its impact on society.

Mapping of COs with POs and PSOs

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

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

22CEL71 **STRUCTURAL ANALYSIS AND DESIGN LABORATORY** **L T P C**
0 0 2 1

Pre-requisites:

22CET51- DESIGN OF REINFORCED CONCRETE ELEMENTS
22CET63- DESIGN OF STEEL STRUCTURES

Preamble

This course gives knowledge about how to analyze and design the various components of the different types of the structure using STADD Pro. software

LIST OF EXPERIMENTS

1. 2D analysis and design of continuous beam with various loading
2. 2D analysis of single and multi-storied frame
3. Analysis and design of single storey RCC building
4. Analysis and design of multi-storey RCC building elements
5. Analysis and design of isolated and rectangular combined footing.
6. Lateral load (wind) analysis of high-raised buildings
7. Analysis and design of RCC rectangular elevated water tank
8. Analysis of plane truss
9. Analysis of steel chimney
10. Analysis and design of a structural steel building.

TOTAL : 45

REFERENCES:

1. Devdas Menon, "Structural Analysis", 2nd Edition, Narosa Publishing House, New Delhi, 2018.
2. Subramanian N, "Design of Steel Structures", Oxford University Press, New Delhi, 2016.
3. Krishnaraju.N, "Design of Reinforced Concrete Structures", 3rd edition, CBS Publishers & Distributors Pvt. Ltd., New Delhi, 2015.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Analysis of frames.
CO2 Analysis and design of RCC buildings.
CO3 Perform wind analysis of high raised building
CO4 Analysis and design of RCC water tank.
CO5 Analysis and design of steel structures.

Mapping of COs with POs and PSOs

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

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

22CEL72 **DESIGN PROJECT**

L	T	P	C
0	0	3	2

Pre-requisites: Knowledge of Civil Engineering and Software packages.

Preamble

This course imparts the knowledge and improves the design capability of the student. It is used to carry out a thematic design project in one of the specializations of Civil Engineering.

The method of evaluation will be as follows:

1. Internal Marks : 100 marks (Scaled to 40 marks)
   (Decided by conducting 3 reviews)
2. Evaluation of Project Report and Viva voce examination : 100 marks (Scaled to 60 marks)
   (The student will be evaluated based on the report and the viva voce examination by an internal and external examiners)

NOTE:

This course conceives purely a design problem in any one of the disciplines of Civil Engineering; e.g., Design of an RC & Steel structure, Design of environmental and irrigation engineering structures, Design of a foundation system, Design of traffic intersection, Design of bridges (ROB and RUB) and water tank etc., The design problem can be allotted to either an individual student or a group of students comprising of not more than four. At the end of the course the group should submit a complete report on the design problem consisting of the data given, the design calculations, specifications if any and a complete set of drawings which follow the design.

TOTAL : 45

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Prepare the plan of a civil engineering structure.
CO2 Identify appropriate techniques to analyze civil engineering structures.
CO3 Design the structure as per Bureau of Indian Standards.
CO4 Prepare the detailed drawings for structural elements.
CO5 Prepare the consolidated project report for tender or any other purpose.

Mapping of COs with POs and PSOs

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

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

22MCT07	INDIAN CONSTITUTION AND TRADITIONAL KNOWLEDGE	L	T	P	C
		3	0	0	0

Prerequisites : Nil

Preamble

The course provides basic information on Indian Constitution and Indian Traditional knowledge. This is essential for all citizens and especially for engineers so that they become aware of Indian polity and governance. This also reminds the citizen about their obligation, adherence and upkeeping of Constitutional rights.

UNIT 1 **6**

Constitution' meaning of the term, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy - Structure of the Indian Union: Federalism, Centre- Staterelationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha.

UNIT 2 **6**

Governor: Role and Position, CM and Council of ministers, State Secretariat: organisation, Structure and Functions District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.

UNIT 3 **6**

Panchayatraj: Introduction, PRI: Zila Panchayat, Elected officials and their roles, CEO Zila Panchayat: Position and role, Blocklevel: Organizational Hierarchy (Different departments),Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT 4 **6**

Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, StateElection Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

UNIT 5 **6**

Basic structure of Indian Knowledge System-Modern Science and Indian Knowledge –Philosophical Tradition - Indian Linguistic Tradition (Phonology, morphology, syntax and semantics) – Indian Artistic Tradition.

Total : 30 Periods

TEXT BOOKS:

1. M.Rajaram, Indian Constitution, New Age International, 2009

REFERENCES:

1. V.Sivaramakrishnan (Ed.) Cultural Heritage of India (Course Material), Bharatiya Vidya Bhavan, Mumbai. 5th Edition,2014

eRESOURCES:

1. https://legislative.gov.in/constitution-of-india/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Describe the emergence and evolution of Indian Constitution, structure and composition of Indian Constitution and federalism in the Indian context.

CO2 List the functions of Centre, States and District Administrations, Fundamental rights needed to develop human personality in free society.

CO3 Identify different levels of Panchayat Raj system and its working.

CO4 Elaborate the role of Election Commission and its power to conduct free and fair election throughout India.

CO5 Develop a broad understanding of Indian society and intercultural literacy through cultural immersion.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1						3	2	2	2	2		2		
CO2						3	2	2	2	2		2		
CO3						3	2	2	2	2		2		
CO4						3	2	2	2	2		2		
CO5						3	2	2	2	2		2		

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

22CEL81 **INTERNSHIP**

L	T	P	C
0	0	0	2

Pre-requisites: Knowledge of Civil Engineering and Software packages.

Preamble

This course provides industrial exposure in Civil Engineering related organisations. It trains the students in field work so as to have a firsthand knowledge of practical problems in carrying out engineering tasks. It helps students to develop skills in facing and solving the field problems.

EVALUATION PROCEDURE

Students have to undergo four-week practical training in Civil Engineering related organizations of their choice but with the prior approval from the institution. At end of the training student will submit a report as per the prescribed format to the department. The student shall make a power point presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made.

Evaluation of Project Report and Viva voce examination : 100 marks

(The student will be evaluated based on the report and the viva voce examination by an internal examiner)

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify the real world civil Engineering related problems.

CO2 Apply the theoretical concepts studied in the class rooms practically.

Mapping of COs with POs and PSOs

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

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

22CEL82 **PROJECT WORK**

L	T	P	C
0	0	20	10

Pre-requisites: Knowledge of Civil Engineering and Software packages.

Preamble

This course deals with the thematic project in one of the specialization of Civil Engineering. It develops the ability to solve a specific problem right from its identification and literature review till the successful solution of the same. It helps the students in preparing project reports and to face reviews and viva-voce examination.

EVALUATION PROCEDURE

The method of evaluation will be as follows:

1. Internal Marks : 100 marks (Scaled to 40 marks)
   (Decided by conducting 3 reviews)
2. Evaluation of Project Report and Viva voce examination : 100 marks (Scaled to 60 marks)
   (The student will be evaluated based on the report and the viva voce examination by an internal and external examiners)

NOTE:

This project work is to enable the students to work in convenient groups of not more than four in a group on the project involving theoretical and experimental studies related to Civil Engineering. Every project work shall have the faculty members of Civil Engineering to act as a supervisor. The hours allotted for this course shall be utilised by the students to receive directions from the supervisor, on library reading, laboratory work, computer analysis or field work and also to present in periodical reviews the progress made in the project. The students also permitted to carry out their project in the neighboring industry under the guidance of faculty members of Civil Engineering.

Each student shall finally produce a project work report covering background information, literature study, problem statement, materials and methodology, experiments conducted, results and discussions with references. This experience of project work shall help the student in expanding his / her knowledge and provide opportunity to utilise the creative high order thinking and inference capability.

Total : 300

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Review and evaluate the available literature on the chosen problem.
CO2 Formulate the methodology to solve the identified problem.
CO3 Apply the principles, tools and techniques to solve the problem.
CO4 Use advanced software techniques/skills.
CO5 Prepare technical reports.

Mapping of COs with POs and PSOs

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

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

22CEE11 **IRRIGATION ENGINEERING**

L	T	P	C
3	0	0	3

Preamble

To introduce the students to the concept of soil-plant characteristics and their water requirements and to understand the necessity of planning an irrigation system to provide water at the right time and right place.

UNIT 1 CROP WATER REQUIREMENT **9**

Need - Classification of irrigation - Merits and demerits of irrigation - types of crops –crop season - Duty, delta and base period - Consumptive use of crops - Estimation of evapotranspiration using experimental and theoretical methods

UNIT 2 IRRIGATION METHODS **9**

Tank irrigation - Well irrigation - Irrigation methods: Surface and Sub-Surface and Micro Irrigation - Design of drip and sprinkler irrigation - Ridge and furrow irrigation - Irrigation scheduling - Water distribution system - Irrigation efficiencies

UNIT 3 DIVERSION AND IMPOUNDING STRUCTURES **9**

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

UNIT 4 CANAL IRRIGATION **9**

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

UNIT 5 WATER MANAGEMENT IN IRRIGATION **9**

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

TOTAL : 45

TEXT BOOKS:

1. Garg, S.K., “Irrigation Engineering and Hydraulic Structures”, Laxmi Publications, New Delhi, 2023.
2. Dr. B. C. Punmia, “Irrigation and Water Power Engineering”, Lakshmi Publications, 2021.

REFERENCES:

1. Linsley R.K. and Franzini J.B, “Water Resources Engineering”, McGraw-Hill Inc, 2000
2. R. K. Sharma and T. K. Sharma, “Irrigation Engineering”, S. Chand & Co, 2006
3. Dilip Kumar Majumdar, “Irrigation Water Management”, Prentice-Hall of India, New Delhi, 2008.

eRESOURCES:

1. https://nptel.ac.in/courses/126105010, -Irrigation and Drainage, Prof. Damodhara Rao Mailapalli, Department of Agriculture and Food Engineering, IIT Khargarpur.
2. https://archive.nptel.ac.in/courses/105/105/105105110/, Water Resources Engineering, Dr.Dhrubajyoti Sen, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Assess the water requirement of crops
CO2 Explain the methods and types of irrigation
CO3 Summarize the types of Impounding structures
CO4 Design the canal systems
CO5 Execute irrigation system management

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1			2						2			1	
CO2	1	1			2					3	2	2	2	2
CO3	3	3		3				3			3		3	1
CO4	3	3						3			3		3	2
CO5		1		2	2	3	3	3	1	1	3			

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

22CEE12 **HYDROLOGY**

L	T	P	C
3	0	0	3

Preamble

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.

UNIT 1 PRECIPITATION MEASUREMENT **9**

Hydrologic cycle - Types of precipitation - Forms of precipitation - Measurement of Rainfall - Rain gauge density - Spatial and temporal measurement methods - Frequency analysis of point rainfall - Intensity, duration, frequency relationship - Probable maximum precipitation.

UNIT 2 INFILTRATION **9**

Losses from precipitation - Evaporation process - Reservoir evaporation - Infiltration process - Infiltration capacity - Measurement of infiltration - Infiltration indices - Isochrones - Factors affecting runoff - Estimation of runoff – Effective rainfall.

UNIT 3 HYDROGRAPHS **9**

Components of hydrograph- Factors affecting hydrograph -Base flow separation - Unit hydrograph - Derivation of unit hydrograph - S curve hydrograph - Unit hydrograph of different deviations - Synthetic unit hydrograph - application of unit hydrograph.

UNIT 4 FLOOD CONTROL **9**

Flood frequency studies - Recurrence interval – Gumbel's method - Flood routing – Reservoir flood routing – Muskingum's channel routing - Flood control - Flood control economics- Flood forecasting and warning.

UNIT 5 GROUND WATER HYDROLOGY **9**

Types of aquifers – Darcy's law – Dupuit's assumptions - Confined aquifer - Unconfined aquifer - Recuperation test - Transmissibility - Specific capacity - Pumping test - Steady flow analysis only - pollution in relation to water use.

TOTAL : 45

TEXT BOOKS:

1. K Subramanya, "Engineering Hydrology", Tata McGraw Hill, New Delhi, 2020.
2. H.M. Raghunath, "Hydrology", 2nd Edition, New Age International (P) Limited, 2015.

REFERENCES:

1. Jayaramy Reddy. P., "Hydrology", Tata McGraw-Hill Publications Pvt. Ltd, New Delhi, 2016.
2. Todd, D.K., and Mays, L. W., "Groundwater Hydrology", John Wiley & Sons, Singapore, 2015.

eRESOURCES:

1. http://nptel.ac.in/downloads/105101002/ "Advanced Hydrology", Dr. Subhankar Karmakar, IIT Bombay.
2. http://www.civilenggforall.com/2015/09/hydrology-for-water-management-by-stephen-thompson-free-download-pdf- civilenggforall.com.html.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain the hydrologic cycle and precipitation measurement in terms of rainfall, intensity and duration frequency.
CO2	Identify and explain the infiltration and evaporation process.
CO3	Discuss the types of hydrograph and amount of flow through graphical method.
CO4	Discuss the different methods of flood routing and forecasting and warning.
CO5	Discuss the groundwater hydrology and different flow laws.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1				3						2	
CO2	2	1		2			1					1	1	1
CO3	3			2	1		2			1			2	
CO4	2	1	1	2	2		2			1			1	2
CO5	2	2		1	1								1	1

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

22CEE13	WATER RESOURCES SYSTEMS ENGINEERING	L	T	P	C
		3	0	0	3

Preamble

To impart the knowledge of water resources and national water policy of India and to familiarise the irrigation management practices of the past, present and future.

UNIT 1 STATISTICS AND PROBABILITY IN HYDROLOGY 9

Probability and probability distributions – basic concepts, Properties of random variables _Some discrete distribution and applications in earth sciences, Normal distribution and other continuous distributions, Parameter estimation theory and methods, Time series analysis.

UNIT 2 HYDROGRAPH THEORY 9

Components of hydrograph, base flow separation, direct runoff hydrograph, Unit hydrograph theory, derivation of unit hydrograph, S-hydrograph and instantaneous unit hydrograph, Derivation of unit hydrograph for ungauged catchments, conceptual models - Time Area Diagram, Clark model, Nash model, Dooge models, synthetic unit hydrograph and its derivation.

UNIT 3 FLOOD ESTIMATION 9

Peak discharge estimation procedures, deterministic and probabilistic approaches, enveloping curve, rational method, SCS and unit hydrograph methods, Design flood, return period, flood frequency analysis, probabilistic and statistical concepts, and time series analysis, Gumbel‘s and log Pearson Type III methods.

UNIT 4 FLOOD ROUTING 9

Concepts of flow routing, hydraulic and hydrologic routing, Reservoir routing, Channel routing, Muskingum and Muskingum-Cunge methods of channel routing and flood forecasting.

UNIT 5 MODELLING APPROACHES IN HYDROLOGY 9

Hydrological Model: Mathematical models and types, watershed models and types. PRMS (Precipitation Runoff Modeling System) model, Hydrologic Modeling System (HEC-HMS), MODFLOW, ARIMA.

TOTAL : 45

TEXT BOOKS:

1. Chow, V.T, Maidment, D.R., and Mays, L.W., “Applied Hydrology”, Tata McGraw Hill, 2010
2. McCuen, R.H., “Hydrologic Analysis and Design”, Prentice Hall Inc. N York, 2005

REFERENCES:

1. Patra, K.C, “Hydrology and Water Resources Engineering”, Narosa Publications, 2008.
2. Viessman, W., Lewis, G.L. and Knapp, J.W. “Introduction to Hydrology”, Harper & Row Publications, 2015

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105201/, Water supply engineering, Prof. Manoj Kumar Tiwari, IIT Kharagpur.
2. https://archive.nptel.ac.in/courses/105/105/105105110/, Water Resources Engineering, Dr.Dhrubajyoti Sen, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Gain knowledge about fundamentals of hydrology and precipitation types and characteristics.

CO2 Analyze infiltration process, evaporation process and Calculate runoff using various measurements.

CO3 Analyze different components of hydrograph, derivation of various types of hydrograph using base hydrograph and formulate various models

CO4 Estimate flood using various approaches, flood frequency analysis and methods and analyze flood routing.
CO5 Determine the hydrologic modeling and watershed modeling.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3						3					3	2	2
CO2	3	2				2	1	2			2	2	2	1
CO3	3	3	2	1	1		2				1	1	2	
CO4	2	2		2	2	1	2	1					1	
CO5	2	2	1	2	2							1	1	

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

22CEE14 **GROUNDWATER ENGINEERING**

L	T	P	C
3	0	0	3

Preamble

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 1 HYDROGEOLOGICAL PARAMETERS 9

Introduction – Water bearing Properties of Rock – Type of aquifers - Aquifer properties – permeability, specific yield, transmissivity and storage coefficient – Methods of Estimation – GEC norms - Steady state flow - Darcy's Law - Groundwater Velocity –- Dupuit Forchheimer assumption – Steady Radial Flow into a Well.

UNIT 2 WELL HYDRAULICS 9

Unsteady state flow - Theis method - Jacob method – Chow's method – Law of Times – Theis Recovery – Bailer method – Slug method - tests - Image well theory – Partial penetrations of wells – Well losses – Specific Capacity and Safe yield - Collector well and Infiltration gallery.

UNIT 3 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 4 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 5 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

TEXT BOOKS:

1. Raghunath H.M., "Ground Water Hydrology", New Age International (P) Limited, New Delhi, 2010
2. Todd D.K., "Ground Water Hydrology", John Wiley and Sons, New York, 2000.

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.

eRESOURCES:

1. http://nptel.ac.in/courses/105105042/16, Groundwater Hydrology,Dr. Anirban Dhar Dr. V.R. Desai, IIT Kharagpur.
2. http://nptel.ac.in/courses/105101002, Advanced Hydrology- Dr. Ashu Jain , IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the importance of artificial recharge and groundwater quality concepts.
CO2 Discuss the design and practical problems of groundwater aquifer.
CO3 Discuss the unsteady flow equation by various methods and obtain the solutions.
CO4 Identify the salinity problems to improve the groundwater quality.
CO5 Explain the basics of groundwater and hydraulics of sub surface flows.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1		1	1						1	2	1
CO2	3	3	1		2	2						1	2	1
CO3	2	2	1		3	2	1						1	
CO4	2	2	2		3	3	2					1	2	
CO5	2	2	2		3	3	2					1	2	

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

22CEE15 **WATERSHED CONSERVATION AND MANAGEMENT**

L	T	P	C
3	0	0	3

Preamble

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 1 WATERSHED CONCEPTS **9**

Watershed - Definition, need and elements - Principles - Influencing factors: Geology - Soil - Morphological characteristics - Toposheet - Delineation - Codification - Prioritization – Watershed atlas.

UNIT 2 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 3 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 4 GIS FOR WATERSHED MANAGEMENT **9**

Applications of Remote Sensing and Geographical Information System - Role of Decision Support System – Conceptual Models and Case Studies.

UNIT 5 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

TEXT BOOKS:

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.

eRESOURCES:

1. https://nptel.ac.in/courses/105101010 - Watershed Management, Dr.T.I.Eldho, IIT Bombay
2. http://ecoursesonline.iasri.res.in/course/view.php?id=542 - Watershed Planning and Management, Dr. V. R. Desai and Dr.A.Mishra ,IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Recognize and Interpret the morphological features of a watershed.
CO2	State, design and sketch the soil conservation structures.
CO3	Describe the micro catchment and apply the concepts to design the small water harvesting structures.
CO4	Illustrate the application of modern tools and technology in the management of watershed.
CO5	Classify the management activities and to develop an integrated watershed development plan.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3			1	1		1		3	2		2	2	
CO2	3	2	2	2	1	2	2	1	1			2	2	1
CO3	3	2	2	2	1	2	2	1	1			1	2	1
CO4									3			1	1	
CO5		2	2	2	3	2	2	3	3	3		2	2	

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

22CEE16 **WATER QUALITY AND MANAGEMENT**

L	T	P	C
3	0	0	3

Preamble

To understand the fundamentals of mathematical models and their importance in water quality modelling, and to impart the skills to use water quality modelling software for surface and groundwater quality modelling.

UNIT 1 MODELLING INSIGHTS **9**

Engineers and Mathematical models -Water quality models - historical development – different types of models - Steps in model development - Importance of model building- Calibration and verification of models- Finite element, finite difference and finite volume methods.

UNIT 2 POLLUTION TRANSPORT **9**

Transport phenomena - Advection, diffusion, dispersion - contamination transport in surface and subsurface water - Simple transport models - Steady state and time variable solutions - Conservation of mass, momentum and energy balance, governing equation for contaminant fate and transport.

UNIT 3 SURFACE WATER QUALITY MODELLING **9**

Water quality modeling of streams, lakes and estuaries - Water quality - Model sensitivity – Assessing model performance; Models for dissolved oxygen, pathogens and COD, BOD - Streeter Phelp's model for point and distributed sources - Modified streeter Phelp's equations.

UNIT 4 GROUNDWATER QUALITY MODELLING **9**

Groundwater flow and mass transport of solutes - Groundwater quality modelling using numerical methods - Parameters, Input-output stresses, Initial and Boundary conditions - Degradation of organic compounds in subsurface - Model calibration : steady state and unsteady state - Sensitivity analysis - Model validation - Seawater intrusion - Basic concepts and modelling.

UNIT 5 WATER QUALITY MANAGEMENT MODELS **9**

Exposure to surface water and groundwater quality modelling software's - MIKE 21, WASP, QUAL2E and MODFLOW - demonstration - case studies – Modeling multilayer groundwater flow system - Artificial recharge feasibility through modeling - Groundwater contamination, restoration and management.

TOTAL : 45

TEXT BOOKS:

1. Steven C. Chapra, "Surface Water Quality Modelling", Tata McGraw-Hill Companies, Inc., New Delhi 2018.
2. Satya Narayana Murthy Challa, "Water Resources Engineering: Principles and Practice", New Age International Publishers, New Delhi, 2020.

REFERENCES:

1. Mollinga.P. etal "Integrated Water Resources Management", Water in South Asia Volume I, Sage Publications, 2006.
2. Chaturvedi, M.C., "Water Resources Systems Planning and Management", Tata McGraw Hill, New Delhi, 1997.

eRESOURCES:

1. https://onlinecourses.nptel.ac.in/noc23_ce12/preview - Water and Wastewater Treatment, Prof.Bhanu Prakash Vellanki,IIT Roorkee.
2. https://nptel.ac.in/courses/105104102 - Raw Water Source and Quality, Dr.P.Bose, IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Define the economic aspects and analysis of water resources systems for comprehensive and integrated planning of a water resources project.
CO2	Apply the concept of linear programming for optimisation of water resources problems.
CO3	Explain the concept of dynamic programming and apply in water resource system.
CO4	Develop the simulation model based on deterministic and stochastic simulation for reservoir operating policy.
CO5	Apply advance optimisation techniques like goal programming, heuristic algorithm in the field of water resources planning and management.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3									2		3	2	
CO2	3	2				3			3		2	2	1	
CO3	3	2	2		2	2			2		2	2	1	
CO4	3	2	3		3	3	2		2		2	1	2	1
CO5	3	3	3	3	3	3		1	3		2	1	2	2

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

22CEE17 **URBAN WATER INFRASTRUCTURE**

L	T	P	C
3	0	0	3

Preamble

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 1 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 2 URBAN HYDROLOGY **9**

The urban hydrological cycle – Function – Human induced changes in urban watershed – Hydrological calculation – Runoff – Infiltration – hydrograph.

UNIT 3 URBAN STORMWATER 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 4 WATER CONSERVATION AND REUSE **9**

Trends in supply and demand – Indoor conservation – Outdoor conservation – Water reuse – Rainwater harvesting – Public education.

UNIT 5 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

TEXT BOOKS:

1. Anand Chiplunkar, Seetharam K and Cheon Kheong, “Good Practices in urban water management” ADB, National University Singapore 2012.
2. Mohammad Karamouz, Ali Moridi, Sara Nazif, “Urban Water Engineering and Management”, 1st Edition, CRC Press 2010.

REFERENCES:

1. Larry W. Mays, “Urban Stormwater Management Tools”, McGraw-Hill Companies 2004.
2. HormozPazwash, "Urban storm water management", CRC Press 2016.

eRESOURCES:

1. https://onlinecourses.nptel.ac.in/noc22_ar16/preview, “Urban Utilities Planning:Water Supply, Sanitation and Drainage”, Prof.Debapratim Pandit, IIT Kharagpur.
2. https://nptel.ac.in/courses/105106115, “Infrastructure Planning and Management”, Prof. A. Veeraragavan, Dr. Ashwin Mahalingam, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain various functional elements of urban ecosystem.
CO2 Calculate urban runoff, compute supply and demand of water, draw hydrograph
CO3 Compare advantages of Newer techniques of green infrastructure and illustrate benefits
CO4 Assess the Operation and Maintenance needs of urban water systems
CO5 Propose best management practices for Indian context

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1				2	3	1	3			3	1
CO2	3	3	3					3	1	3			3	1
CO3	3	3	2		2			3		3			3	
CO4	2	2	2	3		2	2	3		3	2	2	2	2
CO5	2	1	1	3		2	2	3	2	3	2	2	2	1

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

22CEE21 **FINITE ELEMENT METHOD**

L	T	P	C
3	0	0	3

Preamble

This course gives an idea on the mathematical concepts on one, two and three-dimensional problems.

UNIT 1 INTRODUCTION **9**

Mathematical models of physical systems–Analytical Solutions-Variational methods of approximation–Ritz method–Weighted residual method: Galerkin, Least squares and Collocation methods. Piecewise approximation–Finite element method –Basic features-steps of FEM–Numerical solution of finite element equations–Gauss elimination method.

UNIT 2 ONE DIMENSIONAL PROBLEMS **9**

One dimensional element–Interpolation and Shape Functions-Principle of minimum potential energy-Derivation of element equations–Connectivity of elements–Imposition of boundary conditions–Solution of equations-Application to Bars and Plane Trusses.

UNIT 3 TWO AND THREE-DIMENSIONAL PROBLEMS **9**

Constant Strain Triangle - Linear Strain Triangle - Rectangular Elements - Numerical Evaluation of Element Stiffness - Computation of Stresses, Geometric Nonlinearity and Static Condensation – Axi-symmetric Element - Finite Element Formulation of Axi-symmetric Element - Finite Element Formulation for 3 Dimensional Elements

UNIT 4 ISOPARAMETRIC FORMULATION **9**

Natural co-ordinate systems – Iso parametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems – Matrix solution techniques – Solutions Techniques to Dynamic problems.

UNIT 5 APPLICATIONS OF FEM **9**

Stiffness of Truss Members - Analysis of Truss - Stiffness of Beam Members - Finite Element Analysis of Continuous Beam - Plane Frame Analysis - Analysis of Grids- Fluid flow analysis - vibration analysis - Eigen Values and Eigen Vectors used for fluid analysis in pipes - Elastic Stability analysis - Plate bending problem- Introduction to Analysis Software.

TOTAL : 45

TEXT BOOKS:

1. Chandrupatla R.T. & Belegundu A.D., "Introduction to Finite Elements in Engineering", 4thEdition, Pearson Education, 2012.
2. Rao, S.S., “The Finite Element Method in Engineering”, 6th Edition, ButterworthHeinemann,2018.

REFERENCES:

1. Reddy J.N., "An Introduction to Finite Element Method", 3rd Edition, Tata McGraw Hill, New Delhi, 2005.
2. Seshu P., "Text Book of Finite Element Analysis", 4thEdition, Prentice Hall of India, New Delhi, 2007.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105041/ - “Introduction to Finite Element Analysis.
2. https://archive.nptel.ac.in/courses/105/106/105106051/ - “Finite Element Analysis”, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 apply the basic concept of FEM
CO2 solve the one-dimensional problems
CO3 analyse one and two- and three-dimensional problems
CO4 solve dynamic problems
CO5 analyse beam and truss by using FEM

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1		3							1	3	3
CO2	3	3	2		3							1	3	3
CO3	3	3	2		3							1	3	3
CO4	3	3	2		3							1	3	3
CO5	3	2	1		3							1	3	3

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

22CEE22 **BRIDGE ENGINEERING**

L	T	P	C
3	0	0	3

Preamble

The primary objective of this course is to study the loads and forces on bridges, It also imparts the knowledge on design of several types of bridges and check the stability requirements on bridge.

UNIT 1 INVESTIGATIONS AND PLANNING **9**

Components of a bridge structure – inspection and site investigations for a bridge – Determination of linear waterway, design discharge and scour depth – Economical span – Types and choice of bridges. BIS specifications for road bridges and railway bridges – general design considerations.

UNIT 2 CULVERTS **9**

General – design principles, considerations and criteria of pipe culverts, slab culvert, box culvert, and causeways – Design of R.C slab culvert.

UNIT 3 SLAB BRIDGE AND T- BEAM BRIDGES **9**

Slab Bridge - Distribution of concentrated loads by IRC and Pigeaud's Method – Design principles of T-beam bridge - main girder & cross girders – Load distribution by Courbon's Method.

UNIT 4 SUBSTRUCTURES AND BEARINGS **9**

Definition – pier and abutment caps – materials for piers and abutment - piers – forces due to wave action and collision – Design procedure for pier and abutment. Bearings – types of bearing – functions.

UNIT 5 BRIDGE FOUNDATION **9**

General Aspects - Types of foundation - Pile foundations - Well foundation -Component of well foundation - Design procedure for Pile and well foundation - Caisson foundations.

TOTAL : 45

TEXT BOOKS:

1. D.Johnson victor, "Essentials of Bridge Engineering", 6th Edition, Oxford and IBH Publishing Co., New Delhi, 2019
2. Krishna Raju N, "Design of bridges", 5th Edition, Oxford and IBH Publishing Co., New Delhi, 2019.

REFERENCES:

1. Ponnuswamy.S, "Bridge Engineering", 3rd edition, Tata McGraw Hill Publishing Co., Ltd, New Delhi, 2017.
2. Jagadeesh T.R , Jayaram M.A , "Design of bridge structures", PHI Learning Private limited, 2010.
3. IRC 5-2015 (standard specifications and code of practice for road bridges), IRC 6-2014 (standard specifications and code of practice for road bridges) and IRC 112-2011 (code of practice for concrete road bridges).

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105216/ - "Bridge Engineering", Prof. Piyali Sengupta, IIT Dhanbad.
2. https://www.udemy.com/course/fundamentals-of-bridge-designyour-way-to-be-bridge-designer/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Describe components and types of bridges and understand economical span.
CO2 Design of reinforced concrete slab culvert.
CO3 Design of slab bridge by Pigeaud‘s method load distribution
CO4 Design the sub structures
CO5 Apply the principles in the design of bridge foundations.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2		-		-						2	2
CO2	3	3	3		1		1						2	2
CO3	3	3	3		1		1						2	2
CO4	2	2	2		1		1						2	2
CO5	2	2	2		1		1						2	2

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

22CEE23	STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	L	T	P	C
		3	0	0	3

Preamble

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

UNIT 1 INTRODUCTION TO DYNAMICS 9

Dynamics - Degree of freedom – Free and forced vibration - Idealization of structure as Single Degree of Freedom (SDOF) and Multi degree of freedom (MDOF) system – D'Alemberts Principles - Formulation of equation of motion for SDOF system and MDOF system –- Evaluation of natural frequencies and modes - Effect of damping.

UNIT 2 SEISMOLOGY 9

Elements of Engineering Seismology – Seismic hazard - Earthquake phenomenon – Seismotectonics – Seismic Instrumentation – Characteristics of Strong Earthquake motion – Estimation of Earthquake Parameters – Soil Structure Interaction – Liquefaction of soil - Seismic zone map – Response spectra.

UNIT 3 EARTHQUAKE EFFECTS ON STRUCTURES 9

Inertia force on structures – load transfer path – Effect of architectural features on behavior of structures – Hysteretic Behaviour of RCC, steel and prestressed concrete - Pinching Effect – Bouchinger Effects - Energy dissipation - P-delta effect - storey drift - Behavior of brick masonry, stone masonry and reinforced concrete structures under past earthquakes – typical failures - Causes of damage –- Lessons learnt from past earthquakes.

UNIT 4 EARTHQUAKE LOAD ANALYSIS 9

Design spectra – Codal provision – Different methods of earthquake analysis –- Analysis of structure by Equivalent static method – Analysis of structure by Response spectrum method – Introduction to time-history method of analysis.

UNIT 5 EARTHQUAKE RESISTANT DESIGN 9

Philosophy of earthquake resistant design - Planning considerations and Architectural concepts - Design and detailing as per codal provisions - Design and detailing of typical flexural member and column member, Ductile detailing of beam-column joints and footing – Concept and principle of shear wall - Introduction to performance based seismic design - Seismic isolation principles and methods.

TOTAL : 45

TEXT BOOKS:

1. Mario Paz, Structural Dynamics – Theory and Computations, Fifth Edition 2nd printing, CBS publishers, 2006.

2. Agarwal.P and Shrikhande.M. Earthquake Resistant Design of Structures, Prentice Hall of India Pvt. Ltd. 2011.

REFERENCES:

1. Clough.R.W, and Penzien.J, Dynamics of Structures, Second Edition, McGraw Hill International Edition, 1995.

2. Anil K Chopra, Dynamics of structures – Theory and applications to Earthquake Engineering, Prentice Hall Inc., 2007.

eRESOURCES:

1. https://onlinelibrary.wiley.com/journal/10969845.
2. https://www.sciencedirect.com/book/9781845695187/structural-dynamics-of-earthquake-engineering.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Develop the equations of motion for SDOF and MDOF system and to evaluate the natural frequencies and mode shapes.
CO2	Explain the elements of engineering seismology, characteristics of earthquake and seismic instrumentation.
CO3	Explain the behavior of various types of structures under earthquake
CO4	Determine the forces in a structure due to earthquake
CO5	Design earthquake resistant building structures

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1		2							1	2	2
CO2	3	2	1		2							1	2	2
CO3	3	2	1		2							1	2	2
CO4	3	2	1		2							1	2	2
CO5	3	2	1		2							1	2	2

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

22CEE24	ADVANCED DESIGN OF RC STRUCTURES	L	T	P	C
		3	0	0	3

Preamble

This course deals with the designing of RCC structure with the latest code of practice as per the Indian Standard. It inculcates basic knowledge on designing RCC structures like Retaining walls, high rise chimneys and Earthquake Resistant structures.

UNIT 1 RETAINING WALL **9**

Earth Retaining structures - Retaining walls- types - cantilever and counterfort - design - drainage and other construction details - Horizontal Backfill with Surcharge - Design and Drawing.

UNIT 2 LIQUID RETAINING STRUCTURES **9**

Water tanks - types - square, rectangular, circular - Design of underground and elevated tanks - design of staging - spherical & conical roof for circular tanks.

UNIT 3 SPECIAL STRUCTURAL ELEMENTS **9**

Design and Drawing - Deep beams, Shear walls, waffle slabs, corbels. Design and Drawing - flat slabs – direct design method.

UNIT 4 BUNKERS AND SILOS **9**

Design of square bunker - Side Walls - Hopper bottom - Top and bottom edge beams - Design of cylindrical silo - Wall portion - Design of conical hopper - Ring beam at junction.

UNIT 5 EARTHQUAKE RESISTANT STRUCTURES DETAILING **9**

Earthquake forces - Bureau of Indian Standards for Earthquake resistant design - earthquake magnitude and intensity - basic seismic coefficients and seismic zone factors - design forces - design factors - Analysis of structures- choice of method for multistoried buildings. Ductile detailing of frames for seismic forces - general principles.

TOTAL : 45

TEXT BOOKS:

1. Varghese P.C.," Advanced Reinforced Concrete Design", Prentice Hall of India, New Delhi, 2005.
2. Krishna Raju N, "Advanced Reinforced Concrete Design", CBS Publishers, New Delhi, 2010.

REFERENCES:

1. Winter and Nilson A H," Design of Concrete Structures", Tata McGraw Hill Publishing Company Ltd., New Delhi, 2005
2. IS 3370 Part 1 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice–General Requirements, Code of Practice, Bureau of Indian Standards, New Delhi.
3. IS 3370 Part 2 (2009) Indian Standard Concrete Structures for Storage of Liquids-Code of Practice-Reinforced Concrete Structures, Code of Practice, Bureau of Indian Standards, New Delhi.
4. IS 3370–Part 4 (2008) Indian Standard Code of Practice for Concrete Structures for The Storage of Liquids-Design Tables, Code of Practice, Bureau of Indian Standards, New Delhi.
5. IS456:2000, Code of practice for Plain and Reinforced Concrete, Bureau of Indian Standards, New Delhi, 2000.

6. SP16, IS456:1978 “Design Aids for Reinforced Concrete to Bureau of Indian Standards, New Delhi, 1999.

eRESOURCES:

1. http://nptel.ac.in/courses/105101004/, “Introduction to Earthquake Engineering”, Dr.R.S.Jangid, IIT Bombay.
2. https://archive.nptel.ac.in/courses/105/105/105105105/, “Design of Reinforced Concrete Structures”, Prof. NirjharDhang, IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Design counter fort and cantilever retaining walls.
CO2 Design underground and overhead R.C water tanks
CO3 Design various structural members according to codal provisions.
CO4 Design Bunkers and silos.
CO5 Explain the detailing for earthquake resistant structures

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3						1			1	3	
CO2	3	1	3						1			1	3	
CO3	3	1	3						1			1	3	
CO4	3	1	3						1			1	3	
CO5	3	1	3	1					1			1	3	

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

22CEE25 **PREFABRICATED STRUCTURES**

L	T	P	C
3	0	0	3

Preamble

To impart the knowledge among the students to understand the principles, components and design of various prefabricated structural elements.

UNIT 1 DESIGN PRINCIPLES **9**

General principles of fabrication – need for prefabrication – general principles of prefabrication – comparison with monolithic construction, types of prefabrication, site and plant prefabrication, economy of prefabrication, modular coordination, standardization – materials – modular coordination – systems – production – transportation – erection.

UNIT 2 PREFABRICATED COMPONENTS **9**

Planning for components of prefabricated structures, Behaviour of structural components – Large panel constructions – Construction of roof and floor slabs – Wall panels – Columns – Shear walls, disuniting of structures.

UNIT 3 PREFABRICATED JOINTS **9**

Disuniting of structures- Design of cross section based on efficiency of material used – Joint flexibility - joint deformation - Joints – joints for different structural connections, effective sealing of joints for water proofing, provisions for non-structural fastenings, expansion joints in precast construction

UNIT 4 PRODUCTION AND FABRICATION **9**

Production technology – Choice of production setup, manufacturing methods, stationary and mobile production, planning of production setup, storage of precast elements, dimensional tolerances, acceleration of concrete hardening. Hoisting Technology – equipment for hoisting and erection, techniques for erection of different types of members like beams, slabs, wall panels and columns, vacuum lifting pads.

UNIT 5 DESIGN FOR ABNORMAL LOADS **9**

Progressive collapse - Importance of avoidance of progressive collapse - Code provisions - Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc.,.

TOTAL : 45

TEXT BOOKS:

1. Lewitt,M. “Precast Concrete Materials, Manufacture, Properties And Usage”, CRC Press, 2019
2. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift. “Precast Concrete Structures”, Ernst & Sohn, Berlin, 2019.

REFERENCES:

1. Kim S. Elliott, "Precast Concrete Structures", 2nd Edition, CRC Press, United States, 2016.
2. “Handbook on Precast Concrete Buildings”, Indian Concrete Institute, 2016.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/124/105/124105013/ “Building materials and composites”, Prof.Sumana Gupta, IIT Kharagpur.
2. https://nptel.ac.in/courses/105106117 “Introduction of Pre-stressed Concrete Structures”, Prof.Devadad Menon, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the general principles of fabrication.
CO2 Identify the behavior of the components of prefabricated structures.
CO3 Acquire knowledge about design of cross section, joint flexibility.
CO4 Illustrate the production and fabrication process.
CO5 Demonstrate the behavior of structures due to abnormal loads.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2		1							1	3	2
CO2	2	1	1								2	1	3	2
CO3	3	2	1		1					1		1	3	2
CO4	3	2	1									1	3	2
CO5	3	2	2									1	3	2

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

22CEE26 **PRESTRESSED CONCRETE STRUCTURES**

L	T	P	C
3	0	0	3

Preamble

To introduce knowledge on the basic principles and design philosophy of prestress concrete structures. Analysis and design of prestress concrete elements such as beams, tanks and pipes. To impart knowledge in analysis and design of anchorage zone.

UNIT 1 THEORY AND BEHAVIOR **9**

Basic concepts – Pre tensioning - Post tensioning - Advantages and Disadvantages - systems and methods of prestressing - Materials - Characteristics of concrete - Characteristics of high tensile steel. Analysis of sections: Calculating fibre stresses for various sections (Rectangle, I, T) of simply supported beam due to prestressing force, dead and live load - Stress concept - Strength concept - Load balancing concept.

UNIT 2 LOSSES OF PRESTRESS AND DEFLECTION **9**

Losses of prestress: Causes for losses in prestressed – calculation of losses - losses due to elastic shortening, creep, shrinkage, relaxation losses, friction and anchorage losses. Factors influencing deflections – Short term deflections of uncracked members – Prediction of long term deflections due to creep and shrinkage – Check for serviceability limit states.

UNIT 3 DESIGN CONCEPTS **9**

Flexural strength - Basic concepts in selection of cross section for bending - Check for flexural and shear capacity based on I.S.1343 Code (Rectangle, I, T). 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 4 COMPOSITE BEAMS AND CONTINUOUS BEAMS **9**

Analysis 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 5 MISCELLANEOUS **9**

Design of circular water tanks and pipes – Design principles of PT slab - Partial prestressing: Definition, Methods of achieving partial prestressing, merits and demerits of partial prestressing.

TOTAL : 45

TEXT BOOKS:

1. Krishna Raju N., "Prestressed concrete", 5th Edition, Tata McGraw Hill Company, New Delhi, 2012.
2. Rajagopalan.N, "Prestressed Concrete", Narosa Publishing House, 2002.

REFERENCES:

1. Pandit.G.S. and Gupta.S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.
2. Dayaratnam.P., "Prestressed Concrete Structures", Oxford and IBH, 2013.
3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", Third Edition, Wiley India Pvt. Ltd., New Delhi, 2013.
4. IS1343:2012, Code of Practice for Prestressed Concrete, Bureau of Indian Standards, New Delhi, 2012.

5. IS 3370:2008 (Part 3) Indian standard Code of practice for concrete structures for the storage of liquids- Prestressed concrete structures, code of practice, bureau of Indian standards, New Delhi, 2008.
6. IS 3370:2008 (Part 4) Indian standard Code of practice for concrete structures for the storage of liquids - Design tables, code of practice, bureau of Indian standards, New Delhi, 2008.

eRESOURCES:

1. https://nptel.ac.in/courses/105/106/105106117/ "Prestressed Concrete Structures", Dr. Amlan, K Sengupta and Prof. Devdas Menon, Department of Civil Engineering, Indian Institute of Technology, Madras.
2. https://www.udemy.com/course/analysis-and-design-of-prestressed-concrete-part-1/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Analysis of prestressed sections.
CO2 Calculate loss of prestress and deflection of sections.
CO3 Design anchorage zone for prestressed members.
CO4 Analysis composite and continuous beams.
CO5 Design tanks, pipes and poles.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3											2	
CO2	3	3											2	
CO3	3	3	2										3	1
CO4	3	3	1										2	
CO5	3	3	3										3	1

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

22CEE27 **ADVANCED STEEL STRUCTURES**

L	T	P	C
3	0	0	3

Preamble

To study the behaviour of members and connections, analysis and design of Industrial buildings, roofs and towers. Study the design of cold formed steel members and plastic analysis of structures.

UNIT 1 INDUSTRIAL BUILDINGS **9**

Roof trusses – Roof and side coverings – design of loads - design of purlins and elements of truss and end bearing – gable column, gable rafter, side rails, gable wind girder and end bracings of industrial buildings.

UNIT 2 CONNECTIONS **9**

Types of connections – Welded and Bolted – Throat and Root Stresses in Fillet Welds – Seated Connections – Unstiffened and Stiffened seated Connections – Moment Resistant Connections – Clip angle Connections – Split beam Connections – Framed Connections HSFG bolted connections.

UNIT 3 PLASTIC ANALYSIS AND DESIGN **9**

Introduction – Shape factors – Static, Kinematic and uniqueness theorems – Combined mechanisms – Analysis and design of continuous beams and single bay single storey portal frames – Moment redistribution – Effect of axial force and shear force on plastic moment.

UNIT 4 TOWERS **9**

Basic structural configurations - free standing and guyed towers - wind loads - foundation design - design criteria for different configurations and transmission line towers.

UNIT 5 LIGHT GAUGE STEEL STRUCTURES **9**

Types of cross sections - local buckling and lateral buckling - concepts of elastic width – design of compression and tension members, beams, deflection of beams and design of beam webs.

TOTAL : 45

TEXT BOOKS:

1. S K Duggal., “Limit State design of steel Structures”, Mc. Graw Hill Education (India) Private Limited, New Delhi, 2019.
2. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2016.

REFERENCES:

1. Gaylord E.H, Gaylord N.C. and Stallmeyer, J.E, Design of Steel Structures, 3rd edition, McGraw-Hill Publications, 1992.
2. IS 875:2015(Part 3), Code of practice for design loads for buildings and structures (Third revision), Bureau of Indian Standards, New Delhi, 2015.
3. IS: 811-1987 (Reaffirmed 2004), Specification for Cold Formed Light Gauge Structural Steel Sections, Bureau of Indian Standards, New Delhi, 1989.
4. IS 800:2007, General construction in steel-code of practice, (Third revision), Bureau of Indian Standards, New Delhi, 2007.
5. SP:6-5, Hand book for Structural Engineers, Cold-Formed Light gauge steel structures, Bureau of Indian Standards, New Delhi, 1980.
6. IS: 801-1975 (Reaffirmed 2021), Code of practice for use of cold-formed light-gauge steel structural members in general building construction, Bureau of Indian Standards, New Delhi, 1976.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/114/106/114106047/ "Advanced design of steel structures", Prof. Srinivasan Chandrasekaran, Indian Institute of Technology, Madras.
2. https://www.steel-insdag.org/teaching-resource-materials "Teaching Resources for Structural Steel Design – Volume I & II", INSDAG, Kolkatta.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Design of roof truss and its components in industrial structures.
CO2 Design bolted and welded connections.
CO3 Plastic analysis of the structures.
CO4 Design of towers.
CO5 Design of light gauge steel structures.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	1					1				3	3
CO2	3	3	3	1					1				3	3
CO3	3	3	1						1				2	1
CO4	3	3	3	1					1				3	3
CO5	3	3	3	1					1				3	3

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

22CEE31 **SOLID & HAZARDOUS WASTE MANAGEMENT**

L	T	P	C
3	0	0	3

Preamble

The objectives of this course elaborates to apply basic understanding of sources , types, collection, transport, processing techniques and disposal of solid and hazardous waste.

UNIT 1 MUNICIPAL SOLID WASTE MANAGEMENT **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 - Integrated management - Public awareness; Role of NGO's.

UNIT 2 ON-SITE STORAGE AND PROCESSING **9**

On-site storage methods - Purpose and economic benefits of onsite processing - Effect of storage - Desirable characteristics of containers - Materials used for containers - Segregation of solid wastes - Public health and economic aspects of open storage - Source reduction of waste - Reduction, Reuse and Recycling.

UNIT 3 COLLECTION AND TRANSPORT **9**

Methods of residential and commercial waste collection - Collection vehicles - Manpower - Collection routes -Transfer stations - Selection of location, operation and maintenance - Physical processing techniques and equipment - Types and factors affecting composting process - Biomethanation.

UNIT 4 HAZARDOUS WASTE MANAGEMENT **9**

Definition of hazardous wastes - Sources and characteristics - Hazardous waste regulations - Minimization of hazardous waste - Handling and storage of hazardous waste - Physical and chemical treatment of hazardous waste - E waste - Solidification - Incineration.

UNIT 5 DISPOSAL **9**

Land disposal of solid waste - Sanitary landfills - Site selection, design and operation of sanitary landfills - Landfill liners - Landfill bioreactor - Leachate collection and treatment.

TOTAL : 45

TEXT BOOKS:

1. Ramachandra.T.V., "Management of Municipal Solid Waste", Capital Publishing Company, New Delhi, 2006.
2. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil, "Integrated Solid Waste Management, Mc-Graw Hill India, First edition, 2015.

REFERENCES:

1. Bhide. A.D and Sundaresan. B.B., "Solid Waste Management Collection, Processing and Disposal", 2001.
2. Rao M.N, Razia Sultana, Sri Harsha Kota, "Solid and hazardous waste management – Science and Engineering" , Butterworth-Heinemann, 2016
3. Government of India, Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, New Delhi, 2000.

eRESOURCES:

1. http://nptel.ac.in/courses/120108005/, "Municipal Solid Waste Management", Prof. T.V. Ramachandra, IISc Bangalore.
2. https://nptel.ac.in/courses/105103205/, "Municipal Solid Waste Management", Prof. Ajay Kalamdhad, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Discuss the sources, types and characteristics of municipal solid waste management.
CO2 Plan for waste minimization techniques of municipal solid waste.
CO3 Select suitable method of collection and conveyance of municipal solid waste.
CO4 Explain the possible treatment method of hazardous waste.
CO5 Identify and explain proper disposal method of solid waste.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	1			2	2	1		1				2
CO2	2	1	2			2	2	1		1				2
CO3	1	2	1			1	2	1		2				2
CO4	1	2	1			1	1	1		2				2
CO5	1	2	1			1	1	1		2				2

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

22CEE32 **MUNICIPAL SOLID WASTE MANAGEMENT**

L	T	P	C
3	0	0	3

Preamble

The objectives of this course elaborate to apply basic understanding of sources, types, collection, transport, processing and disposal of municipal solid waste.

UNIT 1 SOLID WASTE **9**

Definitions and perspectives - Types of solid wastes - Sources of solid wastes - Properties of solid wastes - Physical and chemical characteristics of municipal solid waste - Functional elements of solid waste management - Municipal solid waste management and handling rules - Role of non-government organization - Examples - Methods of public awareness.

UNIT 2 ENGINEERING SYSTEMS FOR SOLID WASTE MANAGEMENT **9**

Solid waste generation - Methods of generation - Factors affecting generation - On-site storage - Effects of storage - Collection of solid wastes - Factors affecting - Methods of residential and commercial waste collection system - Transfer and transport - Transfer station - Integrated solid waste management concepts.

UNIT 3 ENGINEERING SYSTEMS FOR RESOURCE AND ENERGY RECOVERY **9**

Processing techniques - RRR approach, materials - recovery systems - Recovery of biological conversion products; Recovery of thermal conversion products - Recovery of energy from conversion products - Materials and energy recovery systems.

UNIT 4 PROCESSING OF WASTES **9**

Objectives of waste processing - Types of physical processing techniques - Equipment - Methods of composting - Factors affecting composting - Uses of composting - Biomethanation - Functions - Benefits - Comparison of incineration and pyrolysis process.

UNIT 5 ENGINEERING DISPOSAL OF SOLID WASTE **9**

Sanitary landfills - Site selection, design and operation of sanitary landfills - Methods of sanitary landfill - Advantages of sanitary landfill - Management of leachate and landfill gas - Landfill bioreactor - Dumpsite rehabilitation.

TOTAL : 45

TEXT BOOKS:

1. Tchobanoglous. G, Theisen. H. M and Eliassen. R., "Solid Wastes: Engineering Principles and Management Issues", McGraw Hill, New York, 2016.

2. Vesilind. P.A, Worrell .W and Reinhart. D., Brooks - Cole, "Solid Waste Engineering", Thomson Learning Inc., 2010, 2nd Edition.

REFERENCES:

1. William A. Worrell, P. Aarne Vesilind, Christian Ludwig, "Solid Waste Engineering – A Global perspective", 3rd Edition, Cengage Learning, 2017.

2. CPHEEO, "Manual on Municipal Solid waste management",Vol I, II and III, Central Public Health and Environmental Engineering Organisation , Government of India, New Delhi, 2016.

3. Central Public Health and Environmental Engineering Organisation (CPHEEO),Municipal Solid Waste Management Manual,Ministry of Urban Development,2016

eRESOURCES:

1. http://nptel.ac.in/courses/105106056/, "Solid and Hazardous Waste Management", Dr. Indumathi Nambi, IIT Madras.
2. http://nptel.ac.in/courses/120108005/, "Municipal Solid Waste Management", Prof. T.V. Ramachandra, IISc Bangalore.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify various types of solid wastes and their sources.
CO2 Select suitable method of collection and conveyance of municipal solid waste.
CO3 Analyze the activities associated with the management of solid waste.
CO4 Explain the offsite processing techniques and equipment of solid waste.
CO5 Design a sanitary landfill for disposal of solid waste.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	2			-	2							2
CO2	2	3	2			1	2							2
CO3	2	2	2			1	2							2
CO4	2	2	2			2	2						1	2
CO5	2	2	2			2	2						1	2

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

22CEE33 **PUBLIC HEALTH ENGINEERING**

L	T	P	C
3	0	0	3

Preamble

The aim of this course is to create higher standard of knowledge on healthcare system and services prioritize advanced technologies for the diagnosis and treatment of various diseases.

UNIT 1 WATER SUPPLY **9**

Surface and subsurface water - Predicting demand for water - Impurities of water and their significance - Physical, chemical and bacteriological analysis - Waterborne diseases - Standards for potable water - Intake Structures.

UNIT 2 WATER TREATMENT **9**

Objectives - Unit operations and processes - Principles and functions of water treatment plant units- aerators , flash mixers, coagulation and flocculation - Clarifloccuator - Sand filters - Disinfection - Removal of iron and manganese - Defluoridation - Softening - Desalination process - Residue management - Construction, operation and maintenance aspects.

UNIT 3 WATER DISTRIBUTION **9**

Requirements of water distribution - Components - Service reservoirs - Functions and drawings - Network design - Computer applications - Analysis of distribution networks - Layout of distribution System - Leak detection methods - Components of house service connection.

UNIT 4 SEWERAGE SYSTEM **9**

Sources of wastewater generation - Effects - Estimation of sanitary sewage flow - Factors affecting characteristics and composition of sewage and their significance - Effluent standards - Estimation of storm runoff - Legislation requirements.

UNIT 5 DESIGN OF SEWER **9**

Sewerage - Hydraulics of flow in sewers - Objectives - Design period - Design of sanitary and storm sewers - Laying, joining and testing of sewers - Sewer appurtenances - Pumps - Selection of pumps and pipe drainage - Plumbing system for buildings - One pipe and two pipe systems.

TOTAL : 45

TEXT BOOKS:

1. Garg. S.K., “Environmental Engineering”, Vol I & Vol II, Khanna Publishers, New Delhi, 2014.
2. Punmia. B. C, Ashok Kumar Jain and Arun Kumar Jain., “Waste Water Engineering”, Laxmi Publications Pvt. Ltd., New Delhi,2013.

REFERENCES:

1. Birde. G.S and Birde. J.S., “Water Supply and Sanitary Engineering”, Dhanpat Raj Publishing Co., New Delhi, 2015.
2. Manual on Sewage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2013.

eRESOURCES:

1. http://nptel.ac.in/courses/105104102/, "Water and Wastewater Engineering", Dr. P. Bose, IIT Kanpur.
2. http://nptel.ac.in/courses/105104102/2, "Water and Wastewater Engineering", Prof. C. Venkobachar, Prof. Ligy Philip, Prof. B.S. Murty, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Understand the various components of water supply scheme and design of intake structure and conveyance system for water transmission
CO2	Design an appropriate treatment system for the water available at the source.
CO3	Arrive the quantity of water for given city and to estimate the storage requirement of reservoir.
CO4	Estimate the quantity of wastewater generation.
CO5	Design of sewer line and explain the necessity of pump and plumbing system.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2		2	2	2					2	1	
CO2	3	3	2		2	2	2						1	
CO3	2	2	3		2	3	1					2	1	
CO4	1	2	1		2	-	1							
CO5	1	2			2	2	1					2		

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

22CEE34 **CONSTRUCTION PROJECT MANAGEMENT**

L	T	P	C
3	0	0	3

Preamble

To familiarize the types of organization and their impact on and suitability to construction projects and to impart the knowledge on design and construction procedures along with labour, material and equipment utilization.

UNIT 1 ORGANIZING FOR PROJECT MANAGEMENT 9

Organizing for project management - Project management - Trends in modern management - Strategic planning and project programming - Organization of project participants - Traditional designer - Contractor sequence.

UNIT 2 THE OWNER'S PERSPECTIVE 9

Professional construction operation - Leadership and motivation - Interpersonal behavior in project organizations - Perceptions of owners and contractors.

UNIT 3 DESIGN AND CONSTRUCTION PROCESS 9

Design and construction process - Design and construction as an integrated system - Innovation and technological feasibility - Innovation and economic feasibility - Design methodology - Functional design.

UNIT 4 LABOUR AND EQUIPMENT UTILIZATION 9

Value engineering - Construction planning - Industrialized construction and prefabrication - Computer - aided engineering - Labour productivity - Factors affecting job - Site productivity.

UNIT 5 COST ESTIMATION 9

Cost estimation - Costs associated with constructed facilities - Approaches to cost estimation -Type of construction cost estimates - Cost indices - Applications of cost indices to estimating - Estimate based on engineer's list of quantities.

TOTAL : 45

TEXT BOOKS:

1. Chitkara. K.K., "Construction Project Management: Planning, Scheduling and Control", Tata McGraw - Hill Publishing Company, New Delhi, 2019.
2. Choudhury. S., "Project Management", Tata McGraw - Hill Publishing Company, New Delhi, 2008.

REFERENCES:

1. Chris Hendrickson and Tung Au, "Project Management for Construction - Fundamental Concepts for Owners, Engineers, Architects and Builders", Prentice Hall, Pittsburgh, 2000.
2. Martin Loosemore, "Essentials of Construction Project Management", University of New South Wales Press Ltd, Australia, 2004.

eRESOURCES:

1. http://nptel.ac.in/courses/105103093/, "Construction Planning and Management", Prof. Arbind Kumar Singh, IIT Guwahati.
2. http://nptel.ac.in/courses/105/104/105104161/, "Principles of Construction Management", Prof.Sudhir Misra, IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Coordinate effectively with all the project participants.
CO2 Discuss the professional construction management and interpersonal behavior in project organizations.
CO3 Explain the modern trends in project management.
CO4 Apply value engineering practices and measures to improve job site productivity.
CO5 Estimate costs associated with construction projects.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1			2		1	2		2	1		2
CO2	2	2	2			2		1	2		2	1		2
CO3	2	1	2			2		2	2		1	1		2
CO4	1	1	2			2		2	2		1	1		2
CO5	1	1	1			2		2	2		1	1		2

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

22CEE35 **HOUSING PLANNING AND MANAGEMENT**

L	T	P	C
3	0	0	3

Preamble

The objective of the course is to train the students to have a comprehensive knowledge of planning, design, evaluation, construction and financing of housing projects. The course focuses on cost effective construction materials and methods.

UNIT 1 INTRODUCTION TO HOUSING **9**

Definition of basic terms - House, home, household, apartments, multi storied buildings, special buildings, objectives and strategies of national housing policies including slum housing policy, Principle of sustainable housing - Integrated approach on arriving holding capacity and density norms - All basic infrastructure consideration - Institutions for housing at national, state and local levels.

UNIT 2 HOUSING PROGRAMMES **9**

Basic concepts, contents and standards for housing programmes - Sites and services, Neighborhoods - Plotted land development programs, Open development plots, Apartments, Gated communities, Townships, Rental housing, Cooperative housing, Slum housing programmes - Slum improvement - Slum redevelopment and relocation - Use of GIS and MIS in slum housing projects,, Role of public housing agencies, and Private sector in supply , quality, infrastructure and pricing - Role of Non-government organizations in slum housing.

UNIT 3 PLANNING AND DESIGN OF HOUSING PROJECTS **9**

Formulation of housing projects - Land use and soil suitability analysis - Building bye laws and rules and development control regulations - Site analysis, Layout design, Design of housing units (Design problems) - Housing project formulation.

UNIT 4 CONSTRUCTION TECHNIQUES AND COST-EFFECTIVE MATERIALS **9**

New constructions techniques - Cost effective modern materials and Methods of construction - Green building concept building centers - Concept, functions and performance evaluation.

UNIT 5 HOUSING FINANCE AND PROJECT APPRAISAL **9**

Evaluation of housing projects for sustainable principles - Housing finance, Cost recovery - Cash flow analysis, Subsidy and cross subsidy - Public private partnership projects - Viability gap funding - Pricing of housing units (Problems).

TOTAL : 45

TEXT BOOKS:

1. Meera Mehta.S 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. Development Control Rules for Chennai Metropolitan Area, CMA, Chennai, 2004.

2. Wiley - Blackwell., "Neufert Architects" Data, 4th Edition, Blackwell Publishing Ltd, 2012.

eRESOURCES:

1. https://nptel.ac.in/courses/124107001/ - "Housing Policy and Planning", Dr. Uttam K. Roy, IIT Roorkee.
2. https://nptel.ac.in/courses/105106188/ - "Infrastructure Planning and Managements", Dr. Ashwin Mahalingam, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify and explain the basics of housing and policies.
CO2 Describe the housing programmes and their improvements.
CO3 Plan and design the housing projects.
CO4 Explain the new construction techniques and construction materials.
CO5 Evaluate the housing finance strategies and project appraisal.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2			2	1	2			1	1		2
CO2	2	1	2			2	1	2			1	1		2
CO3	2	1	1			2	2	1			2	1		2
CO4	2	1	1			2	2	1			2	1		2
CO5	2	1	1			2	2	1			2	1		2

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

22CEE36 **BUILDING CONSTRUCTION AND SERVICES**

L	T	P	C
3	0	0	3

Preamble

To impart the various aspects of pumps and machinery involved in Civil Engineering practice and the principles of electrical and air conditioning facilities, acoustics and vibration control systems and information systems.

UNIT 1 BUILDING CLASSIFICATION **9**

Classification of buildings - Row houses (chawls) - Brief information about duplex houses, Apartments, housing colonies for HIG, MIG, LIG and EWS in India - Sizes of plots - Elements of climate, climate zones in India, climate and comfort, building orientation, factors affecting orientation, sun, wind, optimum orientation of a building, principles of anthropometry.

UNIT 2 BUILDING BYE-LAWS AND REGULATIONS **9**

Building bye-laws, objectives of byelaws, minimum plot sizes, open spaces, minimum standard dimensions, built - up area, super built up area, plinth area, carpet area, floor area and FAR, FSI, lighting and ventilation, rules governing parking, fire, water supply - provisions of NBC, HVAC- Line plans for a residential building of a minimum of three rooms including W/C, bath, and staircase as per principles of planning - Line plans for public building - School building, primary health center, post office, function hall, and library.

UNIT 3 PLUMBING SYSTEMS AND ELECTRICAL MAINTENANCE **9**

Drainage, gas pipelines, drinking water pipelines, Plumbing accessories installation, Plumbing fixtures, sanitary fixtures, RO and water features and services - Basics of electricity - Single / Three phase supply - Earthing for safety - Types of earthing - ISI specifications - Types of wires, wiring systems and their choice - Planning electrical wiring for building - Main and distribution boards - Transformers and switch gears - Layout of substations - Solar power system.

UNIT 4 MAINTENANCE AND SPECIAL REPAIRS **9**

Repairs to damaged part of the flooring, Removal of stains from concrete and terrazzo floor, Antitermite treatment (in building, foundations, floors and woodwork) Repair of water storage sumps and tanks, Repair of any joints i.e. wall - beam joint leak, beam column and slab - beam, joints, water proofing and grouting.

UNIT 5 FIRE SAFETY INSTALLATION **9**

Causes of fire in buildings - Safety regulations - NBC - Planning considerations in buildings like non-combustible materials in construction of staircases and lift lobbies - Special features required for physically handicapped and elderly in buildings - Heat and smoke detectors - Fire alarm system, Snorkel ladder - Fire lighting pump and water storage - Dry and wet risers - Automatic sprinklers.

TOTAL : 45

TEXT BOOKS:

1. Kumara Swamy. N and Kameswara Rao. A., “Building Planning and Drawing”, 8th Edition, Charotar Publications, 2019.
2. Harrison.H.W and Trotmanm.P.M., “Building Elements, Building Service”, BRE Press Publishers, 2000.

REFERENCES:

1. Gahlot.B.S and Sanjay Sharma., “Building Repair Maintenance and Management”, CBS Publishers, 1st Edition, 2006.

2. Ambrose.E.R., “Heat Pumps and Electric Heating”, John and Wiley and Sons, Inc., New York,1968.

eRESOURCES:

1. https://nptel.ac.in/courses/105107156/ - “Principles and Applications of Building Science”, Dr.E.Rajasekar,IIT Roorkee.
2. https://nptel.ac.in/courses/105/102/105102176/ - “Basic Concepts of Fire Protection I & II”, Prof. B. Bhattacharjee,IIT Delhi.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Identify the housing colonies in India based on income group.
CO2 Apply the concept of building byelaws in planning of the house.
CO3 Classify various types of power supply and plumbing systems.
CO4 Discuss the maintenance of building and its various repairing techniques.
CO5 Discuss fire safety requirement of a building.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1			1	1	2			2		2	
CO2	2	2	1			2	1	2			1		2	
CO3	2	2	2			2	1	1			1		2	
CO4	1	2	2			2	1	1			1		3	
CO5	1	2	2			1	1	1			2		3	

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

22CEE37 **CONTRACT LAWS AND REGULATIONS**

L	T	P	C
3	0	0	3

Preamble

To impart the various types of construction contracts and their legal aspects and provisions, tenders, arbitration, legal requirements and labour regulations.

UNIT 1 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 2 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 - Transparency in tenders act.

UNIT 3 ARBITRATION **9**

Comparison of actions and laws - Agreements - Subject matter - Violations - Appointment of arbitrators - Conditions of arbitration - Powers and duties of arbitrator - Rules of evidence - Enforcement of award – Costs.

UNIT 4 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 - Property law - Agency law - Local government laws for approval - Statutory regulations.

UNIT 5 LABOUR REGULATIONS **9**

Social security - Welfare legislation - Laws relating to wages, bonus and industrial 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

TEXT BOOKS:

1. Jimmie Hinze., “Construction Contracts”, Second Edition, McGraw Hill, 2010.
2. Joseph T. Bockrath, “Contracts and the Legal Environment for Engineers and Architects”, Sixth Edition, McGraw Hill, 2010.

REFERENCES:

1. Gajaria G.T., “Laws Relating to Building and Engineering Contracts in India”, M.M.Tripathi Private Ltd., Bombay, 2000.
2. Dr P C Markanda “Building and Engineering Contracts- Law and Practice” - 6th Edition - Lexis Nexis’s, 2023.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/129/106/129106006/, "Advanced contracts, tendering & Public procurement", Prof. Sriram Bhat, IIT Madras.
2. https://nptel.ac.in/courses/105104161/, "Principles of Construction Management, Prof.Sudhir Misra, IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Discuss the different types of contracts in construction, arbitration and legal aspects and its provisions.
CO2	Apply the general principles of the law of contract and tenders.
CO3	Discuss the practical and social context in which rules operate.
CO4	Explain the common law, equitable and statutory rules relating to enforceable agreements.
CO5	Explain the different labor regulations.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	1	1		1	1		1		1	2	1	
CO2	2	2	1			1	1		2		1	2	1	1
CO3	2	2	1	2	1	1	1		1		1	2	2	1
CO4	2	2	1	2	1	2	1		1		1	1	1	
CO5	2	2	1	1		2	1		2		1	1	1	

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

22CEE41 CONSTRUCTION EQUIPMENT AND MACHINERY

L	T	P	C
3	0	0	3

Preamble

To study and understand the various types of equipment used for earthwork, tunneling, drilling, blasting, dewatering, material handling conveyors and its applications in construction projects.

UNIT 1 CONSTRUCTION EQUIPMENT 9

Identification – Planning of equipment – Selection of Equipment - Equipment Management in Projects – Maintenance Management – Equipment cost – Operating cost – Cost Control of Equipment - Depreciation Analysis – Replacement of Equipment- Replacement Analysis - Safety Management.

UNIT 2 EQUIPMENT FOR EARTHWORK 9

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

UNIT 3 EQUIPMENT FOR UNDERGROUND OPERATION 9

Equipment for Dredging, Trenching, Drag line and clamshells, Tunneling – Equipment for Drilling and Blasting - Pile driving Equipment - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Equipment for Demolition.

UNIT 4 ASPHALT AND CONCRETING PLANTS 9

Aggregate production- Different Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Pumping Equipment – Ready mix concrete equipment, Concrete pouring equipment. Asphalt Plant, Asphalt Pavers, Asphalt compacting Equipment.

UNIT 5 MATERIALS HANDLING EQUIPMENT 9

Forklifts and related equipment - Portable Material Bins – Material Handling Conveyors – Material Handling Cranes- Industrial Trucks.

TOTAL : 45

TEXT BOOKS:

1. Peurifoy, R.L., Schexnayder, C., Schmitt, R.L. and Aviad Shapira., “Construction Planning, Equipment and Methods”, 9th Edn. McGraw Hill, Singapore, 2018.
2. Granberg G.,Popescu M, “Construction Equipment and Management for Engineers Estimators and Owners”, Taylor and Francis Publishers, New York, 2006

REFERENCES:

1. Deodhar, S.V., “Construction Equipment and Job Planning”, 4th Edn. Khanna Publishers, New Delhi, 2020.
2. Arora S.P. and Bindra S.P., “Building Construction, Planning Techniques and Method of Construction”, Dhanpat Rai and Sons, 2018.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/103/105103206/ -“Construction methods and equipment management”, Prof. Indu Siva Ranjani Gandhi, Department of Civil Engineering IIT Guwahati.
2. https://lntcmb.com/machinery-used-in-construction/

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Develop knowledge on planning of equipment and selection of equipment.
CO2 Explain the knowledge on fundamentals of earth work operations, earth moving operations and types of earth work equipment.
CO3 Develop the knowledge on equipment for underground operation.
CO4 Apply the knowledge on asphalt and concrete plants.
CO5 Identify the knowledge and select the proper materials handling equipment.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2			2					3	2			3	3
CO2	3		3	2					2	2			2	3
CO3	2		3	2					3	2			2	2
CO4	2			2					3	2			3	3
CO5	3		3	2					3	2			2	3

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

22CEE42 **FORMWORK ENGINEERING**

L	T	P	C
3	0	0	3

Preamble

On completion of this course the students will be able to know the detailed planning of formwork, design of forms and erection of form work.

UNIT 1 INTRODUCTION TO FORM WORK **9**

Introduction to Formwork and falsework, Temporary work systems, Requirements, Construction planning and site constraints, Selection, and Classification (Types) of Formwork, General objectives of formwork building - Planning for safety - Development of a Basic System - Key Areas of cost reduction - Planning examples.

UNIT 2 FORMWORK MATERIALS ACCESSORIES & PRESSURES **9**

Formwork Materials, Accessories and consumables – Application of tools, Reconstituted wood - Steel – Aluminum Plywood - Types and grades Standard units - Corner units – Pass units, Calculation of labour constants - Formwork hours - Labour Requirement. Hardware and fasteners - Nails in Plywood - Allowable withdrawal load and lateral load.

UNIT 3 FORMWORK DESIGN **9**

Concepts, Formwork Systems – components, assembly, De-shuttering, safety of work and Design for Tall Structures, Foundation Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.

UNIT 4 FORMWORK FOR SPECIAL STRUCTURES **9**

Formwork for Bridge Structures, Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Nuclear Reactor, Tunnel, Lift Shaft, stairs and Formwork for Precast Concrete. Various climbing system, Table lifting system.

UNIT 5 CASE STUDIES **9**

Formwork failures: Causes of failures – Inadequate shoring - Inadequate bracing of members – improper vibration – Premature stripping Errors in design – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – failure formwork issues in multi - story building construction – vertical and horizontal elements used in the industry.

TOTAL : 45

TEXT BOOKS:

1. Peurify R.L and Oberlender G.D , “Formwork for Concrete Structures”, McGraw Hill Education India ,2015.
2. Jha K N, “Formwork for Concrete Structures”, Tata McGraw Hill Education, 2012.

REFERENCES:

1. IS 14687: 1999, False work for Concrete Structures - Guidelines, BIS.
2. Hurd, M.K., “Formwork for Concrete”, Special Publication No.4, American Concrete Institute, Detroit, 1996.

eRESOURCES:

1. https://lntedutech.com/blogs/getting-started-with-formwork-engineering-a-beginners-guide/
2. https://elearn.cmti.co.in/learn/Formwork

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the overall and detailed planning of formwork.
CO2 Impart knowledge on formwork materials, accessories, pressures and labour requirement.
CO3 Develop the conceptual understanding of design, construction and erection of formwork.
CO4 Impart the knowledge about different types of form work used for special structures.
CO5 Understand the errors in design and judge the formwork failures through case studies.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2				2	2	2		3		3	2	3	
CO2	3	3	3	2	3		2		3		2	2	3	3
CO3	3	3	3	2	3				3		2	2	3	3
CO4	2	3			2				2		2	2	3	
CO5	2	1	2	3	2				2		3	2	3	

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

22CEE43	CONSTRUCTION PLANNING, SCHEDULING AND CONTROL	L	T	P	C
		3	0	0	3

Preamble

To impart the concept of planning, scheduling, cost and quality control, safety during construction, organization and use of project information necessary for construction projects.

UNIT 1 CONSTRUCTION PLANNING AND SCHEDULING 9

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships Among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities.

UNIT 2 SCHEDULING WITH CONSTRAINTS 9

The Critical Path Method (CPM) – Program Evaluation Review Technique (PERT) - Scheduling with Resource Constraints and Precedence - Use of Advanced Scheduling Techniques - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs.

UNIT 3 COST CONTROL, MONITORING AND ACCOUNTING 9

The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

UNIT 4 ORGANIZATION AND USE OF PROJECT INFORMATION 9

Value engineering-Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in databases.

UNIT 5 DATABASE MODEL 9

Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow.

TOTAL : 45

TEXT BOOKS:

1. Chitkara, K.K., “Construction Project Management Planning, Scheduling and Control”, Tata McGraw Hill Publishing Co., New Delhi, Second Edition, 2010.
2. Srinath,L.S., “Pert and CPM Principles and Applications”, Affiliated East West Press, 2001.

REFERENCES:

1. Chris Hendrickson and Tung Au, “Project Management for Construction – Fundamentals 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 Encyclopedia of terms and Applications”, Wiley, New York, 1995.

eRESOURCES:

1. https://books.google.co.in/books?isbn=1118826930, “Handbook for Construction Planning and Scheduling”, Andrew Baldwin and David Bordoli, Wiley Publishers, 2014.
2. http://nptel.ac.in/courses/105103093/, “Construction Planning and Management”, Prof. Arbind Kumar Singh, IIT Guwahati.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Plan and schedule the resources available for a project.
CO2 Discuss the scheduling procedure and techniques for construction projects.
CO3 Explain the elements of cost control and monitoring of construction projects.
CO4 Explain the concept of gathering and using project information.
CO5 Differentiate the different database models used for information transfer.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2		1	3	2	3					3		1	
CO2	2		1	3	2	2					3		1	
CO3	2		1	3	2	2					3		1	
CO4	2		1	3	2	3					2		1	
CO5	2		1	3	2	3					2		1	

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

22CEE44	SAFETY IN CONSTRUCTION	L	T	P	C
		3	0	0	3

Preamble

To know causes of accidents related to construction activities and human factors associated with this accident and understand the construction regulations and quality assurance in construction.

UNIT 1 INTRODUCTION **9**

Introduction to construction industry and safety issues in construction-Human factors in construction safety management- Roles of various groups and stake-holders in ensuring safety in construction industry -Framing of contract conditions on safety and related matters –Relevance of ergonomics in construction safety.

UNIT 2 SAFETY IN CONSTRUCTION OPERATIONS **9**

Safety in various construction operations - Excavation and filling - Under- water works - Underpinning & Shoring - Ladders & Scaffolds - Tunnelling - Blasting - Dismantling - Confined space Temporary Structures. Noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Effects of air pollution in Industry, air pollution episodes; Emission factors inventory and predictive equations. Familiarization with relevant Indian Standards and National Building Code provisions on construction safety.

UNIT 3 CONSTRUCTION MACHINERY **9**

Safety in material handling and equipment - Safety in storage & stacking of construction materials. Safety in the use of construction equipment/vehicles - excavators, graders and dozers - cranes - hoists & lifts - other lifting gears - wire ropes - chain-pulley blocks - mixers – conveyors - pneumatic and hydraulic tools in construction. Safety in temporary power supply and fire safety at construction site.

UNIT 4 ORGANIZATION AND USE OF PROJECT INFORMATION **9**

Contract Labour (R&A) Act and Central Rules: Definitions, Registration of Establishments, Licensing of Contractors, Welfare and Health provisions in the Act and the Rules, Penalties, Rules regarding wages. Building & Other Construction Work (RE & CS) Act, 1996 and Central Rules, 1998: Applicability, Administration, Registration, Welfare Board & Welfare Fund, Training of Building workers, 79 General Safety, Health & Welfare provisions. Code of Practices - Preventive measures against Hazards at work places Part1 & 2.

UNIT 5 SAFETY IN DEMOLITION WORK **9**

Safety in demolition work, manual, mechanical, using explosive - keys to safe demolition, pre survey inspection, method statement, site supervision , safe clearance zone, health hazards from demolition - Indian standard - trusses, girders and beams – first aid – fire hazards and preventing methods – Case studies in construction sites against the fire accidents.

TOTAL : 45

TEXT BOOKS:

1. Hudson,R., “Construction hazard and Safety Handbook”, ButterWorth’s,1985.
2. Raymond Elliot Levitt, Nancy Morse Samelson, “Construction Safety Management”, McGrawHill, London, 1987.

REFERENCES:

1. Jnathea D.Sime, “Safety in the Build Environment”, London, 1988.
2. Davies,V. J., and Tomasin,K, “Construction safety hand book”, Thomas Telford Publishing, London,1996

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/102/105102206/, "Safety in Construction", Prof. J. Uma Maheswari, IIT Delhi.
2. https://www.hsestudyguide.com/safety-in-construction/.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Visualize the safety issues at different stages of construction activity.
CO2 Understand the safety requirements in various construction operations and develop guidelines to ensure safety at construction site.
CO3 Understand the safety requirements in material handling and equipment and develop guidelines to ensure safety at construction site.
CO4 Learn the legal provisions with respect to the health and welfare of workers at construction site.
CO5 List out construction regulations and Indian standards for construction and demolition work

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3			3							2	
CO2	1	2	3			3							2	
CO3	1	2	3			3							2	
CO4	1	2	3			3		2			2		2	
CO5	1	2	3			3							2	

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

22CEE45 ENERGY EFFICIENT BUILDINGS

L	T	P	C
3	0	0	3

Preamble

To provide an understanding of the concept of energy consumption in buildings and design an energy efficient building.

UNIT 1 CLIMATE 9

Climate adapted and climate rejecting buildings – Heat Transfer – Measuring Conduction – Thermal Storage – Measurement of Radiation – The Greenhouse Effect – Convection – Measuring latent and sensible heat – Psychrometry Chart – Thermal Comfort – Microclimate, Site Planning and Development – Temperature – Humidity – Wind – Optimum Site Locations – Sun Path Diagrams – Sun Protection – Types of Shading Devices.

UNIT 2 PASSIVE SOLAR HEATING AND COOLING 9

General Principles of passive Solar Heating – Key Design Elements – Sunspace – Direct gain – Trombe Walls, Water Walls – Convective Air loops – Concepts – Case Studies – General Principles of Passive Cooling – Ventilation – Principles – Courtyards – Roof Ponds– Cool Pools – Predicting ventilation in buildings – Window Ventilation Calculations – Room Organization Strategies for Cross and Stack Ventilation – Radiation – Evaporation and dehumidification.

UNIT 3 DAYLIGHTING AND ELECTRICAL LIGHTING 9

Materials, components and details – Insulation – Optical materials – Radiant Barriers – Glazing materials – Glazing Spectral Response – Day lighting – Sources and concepts –Building Design Strategies – Case Studies – Daylight apertures – Light Shelves – Codal requirements – Day lighting design – Electric Lighting – Light Distribution – Electric Lighting control for day lighted buildings – Switching controls – Coefficient of utilization – Electric Task Lighting – Electric Light Zones – Power Adjustment Factors.

UNIT 4 HEAT CONTROL AND VENTILATION 9

Hourly Solar radiation – Heat insulation – Terminology – Requirements – Heat transmission through building sections – Thermal performance of Building sections – Orientation of buildings – Building characteristics for various climates – Thermal Design of buildings – Influence of Design Parameters – Mechanical controls.

UNIT 5 DESIGN FOR CLIMATIC ZONES 9

Energy efficiency – An Overview of Design Concepts and Architectural Interventions – Embodied Energy – Low Embodied Energy Materials – Passive Downdraft Evaporative Cooling – Design of Energy Efficient Buildings for Various Zones – Cold and cloudy – Cold and sunny – Composite – Hot and dry – Moderate – Warm and humid – Case studies of residences, office buildings and other buildings in each zones.

TOTAL : 45

TEXT BOOKS:

1. Brown, G.Z. and DeKay, M., “Sun, Wind and Light - Architectural Design Strategies”, John Wiley and Sons Inc., 3rd Edition, 2014.
2. Majumdar, M (Ed), “Energy - Efficient Buildings in India”, Tata Energy Research Institute, Ministry of Non-Conventional Energy Sources, 2009.

REFERENCES:

1. Energy Conservation Building Code, Bureau of Energy Efficiency, New Delhi, 2018.
2. SP: 41 (S and T), Handbook on Functional Requirements of Buildings, Part 1 to 4 ,1995.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/102/105102175/ - "Prof. B. Bhattacharjee, IIT Delhi.
2. https://energyeducation.ca/encyclopedia/Energy_efficient_building_design

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Explain environmental energy supplies on buildings.
CO2	Explain the passives solar heating, cooling system.
CO3	Discuss the various aspects of day-lighting and electrical lighting in a building.
CO4	Predict and design building ventilation and heat control for indoor comfort
CO5	Design a building for climatic zone and apply simulation programs of buildings to perform energy calculations.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2					3	2	1			3	
CO2	2	1	2					2		2			3	
CO3	2		2					2		2			3	
CO4	3	1	3					3		2			3	
CO5	3		3					3	2	3			2	

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

22CEE46	ADVANCED CONSTRUCTION TECHNIQUES	L	T	P	C
		3	0	0	3

Preamble

To study and understand the latest construction techniques applied to engineering construction for sub structure, super structure, special structures, rehabilitation and strengthening techniques and demolition techniques.

UNIT 1 MODERN CONSTRUCTION TECHNIQUES 9

Precast Flat Panel System - 3D Volumetric Modules - Flat Slab Construction - Precast Cladding Panels Concrete Wall and Floors - Twin Wall Technology - Precast Concrete Foundation - Concrete Formwork Insulation - Thin joint masonry.

UNIT 2 SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 9

Vacuum dewatering of concrete flooring – Concrete paving technology – Techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – Erection techniques of tall structures, Large span structures –in-situ prestressing in high rise structures, Post tensioning of slab- aerial transporting – Handling and erecting lightweight components on tall structures.

UNIT 3 CONSTRUCTION OF SPECIAL STRUCTURES 9

Erection of lattice towers - Rigging of transmission line structures – Construction sequence in cooling towers, Silos, chimney, sky scrapers - Bow string bridges, Cable stayed bridges – Launching and pushing of box decks – Construction of jetties and breakwater structures – Construction sequence and methods in domes – Support structure for heavy equipment and machinery in heavy industries – Erection of articulated structures and space decks.

UNIT 4 REHABILITATION AND STRENGTHENING TECHNIQUES 9

Seismic retrofitting - Strengthening of beams - Strengthening of columns - Strengthening of slab - Strengthening of masonry wall, Protection methods of structures, Mud jacking and grouting for foundation – Micro piling and underpinning for strengthening floor and shallow profile - Sub grade water proofing, Soil Stabilization techniques.

UNIT 5 DEMOLITION 9

Demolition Techniques, Demolition by Machines, Demolition by Explosives, Advanced techniques using Robotic Machines, Demolition Sequence, Dismantling Techniques, Safety precaution in Demolition and Dismantling.

TOTAL : 45

TEXT BOOKS:

1. Sankar, S.K. and Saraswati, S., “Construction Technology”, Oxford University, New Delhi, 2008.
2. Robertwade Brown, “Practical foundation engineering hand book”, McGraw Hill Publications, 1995.

REFERENCES:

1. Patrick Powers. J., “Construction Dewatering: New Methods and Applications”, John Wiley & Sons, 1992.
2. Peter H.Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008.

eRESOURCES:

1. https://www.digimat.in/nptel/courses/video/105103206/L01.html
2. https://archive.nptel.ac.in/courses/105/106/105106053/ "Modern Construction Materials", Prof. Ravindra Gettu, Department of Civil Engineering, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Understand the modern construction techniques used in the construction.
CO2	Demonstrate knowledge and understanding of the principles and concepts relevant to super structure construction for buildings.
CO3	Understand the concepts used in the construction of special structures.
CO4	Knowledge on various strengthening and repair methods for different cases.
CO5	Identify the suitable demolition technique for demolishing a building.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	3								2		2	3
CO2	2	3	3								2		2	3
CO3	2	3	3								3		2	3
CO4	2	3	3								2		2	3
CO5	1	3	3								3		2	3

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

22CEE47 REPAIR AND REHABILITATION OF STRUCTURES

L	T	P	C
3	0	0	3

Preamble

This course provides the knowledge on quality of concrete, durability aspects, causes of deterioration. It is used to gain the knowledge on assessment of distressed structures, repairing of structures and demolition procedures.

UNIT 1 MAINTENANCE AND REPAIR STRATEGIES 9

Maintenance - repair and rehabilitation – necessity and classification of Maintenance - various aspects of Inspection - Assessment procedure for evaluating a damaged structure - causes of deterioration - Diagnosis of causes and preventive measures.

UNIT 2 CHEMICAL CAUSES AND CORROSION 9

Chemical, salt, biological, chloride and sulphate attack - Carbonation - Alkali and silica reaction – Hydrolysis and leaching, Principles of corrosion – corrosion mechanism - Corrosion process – corrosion protection techniques – Corrosion inhibitors.

UNIT 3 DAMAGE ASSESSMENT 9

Purpose of assessment – Rapid assessment – destructive testing systems – Direct load tests – Non-destructive testing systems – Surface hardness methods – Ultrasonic pulse velocity method – Radiography methods – Pulse attenuation method – radar technique – Semi-destructive testing systems – core sampling and testing – pull out and pull off test – Half cell potential measurements – Break off test - Rapid chloride permeability test.

UNIT 4 TECHNIQUES FOR REPAIR AND DEMOLITION 9

Rust eliminators and polymer coating for rebar during repair – methods of repair for cracks - shoring and underpinning - Gunite / Shotcrete - Engineered demolition techniques – Demolition tools – Modern technology for demolition - Case studies.

UNIT 5 STRENGTHENING TECHNIQUES 9

Structural repair techniques for reinforced concrete - Structural concrete strengthening – Jacketing technique – Externally bonding technique - External post – Tensioning – Strengthening by SIMCON – Strategies for rehabilitation schemes.

TOTAL : 45

TEXT BOOKS:

1. P. C. Varghese, “Maintenance - Repair & Rehabilitation and Minor Works of Buildings”, PHI Learning Pvt. Ltd., 2014.
2. B.Vidivelli, “Rehabilitation of Concrete Structures”, Standard Publishers distributors, 2014.

REFERENCES:

1. M. S. Shetty, “Concrete Technology Theory and Practice”, S. Chand Co., New Delhi, 2019.
2. CPWD and Indian Buildings Congress - Hand book on “Seismic Retrofit of Buildings”, Narosa Publishers, 2008.

eRESOURCES:

1. https://nptel.ac.in/courses/105106202, “Maintenance and Repair of Concrete Structures”, Prof. Radhakrishna G. Pillai, IIT Madras.
2. https://onlinecourses.nptel.ac.in/noc22_ce20/preview, “Retrofitting and Rehabilitation of Civil Infrastructure” , Prof. Swati Maitra and Prof. Sriman Kumar Bhattacharyya , IIT Kharagpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the assessment procedure for evaluating a damaged structure.
CO2 Identify and explain the design and construction errors in concrete construction.
CO3 Discuss the materials and techniques for repair distressed structures.
CO4 Select and explain suitable repair and demolition techniques for structures.
CO5 Explain the various techniques for strengthening of structures.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	3	1		2	1				2		2	1
CO2	2	1	3	1		1	1				2		2	1
CO3	2	2	3	1		1	1				2		2	1
CO4	3	2	3	1		1	2				2		2	1
CO5	2	2	3	1		1	1				2		2	1

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

22CEE51	TRAFFIC ENGINEERING AND MANAGEMENT	L	T	P	C
		3	0	0	3

Preamble

To give an overview of Traffic engineering, various surveys to be conducted, traffic Regulation, management and traffic safety.

UNIT 1 TRAFFIC SURVEYS AND ANALYSES 9

Traffic characteristics: Human, vehicular, and Pavement Characteristics, Problems- presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume; Speed- spot speed, presentation of spot speed data, speed and delay studies, methods of conducting spot-speed studies and Speed and Delay studies; Problems Origin and Destination – methods of conducting the survey and presentation of data; parking surveys, presentation of data and analyses, determination of parking demand; Accident studies and analyses; Different problems.

UNIT 2 TRAFFIC FLOW AND ROADWAY CAPACITY 9

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, SpeedFlow-Density Relations; Passenger Car Units – Mixed traffic flow and related issues – Concept of PCU value-Factors affecting PCU values- Recommended PCU values for different conditions; Capacity and Level of Service – Factors affecting practical capacity – Design Service Volumes.

UNIT 3 COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES 9

Traffic System Management: Regulatory Techniques- one way street, Reversible Street, Reversible lane, Turning moment restrictions, closing streets; Traffic Control Devices – Traffic Signs – Road Markings, Traffic Signals, Miscellaneous traffic control devices; Traffic Segregation – Vehicle segregation, Pedestrian segregation, Traffic signals design; Bus Priority Techniques – Priority manoeuvres – With-flow bus lane and contra-flow bus lane; Self- Enforcing Techniques- Demand Management Techniques (TDM) Road pricing, parking control, Tolls, Staggering of office/educational institution hours.

UNIT 4 DESIGN OF ROAD INTERSECTIONS 9

Importance and Classification; Intersections at-grade – uncontrolled, channelised; Rotary intersections (problems)- Signalised intersections (problems)- Grade Separated Intersections – merits and demerits, types, pattern of intersections with different types of interchanges- Capacity, Concept diagrams.

UNIT 5 DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS 9

Parking: Need for parking studies and its ill effects- Parking Standards for different land uses, different types of parking - Conceptual plans for different types of parking; Pedestrians: Importance, Barriers, Behaviour, Pedestrian facilities – Principles of planning, Level of Service (LoS), Design standards.; Cycle Tracks: Principles of design, Design criteria, Design standards for Rural Expressways.

TOTAL : 45

TEXT BOOKS:

1. Kadiyali. L.R., “Traffic Engineering and Transport Planning”, Khanna Publishers, New Delhi, 2021.
2. Srinivasa Kumar., “Introduction to Traffic Engineering”, Universities Press, Hyderabad, 2018.

REFERENCES:

1. Indian Roads Congress (IRC) Specifications: Guidelines and special publications on Traffic Planning and Management
2. C. JotinKhisty, Kent Lall, “Transportation Engineering: An Introduction”, Prentice Hall, 1998

eRESOURCES:

1. https://nptel.ac.in/courses/105101008/, "Traffic Engineering & Management", Prof. Dr. Tom V Mathew, IIT Bombay.
2. https://www.civil.iitb.ac.in/tvm/nptel/ceTseLn.html

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Apply the knowledge of science and engineering fundamentals in conducting traffic surveys, analyze the problems and relating it with standards.
CO2	Understand the principles of traffic flow characteristics and their relationships.
CO3	Understand various traffic management measures in addressing the demand Pricing and ITS applications.
CO4	Designing various types of control and regulatory measures to meet an efficient traffic network.
CO5	Understand various types of facilities and plan for Non Motorised Transport.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	1	1					3	1	3	3
CO2	3	3	3	3	3	2					3	1	3	2
CO3	3	2	3	2	1	1					2	1	2	2
CO4	2	3	3	3	3	2					3	1	2	3
CO5	2	2	1	1	1	2					2	1	2	2

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

22CEE52 RAILWAYS, AIRPORTS, DOCKS & HARBOUR

L	T	P	C
3	0	0	3

Preamble

To expose the students to Railway planning, design, construction and maintenance, planning and design principles of Airports and Harbors.

UNIT 1 RAILWAY PLANNING 9

Significance of Road, Rail, Air and Water transports - Coordination of all modes to achieve sustainability - Elements of permanent way – Rails, Sleepers, Ballast, rail fixtures and fastenings, - Track Stress, coning of wheels, creep in rails, defects in rails - Points and Crossings.

UNIT 2 RAILWAY CONSTRUCTION AND MAINTENANCE 9

Earthwork – Stabilization of track on poor soil – Soil suitability analysis - drainage - Calculation of Materials required for track laying - Construction and maintenance of tracks - Urban rail – Infrastructure for Metro, Mono and underground railways- Tunneling Methods.

UNIT 3 AIRPORT PLANNING 9

Air transport characteristics-airport classification- airport planning: objectives, components, layout characteristics, and socio-economic characteristics of the Catchment area, criteria for airport site selection and ICAO stipulations, Typical airport layouts, Parking and circulation area.

UNIT 4 AIRPORT DESIGN 9

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

UNIT 5 HARBOUR ENGINEERING 9

Harbor, Port, Satellite Port, Docks, Waves and Tides - Classification, Location– Harbor Layout – Coastal Structures: Piers, Break waters, Wharves, Jetties, Quays, Spring Fenders, Dolphins and Floating Landing Stage– Wave action on Coastal Structures and Coastal Regulation Zone, 2011.

TOTAL : 45

TEXT BOOKS:

1. Saxena S.C. and S.P. Arora, "A text book of Railway Engineering", Dhanpat Rai, 2010.
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, India, 2013.

REFERENCES:

1. Rangwala, "Railway, Airport and Harbour Engineering", Charotar Publishing House, 2013.
2. Oza.H.P. and Oza.G.H., "A course in Docks & Harbour Engineering". Charotar Publishing Co., 2013
3. Mundrey J.S. "A course in Railway Track Engineering". Tata McGraw Hill, 2007.
4. Srinivasan R, "Harbour Dock and Tunnel Engineering", 28th Edition, Charotar Publishing House Pvt. Ltd, 2016.

eRESOURCES:

1. http://nptel.ac.in/courses/105107123/Transportation Engineering II, Prof. Rajat Rastogi, IIT Roorkee.
2. https://books.google.co.in/books?isbn=0071614788/ Handbook of Transportation Engineering Volume II, Myer Kutz , McGraw Hill Professional.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Plan and design the components of railway
CO2 Describe construction, drainage and maintenance practices in railways
CO3 Design runway and taxiways at airports
CO4 Illustrate terminal design concepts
CO5 Identify and explain various harbor elements

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	3	2	2	3	2	3	1				3	3
CO2	2	2	2	2	3	2	2	1	2			2	2	3
CO3	3	3	2	3	3	2	2	1	1		3	2	3	2
CO4	3	2	3	2	2	2	2	3	2		2	2	2	2
CO5	2	3	2	2	2	3	2	1	2		2	1	2	2

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

22CEE53 INFRASTRUCTURE PLANNING AND DESIGN

L	T	P	C
3	0	0	3

Preamble

To understand and explain concepts of infrastructure, private involvement in infrastructure, challenges to successful infrastructure planning and implementation, strategies for successful infrastructure project implementation, sustainable development of infrastructure.

UNIT 1 AN OVERVIEW OF BASIC CONCEPTS RELATED TO INFRASTRUCTURE 9

Introduction to Infrastructure, an overview of the Power Sector in India - An Overview of the Water Supply and Sanitation Sector in India, Road, Rail, Air and Port Transportation Sectors in India, Telecommunications Sector in India, Urban Infrastructure in India, Rural Infrastructure in India and an Introduction to Special Economic Zones -Organizations and layers in the field of Infrastructure, The Stages of an Infrastructure Project Lifecycle - an overview of Infrastructure Project Finance.

UNIT 2 PRIVATE INVOLVEMENT IN INFRASTRUCTURE 9

A Historical Overview of Infrastructure Privatization - The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization - Challenges in Privatization of Water Supply: A Case Study, Challenges in Privatization of Power: Case Study, Privatization of Infrastructure in India: Case Study, Privatization of Road Transportation Infrastructure in India.

UNIT 3 CHALLENGES TO SUCCESSFUL INFRASTRUCTURE PLANNING AND IMPLEMENTATION 9

Mapping and Facing the Landscape of Risks in Infrastructure Projects, Economic and Demand Risks - The Case study for Political Risks, Socio-Environmental Risks, Cultural Risks in International Infrastructure Projects, Legal and Contractual Issues in Infrastructure - Challenges in Construction and Maintenance of Infrastructure.

UNIT 4 STRATEGIES FOR SUCCESSFUL INFRASTRUCTURE PROJECT IMPLEMENTATION 9

Risk Management Framework for Infrastructure Projects - Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts - Introduction to Fair Process and Negotiation -Negotiating with multiple Stakeholders on Infrastructure Projects.

UNIT 5 SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE 9

Information Technology and Systems for Successful Infrastructure Management, - Innovative Design and Maintenance of Infrastructure Facilities, Infrastructure Modeling and Life Cycle Analysis Techniques, Capacity Building and Improving the Governments Role in Infrastructure Implementation, An Integrated Framework for Successful Infrastructure Planning and Management - Infrastructure Management Systems and Future Directions.

TOTAL : 45

TEXT BOOKS:

1. Neil S Grigg, “Infrastructure engineering and management”, J.Wiley Publishers, 1988.
2. Haas R., Hudson W. and Zaniewski J. “Modern Pavement Management” Krieger Publishing Company, Malabar, 1994.

REFERENCES:

1. Peter Hall, “Cities of tomorrow: an intellectual history of urban planning and design since 1880”, Wiley and sons, Hoboken, 2014.
2. Ardmar Revi, “Shelter in India- Sustainable Development Series”, Vikas Publishing House Pvt Ltd, 1990
3. National Urban Transport Policy, Ministry of Urban Development, Govt. of India, New Delhi, 2014.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/106/105106188/, "Infrastructure Planning and Management", Dr.Ashwin Mahalingam, IIT-Madras
2. https://nptel.ac.in/courses/105106115, "Introduction to Infrastructure", Prof. A. Veeraragavan, IIT Madras.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the basic concepts related to Infrastructure Projects
CO2 Discuss the role of private sector in infrastructure growth.
CO3 Describe the strategies for successful Infrastructure Project implementation.
CO4 Develop Infrastructure modeling and Life Cycle Analysis Techniques.
CO5 Explain Sustainable development of Infrastructure

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		3	3	2	3		2	3			1	2	3	2
CO2	3	3		2	2	3	2	1	2			2	3	3
CO3		3	3	2	3		2	3			1	2	3	3
CO4	3	3		2	2	3	2	1	2			2	3	2
CO5	3	2	3	3			2				1		2	2

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

22CEE54 URBAN TRANSPORTATION PLANNING

L	T	P	C
3	0	0	3

Preamble

The main objective of this course is to understand and apply basic concepts and methods of urban transportation planning. Apprise about the methods of designing, conducting and administering surveys to provide the data required for transportation planning.

UNIT 1 URBAN TRANSPORT PLANNING 9

Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.

UNIT 2 DATA COLLECTION AND INVENTORIES 9

collection of data – Organization of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.

UNIT 3 TRIP GENERATION 9

UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor – Problems

UNIT 4 TRIP DISTRIBUTION 9

Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. -Problems

UNIT 5 TRAFFIC ASSIGNMENT 9

Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.

TOTAL : 45

TEXT BOOKS:

1. Hutchinson, B.G, “Introduction to Urban System Planning”, McGraw Hill.
2. Khisty C.J., “Transportation Engineering – An Introduction” Prentice Hall.

REFERENCES:

1. Bruton M.J., “Introduction to Transportation Planning”, Hutchinson of London.
2. Mayer M and Miller E, “Urban Transportation Planning: A decision oriented Approach”, McGraw Hill.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/105/105105208/, “Urban Transport system planning” “Prof. Bhargab Maitra, IIT Kharagpur.
2. https://archive.nptel.ac.in/courses/124/105/124105016/, “Urban Landuse and transportation planning”, Prof. Depapratim Pandit, IIT Khargpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Apply basic concepts and methods of urban transportation planning.
CO2	Design, conduct and administer surveys to provide the data required for transportation planning.
CO3	Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
CO4	Develop and calibrate modal split, trip generation rates for specific types of land use developments.
CO5	Adopt the steps that are necessary to complete a long-term transportation plan.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1				1						1	2
CO2	2	1	1	1			2						1	1
CO3	2	2	1	2			2						2	1
CO4	3	2	2	2			2						2	1
CO5	2	2											1	

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

22CEE55 **SMART CITIES**

L	T	P	C
3	0	0	3

Preamble

To help the leaners to understand the concepts of smart city and to introduce the students about application of technologies in smart cities.

UNIT 1 INTRODUCTION **9**

Urbanisation, need of focused development, role of Authorities, Smart city, Opportunity and Challenges- Smart infrastructures for city- Smart Cities Mission.

UNIT 2 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.

UNIT 3 SUSTAINABILITY AND SMART PLANNING **9**

Relationship Between Sustainability and Smart planning - Place making project guidelinesSurveillance, Smart Street Lighting, Intelligent Emergency Services, Intelligent Disaster Forecasting and Management, GIS-based Spatial Decision Support Systems, Smart Communication Services.

UNIT 4 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 5 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

TEXT BOOKS:

1. P Sharma , “Sustainable Smart cities in India, Challenges and Future Perspectives”, Springer Link, 2017
2. P.P.Anilkumar, “Introduction To Smart Cities”, First Edition, Pearson India, 2019.

REFERENCES:

1. Sameer Sharma,“Smart Cities Unbounded- Ideas and Practice of Smart Cities in India”, Bloomsbury India, 2018.
2. Binti Singh, ManojParmar, “Smart City in India Urban Laboratory, Paradigm or Trajectory? Routledge India,2019

eRESOURCES:

1. https://smartcities.gov.in/guidelines#block-habikon-content .
2. https://smartnet.niua.org/learn/library.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the basics of Urbanisation and the role of smart cities.
CO2 Gain knowledge on implementation of smart physical infrastructure.
CO3 Understand the role of smart planning for sustainable development.
CO4 Comprehend the knowledge of Technologies in Smart City planning.
CO5 Reviewing the case studies of smart city projects.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 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	2
CO4	3	2	2	2	3	2	3	2	3	1	3	2	3	2
CO5	2	2	3	3	2	2	2	2	3	3	2	2	2	3

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

22CEE56 TRANSPORTATION PLANNING PROCESS

L	T	P	C
3	0	0	3

Preamble

To impart knowledge in the rudiments and stages in Transportation Planning Process.

UNIT 1 TRANSPORTATION PLANNING PROCESS 9

Importance of transportation planning, Integration of Land Use and Transport; Systems Approach to Transport Planning; Four Steps in the Transport Planning Process; Travel Demand Modelling Approach; Traffic Analyses Zones – internal and external; Various Transportation Surveys for the collection of data – methodology, analyses of data and presentation of results.

UNIT 2 TRIP GENERATION STAGE 9

Definition and importance; Trip Production and Attraction, Types of trips; Factors governing trip generation: population related data, land and building use, socio-economic, Trip generation models: Types, Assumptions made, Multiple Linear Regression, category analysis- merits and de-merits of the model, verification, calibration and validation of the model.

UNIT 3 TRIP DISTRIBUTION STAGE 9

Definition and objective; Data collection, analyses and presentation of trip matrix table, Desire Line Diagram, Development of Gravity, growth factor methods for Trip Distribution, Calibration of gravity model and its validation.

UNIT 4 MODAL SPLIT STAGE 9

Factors influencing mode choice - Household characteristics; Zonal Characteristics; Network characteristics - Modal split: pre distribution or post distribution - Mode wise trip matrix and modal split analyses- Overview of Probit and Logit model.

UNIT 5 TRAFFIC ASSIGNMENT STAGE 9

Meaning and objective; General principles; Assignment Techniques- all-or-nothing assignments, multiple route assignment, capacity restraint, diversion curves, Trip assignment route selection; Mode-wise trip matrices; element of transportation network, nodes and links, speed flow curves, minimum path trees.

TOTAL : 45

TEXT BOOKS:

1. Kadiyali. L.R., “Traffic Engineering and Transport Planning”, Khanna Publishers, Delhi, 2019
2. C.S. Papacostas and P.D. Prevedouros, “Transportation Engineering and Planning”, Prentice Hall of India Pvt. Ltd., 2009.

REFERENCES:

1. J D Ortuzar and L G Willumnsen, “ Modeling Transport” John Wiley and Sons, New York, 2011
2. John W. Dickey, “Metropolitan Transportation Planning”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1990

eRESOURCES:

1. https://nptel.ac.in/courses/105101087, “Introduction to transportation engineering” “Prof Dr. Tom V Mathew, IIT Bombay.
2. https://archive.nptel.ac.in/courses/124/105/124105016/, “Urban Landuse and transportation planning”, Prof. Depapratim Pandit, IIT Khargpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the principles of the transportation planning process and methods of data collection
CO2 Acquainted with the trip production, trip attraction models and calibration
CO3 Acquainted with the trip production, trip attraction models and calibration.
CO4 Able to understand trip distribution models and its application.
CO5 Gain knowledge on the mode choice behaviour and mode split models.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	2	3	2	2	3	2	3	1	3	1	3	2
CO2	2	3	3	3	2	1	2	1	1	1	2	1	2	1
CO3	2	3	3	3	2	1	2	2	2	1	3	1		1
CO4	2	2	3	2	2	2	2	2	2	2	3	1	1	
CO5			2		2	3	2	2			2	1		2

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

22CEE57	INTELLIGENT TRANSPORT SYSTEM	L	T	P	C
		3	0	0	3

Preamble

To study the Intelligent transport system functional areas and have an overview of ITS implementation in developing countries.

UNIT 1 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 2 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 3 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 4 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 5 ITS APPLICATION IN LOGISTICS **9**

Commercial vehicle operations and intermodal freight-Fleet Management- IT application in freight logistics - E commerce.

TOTAL : 45

TEXT BOOKS:

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.
2. Intelligent Transport Systems, Intelligent Transportation Primer, Washington, US,2001.

REFERENCES:

1. Henry F.Korth, and Abraham Siberschatz, "Data Base System Concepts", McGraw Hill,1992.
2. TurbanE.,"Decision Support and Export Systems Management Support Systems", Maxwell Macmillan,1998.

ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

eRESOURCES:

1. https://nptel.ac.in/courses/105105204 - "Introduction to Multimodal Transportation system", Prof. Arkopal Kishore Goswami, IIT Kharagpur.
2. https://archive.nptel.ac.in/courses/105/101/105101008/ - "Traffic Stream", Prof. Tom Mathew, IIT Bombay.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the fundamentals of ITS and its benefits.
CO2 Gain knowledge on data collection using sensors and its applications.
CO3 Acquainted with the knowledge of ITS in Traffic Management.
CO4 Application of ITS in-Transportation Planning.
CO5 Able to gain knowledge on application of ITS in Logistics.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1		2	3	2	2	1	3	1	2	2	2	2
CO2	2	2	1	3	3	2	2	2	3	2	3	2	2	2
CO3	2	1	2	2	3	2	1	1	3	2	1	1	3	2
CO4	2	2	1	3	3	2	1	1	3	1	3	2	3	3
CO5	3	2	1	3	3	2	1	2	3	2	3	2	3	2

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

22CEE61	ADVANCED SURVEYING	L	T	P	C
		3	0	0	3

Preamble

To understand the use of Astronomy, Photogrammetry, Total Station and GPS.

UNIT 1 ASTRONOMICAL SURVEYING 9

Astronomical terms and definition – Motion of sun and stars – Celestial co-ordinate System - Time system - Nautical Alamance – Apparent attitude and corrections – Field observations and determinations of time, longitude, latitude and azimuth by attitude and Hour angle method.

UNIT 2 AERIAL SURVEYING 9

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

UNIT 3 TOTAL STATION SURVEYING 9

Classification – basic measuring and working principles of an Electro – optical and Microwave total station- sources of errors in Electro – optical and Microwave total station – Care and Maintenance of total station – trilateration – Applications.

UNIT 4 GPS SURVEYING 9

Basic concepts – Space, Control and User segments – Satellite configuration – Signal structure – Orbit determination and representation – Antispoofing and selective availability – hand held and geodetic receivers – Field work procedure – Data processing Applications.

UNIT 5 LASER SCANNING 9

Airborne Topographic Laser Scanner – Ranging Principle – Pulse Laser and Continuous Wave Laser – First Return and Last Return – Ellipsoidal and Geoidal Height - Airborne Laser Scanner (ALS) – Components of ALS - GPS, IMU, LASER Scanner, Imaging Device - Terrestrial Laser Scanners (TLS) – Working Principle – Static, Dynamic and Vehicle Mounted TLS.

TOTAL : 45

TEXT BOOKS:

1. Arora K.R. “Surveying Vol I & II”, Standard Book House, 10th Edition 2008.
2. Roy S.K., “Fundamentals of Surveying”, 2nd Edition, Prentice Hall of India, 2004.

REFERENCES:

1. James M.Anderson and Edward M.Mikhail, “Surveying, Theory and Practice”, 7 th Edition, McGraw Hill, 2001.
2. Bannister and S.Raymond, “Surveying”, 7th Edition, Longman 2004.
3. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
4. Laurila, S.H. Electronic Surveying in Practice, John Wiley and Sons Inc, 1993.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/107/105107121 - "Modern surveying Techniques" by prof.S.K.Gosh.
2. https://archive.nptel.ac.in/courses/105/103/105103176 - "Higher Surveying" by Prof. Ajay Dashora.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Know the astronomical surveying
CO2 Do the photogrammetric surveying and interpretation
CO3 Solve the field problems with Total station
CO4 Know the GPS surveying and the data processing
CO5 Understand the route surveys and tunnel alignments

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3								2	3
CO2	3	3	3	3	3								2	3
CO3	3	3	1	2	3								2	3
CO4	3	3	3	3	3								2	3
CO5	3	2	3	3	3								2	3

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

22CEE62	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

Preamble

To impart knowledge on improve the characteristics of difficult soils as well as design techniques required to implement various ground improvement methods.

UNIT 1 PROBLEMATIC SOIL AND IMPROVEMENT TECHNIQUES 9

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

UNIT 2 DEWATERING 9

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

UNIT 3 INSITU TREATMENT OF COHESIONLESS AND COHESIVE SOILS 9

Insitu densification of cohesionless soils – Shallow and deep compaction – Dynamic compaction - Vibroflotation, Sand compaction piles and deep compaction. Consolidation of cohesionless soils - Preloading with sand drains, and fabric drains, Stabilization of soft clay ground using stone columns and Lime piles-Installation techniques – Simple design - Relative merits of above methods and their limitations.

UNIT 4 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 5 GROUTING TECHNIQUES 9

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

TOTAL : 45

TEXT BOOKS:

1. Purushothama Raj. P, “Ground Improvement Techniques”, Lakshmi Publications, 2nd Edition, 2016.
2. Mittal.S, “An Introduction to Ground Improvement Engineering”, Medtech Publisher, First Edition, 2013.

REFERENCES:

1. Nihar Ranjan Patra, “Ground Improvement Techniques”, Vikas Publishing House, First Edition, 2012.
2. Koerner, R.M. “Construction and Geotechnical Methods in Foundation Engineering”, McGraw Hill, 1994
3. IS 9759 : 1981 (Reaffirmed 1998) “Guidelines for Dewatering During Construction”, Bureau of Indian Standards, New Delhi
4. IS 15284 (Part 1): 2003 “Design and Construction for Ground Improvement – Guidelines” (Stone Column), Bureau of Indian Standards, New Delhi.

eRESOURCES:

1. https://nptel.ac.in/courses/105108075 - Ground Improvement Techniques - IISc Bangalore by Dr. G.L. Sivakumar Babu
2. https://link.springer.com/book/10.1007/978-981-19-3322-6

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Gain knowledge on methods and selection of ground improvement techniques.
CO2 Understand dewatering techniques and design for simple cases.
CO3 Get knowledge on insitu treatment of cohesionless and cohesive soils.
CO4 Design the earth reinforcement through geosynthetics and application
CO5 select different types of grouting methods and stabilization techniques

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1			3						1	3	
CO2	3	2	1			3						1	3	
CO3	3	2	1			3						1	3	
CO4	3	2	1			3						1	3	
CO5	3	2	1			3						1	3	

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

22CEE63 **REMOTE SENSING**

L	T	P	C
3	0	0	3

Preamble

To introduce the concepts of remote sensing processes and its components and to expose the various remote sensing platforms and sensors and to introduce the elements of data interpretation.

UNIT 1 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 – Radiation principles - Wave theory, Planck_s law, Wien‘s Displacement Law, Stefan‘s Boltzmann law, Kirchoff_s law – Radiation sources: active & passive - Radiation Quantities

UNIT 2 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 3 ORBIT AND PLATFORMS 9

Motions of planets and satellites – Newton_s law of gravitation - Gravitational field and potential - Escape velocity - Kepler_s law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Airborne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit

UNIT 4 SENSING TECHNIQUES 9

Classification of remote sensors – Resolution concept : spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors - High Resolution Sensors - LIDAR , UAV – Orbital and sensor characteristics of live Indian earth observation satellites

UNIT 5 DATA PRODUCTS AND INTERPRETATION 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

TOTAL : 45

TEXT BOOKS:

1. John R. Jensen, Introductory Digital Image Processing: A Remote Sensing Perspective, 4th Edition, 2017.
2. Lillesand T.M., and Kiefer,R.W. Remote Sensing and Image interpretation, VI edition of John Wiley & Sons-2015.

REFERENCES:

1. John A.Richards, Springer – Verlag, Remate Sensing Digital Image Analysis 5th edition, 2013.
2. George Joseph, Fundamentals of Remote Sensing, Third Edition, Universities Press (India) Pvt Ltd, Hyderabad, 2018
3. Paul Curran P.J. Principles of Remote Sensing, ELBS; 1985.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/103/105103193 - "Remote sensing & GIS", Prof. Rishikesh Bharti, IIT Guwahati.
2. https://archive.nptel.ac.in/courses/105/107/105107201 -"Remote sensing essentials", Prof. Arun K Saraf, IIT Roorkee.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 understand the concepts and laws related to remote sensing
CO2 understand the interaction of electromagnetic radiation with atmoshphere and earth material
CO3 acquire knowledge about various remote sensing platforms
CO4 understand the characteristics of different types of remote sensors
CO5 gain knowledge about reception, product generation, storage and ordering of satellite data

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	2	3								2	3
CO2	2	2	2	2	3								2	2
CO3	2	3	3	2	3								2	2
CO4	3	3	2	2	3								2	3
CO5	3	3	3	2	3								2	3

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

22CEE64 **STRUCTURAL GEOLOGY**

L	T	P	C
3	0	0	3

Preamble

To develop analytical techniques to solve structural geology problems as well as introduce them to both theoretical and empirical concepts in rock mechanics and tectonic deformation.
Identify and describe geologic structures using geologic maps, cross-sections, and field measurements

UNIT 1 INTRODUCTION **9**

Concept, approach and scope of structural geology-primary and secondary structures-Principles of geological mapping and map reading-V-rules and outcrop patterns-projection diagrams, Stress, Strain and rheological properties of rocks - Behaviour of minerals, sediments and rocks under deformation conditions.

UNIT 2 DEFORMATION MECHANISMS & MICROSTRUCTURES **9**

Planar and linear structures-cleavage, foliation, lineation and unconformities-Structural behaviour of igneous intrusions-Introduction to petro fabrics, Kinematic analysis and Dynamic analysis deformation at microscale dynamic and static recrystallization-controls of strain rate and temperature on development of microfabrics.

UNIT 3 FOLDS **9**

Elements of fold geometry-classification of folds. Folding mechanisms-Regional fold styles structural analysis of folds-Study of Superimposed folding-Type 1, 2 and 3 interference pattern. S and Z patterns-Stereo plot for different interference pattern-Distinction between F1and F2 folds.

UNIT 4 JOINTS AND FAULTS **9**

Joints and shear fractures-brittle and ductile shear zones-Mohr's circle and criteria for failure of rocks-Fault in rocks-recognition in field-classification of faults and fault surfaces on the basis of slip sense and surface effects-Dynamic analysis of faults-measurement of strain in deformed rocks-time relationship between crystallisation and deformation-Normal faults, strike-slip faults and thrust faults terminology-role of fluid pressure-calculation of paleo stress.

UNIT 5 GEOPROSPECTING **9**

Geological mapping techniques; Remote Sensing: Fundamentals and its role in geological mapping; Geophysical methods for subsurface investigations: Electrical, Seismic & Ground Penetrating Radar (GPR); Subsurface logging and their importance in civil engineering projects.

TOTAL : 45

TEXT BOOKS:

1. George H. Davis, Stephen J. Reynolds and Charles F. Kluth, Structural Geology of Rocks and Regions. John Wiley and Sons, Inc., 2012
2. Donal M. Ragan, Structural Geology: An introduction to Geometrical Techniques, Fourth Edition, 2009.

REFERENCES:

1. Robert J. Twiss and Eldridge M. Moores, Structural Geology, W. H. Freeman and Company, New York, 2007.
2. Billings, M.P. Structural Geology, Third Edition, Pearson Education Limited, 2016.
3. R. G. Park, Foundations of Structural Geology, Third Edition, Reprinted by Routlege, Abingdon, 2005.
4. Kearly, Klepies and Vine, Global Tectonics, Third Edition, Wiley, India, 2009.

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/104/105104191 - "Structural Geology", Prof.Santanu Mishra, IIT Kanpur.
2. https://archive.nptel.ac.in/courses/105/104/105104216 - "Field Structural Geology", Prof.Santanu Mishra, IIT Kanpur.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	Identify primary and secondary structures
CO2	Have knowledge on behaviour of minerals and rocks during stress
CO3	Acquire skills on field recognition of faults, folds and their types
CO4	Understanding of plate tectonics and its role in geological processes such as seismicity and volcanism.
CO5	Have knowledge on geological and structural mapping and its application in geo resource exploration.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2										2	
CO2	3	3	2	2									2	
CO3	3	3	2	2					2				2	
CO4	3	3	2	2									2	
CO5	3	2		2	3				2				2	

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

22CEE65 **RAINWATER HARVESTING**

L	T	P	C
3	0	0	3

Preamble

To impart knowledge and skills relevant to water conservation and management towards achieving the sustainability in water resources and relate the engineering principles and practices in estimation of runoff, storage, recharge into the ground and maintain the system through the best management practices followed around the world.

UNIT 1 INTRODUCTION **9**

Water and its sources - Need for water conservation – Types of water demand - Conservation Methods - Global and Indian perspectives - National mission and goals towards rainwater harvesting – National water policy - Legislation on rainwater harvesting in India and Tamil Nadu.

UNIT 2 HYDROLOGY AND GROUND WATER **9**

Hydrological cycle – Precipitation - Rainfall measurement - Rain-gauges – Hyetograph - Infiltration - Runoff estimation – Rooftop runoff estimation. Ground water - Aquifer Properties – Darcy law and well hydraulics - Steady flow.

UNIT 3 METHODS OF RAINWATER HARVESTING **9**

Rainwater harvesting potential of an area - Traditional harvesting practices – Rooftop harvesting - Methods of RWH structures – Site selection for rainwater harvesting - Surface runoff Harvesting - Ground water recharge - Artificial recharge.

UNIT 4 DESIGN OF RAINWATER HARVESTING STRUCTURES **9**

Design Considerations - Components of Rainwater harvesting system - Simple roof water collection system - Design of Storage structure - Design of Recharge structures – Recharge pit - Recharge trench - Recharge well - Gully plug - Contour bund - Percolation tank - Check dam - Recharge shaft - Efficiency of RWH system.

UNIT 5 MANAGEMENT OF RWH AND CASE STUDIES **9**

Difficulties in RWH - At catchment level - At household level - Evaluation of RWH systems – Maintenance of RWH structures - Modernisation of RWH system - Case studies on best practice of RWH in urban - Success stories of Contemporary practices of RWH in India.

TOTAL : 45

TEXT BOOKS:

1. H.M Raghunath, Ground Water‖ 3rd Edition, New Age International, 2007.
2. Jayarami Reddy.P, A Text book of Hydrology‖ Firewall media Publication, 2005.

REFERENCES:

1. Proceedings of UNHABITAT Blue water series - Rainwater harvesting and utilization‖, Book 2 beneficiaries and capacity builders.
2. Rain water Harvesting Techniques to Augment Ground Water: Ministry of Water Resources Central Ground Water Board Faridabad, 2003.

eRESOURCES:

1. https://archive.nptel.ac.in/content/storage2/courses/105101010/downloads/Lecture10.pdf
2. http://nitttrc.edu.in/nptel/courses/video/105105219/lec51.pdf

Course Outcomes: Upon completion of this course, students will be able to:

CO1	On completion of the course, the student is expected to be able to
CO2	Understand the need for and importance of water conservation through global and Indian practices of rainwater harvesting
CO3	Understand and apply the concepts of hydrology and groundwater in the estimation of runoff and recharge potentials
CO4	Understand the various types of rainwater harvesting methods and apply it on the field
CO5	Design the various RWH structures to harvest the rainwater in surface and subsurface

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	3	3		2						2	
CO2	3	3	3	3	3		2						1	
CO3	3	3	3	3	3		2						1	
CO4	3	3	3	3	3		2						1	
CO5	3	2	3	3	3		2						1	

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

22CEE66	CLIMATE CHANGE ADAPTATION AND MITIGATION	L	T	P	C
		3	0	0	3

Preamble

To impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

UNIT 1 INTRODUCTION **9**

Atmosphere – weather and Climate - climate parameters – Temperature, Rainfall, Humidity, Wind – Global ocean circulation – El Nino and its effect - Carbon cycle

UNIT 2 ELEMENTS RELATED TO CLIMATE CHANGE **9**

Greenhouse gases - Total carbon dioxide emissions by energy sector – industrial, commercial, transportation, residential – Impacts – air quality, hydrology, green space - Causes of global and regional climate change – Changes in patterns of temperature, precipitation and sea level rise – Greenhouse effect

UNIT 3 IMPACTS OF CLIMATE CHANGE **9**

Effects of Climate Changes on living things – health effects, malnutrition, human migration, socioeconomic impacts- tourism, industry and business, vulnerability assessment- infrastructure, population and sector – Agriculture, forestry, human health, coastal areas

UNIT 4 MITIGATING CLIMATE CHANGE **9**

IPCC Technical Guidelines for Assessing Climate Change Impact and Adaptation -Identifying adaption options – designing and implementing adaption measures – surface albedo environment-reflective roofing and reflective paving – enhancement of evapotranspiration - tree planting programme – green roofing strategies – energy conservation in buildings – energy efficiencies – carbon sequestration.

UNIT 5 ALTERNATE FUELS AND RENEWABLE ENERGY **9**

Energy source – coal, natural gas – wind energy, hydropower, solar energy, nuclear energy, geothermal energy – biofuels – Energy policies for a cool future - Energy Audit.

TOTAL : 45

TEXT BOOKS:

1. Maximillian Lackner, Baharak Sajjadi and Wei- Yin chen, Handbook of climate change mitigation and Adaptation, Third Edition, Springer Nature, 2022.
2. Ruddiman W.F, freeman W.H. and Company, “Earth‟s Climate Past and Future”, 2001

REFERENCES:

1. IPCC Sixth Assessment Report, 2021.
2. Fletcher C “Climate Change: What the science tells us”. 2nd Edition. John Wiley & Sons 2018.
3. Dessler A “Introduction to Modern Climate Change”. 2nd Edition. Cambridge University Press (2016).
4. Jan C. van Dam, Impacts of “Climate Change and Climate Variability on Hydrological Regimes”, Cambridge University Press, 2003.

eRESOURCES:

1. https://onlinecourses.swayam2.ac.in/nou24_ge21
2. https://www.ipcc.ch/report/ar5/wg1/

Course Outcomes: Upon completion of this course, students will be able to:

CO1	an insight into carbon cycle, physical basis of the natural greenhouse effect, including the meaning of the term radiative forcing, climate change, global warming and measures to adapt and to mitigate the impacts of climate change
CO2	understanding on the growing scientific consensus established through the IPCC as well as the complexities and uncertainties
CO3	ability to plan climate change mitigation and adaptation projects including the use of alternate fuels and renewable energy
CO4	Gain in-depth knowledge on climate change mitigation measures
CO5	Post process the model outputs for climate impact assessment, know about adaptation strategies

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2							1			1	
CO2	2	2	2			2	3			2		1	2	1
CO3	3	2	2	2						1		1	1	2
CO4	2	3	2	2						2			1	1
CO5	3	3	3			2				1			1	

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

22CEE67	STEEL CONCRETE COMPOSITE STRUCTURES	L	T	P	C
		3	0	0	3

Preamble

To develop an understanding of the effect composite action and assess governing limit states for composite elements.

UNIT 1 INTRODUCTION TO COMPOSITE ACTION 9

Introduction to steel - concrete composite construction – codes – composite design – shear connectors – types of shear connectors – degrees of shear connections – partial and full shear connections.

UNIT 2 DESIGN OF COMPOSITE BEAM 9

Introduce composite beams, including shear studs – Determine the location of a beam's neutral axis depending on the level of composite action. Calculate shear stud strength and understand strength modifiers - deflection of composite beams.

UNIT 3 DESIGN OF COMPOSITE COLUMN 9

Types of Composite columns – design of encased columns – design of in-filled columns – axial, uniaxial and bi-axially loaded columns.

UNIT 4 DESIGN OF COMPOSITE SLAB 9

Introduction – Composite slabs – profiled sheeting – sheeting parallel to span – sheeting perpendicular to span.

UNIT 5 CASE STUDIES 9

Case studies on steel concrete composite construction in buildings - seismic behaviour of composite structures.

TOTAL : 45

TEXT BOOKS:

1. Johnson R P, "Composite Structures of Steel and Concrete Beams, Slabs, Columns and Frames for Buildings", Vol. I, Fourth Edition, Blackwell Scientific Publications, 2018.
2. Oehlers D J and Bradford M A, "Composite Steel and Concrete Structural Members, Fundamental behaviour", Revised Edition, Pergamon press, Oxford, 2000.

REFERENCES:

1. Owens G W and Knowles P, "Steel Designers Manual", Seventh Edition, Steel Concrete Institute (UK), Oxford Blackwell Scientific Publications, 2011.
2. Narayanan R, "Composite steel structures – Advances, design and construction", Elsevier, Applied science, UK, 1987.

eRESOURCES:

1. https://www.designingbuildings.co.uk/wiki/Concrete-steel_composite_structures
2. https://www.steel-insdag.org/teaching-resource-materials - Volume 2.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Describe the effect of composite action has on structural component behavior.
CO2 Design of composite beam elements.
CO3 Design of composite column.
CO4 Design of composite slab elements.
CO5 Study and evaluate the case studies related to steel concrete composite structures.

Mapping of COs with POs and PSOs

Cos/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	1			1			1	1			3	1
CO2	3	3	3			1			1	1			3	2
CO3	3	3	3			1			1	1			3	2
CO4	3	3	3			1			1	1			3	2
CO5	3	3	1			1			1	1			2	3

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

22CEO01	CIVIL AND INFRASTRUTURE ENGINEERING	L	T	P	C
		3	0	0	3

Preamble

To impart the basic knowledge on Civil Engineering materials, Sub-structure, Construction practices, Surveying, Highway and Environmental concepts.

UNIT 1 CIVIL ENGINEERING MATERIALS AND SUB -STRUCTURE 9

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.
Sub Structure: Foundations - Types of Foundation – Shallow and Deep foundation - Requirement of good foundations – Compaction and consolidation – Slope stability.

UNIT 2 CONSTRUCTION PRACTICES 9

Masonry - Brick masonry – Bonds in Brickwork – Stone masonry – Classification of stone masonry – Scaffoldings - Types of Scaffoldings - Box Jacking - Pipe Jacking – Sinking cofferdam - Launching girders - Bridge decks - Erection of light weight components.

UNIT 3 SURVEYING 9

Objects – Types – Classification – Principles – Measurements of distances – Chain surveying – Measurement of Angles using theodolite – Leveling – Rise and Fall method – Height of instrument method - Determination of areas – Illustrative examples – Contour - Total Station – GPS.

UNIT 4 HIGHWAY ENGINEERING 9

Significance of highway plans - Classification of highways: NH, SH, MDR and ODR - Highway Cross sectional elements: Road Margins, Right of way, Carriage way, Shoulder, Formation width, Median or Separator, Camber and Kerbs.

UNIT 5 ENVIRONMENTAL CONCEPTS 9

Components of water distribution system – Sources of water – Surface and Ground water – Characteristics of water – Physical and Chemical characteristics – Water quality standards - Sewerage system – Comparison of slow and rapid sand filter.

TOTAL : 45

TEXT BOOKS:

1. Shanmugam G and Palanichamy M S, “Basic Civil and Mechanical Engineering”, 2nd Edition, Tata McGraw Hill Publishing Co., New Delhi, 2010.
2. Venugopal K., Prabhu Raja V. and Sreekanjana G., “Basic Civil and Mechanical Engineering”, 3rd Edition, Anuradha Publishers, Kumbakonam, 2010. Reprint 2016.

REFERENCES:

1. RamamruthamS., “Basic Civil Engineering”, 3rd Edition, DhanpatRai Publishing Company,2013.
2. Varghese, P.C. “Building Construction”, Prentice Hall of India Pvt. Ltd, New Delhi, 2016.
3. Bindra.S.P and Arora.S.P, “Building Construction”, DhanpatRai Publication Pvt, Ltd, 2010.

eRESOURCES:

1. http://nptel.ac.in/courses/105102088/, “Building Materials and Construction”, Prof. Dr. B. Bhattacharjee, IIT Delhi.
2. https://www.britannica.com/technology/building-construction.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the building components, materials and sub-structures.
CO2 Discuss the highway classification and cross-sectional elements.
CO3 Discuss the various construction practices in the field.

CO4 Demonstrate the knowledge on surveying through linear, angular measurement, Total station and GPS.

CO5 Identify and explain water distribution and sewerage system.

Mapping of COs with POs and PSOs

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

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

22CEO02	ENVIRONMENTAL POLLUTION AND WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

Preamble

This course is useful to provide students an knowledge on water, air and noise pollution, solid and hazardous waste management systems

UNIT 1 WATER POLLUTION 9

Water Pollution: Sources and types of water pollution-Causes and effects of water pollution-Control measures of water pollution-Physical and chemical characteristics of water-Water quality standards as per BIS-Water pollution legislation.

UNIT 2 AIR POLLUTION 9

Air Pollution: Components of atmosphere-Sources and types of air pollutants- Effect of air pollution on human and environment- Formation and effects of smog-Preventive measures and control strategies of air pollution-Air pollution controlling equipment‘s-Air pollution laws.

UNIT 3 NOISE POLLUTION 9

Noise Pollution: Sources and types of noise pollution- Effects of noise pollution on environment, human health and animal - Control measures of noise pollution– Noise reducing techniques- Permissible noise limits-Legislation.

UNIT 4 SOLID WASTE MANAGEMENT 9

Sources and types of solid wastes – Waste generation rates-factors affecting generation of solid wastes-Methods of sampling and characterization- Effects of improper disposal of solid wastes – public health - environment- Elements of solid waste management - Public awareness- Role of NGOs.

UNIT 5 HAZARDOUS WASTE MANAGEMENT 9

Definition of hazardous wastes-Sources and characteristics-Hazardous waste regulations-Minimization of hazardous waste-Handling and storage of hazardous waste-Physical and chemical treatment of hazardous waste-Hazardous waste control measures.

TOTAL : 45

TEXT BOOKS:

1. Dr.Suresh K.Dhameja, “Environmental Science and Engineering”, S.K.Kataria & Sons, New Delhi, 2017.
2. Anjaneyulu, D., “Air Pollution and Control Technologies”, Allied Publishers, Mumbai, 2014

REFERENCES:

1. T.V.Ramachandra, “Management of Municipal Solid Waste”, Capital Publishing Company, New Delhi, 2017.
2. PE Cunniff , “Environmental Noise Pollution” , McGraw Hill, New York, 1987.

eRESOURCES:

1. https://nptel.ac.in/courses/105/104/105104099/, “Environmental Air Pollution”, Prof. MukeshSharma, IIT Kanpur.
2. http://nptel.ac.in/courses/120108005, “Municipal Solid Waste Management”, Prof. T.V. Ramachandra, IISc Bangalore.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the basic concepts of water pollution and its effects on human health and ecosystem
CO2 Discuss the major air pollutants, their sources, chemical transformations in the atmosphere.
CO3 Identify the various noise pollution control strategies.

CO4 Discuss the sources and effects of improper disposal of solid waste on health and environment.
CO5 Explain the possible treatment method of hazardous waste.

Mapping of COs with POs and PSOs

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

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

22CEO03	DISASTER MANAGEMENT AND MITIGATION	L	T	P	C
		3	0	0	3

Preamble

This course is useful to provide students an exposure to disasters- their significance and types and knowledge on relationship between vulnerability- disasters- disaster prevention and risk reduction.

UNIT 1 DISASTER AND ITS TYPES 9

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

UNIT 2 APPROACHES TO DISASTER RISK REDUCTION 9

Disaster cycle - Phases - Culture of safety – prevention - mitigation and preparedness community based DRR – Structural - nonstructural measures - Roles and responsibilities of – community - Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs) - States - Centre - and other stakeholders - Institutional Processess and Framework at State and Central Level - State Disaster Management Authority(SDMA) - Early Warning System - Advisories from Appropriate Agencies.

UNIT 3 INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities - differential impacts - impact of Development projects such as dams-embankments - changes in Land-use.- Climate Change Adaptation - IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge- appropriate technology and local resources.

UNIT 4 DISASTER RISK MANAGEMENT IN INDIA 9

Hazard and Vulnerability profile of India - Components of Disaster Relief: Water – Food - Sanitation-Shelter - Health -Waste Management - Institutional arrangements (Mitigation- Response and Preparedness - Disaster Management Act and Policy - Other related policies – plans - programmes and legislation - Role of GIS and Information Technology Components in Preparedness - Risk Assessment - Response and Recovery Phases of Disaster - Disaster Damage Assessment.

UNIT 5 DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS 9

Landslide Hazard Zonation: Case Studies - Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies - Drought Assessment: Case Studies - Coastal Flooding: Storm Surge Assessment - Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies - Man Made disasters: Case Studies - Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

TOTAL : 45

TEXT BOOKS:

1. Singhal J.P, “Disaster Management”, Laxmi Publications- 2010.
2. Singh R, “Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami”, Horizon Press Publications 2017.
3. Gupta Anil, K.Sreeja, S. Nair, “Environmental Knowledge for Disaster Risk Management-NIDM”, New Delhi- 2011.

REFERENCES:

1. Government of India: Disaster Management Act - Government of India- New Delhi- 2005.
2. Government of India: National Disaster Management Policy- 2009.
3. Shaw R (2016), “Community based Disaster risk reduction”, Oxford University Press

eRESOURCES:

1. http://www.ndmindia.nic.in, "National Disaster Management Authority"- Government of India.
2. http://ndma.gov.in/en/, "National Disaster Management Authority"- Government of India.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain the basic concepts of water pollution and its effects on human health and ecosystem
CO2 Discuss the major air pollutants, their sources, chemical transformations in the atmosphere.
CO3 Identify the various noise pollution control strategies.
CO4 Discuss the sources and effects of improper disposal of solid waste on health and environment.
CO5 Explain the possible treatment method of hazardous waste.

Mapping of COs with POs and PSOs

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

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

22CEO04	BUILDING SERVICES	L	T	P	C
		3	0	0	3

Preamble

To impart the various aspects involved in Civil Engineering practice and the principles of ventilation, electrical, mechanical, fire systems, air conditioning facilities and green building.

UNIT 1 LIGHTING AND VENTILATION 9

Definitions - Objective and uses of services - Applications of services for different types building considering - Classification of building services - Types of services and selection of services - Natural and artificial lighting - Principles and factors - Necessity of Ventilation - Types of ventilation - Natural and Mechanical, Factors to be considered in the design of Ventilation.

UNIT 2 ELECTRICAL SERVICES IN BUILDING 9

Technical terms and symbols for electrical installations - Accessories of wiring - Types of insulation - Electrical layout for residence, small work shop, show room, school building and high rise building.

UNIT 3 MECHANICAL SERVICES IN BUILDINGS 9

Lift: Definition, Types of Lifts - Design Considerations – Location – Sizes - Component parts.

Elevators & Escalators: Different types of elevators and Escalators - Freight elevators - Passenger elevators - Hospital elevators - Uses of different types of elevators Escalators.

Air Conditioning: Principles - Temperature Control - Air Velocity Control - Humidity Control -Air Distribution system – Types of air conditioners – HVAC system.

UNIT 4 FIRE PROTECTION 9

Introduction - Causes of fire and Effects of fire - General Requirements of Fire Resisting Building as per IS: 1642:1989 and NBC 2005 - Characteristics of Fire Resisting Materials - Maximum Travel Distance - Fire Fighting Installations for Horizontal Exit - Roof Exit / Fire Lifts, External Stairs.

UNIT 5 MISCELLANEOUS SERVICES AND GREEN BUILDINGS PROVISIONS 9

Plan for Rain Water Harvesting in the New Buildings - Concept and components of green building - Components of Grey Water System – Management of Grey Water System and Distribution Pattern - Solar Power System.

TOTAL : 45

TEXT BOOKS:

1. Mantri Sandeep, “The A to Z of Practical building construction and its management”, Satya Prakashan, New Delhi, 2020.
2. R. Udaykumar, “A text book on Building Services”, Eswar Press, Chennai.

REFERENCES:

1. Krunal Thanki, “Building Services: Part-1”, Kindle Edition, 2019.
2. Krunal Thanki, “Building Services: Electrical services (Part-2)”, Kindle Edition, 2019.
3. SP 7: 2016, “National Building Code of India” 2016.
4. IS: 1642:1989, “Code of Practice for Fire Safety of Building”

eRESOURCES:

1. https://archive.nptel.ac.in/courses/105/102/105102176/, “Fire protection services and maintenance management of building”, Prof. B.Bhattacharjee, IIT Delhi.
2. https://archive.nptel.ac.in/courses/105/102/105102195/, “Sustainable materials and green building”, Prof. B.Bhattacharjee, IIT Delhi.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Acquire knowledge in lighting and ventilation systems.
CO2 Acquire knowledge in electrical components.
CO3 Synchronize with installation of mechanical accessories in buildings.
CO4 Discuss about the fire protection techniques.
CO5 Discuss about green building applications to the new constructions

Mapping of COs with POs and PSOs

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

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

22CEM51	SUSTAINABLE INFRASTRUCTURE DEVELOPMENT	L	T	P	C
		3	0	0	3

Preamble

To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT 1 SUSTAINABLE DEVELOPMENT GOALS 9

Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian – Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands - Constraints and barriers for sustainable development - future directions.

UNIT 2 SUSTAINABLE INFRASTRUCTURE PLANNING 9

Environmental Impact Assessment (EIA), Land acquisition -Legal aspects, Resettlement &Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modeling).

UNIT 3 SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES 9

Sustainability through lean construction approach - Enabling lean through information technology – Lean in planning and design - Integrated Project Delivery (IPD) - Location Based Management System (LBMS) - Role of logistics in achieving sustainable construction – Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics - Sustainability in geotechnical practice – Design considerations, Design Parameters and Procedures.

UNIT 4 SUSTAINABLE CONSTRUCTION MATERIALS 9

Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability – Sustainable consumption – Eco-efficiency - green consumerism - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Case studies.

UNIT 5 SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS 9

Case Studies - Sustainable projects in developed countries and developing nations - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions.

TOTAL : 45

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.

REFERENCES:

1. Craig A. Langston & Grace K.C. Ding, “Sustainable Practices in the Built Environment”, Butterworth Heinemann Publishers, 2011.
2. William P Spence, “Construction Materials, Methods & Techniques”, Yesdee Publication. Pvt. Ltd, 2016.
3. Kerry Turner. R, “Sustainable Environmental Management”, Principles and Practice Publisher, Belhaven Press.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	understand the environment sustainability goals at global and Indian scenario
CO2	understand risks in development of projects and suggest mitigation measures
CO3	apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.
CO4	explain Life Cycle Analysis and life cycle cost of construction materials.
CO5	explain the new technologies for maintenance of infrastructure projects.

Mapping of COs with POs and PSOs

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

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

22CEM52	SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT	L	T	P	C
		3	0	0	3

Preamble

To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.

UNIT 1 AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS 9

Ecosystem definition - Biotic Vs. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems.

UNIT 2 SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT 9

Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control.

UNIT 3 WATER MANAGEMENT 9

Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use.

UNIT 4 ENERGY AND WASTE MANAGEMENT 9

Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture.

UNIT 5 EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS 9

Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies.

TOTAL : 45

TEXT BOOKS:

1. Oberc, B.P. & Arroyo Schnell, A., "Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming", IUCN, Belgium, 2020.
2. Balkrishna, A, "Sustainable Agriculture for Food Security: A Global Perspective", CRC Press, 2021.

REFERENCES:

1. Singh J & Yadav A.N., "Natural bioactive products in sustainable agriculture", Springer, 2020.
2. Nandwani D, "Organic Farming for Sustainable Agriculture", Springer, 2016.
3. Villalobos, F.J. & Fereres, E., "Principles of Agronomy for Sustainable Agriculture", Springer, 2016.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture.

CO2 Discuss the sustainable ways in managing soil health, nutrients, pests and diseases.

CO3 Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources.

CO4 Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas.

CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem.

Mapping of COs with POs and PSOs

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

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

22CEM53	SUSTAINABLE BIOMATERIALS	L	T	P	C
		3	0	0	3

Preamble

To Impart knowledge of biomaterials and their properties, fundamentals aspects of Biopolymers and their applications, bioceramics and biopolymers and make the students understand the significance of bionanomaterials and its applications.

UNIT 1 BIOMATERIALS 9

Introduction: Definition of biomaterials, requirements & classification of biomaterials - Types of Biomaterials - Degradable and resorbable biomaterials - engineered natural materials - Impact and Future of Biomaterials.

UNIT 2 BIOPOLYMERS 9

Molecular structure of polymers - Molecular weight - Types of polymerization techniques –Types of polymerization reactions - Physical states of polymers - Common polymeric biomaterials – Polyurethane - reactions polymers for medical purposes – Collagens – Elastin - Cellulose and derivatives - Synthetic polymeric membranes and their biological applications.

UNIT 3 BIOCERAMICS AND BIOCOMPOSITES 9

General properties - Bioceramics -Silicate glass - Alumina (Al2O3) - Zirconia (ZrO2)-Carbon - Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites Polymer Matrix Composite (PMC) - Ceramic Matrix Composite (CMC) - Metal Matrix Composite (MMC) – glass ceramics - Orthopedic implants -Tissue engineering scaffolds.

UNIT 4 METALS AS BIOMATERIALS 9

Biomedical metals - types and properties - stainless steel - Cobalt chromium alloys - Titanium alloys Tantalum - Nickel titanium alloy (Nitinol) – magnesium based biodegradable alloys - surface properties of metal implants for osteointegration - medical application - corrosion of metallic implants – biological tolerance of implant metals.

UNIT 5 NANOBIOMATERIALS 9

Nanopolymers – Nanoceramics - Nanocomposites - Carbon based nanobiomaterials - transport of nanoparticles- release rate - positive and negative effect of nanosize nanofibres - Nanosurface and coats - Applications nanoantibiotics – Nanomedicines - Biochips – Biomimetics - BioNEMs –Biosensor Bioimaging/Molecular Imaging - challenges and future perspective.

TOTAL : 45

TEXT BOOKS:

1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani “Introduction to Biomaterials Basic Theory with Engineering Applications” Cambridge University Press, 2014.
2. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh “Characterization of Biomaterials” Wood head publishing, 2013

REFERENCES:

1. Buddy D.Ratner and Allan S.Hoffman Biomaterials Science “An Introduction to Material in Medicine” Third Edition, 2013.
2. Joon Park, R.S.Lakes “Biomaterials An Introduction” third edition, Springer 2007.
3. Leopoido Javier Rios Gonzalez. “Handbook of Research on Bioenergy and Biomaterials: Consolidated and green process” Apple academic press, 2021.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Gain familiarity with Biomaterials and they will understand their importance.

CO2 Get an overview of different biopolymers and their properties.

CO3 Gain knowledge on some of the important Bioceramics and Biocomposite materials.
CO4 Gain knowledge on metals as biomaterials.
CO5 Gain knowledge on the importance of nanobiomaterials in biomedical applications.

Mapping of COs with POs and PSOs

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

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

22CEM54	MATERIALS FOR ENERGY SUSTAINABILITY	L	T	P	C
		3	0	0	3

Preamble

To familiarize the students about the challenges and demands of energy sustainability. To provide fundamental knowledge about electrochemical devices and the materials used. To introduce the students to various types of fuel cell. To enable students to appreciate novel materials and their usage in photovoltaic application. To introduce students to the basic principles of various types Super capacitors and the materials used.

UNIT 1 SUSTAINABLE ENERGY SOURCES 9

Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT 2 ELECTROCHEMICAL DEVICES 9

Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) –Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT 3 FUEL CELLS 9

Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) – Thermodynamics of fuel cell – Anatomy of fuel cells : gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and monopolar plates.

UNIT 4 PHOTOVOLTAICS 9

Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application - photovoltaic concentrators – Cu(InGa)Se2 solar cells – Cadmium Telluride solar cells – dye sensitized solar cells – Perovskite solar cells – Measurement and characterization of solar cells.

UNIT 5 SUPERCAPACITORS 9

Supercapacitor – types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor - three and two electrode cell - parameters of supercapacitor - Activated Carbon Fibres (ACF) - Hydroxides-Based Materials - Two-Dimensional Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL : 45

TEXT BOOKS:

1. John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards., “Functional materials for sustainable energy applications”, 4th Edition, Wiley Publishers 2016.
2. B.E. Conway, “Electrochemical supercapacitors: scientific fundamentals and technological applications”, Kluwer Academic / Plenum publishers, New York, 1999.

REFERENCES:

1. T.R. Crompton, “Batteries reference book”, Newners, 3rd Edition, 2002
2. Parnia Forouzandeh, Vignesh Kumaravel and Suresh C. Pillai, “Electrode Materials for Supercapacitors: A Review of Recent Advances”, Yesdee Publication Pvt. Ltd, 2020.
3. Review of next generation photovoltaic solar cell technology and comparative materialistic development Neeraj Kant, Pushpendra Singh, and Materials Today: Proceedings, 2022.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Acquire knowledge about energy sustainability.
CO2 Understand the principles of different electrochemical devices.
CO3 Learn about the working of fuel cells and their application.
CO4 Learn about various Photovoltaic applications and the materials used.
CO5 Gain knowledge on different types of super capacitors and the performance of various materials

Mapping of COs with POs and PSOs

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

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

22CEM55	GREEN TECHNOLOGY	L	T	P	C
		3	0	0	3

Preamble

To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability. To provide green engineering solutions to energy demand reduced energy footprint.

UNIT 1 PRINCIPLES OF GREEN CHEMISTRY 9

Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT 2 POLLUTION TYPES 9

Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT 3 GREEN REAGENTS AND GREEN SYNTHESIS 9

Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions.

UNIT 4 DESIGNING GREEN PROCESSES 9

Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention

UNIT 5 GREEN NANOTECHNOLOGY 9

Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology.

TOTAL : 45

TEXT BOOKS:

1. Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, “Green technology and design for the environment”, Washington, DC, 1997.
2. M. Lancaster, “Green Chemistry – An introductory text”, RSC, 2016.

REFERENCES:

1. Alexi Lapkin and david Constable, “Green chemistry metrics”, Wiley publications, 2008.
2. Stanley E Manahan, “Environmental chemistry”, Taylor and Francis, 2017.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the principles of green engineering and technology.
CO2 Learn about pollution using hazardous chemicals and solvents.
CO3 Modify processes and products to make them green and safe.
CO4 Design processes and products using green technology.
CO5 Understand advanced technology in green synthesis.

Mapping of COs with POs and PSOs

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

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

22CEM56	ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS	L	T	P	C
		3	0	0	3

Preamble

To understand and study the complexity of the environment in relation to pollutants generated due to industrial activity

UNIT 1 ENVIRONMENTAL MONITORING AND STANDARDS 9

Introduction- Environmental Standards- Classification of Environmental Standards- Global Environmental Standards- Environmental Standards in India- Ambient air quality standards- water quality standard- Environmental Monitoring-Need for environmental monitoring- Concepts of environmental monitoring- Techniques of Environmental Monitoring.

UNIT 2 MONITORING OF ENVIRONMENTAL PARAMETERS 9

Current Environmental Issues- Global Environmental monitoring programme-International conventions- Application of Environmental Monitoring- Atmospheric Monitoring - screening parameters – Significance of environmental sampling- sampling methods – water sampling - sampling of ambient air- sampling of flue gas.

UNIT 3 ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING 9

Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods - Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis.

UNIT 4 ENVIRONMENTAL MONITORING PROGRAMME & RISK ASSESSMENT 9

Water quality monitoring programme- national water quality monitoring- Parameters for National Water Quality Monitoring- monitoring protocol; Process of risk assessment- hazard identification-exposure assessment- dose-response assessment; risk characterization

UNIT 5 AUTOMATED DATA ACQUISITION AND PROCESSING 9

Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks -Sensors and transducers- classification of transducers- data acquisition system- types of data acquisition systems- data management and quality control; regulatory overview.

TOTAL : 45

TEXT BOOKS:

1. Frank R. Burden, “Environmental monitoring Handbook”, 2002 by The McGraw-Hill Companies, Inc.
2. Pradyot Patnaik, “Handbook of environmental analysis: chemical pollutants in the air, water, soil, and soild wastes”, CRC Press, Inc., 1997.

REFERENCES:

1. H. H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, “Instrumental Methods of Analysis”, CBP Publishers and Distributors, New Delhi, 1988.
2. Heaslip, G. “Environmental Data Handling” John Wiley & Sons. New York, 1975.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Explain basic concepts of environmental standards and monitoring.

CO2 Explain ambient air quality and water quality standards;
CO3 Explain the various instrumental methods and their principles for environmental monitoring
CO4 Explain the significance of environmental standards in monitoring quality and sustainability of the environment.
CO5 Explain the various ways of raising environmental awareness among the people.

Mapping of COs with POs and PSOs

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

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

22CEM57	INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

Preamble

To create awareness on the energy scenario of India with respect to world and also to understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilization.

UNIT 1 ENERGY SCENARIO 9

Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security

UNIT 2 ENERGY AND ENVIRONMENT 9

Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT 3 SUSTAINABLE DEVELOPMENT 9

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG) - Social development: Poverty, conceptual issues and measures, impact of poverty. Globalization and Economic growth - Economic development: Economic inequalities, Income and growth.

UNIT 4 RENEWABLE ENERGY TECHNOLOGY 9

Renewable Energy – Sources and Potential – Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans – Principle of operation, relative merits and demerits

UNIT 5 ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT 9

National & State Energy Policy - National solar mission - Framework of Central Electricity Authority - National Hydrogen Mission - Energy and climate policy - State Energy Action Plan, RE integration, Road map for ethanol blending, Energy Efficiency and Energy Mix

TOTAL : 45

TEXT BOOKS:

1. Dhandapani Alagiri, "Energy Security in India Current Scenario", The ICFAI University Press, 2006.
2. Godfrey Boyle, "Renewable Energy, Power for a Sustainable Future", Oxford University Press, U.K., 2012.

REFERENCES:

1. M.H. Fulekar,Bhawana Pathak, R K Kale, "Environment and Sustainable Development" Springer,2016.
2. Energy Manager Training Manual available at http://www.em-ea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the world and Indian energy scenario

CO2 Analyse energy projects, its impact on environment and suggest control strategies

CO3 Recognise the need of Sustainable development and its impact on human resource development

CO4 Apply renewable energy technologies for sustainable development

CO5 Apply Energy policies and planning for sustainable development.

Mapping of COs with POs and PSOs

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

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

22CEM58	ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT	L	T	P	C
		3	0	0	3

Preamble

To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation. To create awareness on energy audit and its impacts. To acquaint the techniques adopted for performance evaluation of thermal utilities. To familiarise on the procedures adopted for performance evaluation of electrical utilities. To learn the concept of sustainable development and the implication of energy usage.

UNIT 1 ENERGY AND ENVIRONMENT 9

Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP.

UNIT 2 ENERGY AUDITING 9

Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT 3 ENERGY EFFICIENCY IN THERMAL UTILITIES 9

Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression.

UNIT 4 ENERGY CONSERVATION IN ELECTRICAL UTILITIES 9

Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers.

UNIT 5 SUSTAINABLE DEVELOPMENT 9

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG). Globalization and Economic growth. Economic development: Economic inequalities, Income and growth. Social development: Poverty, conceptual issues and measures, impact of poverty.

TOTAL : 45

TEXT BOOKS:

1. Eastop.T.D & Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, 1990.
2. W.R. Murphy and G. McKay, “Energy Management”, Butterworths, London 1987.

REFERENCES:

1. Matthew John Franchetti, Defne Apul, “Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies”, CRC Press, 2012.
2. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, “Energy and the Environment”, 4th Edition,Wiley, 2022.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Understand the prevailing energy scenario.

CO2 Familiarise on energy audits and its relevance.

CO3 Apply the concept of energy audit on thermal utilities.
CO4 Employ relevant techniques for energy improvement in electrical utilities.
CO5 Understand Sustainable development and its impact on human resource development.

Mapping of COs with POs and PSOs

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

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

22CEV01	REVIT ARCHITECTURE	L	T	P	C
		0	0	2	1

Preamble

The course is to teach students the concepts of Building Information Modeling and introduce the tools for parametric building design and documentation using Revit Architecture.

Module 1 INTRODUCTION TO BIM

Introduction - Proprietary and open-source software - Basic drawing and editing tools - file import - Setting up units, levels and grids - Working with a project - Drawing and modifying Walls - Wall Shapes and Openings - Plastering, Skirting and Dado - Wall Sweep and Wall reveal - Wall Layers - Stacked Wall - Dimensions and measurements - Adding, loading and Creating Doors and Windows, Wall opening.

Module 2 WORKING WITH STRUCTURAL ELEMENTS

Drawing and modifying structural element Footing, Column, Beam and Slab - Creating and working with Floor, Roof and Ceiling - Joining/Unjoining of Roof - Roof Soffit - Roof fascia - Creating Stairs, Ramps, lifts, Railings - Curtain wall, curtain grids and Mullions.

Module 3 WORKING WITH COMPONENTS, VIEWS AND ELEVATIONS

Adding Furniture and fixtures to a project - Working with Components - Creating interior elevations – Adding Lighting fixtures - Creating building sections - Site Design and modifying Topo surfaces - Site Components - Framing plans and elevations - Working with views - Adding Sun Setting - Applying Materials - Rendering and Walkthrough - Working with Rendered File - Schedule - BIM management.

TOTAL : 30

REFERENCES:

1. Autodesk Revit Architecture user guide https://images.autodesk.com/adsk/files/revit_architecture_2011_user_guide_en.pdf
2. Ryan Duell and Tobias Hathorn, 'Autodesk Revit Architecture 2016: Essentials', Auto Desk Official Press, Sybex, 2015.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Use the user interface in Revit Architecture
CO2 work with different types of architectural elements and families
CO3 render the building so as to create a photo realistic image

22CEV02	CIVIL ENGINEERING DRAWING AND BAR BENDING SCHEDULE	L	T	P	C
		0	0	2	1

Preamble

This course provides a detailed understanding of how to create a bar bending schedule for reinforced concrete structures and steel structures.

Module 1 BASICS OF BAR BENDING

Basics of bar bending schedule - understanding relevant specification mentioned in the drawing - Types of steel (TOR, MILD steel) - Difference between clear cover and effective cover - Importance of spacing and diameter of reinforcement - Identification & importance of main & secondary bar - Identification of different types of stirrups and cranks/ shear bars.

Module 2 STRUCTURAL DETAILING – CONCRETE STRUCTURES

Drawing preparation - Continuous one-way slab - Simply supported two-way slab - Continuous beam with two equal spans - Dog-legged staircase - RCC column with square isolated footing

Module 3 STRUCTURAL DETAILING – STEEL STRUCTURES

Drawing preparation – Simple structural steel connections – Tension members – Bracings - Beam - Column – Base plate – Plate girder - Fabrication and erection aspects.

TOTAL : 30

REFERENCES:

1. SP:34B -1987, “Hand book on Concrete Reinforcement and detailing”
2. SP: 6(1)-1964, “Hand book for Structural Engineers”.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	prepare neat and proportionate sketches to detail various structural members and connections between them
CO2	Prepare detailed drawings and bar bending schedule of RC elements.
CO3	Prepare structural steel connection drawing

22CEV03	VAASTU SHASTRA – DESIGN APPLICATION	L	T	P	C
		0	0	2	1

Preamble

This course provides in-depth principles of design, layout, measurements, ground preparation, space arrangement and spatial geometry in Vastu shastra.

Module 1 Basics of Vasthu and Directions

Basic Principles of Vasthu – Nature of Globe – Birth of Vasthu – Five min elements – Scientific Vasthu Relationship of Direction to Vasthu – Geopathic Stress – Direction Check – Direction in the Building and Plot – Effect of Corners – Diagonal Plots - Slope of Land

Module 2 Site Selection

Selection of Site/Plot– Energy level inside the plot - Proper soil Selection – Orientation of road – Presence of water bodies in and around the site - Plan and elevation of building – Dimension of doors and windows – Vasthu Guidelines – Application of Vasthu in building construction

Module 3 Size and Shape of Building

Internal Planning of House – Porch & Parking – Compound wall of Building – Over Head water tank – Various parts of House – I, L, U, E Shape building – Factories – Banks – Educational Institution – Hospital – Shops

TOTAL : 30

REFERENCES:

1. Michael Borden, " Vastu Architecture: Design Theory and Application for Everyday Life", CreateSpace, 2011.

Course Outcomes: Upon completion of this course, students will be able to:

CO1 understand the fundamentals of vasthu shastra
CO2 apply vasthu in selection of a location of a building.
CO3 apply vasthu principles in different category of buildings

22CEV04	BUILDING INFORMATION MODELLING	L	T	P	C
		0	0	2	1

Preamble

This course provides an overall understanding of Building Information Modeling (BIM) concepts throughout the lifecycle of a building, from planning, design, construction and operations.

Module 1 BASICS OF BIM

Definition of BIM, history of BIM. BIM on the architecture - Interface and navigation. 3D drafting: basic model building, Structural grids, support

Module 2 MODELING AND RENDERING

Levels, Floors, Roofs, Ceiling, Windows, Doors. Navigation: Ribbon, Sketch Mode, General Interface. Basic dimensions, Building sections, plans and elevations. - Structural systems, MEP systems - 3D Renderings, Materials, Materials Library, Lighting.

Module 3 ADVANCED STRUCTURAL MODELLING

Starting a structural project based on a linked architectural model - Adding structural columns and walls - Adding foundations and structural slabs - Structural Reinforcement - Beams, trusses and framing systems - Steel Connections - Detailing.

TOTAL : 30

REFERENCES:

1. Eastman, C.; Teicholz, P.; Sacks, R.; Liston, K. (2011) BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors. New York: Wiley

Course Outcomes: Upon completion of this course, students will be able to:

CO1 Create basic building models using structural grids and support systems

CO2 Design basic building components including levels, floors, roofs, etc., and employ parametric modeling in 3D design.

CO3 Create advanced structural components of both RCC and steel.

22CEV05	STRUCTURAL ANALYSIS AND DESIGN USING SOFTWARES	L	T	P	C
		0	0	2	1

Preamble

This course provides the use of structural analysis software for the static and dynamic analysis of Structures.

Module 1

2D analysis and design of continuous beam - 2D analysis of single and multi-storied frame - Analysis and design of single storey RCC building.

Module 2

Analysis and design of multi-storey RCC building elements - Isolated and combined footing.

Module 3

Tension members – Bracings - Beam - Column – Base plate – Plate girder – Connections - Analysis and design of a structural steel building.

TOTAL : 30

REFERENCES:

1. https://wiki.csiamerica.com/display/doc/ETABS
2. Prof. Sham Tickoo, "Learning Bentley STAAD Pro. V8i for Structural Analysis", Dream tech Press, 2015.

Course Outcomes: Upon completion of this course, students will be able to:

CO1	build the mathematical model of a given physical structure
CO2	model a simple building, using a commercial analysis software and analyse it for both static and seismic actions
CO3	perform structural design of the simulated structure, according to the code requirements