Dr. MAHALINGAM
MCET
COLLEGE OF ENGINEERING AND TECHNOLOGY
Enlightening Technical Minds Estd. 1998
An Autonomous Institution
(Since 2011)

Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Affiliated to Anna University, Chennai; Approved by AICTE ; Accredited by NAAC with Grade 'A++'
Accredited by NBA - Tier1 (Mech, Auto, Civil, EEE, ECE, E&I and CSE)
Udumalai Road, Pollachi - 642 003. Tel: 04259-236030/40/50 Fax: 04259-236070 www.mcet.in

Curriculum and Syllabi

B.E CIVIL ENGINEERING

Semester I to IV

Regulations 2023

(2023 Batch only)

Programme: Civil Engineering
Curriculum and Syllabi: Semester I to IV
Recommended by Board of Studies on 12.06.2024
Approved by Academic Council on 03.01.2025

Action	**Responsibility**	**Signature of Authorized Signatory**
Designed and Developed by	BoS Civil Engineering	
Compiled by	Office of the Controller of Examinations	
Approved by	Principal	

Dr. Mahalingam College of Engineering and Technology
Department of Civil Engineering

Vision

To develop Competent Civil Engineers to meet the infrastructure challenges of India and the world.

Mission

- To become one of the reputed departments offering Civil Engineering Program in the country.
- To produce excellent engineers to cope up with the changes through dynamic, innovative, and flexible curriculum.
- To provide a conducive environment for teaching & learning and to develop leaders with effective communication skills.
- To conduct quality research driven by industry & societal needs and provide affordable engineering solutions in an ethical way.

Programme: B.E. – Civil Engineering

Programme Educational Objectives (PEOs) - Regulation 2023

B.E Civil Engineering graduates will:

PEO.1 Graduates who effectively demonstrate engineering knowledge, problem solving skill, design capabilities and entrepreneurial skills by providing practical solutions.

PEO.2 Graduates who effectively demonstrate professionalism in multi-disciplinary engineering environment, leadership quality, teamwork and engage in life-long learning.

PEO.3 Graduates who demonstrate an ethical commitment to the community and the profession through involvement with professional societies.

PEO.4 Graduates who make contributions to knowledge and establish best engineering practice through research and development.

Programme outcomes (Pos) – Regulations 2023

PO.1 **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO.2 **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO.3 **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO.4 **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO.5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO.6 **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO.7 **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO.8 **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO.9 **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO.10 **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO.11 **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

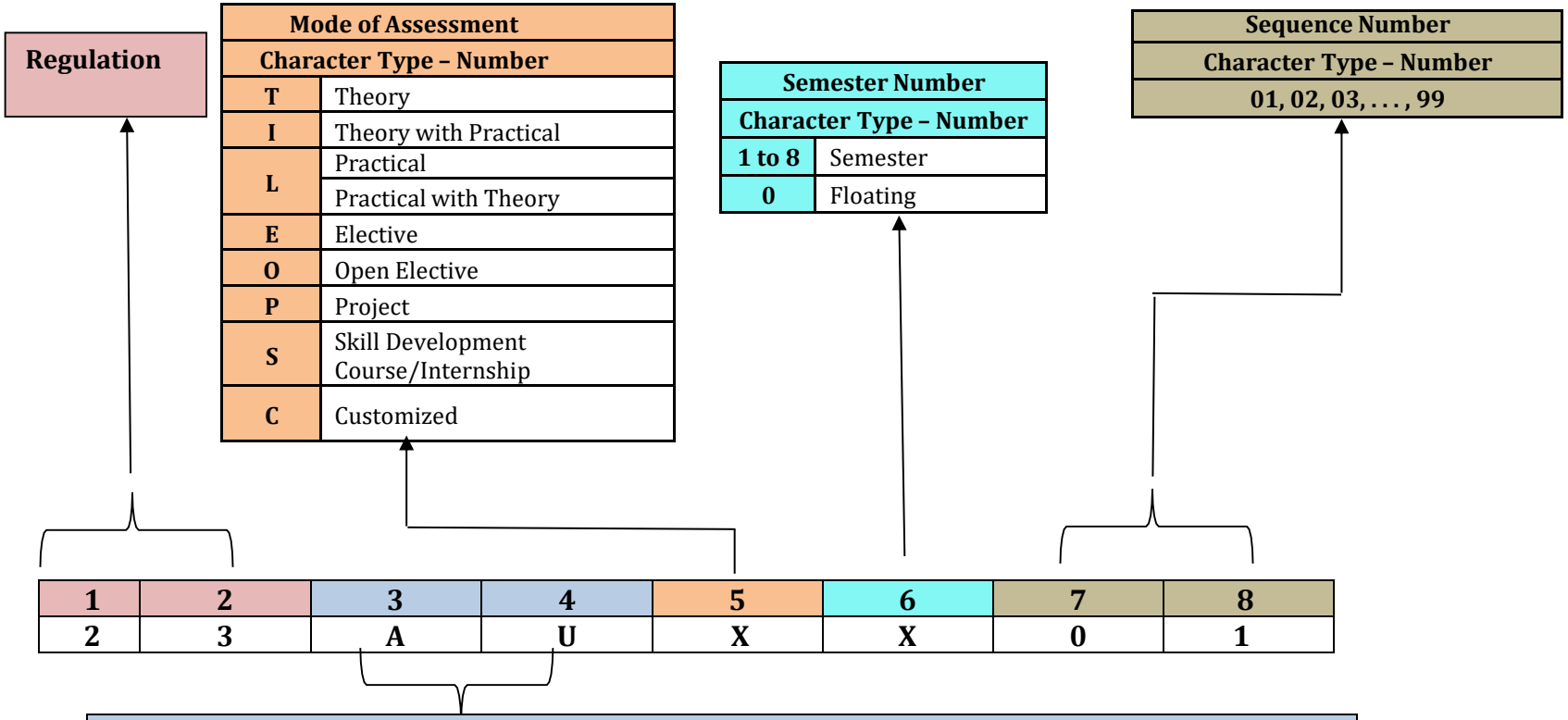
PO.12 **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs) - Regulations 2023

PSO.1 **Problem Analysis:** Able to arrive solutions to real time problems related to various domains of civil engineering through problem solving skills.

PSO2. **Design and Management:** Able to design systems, components and processes considering safety, quality and cost consideration and able to prepare project documents, engineering drawings and construction schedules.

Dr. Mahalingam College of Technology, Pollachi
2023 Regulations - Course Code Generation Procedure for UG Courses



Board/Department/Programme/Course Type			
Character Type – Alphabet			
AD	Artificial Intelligence & Data Science	**ME**	Mechanical
AM	CSE (Artificial Intelligence & Machine Learning)	**SC**	CSE (Cyber Security)
AU	Automobile	**PH**	Physics
CE	Civil	**CH**	Chemistry
CS	Computer Science	**EN**	English
EA	Advanced Communication Technology	**MA**	Mathematics
EC	Electronics and Communication	**ES**	Employability Skills
EE	Electrical and Electronics	**VA**	Value Added Course
EV	VLSI Design & Technology	**SA**	Studio Activities
IT	Information Technology		

Programme: B.E. - CIVIL ENGINEERING
2023 Regulations
Curriculum for semester I to IV (For 2023 Batch only)

Course Type	Course Code	Course Title	Duration	Credits	Marks
VAC	23VAL101	Induction Program	3 Weeks	-	100

SEMESTER I

Course Type	CourseCode	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI101	Communication Skills I	2	0	2	3	100	All
Minor	23MAI101	Linear Algebra and Calculus	3	0	2	4	100	-
Minor	23PHT101	Physics for Civil Engineering	3	0	0	3	100	-
Major	23CET101	Civil Engineers and Society	3	0	0	3	100	-
Minor	23PHL101	Physics for Civil Engineering Laboratory	0	0	3	1.5	100	-
Minor	23CEL101	Engineering Drawing for Civil Engineering	1	0	3	2.5	100	-
VAC	23VAL102	Wellness for Students	0	0	2	1	100	All
VAC	23VAT101	தமிழர்மரபு / Heritage of Tamils	1	0	0	1	100	All
AEC	23SAL101	Studio Activities	0	0	2	-	-	All
		Total	**13**	**0**	**14**	**19**	**800**	

SEMESTER II

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
AEC	23ENI201/ 23FLT201/ 23FLT202	Communication Skills II/ Foreign Language - Japanese/ Foreign Language - German	2	0	2	3	100	All
Minor	23MAI201	Ordinary Differential Equations and Complex Variables	3	0	2	4	100	-
Minor	23CHI201	Chemistry for Civil Engineering	3	0	2	4	100	-
Minor	23CET201	Engineering Mechanics	3	0	0	3	100	-
Multi-disciplinary	23ADT001	C Programming	3	0	0	3	100	CE, EA, EC,EV
Multi-disciplinary	23ADL001	C Programming Laboratory	0	0	3	1.5	100	CE, EA, EC,EV
SEC	23MEL202	Engineering Practices Laboratory	0	0	3	1.5	100	AU, CE, ME
SEC	23ESL201	Professional Skills 1: Aptitude	0	0	2	1	100	All
VAC	23VAT201	தமிழரும்தொழில்நுட்பமும்/ Tamils and Technology	1	0	0	1	100	All
Multi-disciplinary	23CHT202	Environmental Sciences	1	0	0	-	100	All
AEC	23SAL201	Studio Activities	0	0	2	-	-	All
		Total	**16**	**0**	**16**	**22**	**1000**	

SEMESTER III

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Minor	23MAT301	Transforms and Partial Differential Equations	3	1	0	4	100	-
Minor	23CET301	Strength of Materials	3	0	0	3	100	-
Major	23CET302	Surveying	3	0	0	3	100	-
Major	23CET303	Construction Materials and Practices	3	0	0	3	100	-
Major	23CET304	Concrete Technology	3	0	0	3	100	-
Major	23CEL301	Surveying Practice Laboratory	0	0	3	1.5	100	-
Major	23CEL302	Materials Testing laboratory	0	0	3	1.5	100	-
Major	23CEL303	Computer Aided Building Drawing Laboratory	0	0	3	1.5	100	-
SEC	23ESL301	Professional Skills 2: Problem Solving Skills & Logical Thinking 2	0	0	2	1	100	All
VAC	23VAT003	Universal Human Values 2: Understanding Harmony	2	1	0	3	100	All
AEC	23SAL301	Studio Activities	0	0	2	-	-	All
		Total	**17**	**2**	**13**	**24.5**	**1000**	

SEMESTER IV

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23CET401	Structural Analysis I	3	0	0	3	100	-
Major	23CET402	Highway Engineering	3	0	0	3	100	-
Major	23CET403	Water Supply Engineering	3	0	0	3	100	-
Major	23CET404	Remote Sensing and GIS	3	0	0	3	100	-
Major	23CET405	Fluid Mechanics & Hydraulics Engineering	3	1	0	4	100	-
Major	23CEL401	Concrete and Highway Engineering Laboratory	0	0	3	1.5	100	-
Major	23CEL402	Fluid Mechanics & Hydraulics Engineering Laboratory	0	0	3	1.5	100	-
SEC	23ESL401	Professional Skills 3: Professional Development and Etiquette	0	0	2	1	100	All
AEC	23SAL401	Studio Activities	0	0	2	-	-	All
AEC	23CEC011	Survey Camp	1 Week			1	100	-
		Total	**15**	**1**	**10**	**21**	**900**	

Course Type	Course Code	Course Title	Duration	Credits	Marks
SEC	23XXXXXX	Internship - I/ Research Internship/ Skill Development	2 Weeks - 4 Weeks	1	100

Tentative Curriculum for Semester V to VIII

SEMESTER V

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23CET501	Structural Analysis II	3	0	0	3	100	-
Major	23CET502	Geotechnical Engineering I	3	0	0	3	100	-
Major	23CET503	Design of Reinforced Concrete Elements	3	0	0	3	100	-
Major	23CET504	Waste Water Engineering	3	0	0	3	100	
Major	23CEXXXX	Professional Elective - I	3	0	0	3	100	-
Major	23CEXXXX	Professional Elective - II	3	0	0	3	100	-
SEC	23ESL501	Professional Skills 4: Communication Skills and Interview Essentials	0	0	2	1	100	All
Major	23CEL501	Computer Aided Design and Drafting Laboratory - I	0	0	3	1.5	100	-
Major	23CEL502	Environmental Engineering Laboratory	0	0	3	1.5	100	-
AEC	23SAL501	Studio Activities	0	0	2	-	-	All
		Total	**18**	**0**	**10**	**22**	**900**	

Semester VI

Course Type	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23CET601	Design of Steel Structures	3	0	0	3	100	-
Major	23CET602	Geotechnical Engineering II	3	0	0	3	100	-
Major	23CEEXXX	Professional Elective - III	3	0	0	3	100	-
Major	23CEEXXX	Professional Elective - IV	3	0	0	3	100	-
Major	23XXXXXX	Open Elective - I	3	0	0	3	100	-
Major	23CEL601	Computer Aided Design and Drafting Laboratory II	0	0	3	1.5	100	-
Major	23CEL602	Geotechnical Engineering Laboratory	0	0	3	1.5	100	-
SEC	23ESL601	Professional Skills 5: Campus to Corporate	0	0	2	1	100	All
Major	23CEP601	Innovative and Creative Project	0	0	6	3	100	-
AEC	23SAL601	Studio Activities	0	0	2	-	-	All
		Total	**15**	**0**	**16**	**22**	**900**	

Course Type	Course Code	Course Title	Duration	Credits	Marks
SEC	23XXXXXX	Internship - II/Research Internship/ Skill Development	2 Weeks - 4 Weeks	1	100

Semester VII

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23CET701	Construction Project Management	3	0	0	3	100	-
Major	23CEEXXX	Professional Elective - V	3	0	0	3	100	-
Major	23CEEXXX	Professional Elective - VI	3	0	0	3	100	-
Minor	23XXXXXX	Open Elective - II	3	0	0	3	100	-
Major	23CEL701	Quantity Surveying and Estimation	2	0	2	3	100	-
Major	23CEL702	Project Management Laboratory	0	0	3	1.5	100	-
Major	23CEP701	Project Phase - I	0	0	8	4	100	-
		Total	**14**	**0**	**13**	**20.5**	**700**	

Semester VIII

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
			L	T	P			
Major	23CEP801	Project Phase - II	0	0	12	6	200	-
SEC	23XXXXXX	Internship - 3/ Skill Development	8 Weeks			4	100	-
		Total	**0**	**0**	**12**	**10**	**300**	

Total Credits: 163

Vertical Syllabus

Structural Engineering Stream

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks
			L	T	P		
Major	23CEE001	Advanced Concrete Structures	3	0	0	6	100
Major	23CEE002	Maintenance and Rehabilitation of Structures	3	0	0	6	100
Major	23CEE003	Prefabricated Structures	3	0	0	6	100
Major	23CEE004	Prestressed Concrete Structures	3	0	0	6	100
Major	23CEE005	Seismic Design of Structures	3	0	0	6	100
Major	23CEE006	Experimental Techniques	3	0	0	6	100

Environmental Engineering Stream

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks
			L	T	P		
Major	23CEE007	Air Pollution Management	3	0	0	6	100
Major	23CEE008	Industrial Waste Management	3	0	0	6	100
Major	23CEE009	Municipal Solid Waste Management	3	0	0	6	100
Major	23CEE010	Environmental Impact and Risk Assessment	3	0	0	6	100
Major	23CEE011	Climatic Change and Adaption	3	0	0	6	100
Major	23CEE012	Disaster Mitigation and Management	3	0	0	6	100
Major	23CEE013	Sustainable Engineering and Technology	3	0	0	6	100

Geotechnical Engineering Stream

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks
			L	T	P		
Major	23CEE014	Ground Improvement Techniques	3	0	0	6	100
Major	23CEE015	Subsurface Investigation and Instrumentation	3	0	0	6	100
Major	23CEE016	Engineering behavior of Soil	3	0	0	6	100
Major	23CEE017	Shallow Foundation	3	0	0	6	100
Major	23CEE018	Deep Foundation	3	0	0	6	100
Major	23CEE019	Soil Dynamics and Machine Foundation	3	0	0	6	100
Major	23CEE020	Reinforced Soil Structure	3	0	0	6	100

Water Resource Engineering Stream

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks
			L	T	P		
Major	23CEE021	Hydrology	3	0	0	6	100
Major	23CEE022	Groundwater Engineering	3	0	0	6	100
Major	23CEE023	Irrigation Management	3	0	0	6	100
Major	23CEE024	Irrigation Water Quality	3	0	0	6	100
Major	23CEE025	Watershed Conservation and Management	3	0	0	6	100
Major	23CEE026	Remote Sensing and GIS applications in Water Resources	3	0	0	6	100

Construction Engineering and Management Stream

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks
			L	T	P		
Major	23CEE027	Advanced Construction Techniques	3	0	0	6	100
Major	23CEE028	Building Services	3	0	0	6	100
Major	23CEE029	Quality Control and Assurance	3	0	0	6	100
Major	23CEE030	Safety in Construction	3	0	0	6	100
Major	23CEE031	Construction Personnel Management	3	0	0	6	100
Major	23CEE032	Alternative Building Materials	3	0	0	6	100
Major	23CEE033	Economics and financial Management in Construction	3	0	0	6	100

Transportation and Urban Planning Stream

Type of Course	Course Code	Course Title	Hours/Week			Credits	Marks
			L	T	P		
Major	23CEE034	Railways, Airport and Harbour Engineering	3	0	0	6	100
Major	23CEE035	Architecture and Town Planning	3	0	0	6	100
Major	23CEE036	Pavement Engineering	3	0	0	6	100
Major	23CEE037	Traffic Engineering and Management	3	0	0	6	100
Major	23CEE038	Housing Planning and Management	3	0	0	6	100
Major	23CEE039	Introduction to Intelligent Transport Systems	3	0	0	6	100
Major	23CEE040	Urban Planning and Development	3	0	0	6	100

Course Code:23VAL101		Course Title: INDUCTION PROGRAM (Common to all B.E/B.Tech Programmes)
Course Category: VAC		Course Level: Introductory
Duration: 3 weeks	Mandatory Non-Credit Course	Max Marks:100

Course Objectives

The course is intended to:

1. Explain various sources available to meet the needs of self, such as personal items and learning resources
2. Explain various career opportunities, opportunity for growth of self and avenues available in the campus
3. Explain the opportunity available for professional development
4. Build universal human values and bonding amongst all the inmates of the campus and the society.

List of Activities:

1. History of Institution and Management: Overview on NIA Educational Institutions — Growth of MCET – Examination Process –OBE Practices –Code of Conduct – Centre of Excellence.
2. Lectures, interaction sessions and Motivational Talks by Eminent people, Alumni, Employer and Industry Experts.
3. Familiarization of Department / Branch: HoD's & Senior Interaction- Department Association.
4. Universal Human Value Modules: Aspirations and concerns, Self-Management, Relations Social and Natural Environment.
5. Orientation on Professional Skills Courses.
6. Proficiency Modules: Mathematics, English, Physics and Chemistry.
7. Introduction to various Chapters, Cells, Clubs and its events.
8. Creative Arts: Painting, Music and Dance.
9. Physical Activity: Games, Sports and Yoga.
10. Group Visits: Visit to local area and Campus Tour.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 : Explain various sources available to meet the needs of self, such as personal items and learning resources through visit to local areas and campus	Understand
CO2: Explain various career opportunities and avenues available in the campus through orientation sessions	Understand
CO3: Explain the opportunity available for professional development through professional skills, curricular, co-curricular and extracurricular activities	Understand
CO4: Build universal human values and bonding amongst all the inmates of the campus and society for having a better life	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	PO1	PO1	PSO1	PSO2
CO1	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO2	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO3	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO4	2	-	-	-	-	-	-	2	1	2	-	-	-	-

High: 3, Medium: 2, Low: 1

Text Book(s):

T1. Reading material, Workbook prepared by PS team of the college

Reference Book(s):

R1. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster Uk, 2004.
R2. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, aliyar, “value educat harmonious life (Manavalakalai Yoga)”, Vethathri Publications, Erode, 2010.
R3. Dr. R.Nagarathna, Dr.H.R. Nagendra, “Integrated approach of yoga therapy for positive Swami Vivekananada Yoga Prakashana Bangalore, 2008 Ed.

Web References:

1. https://youtube.com/playlist?list=PLYwzG2fd7hzc4HerTNkc3pS_IvcCfKznV.
2. https://www.youtube.com/watch?v=P4vjfEVk&list=PLWDeKF97v9SO0frdgmpaghDMjkom1.
3. https://fdp-si.aicte-india.org/download/AboutSIP/About%20SIP.pdf.

Course Code: 23ENI101	Course Title: COMMUNICATION SKILLS I (Common to all B.E/B.Tech Programmes)		
Course Category: AEC		Course Level: Introductory	
L:T:P(Hours/Week) 2:0:2	Credits: 3	Total Contact Hours:60	Max Marks:100

Course Objectives

The course is intended to impart formal and informal language effectively and accurately in various real-life contexts on par with B1 level of CEFR Scale.

Module I **20 Hours**

Grammar: Synonyms & Antonyms -Tense forms - Modals - Passives – Reported Speech – Comparatives and Descriptive adjectives.

Listening: Listening for gist and specific information - Listening to past events, experiences and job preferences - Listening to descriptions of monuments - Listening for excuses - Listening to description: transportation systems and public places.

Speaking: Introducing oneself - Exchanging personal information — Effective Conversations: Role Play Situations (Describing personality traits - Describing landmarks, monuments and festivals - Making polite requests and excuses - Discussing facts - Asking for and giving information — Expressing wishes - Talking about lifestyle changes - Talking about transportation and its problems - Describing positive and negative features of things and places - Making comparisons)

Reading: Skimming and Scanning - Reading Comprehension - Reading and comprehending online posts and emails — Case Studies

Writing: Letter writing (Permission letters - Online cover letter for job applications) - Instructions - Recommendations - Write a blog (General) - Report Writing (Industrial Visit Report and Event Reports) - formal and informal emails.

Module II **20 Hours**

Grammar: Sequence adverbs - Phrasal verbs - Relative clauses – Imperatives - Infinitives - Conditionals.

Listening: Listening to review of food items - Listening to results of surveys- Listening to motivational talks & podcasts

Speaking: Expressing likes and dislikes - Describing a favourite snack - Giving advices and suggestions - Speculating about past and future Events — Group Discussion

Reading: Reading different expository texts - Reading to factual texts - Print and online media- Reading Comprehension

Writing: Process Descriptions – Email Writing (Requesting for information) - Reviewing Movie – Social media feeds/posts (Any Social Media)

List of Experiments: **20 Hours**

1. Mini Presentation and Picture Prompt Discussion
2. Debate Tournament
3. Listening, Mind Mapping & Summarization
4. Listening to Stories and Providing the Innovative Climax
5. Reading Comprehension
6. Writing - Interpretation of Visuals.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Utilize the basic English grammar and vocabulary to acquire professional communication skills.	Apply
CO 2 : Develop listening and speaking skills through classroom activities based on listening comprehension, recapitulation, interpretation and debate on the same	Apply
CO 3 : Read and write social media posts and comments	Apply
CO 4 : Perform as a member of a team and engage in individual presentation	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	-	-

High-3; Medium-2; Low-1

Textbooks:

T1. Jack C. Richards, Jonathan Hull, and Susan Proctor, “Interchange - Student’s book 2”, 5th Edition, Cambridge University Press, South Asia Edition, 2022.

T2. Jack C. Richards, Jonathan Hull, and Susan Proctor, “Interchange - Student’s Book 1”, 5th Edition, Cambridge University Press, South Asia Edition, 2022.

Reference Book(s):

R1. David Bohlke, Jack C. Richards, “Four Corners”, 2nd Edition, Cambridge University Press,2018.
R2. Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones, Graham Burton, Empower B1 – Student’s Book, Cambridge University Press, 2020.
R3. Raymond Murphy, “Intermediate English Grammar” 30th Edition, Cambridge University Press, 2022.

Web References:

1. https://speakandimprove.com/
2. https://writeandimprove.com/
3. https://www.cambridgeenglish.org/exams-and-tests/linguaskill/.

Course Code: 23MAI101		Course Title: LINEAR ALGEBRA AND CALCULUS	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) 3:0:2	Credits: 4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The course is intended to impart knowledge to formulate and solve matrix based operations, sequences, series and gain proficiency in calculus computations through mathematical software tools.

Module I **23 Hours**

Matrices

Eigen values and Eigen vectors-symmetric, skew symmetric and orthogonal matrices- Diagonalization of matrix through orthogonal transformation- Cayley-Hamilton theorem (without proof) - Reduction of quadratic forms to canonical form-rank, index, signature and nature of quadratic forms.

Sequences and Series

Sequences-definitions and examples- Series-Tests for convergence-comparison test, integral test, Alembert's ratio test- Alternating series –Leibnitz's test.

Differential Calculus I

Curvature-Cartesian and Polar coordinates- radius of curvature-center of curvature-

Module II **22Hours**

Differential Calculus II

Circle of curvature.-Evolute and Involute of standard curves.

Multivariable Differentiation

Partial derivatives - Total derivatives- Differentiation of implicit functions- Taylor's series and Maclaurin's series – Jacobian – Maxima, Minima and saddle points - Method of Lagrange's multipliers.

Multiple Integral

Multiple Integration: Double integrals - Change of order of integration in double integrals - Change of variables (Cartesian to polar) - Triple integrals - Applications: Finding areas and volumes.

List of Experiments: **30 Hours**

1. Introduction to MATLAB.
2. Rank of matrix and solution of system of linear algebraic equations.
3. Characteristic equation of a matrix and Verification of Cayley Hamilton theorem.
4. Finding Eigen values and Eigen vectors of a matrix.
5. Curve fitting and Interpolation.
6. Determining maxima and minima of a function of two variables.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Use orthogonal transformation to transform quadratic for to canonical form.	Apply
CO2: Apply different testing methods to check the nature of infinite series.	Apply
CO3: Calculate the Evolute and envelope of curves.	Apply
CO4: Apply partial derivatives to find extreme values of multivariate functions.	Apply
CO5: Determine the area between plane curves and volume of solids using multiple integrals.	Apply
CO6: Demonstrate the understanding of linear algebra and calculus concepts through modern tool.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	3	-	-	-	-	-	-	-	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & sons, 2010.
T2.T.Veerarajan.,Engineering Mathematics for first year, 3rd edition, Tata McGraw-Hill,2019.NewDelhi, 2008.

Reference Book(s):

R1.G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2002.

R2.B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

R3. P. Sivaramakrishna Das , C. Vijayakumari , ”Engineering Mathematics “2017,PearsonIndia.

Web References:

1.https://nptel.ac.in/courses/111107112

2.https://nptel.ac.in/courses/111104031

Course Code: 23PHT101		Course Title: PHYSICS FOR CIVIL ENGINEERING	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge of the basic properties of Matter, Acoustics, Nano concepts and NDT.

Module I **22 Hours**

Elasticity: Introduction – Concept of Load, Stress and Strain – Hooke's law – Stress-Strain Diagram – Elastic and Plastic Materials – Factors affecting Elastic Properties – Three Moduli of Elasticity – Relation between Young's, Rigidity and Bulk moduli (Qualitative – No derivation) – Bending Moment of a Beam – Determination of Young's modulus using a Cantilever – I-Shaped Girders – Twisting Couple of a wire – Determination of Rigidity Modulus of a thin wire using Torsional Pendulum.

Viscosity: Coefficient of Viscosity – Experimental determination of coefficient of viscosity: Poiseuille's method and Stoke's method.

Thermal Physics: Introduction – Modes of Heat Transfer – Thermal Conductivity – Newton's law of cooling – Specific Heat Capacity determination – Advantages and disadvantages of Newton's law of cooling method – Verification of Newton's law of cooling – Lee's disc method for the determination of thermal conductivity of a bad conductor – Conduction of Heat through a compound media: Bodies in both series and Parallel.

Nanotechnology: Introduction – Importance of Nanotechnology – Nanomaterials – Nanoparticles – Synthesis of Nanoparticles: High-energy ball milling (top-down approach) – Sol-gel process (bottom-up approach) – Application of Nanomaterials.

Module II **23 Hours**

Nanomaterials: Carbon Nanomaterials – Fullerenes: Properties, synthesis and Applications – Carbon Nanotubes – Types – Synthesis of Carbon Nanotubes: Arc-Evaporation method – Properties of Carbon Nanotubes – Application of Carbon Nanotubes.

Architectural Acoustics: Introduction – Classification of Sound – Characteristics of musical sound (Intensity, Frequency and Quality) – Weber – Fechner law – Sound Intensity level – Decibel – Human Audiogram – Phon – Sound reflection – Reverberation Time – Sound Absorption – Sabine's formula for reverberation time (Growth and Decay of Sound Energy in a hall) – Absorption coefficient and its determination – Factors affecting acoustics of a building and their remedies – Acoustic design of a hall.

Non-Destructive Testing (NDT): Introduction – Advantages of NDT over conventional testing techniques – Methods of NDT. Liquid Penetrant Testing (LPT): Steps of LPT – Materials used in LPT – Advantages and Limitations of LPT. Ultrasonic Inspection: Pulse Echo method and through transmission method. Data presentation: A-Scan, B-Scan and C-Scan displays.

Sensors: Sensors for Structural Health Monitoring – Accelerometer – Vibrating wire sensors – Strain Gauges – Inclinometer – Acoustic emission sensor – Temperature sensors.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply the basic concepts of elasticity, heat and nanotechnology to solve the different physical parameters.	Apply
CO2: Perform as a member of team in analysing the concepts of elasticity, heat and nanotechnology involved in real-life applications related to civil engineering and make a presentation.	Apply
CO3: Interpret the concepts of nanomaterials, acoustics and non-destructive techniques and apply it for different engineering applications.	Apply
CO4: Perform as a member of team in articulating the modern technologies behind nanotechnology, architectural acoustics and testing of materials.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	1	3	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	1	3	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. M.N.Avadhanulu, P.G.Kshirsagar, “A Textbook of Engineering Physics”, S.Chand & Co. New Delhi, Revised 8th Edition, 2014.

T2. A. Marikani, “Engineering Physics”, PHI Learning Private Limited, New Delhi, 2nd Edition, 2014.

Reference Book(s):

R1. J. Walker, D.Halliday, R.Resnick,”Principles of Physics”, Wiley Student Edition, New Delhi, 10th Edition, 2015.

R2. D.S.Mathur, “Properties of Matter”, S. Chand & Co., New Delhi, 4th Edition, 2012.

R3. Balasubramaniam "Callister's Material Science and Engineering", John Wiley and Sons Inc., 2nd Edition, 2015.

Web References:

1. https://www.fprimec.com/sensors-for-structural-health-monitoring/
2. http://www.physicsclassroom.com/
3. http://nptel.ac.in/course.php?disciplineId=115

Course Code: 23CET101		Course Title: CIVIL ENGINEERS AND SOCIETY	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to provide an overview of the profession of Civil Engineering and professional ethics.

Module I **22 Hours**

INTRODUCTION

Engineering – Definition – Engineering Education – Graduate Attributes – Engineering functions – Role and Responsibilities of Engineers – Early construction and development over time.

FUNDAMENTALS OF CIVIL ENGINEERING

Introduction to Civil Engineering –Branches in Civil Engineering – Elements of Building Construction - General Requirement of Building, Elementary principles and basic requirements of a building Planning, Importance of Planning – Possible scopes for a career.

OVERVIEW OF NATIONAL PLANNING FOR CONSTRUCTION AND INFRASTRUCTURE DEVELOPMENT

Types of Infrastructures - Impact of infrastructural development on economy and environment of country – Position of Construction Industry five year plan outlays for construction – Current budget for infrastructure works - Role of Civil Engineer in Society.

Module II **23 Hours**

ENGINEERING AS SOCIAL EXPERIMENTATION

The concept of profession – Importance of ethics in engineering – Role of codes of ethics – Professional responsibilities of engineers – Overview of ethical theories and applications - Engineering as Experimentation – Engineers as responsible Experimenters.

SUSTAINABILITY

Reliability, risk and safety – Risk management – Engineering and the environment – Ethics and the environment – Sustainable Engineering – Sustainable Development Goal and Civil Engineering.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Identify and analyze the graduate attributes in their course of study.	Apply
CO.2 Identify and apply the elements of building and importance of Civil Engineering towards nation's economy.	Apply
CO.3 Identify and apply the ethical interest of stake in real world situation or practice.	Apply
CO.4 Engage in independent study as a member of a team and make an effective oral presentation on the application of graduate attributes and ethical values.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	3	-	-	-	-	-	-
CO4	-	-	-	-	-	3	3	3	3	3	-	3	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Kim Strom Gottfried, "Straight Talk about Professional Ethics", Lyceum Books, 2nd edition, 2014.

T2. S S Bhavikati, "Basic Civil Engineering", New Age International (P) Limited Publishers, New Delhi, 2018.

Reference Book(s):

R1. Rebecca Mirsky and John Schaufelberger, "Professional Ethics for the Construction Industry" RICS, USA, 2014.

R2. Ramesh Chandra Das, "Social, Health, and Environmental Infrastructures for Economic Growth", IGI Global Disseminator of Knowledge, 2017.

R3. Kenneth K. Humphreys, "What Every Engineer Should Know about Ethics", CRC Press, 1999.

Web References:

1. https://archive.nptel.ac.in/courses/105/106/105106201/
2. Richard Ashley, "The role of the civil engineer in society: engineering ethics and major projects", **https://doi.org/10.1680/cien.2012.165.3.99**, May 25, 2015.

Course Code: 23PHL101	Course Title: PHYSICS FOR CIVIL ENGINEERING LABORATORY		
Course Category: Minor		Course Level: Introductory	
L:T:P (Hours/Week) 0:0:3	Credits:1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to expose the students to various experimental skills which are very essential for an Engineering student.

List of Experiments (Any ten):

1. Determination of Young's Modulus of the material – Cantilever bending method.
2. Determination of Young's Modulus of the material – Uniform bending method.
3. Determination of Young's Modulus of the material – Non-Uniform bending method.
4. Determination of Rigidity modulus of the metallic wire – Torsion Pendulum method.
5. Determination of Viscosity of low viscous liquid – Poiseuille's method.
6. Determination of Viscosity of high viscous liquid –Stoke's method.
7. Lee's Disc method - Determination of thermal conductivity of the bad conductor.
8. Determination of specific heat capacity of given liquid – Newton's law of cooling method.
9. Ultrasonic interferometer – Determination of velocity of ultrasonics and compressibility of given liquid.
10. Measurement of sound intensity using sound level meter.
11. Measurement of strain using strain gauge.
12. Determination of Wavelength of laser using plane transmission grating and hence estimate particle size of lycopodium powder.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Elucidate the basic principles involved in the given experiments	Understand
CO2: Conduct, analyze and interpret the data and results from physics experiment	Evaluate

Course Articulation Matrix

CO Vs PO	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	3	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Physics Laboratory Manual Prepared by Faculty of Physics, Dr. Mahalingam College of Engineering and Technology

R2. Engineering Physics Laboratory Manual, Dr. R. Jayaraman, V. Umadevi, S. Maruthamuthu, B. Saravanakumar, Pearson India Education Services Pvt. Ltd, 2022.

R3. B.Sc., Practical Physics, C.L. Arora, S. Chand and Co, 2012.

Web References:

1. https://vlab.amrita.edu/index.php?sub=1&brch=280
2. https://vlab.amrita.edu/index.php?sub=1&brch=189
3. https://vlab.amrita.edu/index.php?sub=1&brch=194

Course Code: 23CEL101	Course Title: ENGINEERING DRAWING FOR CIVIL ENGINEERING		
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) 1: 0 : 3	Credits: 2.5	Total Contact Hours:60	Max Marks: 100

Course Objectives:

The course is intended to understand and develop the skill of drawing projection of points and lines, orthographic projection, isometric views of simple objects and buildings, perspective view of simple building. Also, to know the basic commands and applications of AutoCAD.

Module I **8 Hours**

Importance of drawing in engineering applications - BIS conventions and specifications - Size, layout and folding of drawing sheets - Lettering and dimensioning - First angle projection - projection of points and lines - Determination of true lengths and true inclinations - Representation of Three-Dimensional objects - General principles of orthographic projection - Need for importance of multiple views and their placement - layout of views - Orthographic projection - Conversion of pictorial view to orthographic views - Projection of simple solids - Prism, pyramid, cylinder and cone - Isometric projection of simple solids- Prism, pyramid, cylinder & cone - Projection of simple residential building.

Module II **7 Hours**

Perspective projection of simple solids like prism, pyramid, cylinder and cone by Visual Ray Method - Perspective projection of building by vanishing point method- AutoCAD- Applications, Advantages, System requirement, Elements of drawing window, Units, Limits, Drawing Tools - Draw, modify, annotation, layers and properties - Function keys - 3D tools - Orthographic projection of simple solids.

45 Hours

List of Experiments:

1. Lettering & Dimensioning
2. Projection of points and lines
3. Orthographic projection of pictures
4. Orthographic projection of simple solids
5. Isometric projection of simple solids
6. Isometric projection of building
7. Perspective projection of simple solids
8. Perspective projection of building.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Draw orthographic, isometric and perspective projections of solids and buildings.	Apply
CO2: Draw projections of solids using software	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	2	-	-	-	-
CO2	3	-	-	-	3	-	-	-	3	2	-	-	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. K. V. Natrajan, A Text Book of Engineering Graphics, 48th Edition, Dhanalakshmi Publishers, Chennai, 2018.

T2. Rangawala, “A text book of Civil Engineering Drawing”, Charotar publishers, 3rd edition, 2017.

Reference Book(s):

R1. K.L. Narayana and P. Kannaiah, “Engineering Drawing”, Scitech Publications (India) Pvt. Ltd., 3rd Edition, 2021.

R2. Anurag A. Kandya, “Elements of Civil Engineering” Charotar publishers, 3rd edition, 2017 (Reprint).

R3. B.P. Verma, “Civil Engineering Drawing & House Planning”, Khanna publishers, 12th edition, 2006.

Publications of Bureau of Indian Standards:

1. IS 10711 - 2001: Technical Product Documentation - Sizes and layout of drawing sheets.

2. IS 9609 (Part- 0 & 1) - 2001: Technical Product Documentation - Lettering.

3. IS 10714 (Part 20) - 2001: Technical Drawings- General Principles of Presentation- Basic Conventions for Lines.

4. IS 11669 - 1986: General Principles of Dimensioning on Technical Drawings.

5. IS 15021 (Part- 1 to 4) - 2001: Technical Drawings - Projection Methods.

6. SP 46 - 2003: Engineering Drawing Practice for Schools & Colleges.

Course Code: 23VAL102		Course Title: WELLNESS FOR STUDENTS (Common to all B.E/B.Tech Programmes)	
Course Category: VAC		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0 :2	Credits:1	Total Contact Hours:30	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on setting SMART goals for academic, career and life, applying time management techniques, articulating the importance of wellness for success in life and understanding the dimensions of wellbeing and relevant practices.

Module I **15 Hours**

GOAL SETTING Understanding Vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people. Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume. Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment.

TIME MANAGEMENT - TOOLS AND TECHNIQUES Importance of planning and working to time. Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination.

CONCEPT OF WELLNESS – impact of absence of wellness - Wellness as important component to achieve success. Wellbeing as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods

Module II **15 Hours**

Simplified Physical Exercises. Fitness as a subset of Wellness – health related physical fitness - skill related physical fitness. Joint movements, Warm up exercises, simple asanas, WCSC simplified exercises.

PRACTICES FOR MENTAL WELLNESS

Meditation: Mind and its functions - mind wave frequency – Simple basic meditation – WCSC Meditation and introspection tables. Greatness of friendship and social welfare – individual, Family and world peace – blessings and benefits.

Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas.

PUTTING INTO PRACTICE

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Set well-articulated goals for academics, career, and personal aspirations.	Apply
CO 2: Apply time management techniques to complete planned tasks on time.	Apply
CO 3: Explain the concept of wellness and its importance to be successful in career and life.	Apply
CO 4: Explain the dimensions of wellness and practices that can promote wellness.	Apply
CO 5: Demonstrate the practices that can promote wellness.	Valuing

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	1	1	-	1
CO2	-	-	-	-	-	-	-	-	1	-	1	1
CO3	-	-	-	-	-	-	-	-	1	-	-	1
CO4	-	-	-	-	-	-	-	-	1	-	-	1
CO5	-	-	-	-	-	1	1	-	1	-	-	1

High-3; Medium-2;Low-1

Text Book(s):

T1. Reading material, workbook and journal prepared by PS team of the college.

Reference Book(s):

R1. Stephen R Covey, “First things first”, Simon & Schuster UK, Aug 1997

R2. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster UK, 2004.

R3. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, “Value education for harmonious life (Manavalakalai Yoga)”, Vethathiri Publications, Erode, I Ed. (2010).

R4. Dr. R. Nagarathna, Dr. H.R. Nagendra, “Integrated approach of yoga therapy for Positive health”, Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.

R5. Tony Buzan, Harper Collins, “The Power of Physical Intelligence English”

Course Code: 23VAT101	Course Title: HERITAGE OF TAMILS (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

CO.1 மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்ள இயலும்.

CO.2இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்ள இயலும்.

தமிழர் மரபு

அலகு 1 – மொழி மற்றும் இலக்கியம் 3

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் – சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் – பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு 2 – மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு 3 – நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு 4 – தமிழர்களின் திணைக் கோட்பாடுகள் 3

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக் கோட்பாடு – சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறைமுகங்களும் – சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு 5 – இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறபகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுய மரியாதை இயக்கம் – இந்திய மருத்துவத்தில் சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப் படிகள்– தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

Course Outcomes	**Cognitive Level**
மாணவர்கள் இப்பாடத்தை கற்றபின்	
CO.1 மொழி மற்றும் இலக்கியம், பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை , நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் , திணைக் கோட்பாடுகள் மூலம் தமிழர் மரபை அறிந்து கொள்வார்கள்.	அறிதல் (Understand)
CO.2 இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பை அறிந்து கொள்வார்கள்.	அறிதல் (Understand)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் 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.

Course Code: 23VAT101	Course Title: HERITAGE OF TAMILS (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinai Concept.
2. Understand the Contribution of Tamils to Indian National Movement and Indian Culture.

HERITAGE OF TAMILS

UNIT I 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 II 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 III FOLK AND MARTIAL ARTS **3**

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

UNIT IV 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 V 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 PERIODS

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Understand the Heritage of Tamils in terms of Language and Literature, Rock Art Paintings to Modern Art – Sculpture, Folk and Martial Arts, Thinai Concept.	Understand
CO.2 Understand the Contribution of Tamils to Indian National Movement and Indian Culture.	Understand

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் 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.

Course Code: 23ENI201		Course Title: COMMUNICATION SKILLS II (Common to all B.E/B.Tech Programmes)	
Course Category: AEC		Course Level: Introductory	
L:T:P(Hours/Week) 2:0:2	Credits: 3	L:T:P(Hours/Week) 2:0:2	Credits: 3

Course Objectives

The course is intended to impart effective and accurate language in business correspondence on par with B2 level of CEFR Scale.

Module I **20 Hours**

Grammar: Linking Words - Collocations –Sentence Completion - Articles –Adverbs– Indefinite Pronoun

Listening: Listening to short conversations - Listening for gist and summarizing - Listening for detail - Responding to straightforward questions.

Speaking: Making statements of facts - Agreeing and disagreeing to opinions - Respond to queries - Group Discussion.

Reading: Read and select (phrasal verbs & relative clause)- Cloze Test-Gapped sentences - Multiple- choice gap-fill.

Writing: Paragraph Writing: Descriptive, narrative, persuasive and argumentative - Emails: Giving information - Making enquiries - Responding to enquiries - Power Point Presentation.

Module II **20 Hours**

Grammar: Expressions of cause and result – Concord - Error Spotting (Parts of Speech & Indian English) – Prepositions.

Listening: Listening for identifying main points - Responding to a range of questions about different topics - Listening to identify relevant information.

Speaking: Empathetic Enunciation – Situation handling – Visual Interpretation - - Short presentations.

Reading: Intensive Reading: Comprehending business articles, reports and proposals and company websites-- Open gap-fill - Extended reading.

Writing: – Report Writing - Memo – Complaint letter - Business Letters (Seeking permission & Providing Information).

List of Experiments: **20 Hours**

1. Listening to Monologue and Extended Listening Activity I.
2. Listening to Monologue and Extended Listening Activity II.
3. Expressing Opinions and Situational based speaking.
4. Mini Presentation and Visual Interpretation.
5. Reading Comprehension.
6. Writing letter, email and report.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Identify the common errors in written and spoken correspondence.	Apply
CO2: Develop listening, reading and speaking skills through task based activities in listening, reading comprehension, recapitulation, interpretation and discussion.	Apply
CO3: Read business correspondences like memo, Email, letter, proposals and write reports and website entries and product launches.	Apply
CO4:Perform as an individual and member of a team and engage effectively in group discussion and individual presentation.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	-	-

High-3; Medium-2; Low-1

Textbooks:

T1. Guy Brook- Hart, “Business Benchmark Upper Intermediate”, 2nd Edition, South Asian, Cambridge University Press, 2020.
T2. Norman Whitby, “Business Benchmark pre-intermediate to Intermediate”, 2nd Edition, South Asian, Cambridge University Press, 2014.

Reference Book(s):

R1. Hewings Martin - Advanced Grammar in use Upper-intermediate Proficiency, CUP,3rd Edition,2013.
R2. Clark David – Essential BULATS (Business Language Testing Service), CUP, 2006.
R3. Adrian Doff, Craig Thaine, Herbert Puchta, Jeff Stranks, Peter Lewis-Jones, Rachel Godfrey,Gareth Davies, Empower B1+ – Student’s Book, Cambridge University Press, 2015.

Web References:

1. https://speakandimprove.com/
2. https://writeandimprove.com/
3. https://www.cambridgeenglish.org/exams-and-tests/linguaskill/

Course Code:23FLT201	Course Title: FOREIGN LANGUAGE - JAPANESE (Common to all B.E/B.Tech Programmes)		
Course Category: AES		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max. Marks:100

Course Objectives:

The course objectives intended to:

1. Express a basic exposure on Japanese language and culture
2. Express thoughts and communicate in the beginner level of Japanese with native Japanese speaker
3. Identify the kanji etymology as well as use it in basic vocabulary required for the JLPT/NAT 5 examination level
4. Read and write 100 kanji of the official JLPT N5
5. Choose the appropriate verb forms for learning and practicing the Japanese language

UNIT I Introduction to Japan and greetings 9 Hours

Japan : Land and culture - Introduction to Japanese language — Greetings — Seasons - Days of the week - Months of the year – Dates of the month - Self introduction – Numbers (Upto 99,999) – Expressing time – Conversation audio and video.

Listening: Listening to Greetings - Listening for Specific Information: Numbers, Time. Speaking: Self-Introduction

UNIT II Building vocabulary 9 Hours

Family relationships - Colours - Parts of body - Profession - Directions - Time expressions (today, tomorrow, yesterday, day before, day after) - Japanese housing and living style - Food and transport (vocabulary) - Stationery, fruits and vegetables

Listening: Listening for Specific Information: Directions, Family Members, Parts of body Speaking: Introducing one's family.

UNIT III Writing systems 9 Hours

Hiragana Chart 1 - vowels and consonants and related vocabulary – Hiragana Charts 2&3, double consonants, vowel elongation and related vocabulary – Introduction to Kanji – Basic Vocabulary – Basic Conversational Phrases.

Listening: Listening to Japanese Alphabet Pronunciation, Simple Conversation. Speaking: Pair Activity (Day to day situational conversation)

UNIT IV Kanji and preposition 9 Hours

Katakana script and related vocabulary — Basic kanjis: naka, ue, shita, kawa , yama , numbers (1- 10, 100, 1000, 10,000 and yen) , person, man, woman, child, tree , book , hidari, migi, kuchi , 4 directions - Usage of particles wa, no, mo and ka and exercises - Usage of kore, sore, are, kono, sono, ano, arimasu and imasu - Particles — ni (location) and ga , donata and dare - Particles ni (time), kara, made , ne , koko, soko, asoko and doko - Directions : kochira, sochira, achira and dochira , associated vocabulary (mae, ushiro, ue, shita, tonari, soba, etc.)

Listening: Listening to conversation with related particles

UNIT V Verb forms 9 Hours

Introduction to Verbs - Verbs –Past tense, negative - i-ending and na-ending adjectives introduction - ~masen ka, mashou - Usage of particles de, e , o, to, ga(but) and exercises - Adjectives (present/past — affirmative and negative) — Counters - ~te form

Listening: Listening to different counters, simple conversations with verbs and adjectives.

Speaking: Pair Activity (Explaining one's daily routine by using appropriate particles and verbs).

Course Outcomes **At the end of this course, students will be able to:**	**Cognitive Level**
CO1: Recognize and write Japanese alphabet.	Understand
CO2: Comprehend the conversation and give correct meaning.	Understand
CO3: Apply appropriate vocabulary needed for simple conversation in Japanese language.	Apply
CO4: Apply appropriate grammar to write and speak in Japanese Language.	Apply
CO5: Speak using words of the Japanese language.	Apply

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Text Book:

T1.Genki 1 Textbook: An Integrated Course in Elementary Japanese by Eri Banno, Yoko Ikeda, Yutaka Ohno, Yoko Sakane, Chikako Shinagawa, Kyoko Tokashiki published by The Japan Times

T2.Genki 1 Workbook: An Integrated Course in Elementary Japanese by Eri Banno published by The Japan Times

Reference:

1. *Japan**e**se for Everyone: Elementary Main Textbook1-1*, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007
2. *Japanese for Everyone: Elementary Main Textbook1-2*, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007
3. www.japaneselifestyle.com
4. www.learn-japanese.info/
5. www.learn.hiragana-katakana.com/typing-hiragana-characters/
6. www.kanjisite.com/

Course Code:23FLT202	Course Title: FOREIGN LANGUAGE - GERMAN (Common to all B.E/B.Tech Programmes)		
Course Category: AEC		Course Level: Introductory	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max. Marks:100

Course Objectives:

The course is intended to:

1. Listen and understand numbers, names and dialogues of a native speaker on par with A1 level.
2. Speak and introduce self in simple sentences to convey their opinion and ideas on par with A1 level.
3. Read simple passages and given text on par with A1 level.
4. Write letter and simple sentences on par with A1 level.

UNIT I BASIC INTRODUCTION TO GERMAN SCRIPTS 9 Hours

Theme and Text (Introduction to German - German script, Deutsche Namen, Daily Greetings and Expressions) — Grammar ('wh' questions, das Alphabet)– Speak Action (Buchstabieren, sich und andere vorstellen nach Namen und Herkunft fragen, internationale Wörter auf Deutsch verstehen, jemanden begrüßen)– pronunciation (Buchstabieren J,V,W,Y, - Long vowels A,E,I,O,U - Pronunciation of Ä,Ü,Ö) — To learn (internationale Wörter in Texten finden, Wörter sortieren)

Theme and Text (Gespräche im caf'e, Getränkekarte, Telefon-buch, Namen, Rechnungen) — Grammar (Frägesatze mit wie, woher, wo, was Verben in präsens Singular und Plural, das Verb Sein, Personalpronomen und Verben)– Speak Action (eine Gespräch beginnen sich und andere vorstellen zählen, etwas bestellen und bezhalen Telefonnummern und verstehen)– pronunciation (Wortakzent in Verben und in Zahlen) –

To learn (Grammatiktabelle ergänzen, mit einem Redemittelkasten arbeiten)

UNIT II NUMBERS AND NOMINATIVE CASE 9 Hours

Theme and Text (Numbers – 1 to 12 (Eins bis Zwolf) – 20, 30, 40, 90 (zwanzig-Neunzig) – All Numbers (1-10000) – German Currency (Euro) – Basic Mathematics (plus, Minus, Malen, Geteilt durch)) – Grammar (Introduction of verbs –Have Verb – To Come, To Speak, To Read, To Drive, To Fly, To write, To Eat, To sleep, To take etc.,)

Theme and Text (Communication in course) — Grammar (Singular and Plural, Artikel: der,das,die/ ein,eine, verneinung: kein, keine, Komposita: das Kursbuch) – Speak Action (Gegenständen fragen/ Gegenstände benennen im kurs:) – pronunciation (word accent Marking, Umlaute ö ä ü hören und sprechen) — To learn (Lernkarten schreiben, Memotipps, eine Regel selbst finden) Theme and Text (City, Town, Language: Nachbar, Sprachen, Sehenswürdigkeiten in Europa) – Grammar (Past tense for Sein, W-Frage, Aussagesatz und Satzfrage) – Speak Action (about city and siteseeing) — pronunciation (Satzakzent in Frage- und Aussagesätzen) — To learn (eine Regel ergänzen, eine Grammatiktabelle erarbeiten, Notizen machen).

UNIT III AKKUSATIVE CASE AND PREPOSITIONS 9 Hours

Theme and Text (Menschen und Hauser, Furniture catalogue, E-Mail, House information) – Grammar (possesivartikel im Nominativ, Artikel im Akkusativ, Adjektive im satz, Graduierung mit zu)– Speak Action (Whonung bescreiben about perons and things)– pronunciation (consonant - ch) — To learn (wortschatz systematisch)

Theme and Text (Termine - Appointment and punctuality in Germany) — Grammar (questions with wann?, Preposition (am, um, von... bis), verneinung mit nicht, trennbare verben, präteritum von haben) — Speak Action (Daily plan making, time commitment, excuse for late coming) — pronunciation (consonants- p,b,t,d / k,g) — To learn (Rollenkarten arbeiten)

Theme and Text (orientation in working area, go for work, floor plan city plan, office and computer) — Grammar (preposition: in,neben, unter, auf, vor, hinter, an, zwischen, bei und mit + Datic)– Speak Action (work place, work, giving appointments)– pronunciation (consonants: f,w und v) – To learn (Making notice in calender)

UNIT IV DATIV CASE AND PREPOSITIONS 9 Hours

Theme and Text (Holiday and Party, holiday plan, party plan in Germany) – Grammar (regular and iregular verbs) – Speak Action (holiday speak, accident, Ich-Text schreiben) – pronunciation (lange und kurze vokale markieren) – To learn (Text Order)

Theme and Text (organising an Excursion to Berlin through city orientation, Bus plan, City plan, post card, Excursion programme) — Grammar (preposition: in, durch, über + Akkusativ: zu, an... vorbei + Dativ, Modalverb wollen) – Speak Action (Tourism, culture, postcard preparation, travel description) — pronunciation (r and l)– To learn (plaket making)Theme and Text (Beruf und all Tag, Visiten karten, wörterbuch) – Grammar – Speak Action (profession, statistic speaking) – pronunciation (n,ng and nk)– To learn (wörterbuch , text information in tabel)

UNIT V ADJECTIVES AND PRONUNCIATION 9 Hours

Theme and Text (Haushaltstipp, kochrezept, maße und gewichte, Mahlzeiten und Gerichte) – Grammar (jeden Tag, manchmal, nie, Question - welche, Comparison – viel, gut, gern) — Speak Action (about eat, drink question and answers) — pronunciation (e,en,el,er) – To learn (Text auswerten und zusammenfassen)

Theme and Text (Clothing , colour, weather) — Grammar (Adjecktive im Akkusativ, unbestimmer Artikel) — Speak Action (weather, dress and colour understanding) — pronunciation (e-o- ö and ie-u- ü) – To learn (wetter and Farben interkulturelle)

Theme and Text (in super market,purchase, House Maintainence, Emotion, Sports, Body parts) – Grammar (Modal Verb) – Speak Action (Body parts) – To learn (Rollenkarten arbeiten)

Course Outcomes **At the end of this course, students will be able to:**	**Cognitive Level**
CO1: Recognize and write German alphabet, numbers.	Understand
CO2: Comprehend the conversation and give correct meaning.	Understand
CO3: Apply appropriate grammar and vocabulary to write and speak.	Apply
CO4: Apply appropriate cases and texts to listen, write and speak.	Apply
CO5: Speak and read using words of the German language	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

TEXT BOOK(s)

T1. Netzwerk, “Deutsch als Fremdsprache” by Stefanie Dengler, Paul Rusch, Helen Schmitz published by Goyal Publishers & Distributors Pvt Ltd;
T2. Funk, Kuhn, Demme, “Studio D A1 Deutsch als Fremdsprache” published by Goyal Publishers & Distributors Pvt Ltd;

REFERENCES(s)

R1. Hueber, “Fit for Goethe- Zertifikat A1 (Start Deutsch 1)” by GOYAL PUBLISHERS AND DISTRIBUTORS; 2016

Course Code: 23MAI201	Course Title: ORDINARY DIFFERENTIAL EQUATION AND COMPLEX VARIABLES		
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) 3:0 :2	Credits: 4	Total Contact Hours:75	Max Marks:100

Course Objectives:

The objective of this course is to familiarize the graduate engineers with techniques in vector calculus, complex variables and ordinary differential equations.

Module I **23 Hours**

Vector Calculus

Gradient – Divergence – Curl – Line integrals – Surface integrals – Volume integrals – Theorems of Green, Gauss and Stokes (without proof) and their applications.

Complex Variables (Differentiation)

Cauchy-Riemann equations – Analytic functions – Properties – Harmonic functions – Finding harmonic conjugate – Conformal mapping (w=z+a, w= az, w=1/z) – Mobius transformation and their properties.

Complex Variables I (Integration)

Cauchy Integral formula– Cauchy Integral theorem – Taylor's series– Singularities of analytic functions – Laurent's series.

Module II **22 Hours**

Complex Variables II (Integration)

Residues – Cauchy Residue theorem – Contour integrals – Evaluation of real definite integrals around unit circle and semi-circle (Excluding poles on the real axis).

Ordinary Differential Equations of Higher Orders

Second and higher order linear differential equations with constant coefficients – Second order linear differential equations with variable coefficients – Method of variation of parameters – Solution of first order simultaneous linear ordinary differential equations.

Laplace Transform

Laplace Transform – Properties of Laplace Transform – Laplace transform of periodic functions -Inverse Laplace transforms - Convolution theorem – Solution of ordinary differential equations by Laplace Transform.

List of Experiments(Using Python): 30 Hours

1. Find gradient of a given scalar function, divergence and curl of a vector function.
2. Verify Green's theorem in a plane.
3. Graphically plot time and frequency domain of standard functions and compute Laplace transform of In- built functions.
4. Compute second order ordinary differential equation.
5. Compute Inverse Laplace transform of In- built functions.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of Vector Differentiation and Integration to solve problems in Science and Engineering.	Apply
CO2: Using the concept of complex variables to construct analytical functions.	Apply
CO3: Use the concept of complex integration to evaluate definite integrals.	Apply
CO4: Determine the solution of second and higher order ordinary differential equations.	Apply
CO5: Apply Laplace transform techniques to solve ordinary differential equations.	Apply
CO6: Develop programs using differential equations concepts through modern tool.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	3	-	-	-	-	-	-	-	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Erwinkreyzig, Advanced Engineering Mathematics, 9th edition, John Wiley& Sons, 2006.
T2. Veerarajan T., Engineering Mathematics for first year, 3rd edition, Tata McGraw-Hill, New Delhi, 2019.

Reference Book(s):

R1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2002.
R2. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
R3. P. Sivaramakrishna Das , C. Vijayakumari , Engineering Mathematics, Pearson India, 2017.

Web References:

1. https://nptel.ac.in/courses/111107112
2. https://nptel.ac.in/courses/111104031

Course Code:23CHI201	Course Title: CHEMISTRY FOR CIVIL ENGINEERING		
Course Category: Minor	Course Level: Introductory		
L:T:P (Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Course Objectives

The course is intended to impart the knowledge of chemistry involved in Water technology, Corrosion and its control, Engineering materials, Spectroscopic techniques, and Building Materials.

Module: I **22 Hours**

Water Technology: Water quality parameters - Types of water - Hardness of water - Types, expression, units, problems - Determination of hardness by EDTA method - Boiler feed water - Boiler troubles (Scale, Sludge, Priming, Foaming, Caustic embrittlement, Boiler Corrosion) - Water conditioning methods - Internal conditioning - Phosphate, Calgon, and Sodium aluminate conditioning. External conditioning - Demineralization, Desalination of brackish water -Reverse Osmosis process.

Corrosion and its Control: Corrosion – Causes – Consequences - Types- Chemical, electrochemical corrosion (galvanic, differential aeration - Pitting corrosion) - Factors influencing corrosion (Based on Metal and Environment) - Corrosion control - Cathodic protection methods and Metallic coating - Galvanizing and Tinning. Paints - Constituents and their functions.

Polymers, Plastics and Composites: Polymers – definition –Terminologies – Polymerization – Types - Addition and Condensation Polymerization - Classification. Plastics - Classification.

Module: II **23 Hours**

Polymers, Plastics and Composites: Engineering Plastics (PVC, Teflon, Polycarbonates, Polyurethanes, PET) - Preparation, Properties and Uses. Compounding of Plastics - Moulding technique - Blow and Extrusion. Polymer composites - FRP and Ceramic matrix composites.

Analytical Techniques: Spectroscopy - Electromagnetic Spectrum, Absorption and Emission Spectroscopy - Beer-Lambert's law (Problems). UV-Visible Spectroscopy – Principle - Instrumentation (block diagram only) - Estimation of Iron by Spectrophotometry. Atomic Absorption Spectroscopy – Principle - Instrumentation (block diagram only) - Estimation of Nickel by AAS. Flame Photometry – Principle - Instrumentation (block diagram only) - Estimation of Sodium by Flame Photometry.

Chemistry of Building Materials: Chemistry of lime and gypsum. Cement - Chemical Composition, Classification, Manufacture by wet and dry process, Setting and Hardening of Cement, Chemical reactions during the Hydration of Cement, Waterproof and White Cement - Properties and Uses. Chemistry and applications of Admixtures.

LIST OF EXPERIMENTS: (Any 6 experiments) **30 Hours**

1. Estimation of hardness of Water by EDTA method.
2. Determination of alkalinity in Water Sample by indicator method.
3. Determination of corrosion rate of mild steel by weight –loss method.
4. Determination of molecular weight of polymer by viscometric method.
5. Estimation of iron by spectrophotometry
6. Determination of percentage of calcium oxide in cement by titrimetric method.
7. Determination of strength of acid by pH metry.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Understand and explain the chemistry involved in Water treatment, Corrosion and its control, Engineering materials, Spectroscopic techniques, and Building materials.	Understand
CO2: Apply the acquired knowledge of chemistry to solve the Engineering problems.	Apply
CO3: Analyze Engineering problems through the concept of Water technology Corrosion, Engineering materials, Analytical techniques, and Building materials.	Apply
CO4: Investigate Engineering materials by volumetric and instrumental methods in chemistry and analyze, interpret the data to assess and address the issues of Environmental Problems.	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	3	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Jain and Jain, Engineering Chemistry, 17th Edition, Dhanpat Rai Publishing Company, New Delhi, 2018.

T2. Wiley Engineering Chemistry, 2nd Edition, Wiley India Pvt Ltd, New Delhi, 2011.

Reference Book(s):

R1. Dara S. S and Umare S. S., A textbook of Engineering Chemistry, 12th Edition, S.Chand & Co Ltd, New Delhi , 2014.

R2. V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar, Polymer Science,4th Edition, New Age International(P) Ltd, Chennai ,2021.

R3. Jeffery G. H., Bassett. J., Mendham J and Denny R. C., Vogel's Textbook of Quantitative chemical analysis, 5th Edition, Oxford, ELBS, London ,2012.

Web References:

1. http://nptel.ac.in/courses/122101001/downloads/Iec.23.pdf
2. https://nptel.ac.in/courses/104106075/Week1/MODULE%201.pdf2.

Course Code: 23CET201		Course Title: ENGINEERING MECHANICS	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to expose the students to the fundamental concepts of mechanics and enhance their problem-solving skills. It introduces students to the influence of applied force system and the geometrical properties of the rigid bodies while in stationary or in motion.

Module I **23 Hours**

STATICS OF PARTICLES

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces –– Vectorial representation of forces – Vector operations of forces - additions, subtraction, dot product, cross product – Coplanar Forces – Non-Coplanar Forces - rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

EQUILIBRIUM OF RIGID BODIES

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 – Equilibrium of Rigid bodies in three dimensions.

CENTROIDS OF SURFACES AND SOLIDS

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula - Theorems of Pappus.

Module II **22 Hours**

PROPERTIES OF SURFACES AND SOLIDS

Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

FRICTION

The Laws of Dry Friction, Coefficients of Friction, Angles of Friction, Wedge friction, Wheel Friction, Rolling Resistance, Ladder friction.

DYNAMICS OF PARTICLES

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles. Kinetics- Newton's Second Law of Motion -Equations of Motions, Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force, Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact of bodies.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Calculate resultant forces, moments and couples using principles of mechanics and draw free body diagrams for any system of forces	Apply
CO2: Calculate the centroids and properties of surfaces and solids using principles of mechanics	Apply
CO3: Calculate the motion of particles using principles of dynamics	Apply
CO4: Exhibit a static or a dynamic model of a system using principles of mechanics	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	3	2	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Beer Ferdinand P, Russel Johnston Jr., David F Mazurek, Philip J Cornwell, Sanjeev Sanghi, “Vector Mechanics for Engineers: Statics and Dynamics”, McGraw Higher Education, 11th Edition, 2017.

T2. Vela Murali, “Engineering Mechanics-Statics and Dynamics”, Oxford University Press, 2018.

Reference Book(s):

R1. Boresi P and Schmidt J, Engineering Mechanics: Statics and Dynamics, 1/e, Cengagelearning, 2008.

R2. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.

R3. Meriam J L and Kraige L G, Engineering Mechanics: Statics and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.

Web References:

1. https://archive.nptel.ac.in/courses/112/106/112106286/
2. https://www.selfstudys.com/mcq/gate/mechanical-engineering/online-test/chapter-7-engineering-mechanics.

Course Code: 23ADT001		Course Title: C PROGRAMMING (Common to CE,EA,EC,EE& EV)	
Course Category: Multi-disciplinary		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course helps to understand the structured and procedural programming skills. The major objective is to provide students with understanding of code organization and functional hierarchical decomposition using complex data types.

Module I **22 Hours**

Basics Of Computer Organization: Generation and Classification of Computers – Basic Organization of a Computer — Software development life cycle – Problem Solving Techniques, Algorithm, Pseudo code and Flow Chart.

Introduction To C Programming: Introduction – Structure of a C program – Keywords – Identifiers – Constants – Variables – Data Types – Operators and Expressions – Formatted & Unformatted I/O functions – Decision statements – Loop control statements.

Arrays: Characteristics – Declaration- One-dimensional array, Two-dimensional arrays

Module II **23 Hours**

Functions: Declaration & Definition of function – Built in function – User defined function -Typesof functions – Call by value & reference.

Strings and Pointers: Formatting strings – String handling functions. Pointers: Features and Types of pointers – Arithmetic operations with pointers–Pointers and Arrays- Array of Pointers- Pointers and Strings

Structures and Union: Structures: Features – Operations on Structures – Array of structures – Pointers to Structures -Unions-Union of Structures.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Correlate the fundamental concepts of computer organization such as architectures of the processors and project management for real time application	Apply
CO2: Infer the fundamental concepts of programming, such as variables, data types and control structures for real time problems	Analyze
CO3: Apply programs solving skills and knowledge of C programmingconstructs to solve the given one dimensional and two dimensional datasets	Apply
CO4: Build a modules to solve the given application using functions	Apply
CO5: Develop a program by accessing the address of the variable using pointers and manipulation of characters using string handling functions	Apply
CO6: Test the performance of the students by group assignments and projects on real time problems	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	2	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-
CO4	2	-	1	-	-	-	-	-	-	-	-	-
CO5	3	-	-	1	-	-	-	-	-	-	-	-
CO6	-	1	-	3	2	-	-	-	2	-	-	2

High-3; Medium-2; Low-1

Text Book(s):

T1. Ashok N.Kamthane, Amit.N.Kamthane, “Programming in C”, 3rd Edition, Pearson Education, 2015.

T2. Deitel H M and Deitel P J, “C How to Program”, Prentice Hall, 2013.

Reference Book(s):

R1. Ajay Mittal, “Programming in C-A Practical Approach”, 3rd Edition, Pearson Education,2010.

R2. Yashavant P.Kanetkar,” Let Us C” , 16th Edition, BPB Publications, 2018.R3. Herbert Schildt, “C The Complete Reference", Tata McGraw Hill, 2010.

R4. S Gottfried Byron, “Programming With C”, Tata McGraw Hill, 2011.

Web References:

1. NPTEL course content on Introduction To Programming In https://onlinecourses.nptel.ac.in/noc22_cs40.
2. Complete guide on Learn C programming: http://www.cprogramming.com/
3. Complete reference manual on C programming: http://www.c4learn.com/

Course Code:23ADL001	Course Title: C PROGRAMMING LABORATORY (Common to CE,EA,EC,EE &EV)		
Course Category: Multi-disciplinary		Course Level: Introductory	
L:T:P(Hours/Week) 0:0:3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Course Objectives

The course introduces students to the practical knowledge of programming using C programming language as an implementation tool. It aims at providing students with understanding of programming essentials used within the framework of imperative and structural programming paradigms.

List of Experiments:

1. Implement basic C programs using data types
2. Implement programs using Operators and Expressions
3. Develop Programs using Branching statements
4. Implement Programs using Control Structures
5. Develop programs using Arrays
6. Implement programs using Functions
7. Implement programs using String Operations
8. Develop programs using Pointers
9. Implement programs using Structures
10. Develop programs using Union

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Write programs using appropriate programming constructs.	Apply
CO2: Apply programs solving skills and knowledge of C programming constructs to solve the given one dimensional and two dimensional dataset	Apply
CO3: Develop a program by accessing the address of the variable using pointers and manipulation of characters using string handling functions	Analyze
CO4: Evaluate modular programming techniques to break down complex programs into smaller and manageable modules	Evaluate

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	3	-	-	-	-	-	-	-
CO2	3	-	-	-	3	-	-	-	-	-	-	-
CO3	-	2	-	-	3	-	-	-	-	-	-	-
CO4	-	-	-	3	3	-	-	-	-	-	-	1

High-3; Medium-2; Low-1

Text Book(s):

T1. Ashok N.Kamthane, Amit.N.Kamthane, “Programming in C”, 3rd Edition, Pearson education, 2015.

T2. Deitel H M and Deitel P J, “C How to Program”, Prentice Hall, 2013.

Reference Book(s):

R1. Ajay Mittal, “Programming in C-A Practical Approach”, 3rd Edition, Pearson Education, 2010.

R2. Yashavant P.Kanetkar, “Let Us C”, 16th Edition, BPB Publications, 2018.

R3. Herbert Schildt, “C The Complete Reference", Tata McGraw Hill, 2010.

Web References:

1. C programming resources: https://electronicsforu.com/resources/15-free-c-programming-Ebooks.
2. C programming tutorials: https://www.fromdev.com/2013/10/c-programming-tutorials.html.
3. C Manual: https://books.goalkicker.com/CBook.

Course Code: 23MEL202		**Course Title: ENGINEERING PRACTICES LABORATORY** (Common to AU,CE,ME)	
Course Category: SEC		**Course Level: Practice**	
L:T:P(Hours/Week) 0: 0: 3	**Credits:1.5**	**Total Contact Hours:45**	**Max Marks:100**

Course Objectives:

The course is intended to impart knowledge on basic electrical, mechanical and civil operations.

List of Experiments

Electrical & Electronics

1) Symbols of electrical and electronic components and study of electrical drawing.
2) Insulation Testing using Megger.
3) Soldering practice of simple circuit and testing.
4) Fluorescent tube, staircase and house wiring.
5) Verification of Kirchhoff's current and voltage law.

Civil & Mechanical

1. Make a wooden Tee joint to the required dimension.
2. Make a "V" filling to the required dimension using fitting tools.
3. Make a tray in sheet metal to the required dimension.
4. Assemble the pipeline connections with different joining components for the given layout.
5. Demonstrate a butt joint using welding process to the required dimension.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Apply engineering knowledge to conduct experiments and analyze the electrical and electronic connections as per the given circuit.	Analyze
CO2: Apply to make wooden 'T' joint, and pipeline connection individually using various workshop tools as per the given dimensions.	Apply
CO3: Apply to make metal 'V' joint with various joining components and a permanent joint as per the given dimensions using modern workshop tools and engineering principles.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	2	-	-	-	-	2	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	2	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. Jeyachandran.K, Natarajan.S & Balasubramanian.S, “A Primer on Engineering Practices Laboratory”, Anuradha Publications, Tamilnadu (India), 2016.

R2. 19EPL21 - Engineering practices laboratory Manual.

Web References:

1. http://nptel.ac.in/courses/112103019/
2. https://www.aaaenggcoll.ac.in/engineering-practices-lab/
3. https://www.coursera.org/courses?query=engineering

Course Code: 23ESL201		Course Title: PROFESSIONAL SKILLS 1:PROBLEM SOLVING SKILLS & LOGICAL THINKING 1 (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0: 2	Credits: 1	Total Contact Hours:30	Max Marks:100

Course Objectives:

The course is intended to enhance the students' numerical, analytical and logical reasoning ability. Also course focus to make learners prepare for various public and private sector exams and placement drives.

Module I Quantitative Ability **20 Hours**

Number System and LCM & HCF- Percentage- Ratio and Proportion - Average- Progressions- Ages- Partnership- Mixture & Allegation - Profit and loss- Interest calculation- Data interpretation.

Module II Reasoning Ability **10 Hours**

Seating Arrangement- Linear, circular and Complex – Direction Problems- Blood Relation- Puzzles- Crypt arithmetic- Venn diagrams- Statement and conclusion- Statement and argument- Causes and effects- Self-Learning.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Build the competence in numerical, analytical and logical reasoning ability	**Apply**

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1: Dr. R. S. Aggarwal. "Quantitative Aptitude for Competitive Examinations" Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

T2: Dr. R. S. Aggarwal. "A Modern Approach to Logical Reasoning", Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018

Reference Book(s):

R1: R. V. Praveen. "Quantitative Aptitude and Reasoning" 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd, 2013

R2: Arun Sharma. "Quantitative Aptitude for Common Aptitude Test", McGraw Hill Publications, 5th Edition, 2020

R3: Arun Sharma. "Logical Reasoning for Common Aptitude Test", McGraw Hill Publications, 6th Edition, 2021.

Web References:

1 https://www.indiabix.com/aptitude/questions-and-answers/

2 https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Course Code: 23VAT201	Course Title: TAMILS AND TECHNOLOGY (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

மாணவர்கள் இப்பாடத்தை கற்றலின் மூலம்

CO.1 நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்ள இயலும்.

CO.2 அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்ள இயலும்.

தமிழரும் தொழில்நுட்பமும்

அலகு 1 – நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் – கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்

அலகு 2 – வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் ஷ சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு – சங்க காலத்தில் கட்டுமானப் பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் – மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் – மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள், பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ – சாரோசெனிக் கட்டிடக் கலை.

அலகு 3 – உற்பத்தித் தொழில்நுட்பம் 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு 4 வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் 3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன் வளம் – முத்து மற்றும் முத்துக் குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு 5 – அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி – கணினித் தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின் பதிப்பு செய்தல் – தமிழ் மென் பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

Course Outcomes மாணவர்கள் இப்பாடத்தை கற்றபின்	**Cognitive Level**
CO.1 நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம், வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம் ஆகியன குறித்து அறிந்து கொள்வார்கள்.	அறிதல் (Understand)
CO.2 அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் குறித்து அறிந்து கொள்வார்கள்.	அறிதல் (Understand)

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் 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.

Course Code: 23VAT201	Course Title: TAMILS AND TECHNOLOGY (Common to all B.E/B.Tech Programmes)		
Course Category: VAC		Course Level: Introductory	
L:T:P (Hours/Week) 1: 0 :0	Credit: 1	Total Contact Hours: 15	Max Marks:100

Pre–requisites

- NIL

Course Objectives

The course is intended to:

1. Understand Weaving and Ceramic Technology, Design and Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology.
2. Understand the Scientific Tamil & Tamil Computing.

TAMILS AND TECHNOLOGY

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II 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 - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III 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 Silappathikaram.

UNIT IV 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 V 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 PERIODS

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Understand Weaving and Ceramic Technology, Design and Construction Technology, Manufacturing Technology, Agriculture and Irrigation Technology.	Understand
CO.2 Understand the Scientific Tamil & Tamil Computing.	Understand

Course Articulation Matrix

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	1	-	-

High–3; Medium–2; Low–1

TEXT - CUM REFERENCE BOOKS

1 தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே.பிள்ளை
(வெளியீடு. தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)

2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)

3. கீழடி – வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் 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.

Course Code: 23CHT202		Course Title: Environmental Sciences (Common to all B.E/B.Tech Programmes)	
Course Category: Mandatory Non-Credit Course		Course Level: Introductory	
L:T:P(Hours/Week) 1: 0: 0	Credits: 0	Total Contact Hours: 15	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on sustainable utilization of natural resources, prevention of pollution, disaster management and environmental issues & public awareness on ecosystem.

Module I **8 Hours**

Natural Resources

Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

Environmental Pollution and Disaster Management

Role of an individual in prevention of pollution; Disaster management : floods, earthquake, cyclone and landslides.

Environmental Ethics and Legislations

Environmental ethics : Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.

Module II **7 Hours**

Environmental Issues and Public Awareness

Public awareness - Environment and human health.

Environmental Activities

(a) Awareness Activities:

i. Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.
ii. Slogan making event.
iii. Poster making event.

(b) Actual Activities:

i. Plantation.
ii. Cleanliness drive.
iii. Drive for segregation of waste.
iv. To know about the different varieties of plants.
v. Shutting down the fans and ACs of the campus for an hour or so.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Explain the use of natural resources for a sustainable life as an individual in prevention of pollution.	Understand
CO 2: Apply the environmental ethics and legislations for various environmental issues.	Apply
CO 3: Create the public awareness on environment and human health as an individual or team through various activity based learning.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	3	3	-	-	-	-
CO3	3	-	-	-	-	3	3	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Benny Joseph, “Environmental Studies", Tata McGraw Hill, New Delhi, 2006.

T2. Mackenzie Davis and Susan Masten, “Principles of environmental engineering and science”, Mc-Graw Hill, 3rd Edition, 2014.

Reference Book(s):

R1. Trivedi R.K. “Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, Enviro Media.

R2. Cunningham, W.P.Cooper, T.H. Gorhani, “Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview.
2. https://en.wikipedia.org/wiki/Environmental_science.

Course Code: 23MAT301		Course Title: TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS (CE)	
Course Category: Minor		Course Level: Introductory	
L:T:P(Hours/Week) : 3 : 1 : 0	Credits: 4	Total Contact Hours: 60	Max Marks: 100

Course Objectives:

The objective of the course is to equip the students to solve various partial differential equations (PDEs) of different orders, and solving the wave equation and heat conduction problems in one and two dimensions by Fourier series method.

Module I **22+8 Hours**

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

FOURIER SERIES: Dirichlet's conditions — General Fourier series — Odd and even functions — Half range sine series — Half range cosine series — Parseval's identity — Complex form of Fourier series — Harmonic analysis.

CLASSIFICATION OF SECOND ORDER LINEAR PARTIAL DIFFERENTIAL EQUATIONS: Method of separation of variables - Classification of second order linear partial differential equations

Module II **23+7 Hours**

SOLUTIONS OF ONE-DIMENSIONAL WAVE EQUATION: Solutions of one-dimensional wave equation by Fourier series method.

SOLUTION OF ONE AND TWO-DIMENSIONAL HEAT FLOW EQUATION: One dimensional equation of heat conduction - Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded), Solution by Fourier series method.

FOURIER TRANSFORMS: Fourier transform pair — Fourier sine and cosine transforms — Properties — Transforms of simple functions — Convolution theorem — Parseval's identity.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Demonstrate the concept of transform and partial differential equations to civil engineering.	Apply
CO2: Apply Fourier series techniques in solving heat flow and wave equations	Apply
CO3: Determine the solution of first and higher order partial differential equations.	Apply
CO4: Calculate the Fourier transformation for a periodic function.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	-	-	1	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	-	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Erwinkreyzig, Advanced Engineering Mathematics, 10th edition, John Wiley& Sons, 2015.

T2. Veerarajan T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.

T3. Ramana B.V., higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

Reference Book(s):

R1. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education (2007).

R2. N. P. Bali and Manish Goyel, A text book of Engineering Mathematics, Laxmi Publication, Reprint, 2008.

R3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010. 11th Reprint, 2010

Web References:

1. http://nptel.ac.in/courses/122107037/19 2
2. http://nptel.ac.in/video.php?subjectIId=108106075
3. https://nptel.ac.in/courses/111103021/

Course Code: 23CET301		Course Title: STRENGTH OF MATERIALS	
Course Category: Major – Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on the fundamental concepts of stress, mechanism of load transfer in beams, deformation in determinate beams, basic concepts in analysis of indeterminate beams, crippling load in columns and stresses in cylinders

Module I **25 Hours**

SIMPLE AND COMPOUND STRESSES

Stresses in simple and compound bars – Thermal stresses – Elastic constants – Biaxial state of stress – Principal stresses and principal planes – Mohr's circle of stresses – Torsion on circular shafts

BENDING OF BEAMS

Types of beams and transverse loadings– Shear force and bending moment for simply supported, cantilever and over - hanging beams – Theory of simple bending

DEFLECTION OF BEAMS

Double Integration method – Macaulay's method – Area moment method – Conjugate beam method – Castigliano's theorem

Module II **20 Hours**

INDETERMINATE BEAMS

Propped Cantilever and Fixed Beams – Fixed end moments and reactions, slope and deflection for standard cases of loading – Continuous beams – support reactions and moments – Theorem of three moments – Shear Force and Bending Moment Diagrams

COLUMNS

Middle third rule – Types of columns – Euler's theory – Rankine's formula

CYLINDERS

Types of cylinders – Thin cylinders – strain under internal pressure – Stresses in thin compound cylinder

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply suitable method to determine the stresses in compound bars, column and cylinders	Apply
CO2: Apply suitable method to calculate the bending and deflection of beams	Apply
CO3: Present pictorial representation of a structural element by applying reverse engineering practices	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	3	2	-	-	3	2

High-3; Medium-2;Low-1

Text Book(s):

T1. Rajput R.K., "Strength of Materials", S. Chand & Company Pvt. Ltd., New Delhi, Seventh Edition, 2018.

T2. Bansal R.K., "A Text Book of Strength of Materials", Laxmi Publications (P) Ltd., New Delhi, Sixth Edition, 2018.

Reference Book(s):

R1.Timoshenko. S.P. and Young D.H., "Elements of Strength of Materials", Affiliated East-West Press Ltd., New Delhi, 5th edition (SI Units), Reprint 2014.

R2.Kazimi S.M.A, “Solid Mechanics”, Tata McGraw-Hill Publishing Co., New Delhi, First Revised Edition, 2017

R3.Ferdinand P. Beer, E. Russell Johnston Jr., John T. De Wolf and David F. Mazurek "Mechanics of Materials", McGraw Hill Education, New York, Seventh Edition, 2015.

Web References:

1.http://nptel.ac.in/courses/105106116

2.http://web.mit.edu/emech/dontindex-build/

3.http://www.aboutcivil.org/solid-mechanics.html

Course Code: 23CET302		Course Title: SURVEYING	
Course Category: Major-Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to expose the students to the fundamental concepts of surveying. It introduces students to the influence of various equipments and their applications in measuring distance, areas and volumes.

Module I **23 Hours**

FUNDAMENTALS OF SURVEYING

Surveying: Classifications and basic principles – Types of surveying – Equipment and accessories for various types of surveying. **Levelling:** Methods of levelling – Booking – Reduction – Curvature and refraction correction – Contouring.

THEODOLITE SURVEYING AND COMPUTATIONS

Horizontal and vertical angle measurements by Theodolite and Tacheometric surveying – Heights and distances – Trigonometric levelling - Computation of cross sectional areas and volumes – Earthwork calculations – Mass haul diagrams.

CONTROL SURVEYING AND ADJUSTMENT

Horizontal and vertical control: Methods – Triangulation – Traversing – Gale‘s table – Trilateration – Concepts of measurements and errors – error propagation and linearization – adjustment methods – least square methods – angles, lengths and levelling network.

Module II **22 Hours**

MODERN SURVEYING

Total Station: Digital Theodolite, EDM, Electronic field book – Advantages – Parts and accessories – working principle – Observables – Errors - COGO functions – Field procedure and applications.

GPS: Advantages – System components – Signal structure – Selective availability and antispoofing – receiver components and antenna – Planning and data acquisition – Data processing – Errors in GPS – Field procedure and applications.

MISCELLANY

Route Surveying – Reconnaissance – Route surveys for highways and railways– Simple curves – Compound and reverse curves – Transition curves – Setting out different methods of simple curve – Vertical curves. Introduction to Hydrographic and Astronomical surveying.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Analyse the principles and methodologies of traditional and modern surveying techniques to evaluate their suitability for different surveying tasks	Apply
CO2: Apply surveying principles and computation techniques to execute and interpret practical surveying tasks	Apply
CO3: Produce a report justifying the chosen surveying method based on the field scenario	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	-	-	-	-	-	-	-	3	2	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Punmia B C, “Surveying” - vol. 1, vol. 2 and vol 3, Laxmi Publications (P) Ltd., New Delhi, Seventeenth Edition, 2016

T2. Agor. R, “A Text Book of Surveying and Levelling”, Khanna Publishers, Twelfth Edition, 2015

T3. Duggal R K, “Surveying”, Vol I & II, Tata McGraw Hill Publishing Company Ltd., New Delhi, Fourth Edition, 2017

Reference Book(s):

R1. Basak N N, “Surveying and Levelling”, McGraw Hill Education India, Second Edition, Twelfth reprint, 2017

R2. R. Subramanian, “Surveying and Levelling”, Oxford University Press, Second Edition, 2012.

R3. Chandra. A.M., “Surveying”, New Age International Private Ltd Publishers, Second Edition, 2015.

Web References:

1. http://www.aboutcivil.org/surveying-levelling%20II.html
2. https://nptel.ac.in/courses/105107121
3. http://www.vssut.ac.in/lecture_notes/lecture1428642587.pdf

Course Code: 23CET303	Course Title: CONSTRUCTION MATERIALS AND PRACTICES		
Course Category: Major – Professional Core		Course Level: Introductory	
L :T :P (Hours/Week) 3 : 0 :0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on various building materials and their applications used in construction and to identify the scope for sustainable development.

Module I **23 Hours**

BASIC CONSTRUCTION MATERIALS

Stones: Criteria for selection – Tests on Stones. Bricks: Classification – Manufacturing of Clay Bricks – Tests – Special Bricks. Cement Concrete Blocks – Compressed and Stabilized Earth Blocks. Lime: Types – Properties and Uses. Cement: Classification – Manufacturing Process – Properties and Uses. Aggregates: Classification – Properties. Mortar and Concrete: Classification – Preparation – Selection criteria

METALS, TIMBER AND OTHER MATERIALS

Steel: Types – Manufacturing process – Tests – Structural steel – Rebar – Alloy steels. Aluminium – Properties and Uses. Timber: Types – Characteristics – Seasoning – Defects. Glass: Characteristics – Selection criteria. PVC – UPVC – Properties and uses – Ceramics – Composite materials – Refractories – Geo-synthetics

SUSTAINABLE MATERIALS

Alternate Materials – Fly Ash – Industrial waste materials – Construction Debris – properties and applications – Construction products using waste materials

Module II **22 Hours**

SUB STRUCTURE CONSTRUCTION PRACTICES

Components of Buildings – Sequence of activities – Details and Specifications – Site Clearance – Marking – Earthwork – Excavation – Dewatering – Back filling – Anti-termite treatment – Damp proofing – Sand filling – Shallow and Deep Foundations – Plinth beam

SUPER STRUCTURE CONSTRUCTION PRACTICES

Types of Masonry – Types of Formwork – Scaffolding – Shoring – Underpinning - Roofs and roof covering – Types of flooring – Construction Joints – Staircase: Types and Constructions – Lintel – Column – Plastering – Plastering methods – Pointing – Types – Painting: Preparation and Process – Defects. Fire Protection – Thermal Insulation – Water Proofing.

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO.1	Justify the sustainability impacts of alternative materials compared to conventional materials in construction	Apply
CO.2	Suggest the suitability of various building materials and practices for sub structure and super structure construction	Apply
CO.3	Prepare a report based on the knowledge of various construction materials and sustainable practices	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	2	-	3	2	-	-	3	-

High-3; Medium-2;Low-1

Text Books:

T1. T1. Bindra and Arora, “Building Materials and Construction”, Dhanpat Rai & Sons, New Delhi, 2020

T2. Punmia B.C., Ashok Kumar Jain, Arun Kumar Jain, “Building Construction”, Laxmi Publications Pvt. Ltd., 11th edition, 2016

T3. Varghese. P.C, “Building Materials”, PHI Learning Pvt. Ltd, New Delhi, 2nd Revised edition, 2015

Reference Books:

R.1 S.C. Rangwala, “Engineering Materials” Charotar Publishing House, Anand, India, 43rd edition, 2019

R.2 P.C. Varghese, “Building Construction”, PHI Learning Private Limited, New Delhi, 2nd edition, 2017

Web References:

1. www.understandconstruction.com
2. www.engineeringcivil.com

Course Code: 23CET304		Course Title: CONCRETE TECHNOLOGY	
Course Category: Major-Professional Core		Course Level: Introductory	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on the concrete ingredients, application of admixtures in concrete, IS method of concrete mix design, mechanical & durability properties of concrete and introduction to special concrete.

Module I **22 Hours**

CONCRETE CONSTITUENTS

Composition of cement - Hydration of cement - Structure of hydrated cement paste - Aggregates- grading requirements as per BIS - Quality of water.

ADMIXTURES

Chemical admixtures - accelerators, retarders, plasticizers and water retarding admixtures - Mineral admixtures - fly ash, silica fume, ground granulated blast furnace slag and metakaolin - Effects on fresh and hardened properties.

CONCRETE MIX PROPORTIONING

Mix proportioning - basic considerations - quality control - methods of mix proportioning - IS method of mix design - correction for moisture content and bulking.

Module II **23 Hours**

PROPERTIES OF CONCRETE

Fresh concrete properties: workability - segregation - bleeding - Hardened concrete properties: compressive, tensile and flexural strength - Creep & shrinkage - Stress-strain curve for concrete - Durability - tests on permeability - Rapid Chloride Permeability Test, Half-cell potentiometer - factors affecting durability - chemical attack on concrete - sulphate, chloride and acid attacks - carbonation - corrosion of steel rebars, corrosion preventive measures.

SPECIAL CONCRETES

Properties and applications of light weight concrete - HSC - HPC - FRC - Ferrocement - Polymer Concrete - RMC - Shotcrete- SCC-smart concrete - self healing concrete - light transmitting concrete - porous concrete - aerated concrete - SIFCON - reactive powder concrete - concrete canvas.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Design a concrete mix as per IS codal provisions with the selection of suitable ingredients.	Apply
CO 2: Justify the selection of conventional and special concrete for various applications based on its fresh and hardened properties.	Apply
CO 3: Prepare and exhibit special concrete models using sustainable materials.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	3	-	3	3	-	-	3	-

High-3; Medium-2; Low-1

Text Book(s):

T1. M.S. Shetty and A.K. Jain, “Concrete Technology: Theory and Practice”, 8th Edition, S Chand Publishing., New Delhi, 2018

T2. M.L. Gambhir, “Concrete Technology: Theory and Practice”, 5th Edition, McGraw Hill (India) Private Limited, Noida, 2013.

Reference Book(s):

R1. A.R. Santhakumar, “Concrete Technology”, 2nd Edition, Oxford University Press, New Delhi, 2018.

R2. Neville A.M “Properties of Concrete”, Pearson Education Asia Pvt Ltd., New Delhi, 2012.

R3. Mehta, P.K., "Concrete: Microstructure, Properties and Materials " 4thedition, McGraw Hill (India) Private Limited, Noida, 2013.

Web References:

1.http://nptel.ac.in/courses/105102012/

2.http://freevideolectures.com/Course/3357/Concrete-Technology/1

Course Code: 23CEL301	Course Title: SURVEYING PRACTICE LABORATORY		
Course Category: Major-Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 0: 0: 3	Credits: 1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to expose the students to various surveying techniques which are very essential for a Civil Engineering student.

List of Experiments:

1. Determination of Pace Value of Surveyor using Chaining and Ranging
2. Computation of Included Angle after adjustment of Local Attraction
3. Determination of various points RL by Fly and Check levelling using dumpy level.
4. Contour Mapping using Grid Levelling
5. Determine the Angle Observations by Repetition using Theodolite.
6. Establishment of Horizontal Control Points by Traversing.
7. Determination of horizontal distance and height difference between two points by Stadia method.
8. Preparation of Planimetric Map using Stadia Tacheometry.
9. Determination of horizontal distance and height difference between two points by Tangential Tacheometry
10. Setting out of foundation using centre line marking
11. Determination of locations and distances using hand held GPS and Distomat.
12. Determination of area and volume using Total-station.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Determine the distance, height, area and volume of boundaries given using a suitable surveying technique	Apply
CO2. Execute marking and prepare a report representing topographic and spatial data	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	3	2	-	-	-	3
CO2	3	-	-	-	3	-	-	-	3	2	-	-	-	2

High-3; Medium-2;Low-1

Reference Book(s):

R1. Punmia B C, “Surveying” - vol. 1, vol. 2 and vol 3, Laxmi Publications (P) Ltd., New Delhi, Seventeenth Edition, 2016

R2. Agor. R, “A Text Book of Surveying and Levelling”, Khanna Publishers, Twelfth Edition 2015

R3. Surveying Laboratory manual, Department of Civil Engineering, Dr. Mahalingam College of Engineering and Technology, Pollachi.

Web References:

1. http://www.aboutcivil.org/surveying-levelling%20II.html
2. http://civil.engineering.webservices.utoronto.ca/Assets/Civil+Engineering+Digital+Assets/
3. http://www.nptel.ac.in/courses/105107122/programs/courses/Survey+Camp+Class+Notes.pdf?method=1

Course Code: 23CEL302		Course Title: MATERIALS TESTING LABORATORY	
Course Category: Major – Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 0:0 :3	Credits: 1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives

The course is intended to provide an understanding of the basic properties of construction materials and testing requirements for these materials.

List of Experiments:

Determination of

1. Modulus of elasticity for a given metal specimen
2. Properties of bricks and blocks
3. Physical properties of cement
4. Properties of fine aggregates and coarse aggregate
5. Torsional strength and modulus of rigidity for a given metal specimen
6. Deflection of beam and Verify using Maxwell reciprocal theorem
7. Hardness and impact strength for a given specimen
8. Spring constant for a given spring specimen
9. Slope and deflection of a beam by moment area theorem
10. Flexural Rigidity (EI) for a given specimens
11. Shear strength of metals (Double Shear test)
12. Buckling load for a given end condition of a column

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Determine the various properties of materials used in construction	Apply
CO 2: Interpret the results and recommend suitable materials for various applications	Apply

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	-	-	-	-	-	-	-	3	-	-	-	3	-
CO 2	3	-	-	-	-	-	-	-	3	-	-	-	3	-

High-3; Medium-2; Low-1

Reference Book(s):

R 1. Bansal, R.K., “A Text Book of Strength of Materials”, Laxmi Publications (P) Ltd., New Delhi 2010.

R 2. Timoshenko. S.P. and Young D.H., “Elements of Strength of Materials”, Affiliated East-West Press Ltd., New Delhi, 5th edition (SI Units), 2012.

R 3. 19CECN3302 - Materials Laboratory Manual.

Web References:

1. https://sm-nitk.vlabs.ac.in/
2. https://eerc01-iiith.vlabs.ac.in/
3. https://www.youtube.com/c/constructionmaterialtesting

Course Code: 23CEL303		Course Title: COMPUTER AIDED BUILDING DRAWING LABORATORY	
Course Category: Major – Professional Core		Course Level: Introductory	
L:T:P(Hours/Week) 0:0 :3	Credits: 1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on the principles of planning for various buildings by incorporating building bye laws and develop the skill sets required for the drawing of different components of buildings.

List of Exercises:

Preparation of

1. Plan, elevation and Section of different types of footing. (Sketch)
2. Plan, elevation and section of dog legged staircase and bifurcated staircase. (Sketch)
3. Plan, elevation & section of simple building. (Sketch)
4. Introduction to CAD commands and drawing of simple objects.
5. Plan, elevation and section of types of foundations. (Wall foundation, Column footing – Stepped, Combined and Trapezoidal).
6. Plan, elevation of dog legged staircase and bifurcated staircase.
7. Plan, elevation & section of simple buildings.
8. Plan, elevation & section of two BHK residential building with RCC flat roof – single storey – load bearing structure.
9. Plan, elevation & section of two BHK residential building with RCC flat roof – single storey – framed structure.
10. Plan, elevation & section of Commercial building.
11. Section of King post & Queen Post for wooden/steel truss.
12. New plan for a dream house with proper orientation, scale and norms.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Draw the various components of a building manually and by using software	Apply
CO2: Prepare a plan, elevation and section of a residential building using software	Apply

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	3	2	-	-	-	3
CO2	3	-	-	-	3	-	-	-	3	2	-	-	-	3

High-3; Medium-2;Low-1

Reference Book(s):

R1. Rangawala, "A text book of Civil Engineering Drawing (including computer aided building drawing), Charotar publishers, 3rd edition, 2017.

R2. N. Kumaraswamy & A. Kameswara Rao, "Building Planning and Drawing", Charotar publishers, 9th edition, 2023.

R3. B.P. Verma, "Civil Engineering Drawing & House Planning", Khanna publishers, 13th edition, 2023.

Course Code: 23ESL301		Course Title:Professional Skills 2: Problem solving skills & Logical Thinking 2 (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0: 2	Credits: 1	Total Contact Hours:30	Max Marks:100

Course Objectives:

The course is intended to enhance the students' numerical, analytical and logical reasoning ability. Also course focus to make learners prepare for various public and private sector exams and placement drives.

Module I **20 Hours**

Quantitative Ability

Time and work –Pipes and cisterns- - Time Speed Distance-Problems on Trains-Boats and Streams- Permutation and Combination-Probability, Menstruation- Heights and distance- Logarithms- Clocks and Calendars – Data Sufficiency

Module II **10 Hours**

Reasoning Ability

Number & Alpha series- Odd man out-Coding and Decoding-Syllogisms- -Problems on Cubes and Dices- Logical Venn diagram -Visual Reasoning- Element & logical series-Analogies

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Enhance their problem solving skills & Logical thinking Skills	**Apply**

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	3	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1: Dr. R. S. Aggarwal. "Quantitative Aptitude for Competitive Examinations" Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018.

T2: Dr. R. S. Aggarwal. "A Modern Approach to Logical Reasoning", Sultan Chand & Sons Pvt. Ltd, New Delhi, 2018

Reference Book(s):

R1: R. V. Praveen. “Quantitative Aptitude and Reasoning” 2nd Revised Edition, Prentice-Hall of India Pvt.Ltd, 2013

R2: Arun Sharma. “Quantitative Aptitude for Common Aptitude Test”, McGraw Hill Publications, 5th Edition, 2020

R3: Arun Sharma. “Logical Reasoning for Common Aptitude Test”, McGraw Hill Publications, 6th Edition, 2021.

Web References:

1 https://www.indiabix.com/aptitude/questions-and-answers/

2 https://www.geeksforgeeks.org/aptitude-questions-and-answers/

Course Code: 23VAT301		Course Title: UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	
Course Category: VAC		Course Level: Practice	
L:T:P (Hours/Week) 2:1: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Induction Program

Course Objectives

The course is intended to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Strengthening of self-reflection
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Development of commitment and courage to act
5. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

Unit I Introduction to Value Education 9 Hours

Need for the Value Education; Self -exploration as the process for value education; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding: Relationship and Physical Facilities; Happiness and Prosperity: current scenario; Method to fulfill the Basic human aspirations

Unit II Harmony in Human Being 9 Hours

Human being as a co-existence of self (‘I’) and the material ‘Body’; needs of Self ('I') and 'Body'; The Body as an instrument of ‘I’; Harmony in the self (‘I’); Harmony of the self (‘I’) with body; Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III Harmony in the Family and Society 9 Hours

Harmony in the Family the basic unit of human interaction; Values in human to human relationship; Trust as the foundational values of relationship; Respect as the right evaluation ;Understanding harmony in the society (society being an extension of family); Vision for the universal human order.

Unit IV Harmony in the Nature 9 Hours

Understanding the harmony in the Nature Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature; Existence as Co-existence at all levels; Holistic perception of harmony in existence.

Unit V Harmony on Professional Ethics 9 Hours

Natural acceptance of human values; Definitiveness of Ethical Human Conduct; Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics; Case study: holistic technologies, management models and production systems; Strategy for transition towards value-based life and profession

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Reflect on values, aspiration, relationships and hence identify strengths and weaknesses.	Responding
CO.2 Appraise physical, mental and social wellbeing of self and practice techniques to promote wellbeing.	Responding
CO.3 Value human relationships in family and society and maintain harmonious relationships.	Valuing
CO.4 Respect nature and its existence for survival and sustainable of all life forms and hence practice conservation of nature	Valuing
CO.5 Appreciate ethical behaviour as a result of value system in personal and professional situations	Receiving

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	1	2	2	-	-	2	-	-
CO2	-	-	-	-	-	1	2	2	2	1	-	2	-	-
CO3	-	-	-	-	-	2	2	2	2	1	-	2	-	-
CO4	-	-	-	-	-	2	2	2	2	-	-	2	-	-
CO5	-	-	-	-	-	1	2	2	2	-	-	2	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

Reference Book(s):

R1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

R2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

R3. The story of stuff, Annie Leonard, Free Press, New York 2010.

Web References:

1. https://aktu.ac.in/hvpe/ResourceVideo.aspx
2. http://hvpenotes.blogspot.com/
3. https://nptel.ac.in/courses/109/104/109104068/

Course Code: 23CET401		Course Title: STRUCTURAL ANALYSIS I	
Course Category: Major – Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours:45	Max Marks: 100

Course Objectives:

The course is indented to impart knowledge on the concepts of virtual work to determine the deflection of trusses, frames and beams and to determine the bending moment and shear force for the determinate and indeterminate structures.

Module I **25 Hours**

DEFLECTION OF STRUCTURES: Deflection of determinate structures - Principle of Virtual work – Deflection of determinate plane trusses, beams and rigid plane frames.

SLOPE DEFLECTION METHOD: analysis of determinate and indeterminate structures (beam and frame) – Settlement of supports - sway.

MOMENT DISTRIBUTION METHOD: analysis of determinate and indeterminate structures (beam and frame) - settlement of supports - sway.

Module II **20 Hours**

FLEXIBILITY MATRIX METHOD: flexibility coefficients - flexibility matrix - analysis of determinate and indeterminate structures (beam and frame) – Analysis of pin jointed plane frames (truss).

STIFFNESS MATRIX METHOD: stiffness coefficients - stiffness matrix - analysis of determinate and indeterminate structures (beam and frame) – Analysis of pin jointed plane frames (truss).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Calculate the bending moment, shear force and deflection of statically determinate and indeterminate structures by force methods	Apply
CO2: Calculate the bending moment and shear force of statically determinate and indeterminate structures by displacement methods	Apply
CO3: Prepare a comparative study report on various methods of analysis of a structure	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	3	2	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Vaidyanathan R, Perumal P, "Structural Analysis - Vol. 1", Fourth Edition, Laxmi Publications (P) Ltd., New Delhi, 2019.

T2. Bhavikatti S S, "Structural Analysis", Fourth Edition, Vikas Publishing House (P) Ltd., New Delhi, 2021.

Reference Book(s):

R1.Timoshenko S P and Young D H, "Theory of Structures", Second edition, McGraw Hill Publishing Int Ltd., 1965.

R2. Punmia B C, Ashok Kumar Jain, Arun Kumar Jain, “Theory of Structures”, Thirteenth Edition, Laxmi Publications (P) Ltd., New Delhi, 2017

R3. Hibbler R C, "Structural Analysis", Tenth Edition, Pearson Education, 2022.

Web References:

1. http:// nptel.ac.in/courses/105/105/105105166/
2. https://www.udemy.com/course/structural-analysis-i/?couponCode=NVDPRODIN35
3. https://courses.structure.education/courses/structural-analysis-i

Course Code: 23CET402		Course Title: HIGHWAY ENGINEERING	
Course Category: Major - Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to impart the knowledge on concept and design of highway geometrics, properties and testing of highway materials and design, evaluation and maintenance of highway pavement.

Module I **22 Hours**

HIGHWAY ALIGNMENT

Modes of transportation - Highway development in India - Highway alignment: Factors controlling the alignment, horizontal and vertical profile - Engineering surveys for Highway alignment.

HIGHWAY ELEMENTS

Cross sectional elements of highway - Super elevation: Problems on super elevation - Sight distance: types, calculation of sight distance – Types of gradient – Types of curves, extra widening, problems on horizontal curves and vertical curves.

HIGHWAY CONSTRUCTION MATERIALS

Characteristics and properties of sub grade soil, aggregates and bitumen - Modern materials used in highway construction: Polymer modified bitumen, Geo-Textiles and Geo-Membrane.

Module II **23 Hours**

TESTS ON HIGHWAY CONSTRUCTION MATERIALS

Testing of sub grade soil: CBR Test, specific gravity test, proctor compaction test - Testing of aggregates: impact test, abrasion test, crushing strength test, specific gravity and water absorption test - Testing of bitumen: penetration test, ductility test, softening point test, viscosity test, flash and fire point test.

HIGHWAY PAVEMENT DESIGN

Types of pavements – Elements of pavement - Factors for pavement design - Design of flexible pavement (as per IRC: 37- 2018) - Design of rigid pavement (as per IRC:58- 2015) - Construction practice of flexible and concrete pavement – Pavement failures.

HIGHWAY MAINTENANCE

Highway drainage - Evaluation of pavements – Highway maintenance - Special repairs for highway pavement - Detailed Project Report (DPR).

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Calculate the geometric design elements of a highway.	Apply
CO2 Design flexible and rigid pavement with suitable highway construction materials as per the IRC codes.	Apply
CO3 Prepare a case study report on pavement failure and suggest suitable mitigation measures.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	-	-	-	-	-	-	-	3	2	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Khanna, S. K. and Justo, C.E.G., Highway Engineering, Nem Chand & Bros, 10th Edition 2017, Roorkee.

T2. Kadiyali, L.R., Highway Engineering, Khanna Publishers, 1st edition,2018, Delhi.

Reference Book(s):

R1. IRC:37 - 2018, Guidelines for the Design of Flexible Pavements, Indian Roads Congress, New Delhi.

R2. IRC:58 - 2015, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) , Indian Roads Congress, New Delhi.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_ce94
2. https://www.civil.iitb.ac.in/~vmtom/nptel/401_lnTse/web/web.html

Course Code: 23CET403		Course Title: WATER SUPPLY ENGINEERING	
Course Category: Major - Professional Core		Course Level: Intermediate	
L: T: P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to explain the sources of drinking water supply systems and its quality, describe the conveyance systems for the water supply, describe the primary methods for water treatment, outline the advanced methods invoked in the treatment of water, design the water distribution networks for buildings.

Module I **23 Hours**

PLANNING FOR WATER SUPPLY SYSTEM

Public water supply system: Planning – Objectives – Design period – Population forecasting – water demand – Sources of water and their characteristics – Surface and ground water – impounding reservoir – well hydraulics – Development and selection of source – Water quality – characterization and standards – Impact of climate change

CONVEYANCE SYSTEM

Water supply – Intake structures – functions and drawings – Pipes and conduits for water – pipe materials – Hydraulics of flow in pipes – Transmission main design – Laying, jointing and testing of pipes – Types and capacity of pumps – Selection of pumps and pipe materials

WATER TREATMENT

Objectives – Unit operations and processes – Principles, functions, design and drawing of chemical feeding, flash mixers, flocculators, sedimentation tanks and sand filters – Disinfection – Residue management – Construction, operation and maintenance aspects of water treatment plants

Module II **22 Hours**

ADVANCED WATER TREATMENT

Principles and functions of aeration – Iron and manganese removal, defluoridation and mineralization – Water softening – Desalination – Membrane systems – Recent advancements

WATER DISTRIBUTION AND SUPPLY TO BUILDINGS

Requirements of water distribution – Components- Service reservoirs – Functions and drawings - Network design – Economics – Analysis of distribution networks – Appurtenances – Operation and maintenance – Leakage detection – Methods, principles of design of water supply in buildings – House service connection – Fixtures and fittings – Systems of plumbing

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Design and draw conveyance systems and treatment processes for the water supply	Apply

CO2: Suggest suitable water distribution network as per the requirements of the community	Apply
CO3: Prepare a comparative study report on various water treatment methods	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	3	2	-	-	3	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Garg, S.K., “Environmental engineering” volume 1, Kanna publishers, New Delhi, 2005.
T2. Modi, P.N., “Water supply engineering” volume 1, Standard book house, New Delhi, 2005.

Reference Book(s):

R1. Punmia, B.C., Jain, A.K, Jain, A.K., ”Water supply engineering”, Lakshmi publications Pvt Limited, New Delhi, 2005.
R2. Government of India manual on “Water supply and treatment”, CPHEEO, Ministry of Urban Development, New Delhi, 2003.
R3. Syed, R.Q., Motley, E.M., Zhu, G., “Water works engineering - planning design and operation”, Prentice Hall of India Private limited, New Delhi, 2006.

Web References:

1. http://nptel.ac.in/courses/105104102/

Course Code: 23CET404		Course Title: REMOTE SENSING AND GIS	
Course Category: Major-Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to expose the students to the fundamental concepts of Remote Sensing and GIS. It introduces students to the influence of various sensors and their data applications in various fields of engineering.

Module I **23 Hours**

PHYSICS OF REMOTE SENSING

Introduction of Remote Sensing – Electro Magnetic Spectrum, Physics of Remote Sensing – Effects of Atmosphere Scattering – Different types – Absorption – Atmospheric window – Energy interaction with surface features – Spectral reflectance of vegetation, soil ,and water – atmospheric influence on spectral response patterns.

BASICS OF SENSORS AND PLATFORM CONCEPTS

Passive and Active sensors – Across track and along track scanners – Multi spectral scanners and thermal scanners - Types of platforms – PSLV and GSLV – Resolution – Spatial, Spectral, Radiometric and temporal resolutions – Pay load description of LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD, CHANDRAYAAN, MANGALYAAN.

IMAGE PROCESSING

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

Module II **22 Hours**

INTRODUCTION TO GEOGRAPHIC INFORMATION SYSTEM

Introduction – Maps – Map projections – types of map projections – GIS definition – components of GIS – standard GIS software's – Data type – Spatial and non-spatial data – measurement scales – Input and Output devices – Analysis Tools.

DATA ENTRY, STORAGE AND ANALYSIS

Data models – vector and raster data – data compression – data input by digital and analog methods – attribute data analysis – integrated data analysis – Modeling in GIS – Different case studies in Remote Sensing and GIS applications

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of remote sensing to interpret the spectral reflectance characteristics of various surface features, sensors and	Apply

platforms	
CO2: Apply image processing techniques to interpret the remote sensing data using GIS	Apply
CO3: Produce a report integrating remote sensing and GIS tools to analyse and map surface features	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	3	2	2	-	-	2	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman, “Remote Sensing and Image Interpretation”, John Willey and Sons (Asia) Pvt. Ltd., New Delhi, Seventh Edition, 2015.

T2. Anjireddy. M., “Remote Sensing and Geographical Information Systems: An Introduction, BS Publications”, Fourth Edition, 2014.

T3. Basudeb Bhatta, Remote Sensing and GIS, Oxford University Press, New Delhi, Third Edition, 2020

Reference Book(s):

R1. Victor Mesev, “Integration of GIS and Remote Sensing”, John Wiley and Sons Ltd., First Edition, 2008.

R2. Dr. S. Kumar, “Basics of Remote Sensing and GIS”, Laxmi Publications, First Edition, 2006.

R3. Chandra. A. M, Ghosh. S. K., “Remote sensing and Geographical Information System”, Alpha Science Publications, Second Edition, 2015

Web References:

1. http://www.wamis.org/agm/pubs/agm8/Paper-1.pdf
2. http://ags.geography.du.ac.in/Study%20Materials_files/Punyatoya%20Patra_AM.pdf
3. http://hydrologie.org/hsj/410/hysj_41_04_0593.pdf
4. http://www.wiley.com/legacy/wileychi/gis/Volume1/BB1v1_ch14.pdf
5. http://gis-lab.info/docs/books/aerial-mapping/cr1557_15.pdf

Course Code: 23CET405		Course Title: FLUID MECHANICS AND HYDRAULICS ENGINEERING	
Course Category: Major-Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 3:1:0	Credits: 4	Total Contact Hours: 60	Max Marks:100

Course Objectives:

The course is intended to introduce the concepts of static pressure, buoyant force and metacentric height; Know the flow properties through velocity potential function and stream function; Apply the Bernoulli's theorem for pipe flow; Understand the major and minor losses in pipe flow; Study the principles of most economical channel section; Impart knowledge on dimensional and model analysis

Module I **30 Hours**

FLUID PROPERTIES AND FLUID STATICS

Fluid: Definition, distinction between solid and fluid – Units and dimensions – Properties of fluid.

Fluid statics: Concepts of fluid static pressure, absolute and gauge pressure – Pressure measurements using manometers and pressure gauges – Forces on planes: centre of pressure – Buoyancy – Metacentric height – Floatation

FLUID KINEMATICS AND DYNAMICS

Fluid kinematics: Flow visualisation – Lines of flow – Types of flow – Velocity field and acceleration – Continuity (one dimensional and three dimensional form) – stream function – velocity potential function

Fluid dynamics: Euler's equation along a streamline – Bernoulli's equation – Applications – Venturimeter, Orificemeter

FLOW THROUGH PIPES

Flow through pipes: Darcy Weisbach equation – Friction factor – Moody's diagram – Major and minor losses of flow in pipes – Pipes in series and in parallel – Boundary layer concept: Types of boundary layer thickness

Module II **30 Hours**

FLOW THROUGH OPEN CHANNELS

Types of open channels – Types of Flow – Fundamental equations – Chezy equation, Manning equation – Velocity distribution in open channel –- Most economical channel section for uniform flow (Rectangular and Trapezoidal) – Specific energy and specific force – Hydraulic jump

DIMENSIONAL ANALYSIS AND MODEL STUDIES

Fundamental dimensions – Dimensional homogeneity – Rayleigh's method and Buckingham pi-theorem – Dimensionless parameters – Similitude and model studies – Distorted models

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Calculate the characteristics of fluid at rest and in motion	Apply

CO2: Determine the relationship between various fluid parameters by dimensional and model analysis	Apply
CO3: Demonstrate a model showing the various characteristics of fluid flow	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	3	2	-	-	3	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Bansal, R.K., “Fluid mechanics and hydraulic machines”, Laxmi Publications Ltd, New Delhi, 2010.
T2. Rajput, R.K., “A text book of fluid mechanics”, S. Chand Publishing, 2019.
T3. Subramanya, K., “Flow in open channels”, Tata McGraw Hill Publishing Company Ltd, New Delhi, 2015.

Reference Book(s):

R1. Ven Te Chow, “Open Channel hydraulics”, Tata McGraw Hill Book company Ltd, New Delhi, 2009.
R2. Modi, P.N., Seth, S.M., “Hydraulics and Fluid Mechanics”, Standard book house, New Delhi, 2019.
R3. Srivastava, R., “Flow through open channels”, Oxford University Press, New Delhi, 2007.

Web References:

1. http://nptel.ac.in/courses/105103095
2. http://www.vidhyarthiplus.com/vp/Thread-ME2204-Fluid-Mechanics-and-Machinery-Lecture-Noes-2013-Edition#.VxG4X_1971U
3. http://www.et.byu.edu/~2014/che374/lectureNotes/lectureNotes.html

Course Code: 23CEL401		Course Title: CONCRETE AND HIGHWAY ENGINEERING LABORATORY	
Course Category: Major-Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on preparing concrete mix design; testing the fresh and hardened properties of concrete; workability and flowability tests on SCC; finding the properties of bitumen and binder content of asphalt mix.

List of Experiments:

1. Preparation of concrete mix using IS method.
2. Preparation of concrete mix using ACI method.
3. Determination of workability of concrete.
4. Determination of compressive, split tensile and flexural strength of hardened concrete.
5. Determination of modulus of elasticity of concrete.
6. Determination of strength & quality of concrete using NDT.
7. Determination of workability of self-compacting concrete.
8. Determination of specific gravity of bitumen.
9. Determination of softening point of bitumen.
10. Determination of ductility of bitumen.
11. Determination of flash and fire point of bitumen.
12. Determination of binder content of asphalt mix using binder recovery extraction test.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Design a concrete mix as per IS standards and determine the fresh and hardened properties of concrete.	Apply
CO2: Determine the properties of bitumen and optimal content of bitumen for a bituminous mix.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	-	3	-
CO2	3	-	-	-	-	-	-	-	3	3	-	-	3	-

High-3; Medium-2; Low-1

Reference Book(s):

R1. M.S. Shetty and A.K. Jain, “Concrete Technology: Theory and Practice”, 8th Edition, S Chand Publishing., New Delhi, 2018.

R2. S.K. Khanna, C.E.G Justo and A. Veeraragavan, “Highway Engineering”, Revised 10th Edition, Nem Chand & Bros, Uttarakhand, 2017.

R3. 23CEL401 - Concrete and Highway Engineering Laboratory Manual.

Course Code: 23CEL402		Course Title: FLUID MECHANICS AND HYDRAULICS ENGINEERING LABORATORY	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) : : 0:0:3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to provide hands-on experience of the application of flow measuring devices and performance characteristics of pumps and turbines.

List of Experiments:

1. Determination of metacentric height of a floating body
2. Classification of flow based on Reynolds number
3. Verification of Bernoulli's theorem
4. Measurement of flow using venturi meter and orifice meter
5. Measurement of flow through orifice
6. Determination of friction factor of various pipe materials
7. Determination of losses of different pipe fittings
8. Measurement of flow through notches
9. Measure the performance of centrifugal pump
10. Measure the performance of reciprocating pump
11. Measure the performance of Kaplan turbine
12. Measure the performance of Pelton Wheel turbine

Demonstration on:

1. Multistage centrifugal pump
2. Francis turbine
3. Submersible pump

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Investigate the flow characteristics of fluids	Apply
CO 2: Determine the efficiency of hydraulic machines and draw characteristic curves	Apply

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	-	3	-
CO2	3	-	-	-	-	-	-	-	3	3	-	-	3	-

R 1. R.K. Rajput., “A textbook of hydraulic machines”, S. Chand Publishing, New Delhi, 2019.
R 2. R.K. Bansal, “Fluid mechanics and hydraulic machines”, Laxmi Publications Ltd, New Delhi, 2010.
R 3. 23CEL402 – Fluid Mechanics and Hydraulics Engineering Laboratory Manual, Dr. MCET.

Web References:

1. https://me.iitp.ac.in/Virtual-Fluid-Laboratory/
2. https://fm-nitk.vlabs.ac.in/

Course Code: 23ESL401		Course Title Professional Skills 3 : Professional Development and Etiquette (Common to all B.E/B.Tech Programmes)	
Course Category: SEC		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0: 2	Credits: 1	Total Contact Hours:30	Max Marks:100

Course Objectives:

The course is intended to cultivate students' appropriate etiquette across various personal and professional contexts, fostering professionalism and effective communication.

Module I **15 Hours**

Emotional Intelligence

Intrapersonal Skill: Goal Setting- Self-management- Emotional Intelligence: Understanding & Developing EI for Effective Communication and Relationships – Enhancing Social Skills

Professional Development

Introduction to Professional Development - Career State Assessment - Set Career Goals- Stay on Industry Trends - Self & Lifelong learning – Creativity - Problem Solving Skills - Strong Fundamentals – Using/ Creating Opportunities – Work & Life Balancing - Revisiting Goals

Teamness and Interpersonal skills

Paraphrasing: Techniques for Active Listening -Paraphrasing as a Tool for Effective Understanding and Communication – Collaboration and Team Building: Building Trust and Rapport - Self-paced learning.

Module II **15 Hours**

Effective Communication

Effective Verbal Communication - Assertive Communication - Elements of Effective Communication - Barriers to Effective Communication - Persuasion Skills - Effective Presentation: Oral and visual presentation – Drafting formal reports.

Professional Etiquette

Introduction - Types of professional Etiquette- Personal Grooming: Importance of Personal Grooming in Professional Settings- Dress Codes and Professional Appearance Guidelines- Body language - Social – Email – Telephonic – Dining – Classroom - Business.

Activities:

- Emotional Intelligence: Scenario based role play, Debate
- Paraphrasing: Listening, Reading
- Effective Presentation:
    - Oral Presentation: Self-Introduction, JAM , Extempore speech
    - Visual presentation: Email Writing, Power Point Presentation, Vlog
- Professional Etiquette: Demonstrate required Professional Etiquette in all the above activities.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Communicate effectively and exhibit Professional etiquettes in various social forums.	**Apply**

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	2	3	-	1	-	-

High-3; Medium-2; Low-1

Textbook(s):

T1. Sabina Pillai, Agna Fernandez, “Soft Skills & Employability Skills”, Cambridge University Press 2018

T2. Peggy Post &Peter Post, “The Etiquette Advantage in Business: Personal Skills for Professional Success”, 2nd edition (May 3, 2005), William Morrow.

Reference Book(s):

R1. Ashraf Rizvi, "Effective Technical Communication" 2nd Edition, McGraw-Hill India, 2018

R2. Maithry Shinde, Jyotsna Sreenath, “Life Skills & Personality Development”, Cambridge University Press 2022

Web References:

1. https://www.indeed.com/career-advice/career-development/etiquette-at-work
2. https://www.skillsyouneed.com/interpersonal-skills.html

Course Code: 23CEC011		Course Title: SURVEY CAMP	
Course Category: Major-Professional Core		Course Level: Intermediate	
L:T:P (Hours/Week) 0:0:0	Credits: 1	Total Contact Hours: 1 week	Max Marks: 100

Course Objectives:

The course is intended to provide practical knowledge for implementation of different survey works using modern surveying instruments.

List of Experiments:

1. **Preparation of Topographic Map**
   a. Reconnaissance Survey for selection of Control Framework, Observation Stations
   b. Establishment of Horizontal Control Network (Traversing and Triangulation methods)
   c. Establishment of Vertical Control Network using Level Net
   d. Adjustment of Weighted Observations
   e. Measurement of Coordinates (X,Y and Z) of Features
   f. Preparation of Topographic Map using CAD software
2. **Setting out work and Computation work.**
   a. Setting out simple Road curve by linear method (Degree of Curve: 1 - 20°)
   b. Setting out simple Railway curve by Instrument method (Degree of Curve: 1 - 5°)
   c. Spread Footing Foundation marking for residential building.
   d. Column Footing Foundation marking for commercial / industrial building.
   e. Cut and fill volume calculation using profile levelling and Cross sectioning.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Execute topographic survey techniques to observe and process field data for map creation.	Apply
CO2. Prepare a comprehensive topographic map using software.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	3	-	-	-	3	3	-	-	-	3
CO2	3	3	3	3	3	-	-	-	3	3	-	-	-	3

SEMESTER V

Course Code: 23CET501		Course Title: STRUCTURAL ANALYSIS II	
Course Category: Major – Professional Core		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on the analysis of influence lines for beams, arches and cables and explore plastic analysis to understand structural behavior and load distribution effectively.

Module I **25 Hours**

INFLUENCE LINES FOR DETERMINATE AND INDETERMINATE BEAMS

Influence lines for reactions in statically determinate beams - Influence lines for shear force and bending moment - Calculation of critical stress resultants due to concentrated and distributed moving loads - absolute maximum bending moment - Muller Breslau's principle (propped cantilever, continuous beams (Redundancy restricted to one), and fixed beams).

ARCHES

Arches - Types of arches - Analysis of three hinged, two hinged and fixed arches - Parabolic and circular arches - Settlement and temperature effects.

Module II **20 Hours**

CABLES AND SUSPENSION BRIDGES

Equilibrium of cable - length of cable - anchorage of suspension cables - stiffening girders - cables with three hinged stiffening girders - Influence lines for three hinged stiffening girders.

PLASTIC ANALYSIS

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

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of influence lines to determine reactions, shear forces and bending moments in statically determinate and indeterminate beams.	Apply
CO2: Apply analytical techniques to understand the behavior of three-hinged, two-hinged and fixed arches, cables and suspension bridges under various loads.	Apply
CO3: Prepare a report to provide a comprehensive analysis of the principles and techniques applied to determine the reactions, shear forces and bending moments in various structural systems, along with the behavior of arches, cables and suspension bridges under different loading conditions.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	3	3	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Bhavikatti S.S, Structural Analysis, Vol.1 & 2, Vikas Publishing House Pvt. Ltd., New Delhi - 4, 2014.

T2. Punmia B.C, Ashok Kumar Jain and Arun Kumar Jain, Theory of structures, Laxmi Publications, 2004.

T3. Dr. Vaidyanathan R & Dr. Perumal P, Structural Analysis Vol.1 & 2, Laxmi Publications, 4th edition, 2019.

Reference Book(s):

R1. Gambhir M.L, Fundamentals of Structural Mechanics and Analysis, PHI Learning Pvt. Ltd., 2011.

R2. Vazrani V.N and Ratwani M.M, Analysis of Structures, Vol. II, Khanna Publishers, 2015.

R3. Negi L.S and Jangid R.S, Structural Analysis, Tata McGraw - Hill Publishers, 2004.

Web References:

1. https://archive.nptel.ac.in/courses/105/105/105105109/

2.https://archive.nptel.ac.in/courses/105/101/105101086/

Course Code: 23CET502		Course Title: GEOTECHNICAL ENGINEERING I	
Course Category: Major – Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on understanding of soil properties, classification, and behavior under various loading conditions, enabling them to apply geotechnical principles in the design and analysis of soil related problems.

Module I **22 Hours**

INDEX PROPERTIES

Formation and types of soil – particle behaviour – soil structure – phase relationship – Index properties – classification – BIS classification system – Unified classification system – compaction – laboratory and field tests – factors affecting soil compaction - field compaction methods.

EFFECTIVE STRESS AND PERMEABILITY

Soil water – various forms – capillary rise – effective stress concepts in soil – total, neutral and effective stress distribution in soil – Permeability – Darcy's law – permeability measurement in the laboratory and field. Liquefaction – seepage – two dimensional flow – Laplace equation – Introduction to flow nets – properties and uses.

Module II **23 Hours**

STRESS DISTRIBUTION AND SETTLEMENT

Stress distribution in soil medium – Boussinesq's theory – Use of Newmark influence charts – – Terzaghi's one dimensional consolidation theory – laboratory consolidation test – Components of settlement – Immediate and consolidation settlement – Problems on final and time rate of consolidation.

SHEAR STRENGTH

Shear strength of cohesive and cohesionless soils – Mohr-Coulomb failure theory – shear strength parameters – Direct shear, Triaxial compression, Unconfined Compression and Vane shear tests – shear tests based on drainage conditions – pore pressure parameters.

SLOPE STABILITY

Slope failures-types, causes and mechanisms – Infinite slopes – Finite slopes – Total and Effective stress analysis – Stability analysis for purely cohesive and c-ø soils- Method of slices – Friction Circle method – Stability number – Slope Protection measures.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Determine the engineering properties and seepage pressure of the soil.	Apply
CO 2: Evaluate the stress distribution, shear strength and slope stability of the soil.	Apply
CO 3: Prepare a report of soil properties, shear strength parameters of the locally available soil.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Venkatramaiah. C “Geotechnical Engineering”, New Age International (P) Ltd. Publishers, New Delhi, 2019.

T2. Arora. K. R “Soil Mechanics and Foundation (Geotechnical Engineering)”, Standard Publishers Distributors, Nai Sarak, New Delhi, 2020.

Reference Book(s):

R1. Punmia B.C., Ashok K Jain, Arun K Jian., “Soil Mechanics and Foundations", Laxmi Publications, 17th Edition, 2018.

R2. Varghese P.C. “Foundation Engineering”, PHI Learning Private Limited, New Delhi, 2012.

R3. Murthy V.N.S., “Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering”’ CBS Publishers and Distributors, New Delhi, 2018.

Course Code: 23CET503		Course Title: Design of Reinforced Concrete Elements	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is indented to impart knowledge on the design concepts of beam, slab, staircase, column and footings.

Module I **25 Hours**

Introduction

Introduction to R.C structures – Review of basic material properties - Concrete and Reinforcing steel. Demands on structural elements - Design philosophies - Working stress method (WSM), Ultimate load method (ULM), Limit state method (LSM). Behavior in Flexure, Shear and Torsion, design for bond - development length, splicing, curtailment. Serviceability requirements.

Design of Beam and Slab

Design of Beams using Limit State Method - singly and doubly reinforced rectangular and flanged sections. Design for shear – Modes of shear failure – shear reinforcement – Design for Torsion – Overview of design for combined actions (torsion- shear-axial-flexure).

Analysis and design of cantilever, one way, two way and continuous slabs subjected to uniformly distributed load for various boundary conditions- Types of Staircases – Design of dog-legged Staircase – Introduction to Flat Slab – Preparation of Design sheets for different structural elements.

Module II **20 Hours**

Design of Column

Design of Compression Members: effective length, short columns subject to axial compression with and without uniaxial / biaxial eccentricities. Design of beam-column joint.

Design of Footing

Design of wall footing – Design of axially and eccentrically loaded rectangular isolated footings – Design of combined rectangular footing for two columns only.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Design reinforced concrete elements to understand the behavior of these structures under flexure, shear, torsion, and combined actions as per the codal provisions.	Apply
CO 2: Design compression members and various types of footings ensuring structural stability and compliance to codal provisions.	Apply
CO 3: Design structural elements for a given plan.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3							2						3
CO2	3							2						3
CO3	3							2	3	3				3

High-3; Medium-2;Low-1

Text Book(s):

T1. Unnikrishna Pillai, S., Devdas Menon, “Reinforced Concrete Design”, Fourth Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2021.

T2. Gambhir.M.L., "Fundamentals of Reinforced Concrete Design", First Edition, Prentice Hall of India Private Limited, New Delhi, 2010.

Reference Book(s):

R1. Subramanian N, “Design of Reinforced Concrete Structures”, First edition, Oxford University Press India, 2014.

R2. Varghese P C, “Limit State Design of Reinforced Concrete”, Thirteenth Edition, Laxmi Publications (P) Ltd., New Delhi, 2017.

R3. Krishna Raju N, "Design of Reinforced Concrete Structures", Fourth Edition, CBS Publishers & Distributors Pvt Ltd., New Delhi, 2016.

Code Books:

1. IS 456-2000 “Plain and Reinforced Concrete - Code of Practice”, Bureau of Indian Standards.

Course Code: 23CET504		Course Title: WASTE WATER ENGINEERING	
Course Category: Major		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart the knowledge to analyze, design, and implement effective wastewater and sludge treatment systems, compliance with environmental standards.

Module I **22 Hours**

PLANNING AND DESIGN OF SEWRAGE SYSTEM

Characteristics and composition of sewage - population equivalent -Sanitary sewage flow estimation - Sewer materials - Hydraulics of flow in sanitary sewers - Sewer design - Storm Drainage-Storm runoff estimation - sewer appurtenances - corrosion in sewers - prevention and control - sewage pumping-drainage in buildings-plumbing systems for drainage.

PRIMARY TREATMENT OF SEWAGE

Objectives - Unit operations and Processes - Selection of treatment processes - Onsite sanitation - Septic tank- grey water harvesting - Primary treatment - Principles, functions and design of sewage treatment units - screens - grit chamber-primary sedimentation tanks - Construction, Operation and Maintenance aspects.

Module II **23 Hours**

SECONDARY TREATMENT OF SEWAGE

Objectives - Selection of Treatment Methods - Principles, Functions, - Activated Sludge Process and Extended aeration systems -Trickling filters–UASB - Waste Stabilization Ponds - Other treatment methods -Reclamation and Reuse of sewage - Recent Advances in Sewage Treatment - Construction, Operation and Maintenance aspects.

DISPOSAL OF SEWAGE

Standards for Disposal - Methods - dilution - Mass balance principle - Self-purification of river- Oxygen sag curve - deoxygenation and reaeration - Land disposal - Sewage farming - sodium hazards - Soil dispersion system.

SLUDGE TREATMENT AND DISPOSAL

Objectives - Sludge characterization - Thickening - Design of gravity thickener - Sludge digestion - Standard rate and High-rate digester design- Biogas recovery - Sludge Conditioning and Dewatering - Sludge drying beds- ultimate residue disposal.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply the principles of sewerage system planning and design to develop functional layouts and select suitable materials and alignments for efficient wastewater transportation.	Apply
CO 2: Apply the principles of primary and secondary wastewater treatment processes to design, evaluate systems for the effective treatment of wastewater and to develop effective treatment strategies for sewage and sludge disposal.	Apply
CO 3: Prepare a report on designing an efficient sewerage system for an urban area, incorporating appropriate disposal techniques to ensure environmental sustainability, public health, and regulatory compliance	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	3	3	-	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	-	3	3	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Garg S.K, Environmental Engineering Vol I and II, Khanna Publishers, New Delhi, 2019.

T2. Mark J Hammer Sr, Mark J Hammer Jr, Water and Wastewater technology, Prentice Hall of India, Hall of India, 2012.

Reference Book(s):

R1. Birdie G.S, Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, 2018.

R2. Shah C.S, Water Supply and Sanitation, Galgotia Publishing Company, New Delhi, 2016.

Web References:

1. https://onlinecourses.nptel.ac.in/noc25_ce63/preview
2. https://onlinecourses.nptel.ac.in/noc25_ce33/preview
3. https://onlinecourses.nptel.ac.in/noc25_ch37/preview

Course Code: 23CEL501	Course Title: COMPUTER AIDED DESIGN AND DRAFTING LABORATORY - I		
Course Category: Major		**Course Level: Intermediate**	
L: T:P (Hours/Week) 0:0:3:1.5	**Credits:1.5**	**Total Contact Hours: 45 Hours**	**Max Marks:100**

Course Objective:

The course is intended to impart the knowledge on the computer aided design and drafting of building elements using Software.

LIST OF EXPERIMENTS **45 Hours**

1. Design of simply supported beams and cantilever beams
2. Design of continuous beams and fixed beams
3. Design of short column
4. Design of long column
5. Design of One way slab
6. Design of Two way slab
7. Design of beam-column connection
8. Design of two storey framed RC structure
9. Design of high rise RC structure (G+2)
10. Modeling and rendering of three storey framed RC structure

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Design of various types of beams, columns and slab.	Analyze
CO.2 Design of two storey and high rise RC buildings and of beam-column connection.	Analyze
Reference Book(s):	

R1. Computer Aided Design and Drafting Laboratory manual of Civil Engineering Department, MCET, Pollachi.

R2. S. Unnikrishna Pillai and Devdas Menon, Reinforced concrete design, Tata Mc-Graw Hill Publication., 2019

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3			3			2	3					
CO2		3			3			2	3					

High–3; Medium–2; Low–1

Course Code: 23CEL502		Course Title: ENVIRONMENTAL ENGINEERING LABORATORY	
Course Category: Major		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 0:0:3	Credits: 1.5	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to learn the experimental determination of Physio-chemical parameters of water and waste water.

List of Experiments:

1. Determination of pH and Electrical Conductivity.
2. Determination of Dissolved Solids, Suspended Solids, Volatile Solids and Turbidity.
3. Determination of Sulphates.
4. Determination of Chlorides.
5. Determination of Dissolved Oxygen (DO).
6. Determination of Chemical Oxygen Demand.
7. Determination of Acidity.
8. Determination of Alkalinity.
9. Determination of Total Hardness.
10. Determination of Available Chlorine in Bleaching powder.
11. Determination of Residual Chlorine, Chloride and Fluoride.
12. Determination of Optimum amount of Coagulant.
13. Field Visit of Water/ Sewage Treatment Plant of a nearby area.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Determine the physical and chemical characteristics of water and wastewater.	Apply
CO 2: Determine the optimum dosage of coagulant and breakpoint chlorination	Apply
CO 3: Apply field observations of water and wastewater treatment processes and prepare detailed report that demonstrates understanding of practical treatment methods and operational challenges.	Apply

Reference Book(s):

R1. Environmental Engineering Laboratory Manual of Civil Engineering Department, MCET, Pollachi.

R2. Csuros Maria, Environmental Sampling and analysis for technicians, Lab Manual, 1st edition, CRC Press.

R3. Indian standard code book of IS 3025 (Various Parts) and IS 10500: 2012(Various Parts).

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	-	3	3	-	-	3	3	-	-	-	-	3
CO2	-	3	-	3	3	-	-	3	3	-	-	-	-	3
CO3	-	3	-	3	3	-	-	3	3	3	-	-	-	3

High-3; Medium-2;Low-1

SEMESTER VI

Course Code: 23CET601	Course Title: DESIGN OF STEEL STRUCTURES		
Course Category: Major- Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on limit state design of structural steel members including connections and the tools necessary for designing structural systems such as roof trusses and gantry girders as per IS standards.

Module I — **24 Hours**

DESIGN OF CONNECTIONS, TENSION AND COMPRESSION MEMBERS IN STEEL STRUCTURES:

Design of Connections: General -Types of Steel -Properties of structural steel - I.S. rolled sections - Concept of Limit State Design - Design of Simple and eccentric Bolted and welded connections - Types of failure and efficiency of joint – prying action - Introduction to HSFG bolts.

Design of Tension Members: Behaviour and Design of simple and built-up members subjected to tension - Shear lag effect - Design of lug angles - tension splice.

Design of Compression Members: Behaviour of short and long columns - Euler's column theory - Design of simple and built-up compression members with lacings and battens - Design of column bases - slab base and gusseted base.

Module II — **21 Hours**

DESIGN OF FLEXURAL MEMBERS AND INDUSTRIAL STRUCTURAL ELEMENTS:

Design of Beams: Design of laterally supported and unsupported beams - Design of built-up beams - Design of plate girders.

Industrial Structural Elements: Introduction to roof trusses – loads on trusses – Design of angle and channel section purlins –Design of joints and end bearings–Design of gantry girder - Introduction to pre-engineered buildings.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply the design principles for bolted, welded connections, tension members and compression members as per IS code to ensure structural integrity and efficiency.	Apply
CO 2: Apply the design principles as per IS code for flexural members and industrial structural elements.	Apply
CO 3: Prepare a report on the structural behavior of various steel connections and structural elements of existing steel structure using limit state design as per IS code.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	3	3	-	-	-	3

Text Books:

1. Duggal S.K., Design of Steel Structures, Tata McGraw Hill, Publishing Co. Ltd., New Delhi, 2010.
2. Bhavikatti S.S, Design of Steel Structures, IK International Publishing House, New Delhi, 2017.

References:

1. Gambhir M L, Fundamentals of Structural Steel Design, McGraw Hill Education India Pvt Limited, 2013.
2. Jack C. Mc Cormac and Stephen F Csernak, Structural Steel Design, Pearson Education Limited, 2013.
3. Sarwar Alam Raz, Structural Design in Steel, New Age International Publishers, 2014.
4. Subramanian N, Design of Steel Structures, Oxford University Press, New Delhi, 2016.
5. IS 800:2007 - Indian Standard General Construction in Steel - Code of Practice, 2007.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_ce37/preview

Course Code: 23CET602		Course Title: GEOTECHNICAL ENGINEERING II	
Course Category: Major – Professional Core		Course Level: Advanced	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on understanding of geotechnical site analysis, equipping them to analyze complex soil behavior, design safe and efficient foundations, and apply geotechnical principles in the construction of infrastructure.

Module I **22 Hours**

SITE INVESTIGATION AND SELECTION OF FOUNDATION

Scope and objectives- Methods of exploration- Boring – Depth of boring – Spacing of bore hole – Sampling – Types of samples- Sampling techniques – In situ penetration tests (SPT and SCPT) – Bore Log report, Interpretation of test results – Subsurface profile – Types of foundation - Selection of foundation based on soil condition.

BEARING CAPACITY OF SOIL AND SETTLEMENT OF SHALLOW FOUNDATIONS

Location and depth of foundation – bearing capacity of shallow foundation on homogeneous deposits - Terzaghi's formula and BIS formula (only) - factors affecting bearing capacity - problems - Bearing Capacity from in-situ tests (SPT, SCPT and Plate load) - Allowable bearing pressure - Components of settlement - Settlement of foundations on granular and clay deposits - Allowable and differential settlements - codal provisions, Methods of minimizing settlement.

Module II **23 Hours**

FOOTINGS AND RAFT FOUNDATION

Contact pressure distribution below footings & raft – Design of Isolated, combined footings (rectangular and trapezoidal), strap footings – mat foundation types – importance of proportioning – floating foundation – Identification of expansive soil – foundations on expansive soil - under reamed piles.

PILE FOUNDATIONS

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 Hiley's) - Pile load test - Negative skin friction - uplift capacity - Group capacity (Individual pile method and Block failure criterion) - Pile group efficiency by Feld's rule, Converse Labarra formula – pile cap – pile integrity test - Settlement of pile groups.

EARTH PRESSSURE AND RETAINING WALLS

Plastic equilibrium in soils - active and passive states - Rankine's theory - cohesionless and cohesive soil - Coloumb's wedge theory - Types of retaining walls - Earth pressure on retaining walls of simple configurations - Culmann's graphical method- Stability of retaining walls.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Determine the load bearing capacity of soil with various soil investigation methods.	Apply
CO 2: Design of shallow foundation, pile foundation and retaining walls.	Apply
CO 3: Prepare a soil investigation report consists of soil exploration methods, suggestions and design of foundation of a G+2 building.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	-	3	2	-	-	2	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, New Delhi, 2017

T2. Murthy, V.N.S, Text book of "Soil Mechanics and Foundation Engineering", CBS Publishers Distribution Ltd, New Delhi, 2018.

Reference Book(s):

R1. Punmia, B.C., Ashok K Jain, Arun K Jian., “Soil Mechanics and Foundations", Laxmi Publications, 17th Edition, 2018.

R2. Coduto, D.P., "Geotechnical Engineering Principles and Practices", 2nd edition, Prentice Hall of India Private Limited, New Delhi, 2010.

R3. Varghese P.C., "Foundation Engineering", PHI Learning Private Limited, New Delhi, 2012.

Course Code: 23CEL601	Course Title: COMPUTER AIDED DESIGN AND DRAFTING LABORATORY - II		
Course Category: Major		**Course Level: Advanced**	
L: T:P (Hours/Week) 0:0:3:1.5	**Credits:1.5**	**Total Contact Hours: 45 Hours**	**Max Marks:100**

Course Objective:
The course is intended to impart the knowledge of designing components of buildings, retaining walls, water tanks and steel structures using software.

LIST OF EXPERIMENTS **45 Hours**

1. Design of isolated footing
2. Design of combined footing
3. Design of retaining walls
4. Design of underground water tanks
5. Design of elevated water tanks
6. Design of steel beams for flexure
7. Design of steel roof truss
8. Design of gantry girder
9. Design of transmission tower
10. Design of RC bridge deck slab

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO.1 Design various types of footings, retaining walls and water tanks.	Analyze
CO.2 Design of various steel structures and RC bridge deck slab as per IRC loading.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3			3			2	3					
CO2		3			3			2	3					

High–3; Medium–2; Low–1

Reference Book(s):

R1. Computer Aided Design and Drafting Laboratory manual of Civil Engineering Department, MCET, Pollachi.

R2. S. Unnikrishna Pillai and Devdas Menon, Reinforced concrete design, Tata Mc-Graw Hill Publication., 2019

R3. N. Subramanian, Design of Steel Structures, Oxford University Press, 5th edition**,** 2020.

R4. V. K. Krishnaraju, Design of Bridges, Oxford University Press, 4th edition, 2017.

Course Code: 23CEL602	Course Title: GEOTECHNICAL ENGINEERING LABORATORY		
Course Category: Major – Professional Core		Course Level: Intermediate	
L:T:P(Hours/Week) 0:0: 3	Credits: 1.5	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on determining both index and engineering properties of soil through hands on experience.

List of Experiments:

1. Determination of Water content by Oven drying method and Specific gravity of soil grains by Pycnometer method and Density bottle method.
2. Determination of Relative density of sands and Grain size distribution of coarse-grained soils by Sieve analysis.
3. Determination of grain size distribution of fine-grained soils by Hydrometer Analysis.
4. Determination of Field density by core cutter method and sand replacement method.
5. Determination of Liquid limit, Plastic limit and shrinkage limit of cohesive oil. (Casagrande's Method).
6. Determination of moisture - density relationship by Standard Proctor compaction test.
7. Determination of Soil Permeability by constant head and falling head methods.
8. Determination of coefficient of consolidation of clays by one dimensional consolidation test.
9. Determination of shear strength parameters of cohesion less soils by Direct shear test.
10. Determination of shear strength parameters by unconfined compression test on cohesive soil.
11. Determine the shear strength of soft soils by Vane shear test.
12. Determination of shear strength parameters of soils by Triaxial compression test.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Determine the index properties of cohesive and cohesionless soil.	Apply
CO 2: Determine the engineering properties of cohesive and cohesionless soil.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	3	-	-	3	-
CO2	3	-	-	-	-	-	-	-	3	3	-	-	3	-

High-3; Medium-2;Low-1

Reference Book(s):

R1. Geotechnical Engineering Laboratory Manual of Civil Engineering Department, MCET, Pollachi.

R2. Soil Mechanics Laboratory Manual, Braja M. Das, 8thEdition, Oxford University Press.

R3. I.S Code of Practice (2720) Relevant Parts.

Course Code: 23CEP601		Course Title: INNOVATIVE AND CREATIVE PROJECT	
Course Category: Project		Course Level: Practice	
L:T:P (Hours/Week) 0:0: 4	Credits:2	Total Contact Hours:60	Max Marks:100

Course Objectives

The course is intended to

- Gain knowledge on problem identification and to formulate the methodology to arrive a suitable solution.
- Enhance students' skills pertaining to scientific and technical report writing and presentation.

The student should carry out the literature survey, identification of the problem, development of the methodology and execution of their project in the civil engineering discipline. The project work can be allotted to either an individual student or a group of students comprising of not more than three. The progress of the project is evaluated based on a minimum of three reviews by the project review committee. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department. The students will be evaluated through based on the report and the viva-voce examination by a panel of examiners.

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO.1	Analyze and compile information from various resources relevant to the specific area of project to be undertaken and relate with societal and global issues.	Analyse
CO.2	Analyze regional, national and international scenarios and compose the problem statements and the objectives of the project towards a sustainable development.	Analyse
CO.3	Formulate project methodology integrating clear fundamentals, theories and standards governing the project as well as project planning.	Analyse
CO.4	Apply relevant engineering principles and theories to design, built, operate, simulate and analyze the development of a system or concept.	Apply
CO.5	Plan and manage time effectively as a team or individually.	Apply
CO.6	Organize and present technical and scientific findings effectively through written and oral mode with the aid of multimedia tools and appropriate code of ethics.	Create

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	3	-	3	-	3	3	-	3	3	3
CO2	3	3	2	-	3	-	3	-	3	3	-	3	3	3
CO3	3	3	2	-	3	-	3	-	3	3	-	3	3	3
CO4	3	3	2	-	3	2	3	-	3	3	-	3	3	3
CO5	3	2	-	-	3	-	3	-	3	3	3	3	3	3
CO6	3	3	3	3	3		3	3	3	3	-	3	3	3

High -3, Medium - 2, Low-1

ELECTIVES

Course Code: 23CEE001		Course Title: ADVANCED CONCRETE STRUCTURES	
Course Category: Professional Elective		Course Level: ADVANCED	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is indented to impart knowledge on the design concepts of retaining wall, liquid retaining structures, bridges and portal frames.

Module I **22 Hours**

RETAINING WALL

Design of cantilever and counter fort retaining walls - Flat Slabs.

WATER TANK

Liquid Retaining structure - Water tanks - types - square, rectangular, circular- Design of underground and elevated tanks - design of staging.

Module II **23 Hours**

DECK SLAB BRIDGE

Introduction, Classification of bridges – IRC Loadings – Effective width of load dispersion – Design of solid slab Bridge – Box culverts.

PORTAL FRAME

Portal frames – Analysis of portal frames – substitute frame method – cantilever method – portal method (concept only) – Design of single bay portal frame by substitute frame method and cantilever method.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Design retaining walls, flat slabs and water tanks ensuring structural integrity, stability and compliance with relevant standards and codes.	Apply
CO 2: Design solid slab bridges and box culverts, single bay portal frames by substitute frame and cantilever methods using relevant standards.	Apply
CO 3: Develop a structural model for the given specifications ensuring relevant codes and safety standards.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	2	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	2	-	-	-	-	-	-
CO3	3	3	2	-	3	-	-	3	3	3	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Unnikrishna Pillai S, Devdas Menon, Reinforced Concrete Design, Fourth Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2021.

T2. Subramanian N, Design of Reinforced Concrete Structures, First edition, Oxford

Reference Book(s):

R1. Krishna Raju N, Design of Reinforced Concrete Structures, Fourth Edition, CBS Publishers & Distributors Pvt Ltd., New Delhi, 2016.

R2. Punmia B C, Ashok Kumar Jain, Arun Kumar Jain, R C C Designs, Tenth Edition, Laxmi Publications (P) Ltd., New Delhi, 2015.

R3. Gambhir A L, Design of Reinforced Concrete Structures, Prentice-Hall of India Pvt. Ltd., New Delhi, 2008.

List of Code Books:

1. IS 456-2000, Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards.
2. IRC-6: 2017, Standard specifications and code of practice for road bridges - Loads and Load Combinations, Bureau of Indian Standards.
3. IRC-21: 2000, Standard specifications and code of practice for road bridges - Concrete Roads (Plain & Reinforced), Bureau of Indian Standards.
4. IS 3370 (Part-II & IV), Concrete structures for storage of liquids - code of practice, Bureau of Indian Standards.

Course Code: 23CEE002		Course Title: MAINTENANCE AND REHABILITATION OF STRUCTURES	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on maintenance, repair, and rehabilitation of structures, focusing on quality assurance, special concretes, strengthening techniques, and demolition planning.

Module I **24 Hours**

Maintenance – repair and rehabilitation, facets of maintenance, importance of maintenance – Various aspects of inspection – Assessment procedure for evaluating a damaged structure – Causes of deterioration.

Quality assurance for concrete construction – Concrete properties – strength, permeability, thermal properties and cracking – Effects due to climate, temperature, chemicals, corrosion – Design and construction errors – Effects of cover thickness and cracking.

Concrete chemicals, Special elements for accelerated strength gain – Expansive cement – polymers coating for rebars – Mortar and dry pack – Vacuum concreting- Epoxy injection – Mortar repair for cracks.

Module II **21 Hours**

Strengthening of super structures, sub structures – Increasing the load carrying capacity of footing – Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure – Methods of corrosion protection – Corrosion inhibitors – Corrosion resistant steels – Coatings and cathodic protection.

Introduction – planning, precautions and protective measures in demolition works –Sequences of operations – Demolition of structural elements – Engineered demolition techniques for dilapidated structures – Case studies.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply various maintenance and inspection techniques to evaluate and enhance the longevity of structures.	Apply
CO2: Apply quality assurance methods to concrete construction, considering the effects of environmental factors and design errors to prevent defects.	Apply
CO3: Apply strengthening techniques to enhance the performance and durability of structural elements.	Apply
CO4: Prepare a detailed report for structural maintenance, inspection, quality assurance, strengthening, corrosion protection and demolition techniques addressing real time problems.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	3	-	3	-	-	-	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Dr.R.P.Rethaliya, “Maintenance and Rehabilitation of Structures”, Atul Prakashan publications, 2019

T2. Dayarathnam. P and Rao. R,“Maintanence and Durability of Concrete Structures”, University Press,India 2015

Reference Book(s):

R1. Gambhir. M.L, “Concrete Technology”, Tata Mc–Graw Hill Company, New Delhi, 2013.

R2. Gupta B.L. and Amit Gupta, “Maintenance and Repair of Civil Structures”, Standard Publishers Distributors, 2009

R3. CPWD and Indian Building Concepts, Hand Book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.

Web References:

1. https://nptel.ac.in/courses/105/106/105106202/

Course Code: 24XXXX		Course Title: Prefabricated Structures	
Course Category: Professional Elective		**Course Level:** Intermediate	
L:T:P(Hours/Week) 3:0 : 0	**Credits:3**	**Total Contact Hours:45**	**Max Marks:100**

Course Objectives:

To study the design principles, analysis and design of Prefabricated structures.

Module I	**24 Hours**

Introduction

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standarization– Loads and load combinations– Materials – Production – Transportation – Erection.

Prefabricated Components and Systems

Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame system - Large panel systems- block system

Design Principles

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems- Design for stripping , stacking ,transportation and erection of elements.

Module II	**21 Hours**

Joints and Connections in Structural Members

Types of Joints – based on action of forces - compression joints - shear joints - tension joints – based on function - construction joints, contraction joints, expansion joints. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

Design for Abnormal Loads

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse -case study.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply the concepts about principles of prefabrication, production, transportation, erection along with knowledge of panel systems, slabs, beams, shear walls and columns used in precast construction	Apply
CO 2: Apply the design principles for designing cross-sections, connections.	Apply
CO 3: Prepare an structural stability report on existing prefabricated structure.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	3	3	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.
2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage ,CRC Press, 2019.
3. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift, "Precast Concrete Structures",Ernst & Sohn, Berlin, 2019.

Reference Book(s):

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016
3. " Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

Course Code: 23CEE004		Course Title: PRESTRESSED CONCRETE STRUCTURES	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to impart the knowledge on concept of prestressing, design of different beam elements, composite members and special structures.

Module I **22 Hours**

BASICS OF PRESTRESSING CONCEPTS

Principles of Prestressing – Classification and types – Methods of Prestressing – Freyssinet, Magnel Blaton, Lee Mc Call and Killick anchorage systems – Analysis of sections for stresses by stress concept, strength concept and load balancing concept – Losses of prestress.

DESIGN FOR FLEXURE AND SHEAR

Permissible stresses in steel and concrete– Design of sections of Type I and Type II post-tensioned beams (As per IS) –Factors influencing deflections – Short term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams– design of anchorage zone reinforcement – Check for strength limit– Layout of cables in post-tensioned beams – Design for shear.

Module II **23 Hours**

COMPOSITE AND CIRCULAR PRESTRESSED STRUCTURES

Analysis and design of composite beams - Shrinkage strain and its importance. Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing. Circular prestressing- Design of Prestressed Concrete Pipes and water tanks – Design of Tension members and Compression members.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Design pre-tensioned and post tensioned beams for flexure and shear and estimate deflection and losses of prestressing.	Apply
CO2: Apply the prestressing concepts to design the anchorage zone for post-tensioned members and analyse the composite beams, tension and compression members.	Apply
CO3: Prepare a design of the prestressed tension and compression member.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	-	-	-	-	-	-	-	2	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Krishna Raju N., "Prestressed concrete", 6th Edition, Tata McGraw Hill Company, New Delhi, 2018

T2. Pandit. G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.

Reference Book(s):

R1. Dayaratnam. P., "Prestressed Concrete Structures", Oxford and IBH, 2013.

R2. Karuna Moy Ghosh, “Prestressed Concrete: Analysis and Design Practice Of Members”, PHI Learning Pvt. Ltd.,2014.

R3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2013.

IS Code Book:

1. IS 1343-2012: Code of practice for Pre-stressed concrete
2. IS 784-2001: Code of practice for Pre-stressed concrete pipes
3. IS 3370-1999: Code of practice for concrete structures for the storage of liquids

Web References:

1. http://www.nptel.ac.in/courses/105106118/

Course Code: 23CEE005		Course Title: SEISMIC DESIGN OF STRUCTURES	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to impart the knowledge on concept of engineering seismology and structural dynamics for the design and detailing of earthquake resistant buildings using Indian Standard codal provisions.

Module I **22 Hours**

ENGINEERING SEISMOLOGY

Internal structure of earth, Continental drift theory, Plate tectonics, Elastic Rebound theory - Earthquake: classification, causes and effects - Earthquake waves – Quantification of Earthquakes: Intensity and Magnitude, Recording Earthquakes - Seismotectonics and Seismic Zoning of India.

STRUCTURAL DYNAMICS

Laws of Equilibrium – Newton's Law of Motion – D'Alembert's Principle and Principle of virtual displacement - Types of Dynamic Loading - Degree of Freedom: Definition and Types - Formulation of equation of motion for various SDOF system – Free and forced vibration of damped and undamped structures - Formulation of equation of motion for multi degree of freedom (MDOF) system – Response to Free And Forced Vibration of Undamped and Damped MDOF systems – Determination of Natural frequencies and Mode shapes.

Module II **23 Hours**

EARTHQUAKE RESISTANT DESIGN AND DETAILING

General principles and design criteria for Earthquake resistant structures as per codal provisions - Assumptions – Design of imposed loads – Seismic weight – Analysis by Equivalent Static Method and Dynamic Method (Response Spectrum Method) – Storey drift limitation - General specifications for Beams, Columns, Shear walls as per codal provisions - Special confining reinforcement – Base Isolation Techniques and Seismic Dampers.

BUILDING CONFIGURATIONS

Plan Irregularities – Torsion Irregularity – Re-entrant corners - Floor slabs having excessive cut-outs or openings - Out of plane offsets in Vertical Elements – Non-parallel Lateral Force system - Vertical Irregularities – Stiffness Irregularity (soft storey) – Mass Irregularity – Vertical Geometric Irregularity – In-plane discontinuity in Vertical Elements resisting lateral force – strength Irregularity (weak storey) – Floating or stub columns – Irregular Modes of Oscillation in two Principle Plan Directions.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Determine the natural frequencies and mode shapes of various DOF systems using concepts of engineering seismology and structural dynamics.	Apply
CO2 Calculate design seismic force by static analysis method and dynamic analysis method and review the IS codal provisions for the seismic resistant design.	Apply
CO3 Present a case study on building irregularities during earthquakes.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Duggal S.K., “Earthquake Resistant Design of Structures”, Oxford University Press, 2nd Edition, 2014.

T2. Pankaj Agarwal & Manish Shrikhande, “Earthquake Resistant Design of Structures”, 5th Edition Prentice Hall of India, New Delhi, 2011.

Reference Book(s):

R1. Mario Paz, “Structural Dynamics - Theory and Computations”, 6thEdition, Pearson Education, 2005.

R2. David Dowrick, “Earthquake Resistant Design and Risk Reduction”, 2nd Edition, John Wiley & Sons Ltd., 2011.

List of Code Books:

1. IS 1893 (Part 1): 2016, Indian Standard “Criteria for Earthquake Resistant Design of Structures, Part 1, General provisions and Buildings (six revision) Bureau of Indian Standard, New Delhi. (or latest).
2. IS 13920: 2016 Indian Standard “Ductile Design and Detailing of Reinforced Concrete Structures, subjected to Seismic forces - Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).
3. IS 4326: 2013 Indian Standard “Earthquake Resistant Design and Construction of Buildings - Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce74
2. https://onlinecourses.nptel.ac.in/noc24_ce96

Course Code: 23CEE006		Course Title: EXPERIMENTAL TECHNIQUES	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on concepts of measurements and related instruments, theory and principles involved in model analysis.

Module I **24 Hours**

FORCE AND STRAIN MEASUREMENTS

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long term monitoring – vibrating wire sensors– Fibre optic sensors.

VIBRATION MEASUREMENTS

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – Digital data Acquisition systems.

DISTRESS MEASUREMENT

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete and measurements.

Module II **21 Hours**

DAMAGE ASSESSMENT

Controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring.

NON-DESTRUCTIVE TESTING METHODS

Load testing on structures – Rebound Hammer – acoustic emission – ultrasonic testing principles and application– Advanced NDT methods – Ultrasonic pulse velocity, Impact echo.

MODEL ANALYSIS

Model Laws – Laws of similitude – Model materials – Necessity for Model analysis – Advantages – Applications – Types of similitude – Scale effect in models – Indirect model study – Direct model study - Limitations of models – investigations.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of measurement to determine force, strain, vibration and distress of an element.	Apply
CO2: Apply the principle of non-destructive testing techniques for structural health monitoring of structural elements.	Apply
CO3: Prepare a structural health monitoring report of an existing building.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 2015

T2. Rangan C S et al., 'Instrumentation – Devices and Systems', Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 2017

Reference Book(s):

R1. U.C. Jindal, Experimental Stress Analysis, Pearson Publication, Noida, 2012.

R2. Ravisankar.K. and Chellappan.A., "Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures", SERC, Chennai, 2007.

R3. Gandhi.M.V and Thompson.B.S, "Smart Materials and Structures", Chapman and Hall, NewYork,1992.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_me02/preview
2. https://nptel.ac.in/courses/112106198/

Course Code: 23CEE007	Course Title: AIR POLLUTION MANAGEMENT		
Course Category: Elective		Course Level: Intermediate	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to understand the sources and effects of air pollution, understand dispersion of pollutants, understand air pollution control, understand air quality management and also understand noise pollution.

Module I **23 Hours**

SOURCES AND EFFECTS OF AIR POLLUTANTS

Sources and classification of air pollution – Effects of air pollution on human beings, materials, vegetation, animals – Global warming– Ozone layer depletion, Sampling and Analysis – Basic principles of sampling – Source and ambient sampling – Stack sampling

DISPERSION OF POLLUTANTS

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Inversion, Introduction to air quality modeling.

AIR POLLUTION CONTROL

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – gaseous pollutant control by adsorption, absorption, condensation, combustion – Biofiltration (Only theory and working of equipments only)

Module II **22 Hours**

AIR QUALITY MANAGEMENT

Air quality standards – Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement– National Ambient Air quality standards – Air quality management in India

NOISE POLLUTION

Sources of noise pollution-Effects-Assessment-Standards-Control methods (at the source and transmission) – Prevention – Protection for exposed people

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of air pollution to identify the sources of air pollutants and analyze their effects on human health and the environment.	Apply
CO2: Implement methods for controlling air pollution from various sources in practical applications.	Apply
CO3: Prepare a report on air quality standards and regulation for management of air quality in the Indian scenario.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Anjaneyulu, Y., “Air Pollution: Prevention and Control Technologies”, B.S. Publications, 2nd edition, 2020.

T2. Rao, C.S. “Environmental Pollution Control Engineering”, New Age International publishers, Third Edition, 2018.

T3. Rao M.N., and Rao H. V. N., “Air Pollution Control”, Tata McGraw Hill, New Delhi,

T4. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi, 2019.

Reference Book(s):

R 1. Heumann, W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 1997.

R 2. Mahajan, S.P., "Pollution Control in Process Industries", Tata Mc–Graw Hill Publishing Company, New Delhi, 2017.

R 3. Peavy, S.W., Rowe, D.R. and Tchobanoglous, G. "Environmental Engineering", Tata Mc-Graw Hill, New Delhi, 2017.

Web References:

1. https://metnet.imd.gov.in/imdetp/lecture_notes/course11/LN_11_61_Air%20Pollution%20\Measurment.pdf
2. https://web.iitd.ac.in/~arunku/files/CVL212_Y18/Airpollutioneffects.pdf

Course Code: 23CEE008		Course Title: Industrial Waste Management	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to learn the industrial pollution prevention, learn industrial wastewater treatment, learn zero liquid discharge concepts, learn sludge and hazardous waste management, and learn wastewater treatment process of selected industries.

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Module I **23 Hours**

INDUSTRIAL POLLUTION PREVENTION

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters– Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay back period.

INDUSTRIAL WASTEWATER TREATMENT

Physico–Chemical Treatment Processes – Equalisation, Neutralisation, Oil Seperation, Flotation – Precipitation, Aerobic and Anaerobic Biological Treatment Processes – Sequencing batch reactors, membrane bioreactors, Advanced oxidation and Tertiary

Module II **22 Hours**

ZERO LIQUID DISCHARGE

Individual and Common Effluent Treatment Plants – Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse-Industrial reuse, Dispoal on water and land.

SLUDE AND HAZARDOUS WASTE MANAGEMENT

Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills – Hazardous waste management.

CASE STUDIES

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries– Textiles– Pulp and Paper – Metal finishing – Sugar and Distilleries.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply principles of industrial pollution prevention to develop sustainable practices in real-life scenarios.	Apply
CO2: Apply the concept of zero effluent discharge and evaluate quality requirements for the disposal of effluents on land and water bodies.	Apply
CO3: Prepare a report on applying the techniques for sludge and hazardous waste management in an industrial setting.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Bhatia, S.C., “Handbook of Industrial Pollution and Control”, Volume I & II, CBS Publishers, New Delhi,2003.
T2. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw Hill Publishing Co., New Delhi, 2017.

Reference Book(s):

R1. Eckenfelder, W.W., “Industrial Water Pollution Control", Mc–Graw Hill,2000.
R2. Frank Woodard, “Industrial waste treatment Handbook", Butterworth Heinemann, New Delhi,2005.
R3. Wang L.K., Yung–Tse Hung, Howard H. Lo and Constantine Yapijakis, “Handbook of Industrial and Hazardous Wastes Treatment", Marcel Dekker, Inc., USA, 2004.

Web References:

1. http://nptel.ac.in/courses/105106119/36

Course Code: 23CEE009		Course Title: MUNICIPAL SOLID WASTE MANAGEMENT	
Course Category: Major		Course Level: MASTERY	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart the knowledge on sources and types of municipal solid waste, its on-site and off-site storage and processing, collection and transfer methods, and various disposal techniques is essential for effective waste management.

Module I **22 Hours**

SOURCES AND TYPES

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 arid environmental effects. Elements of solid waste management - Municipal solid waste (M&H) rules- Integrated management - Social and Financial aspects; Public awareness; Role of NGO's.

SOURCE REDUCTION AND ON-SITE STORAGE

Source reduction of waste- Reduction, Reuse and Recycling - On-site storage methods- Effect of storage, materials used for containers- segregation of solid wastes - Public health and economic aspects of open storage - waste segregation and storage - case studies under Indian conditions -Critical Evaluations of Options.

Module II **23 Hours**

COLLECTION AND TRANSFER

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

PROCESSING OF WASTES

Objectives of waste processing - Physical Processing techniques and Equipment’s; Resource recovery from solid waste composting and bio-methanation composting, Thermal processing options-incineration, Pyrolysis; case studies under Indian conditions.

DISPOSAL

Disposal of solid waste; Sanitary landfills· site selection, design and operation of sanitary landfills -Landfill liners - Leachate collection & treatment-Management of leachate and landfill gas - Land fill bioreactor-Dumpsite Rehabilitation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply knowledge of the types and sources of municipal solid waste to categorize waste effectively, and implement on-site storage and processing techniques.	Apply
CO 2: Apply appropriate methods for the collection, transport, processing techniques and disposal methods of municipal solid waste to manage landfilling, composting, incineration and recycling.	Apply
CO 3: Prepare and present report on Municipal waste handling and disposal methods for Indian conditions.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	3	3	-	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	-	3	3	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd., 2018.

T2. Rao M.N, Razia Sultana, Sri Harsha Kota, Solid and Hazardous waste management - Science and Engineering, Butter Worth-Heinemann, 2016.

Reference Book(s):

R1. CPHEEO, Manual on Municipal Solid Waste Management, Vol I, II and III, Central Public Health and Environmental Engineering Organization, government of Inida, New Delhi, 2016.

R2. Bhide A.O and Sundaresan B.B, Solid Waste Management Collection, Processing and Disposal, 2001, ISBN 81-7525-282-0.

R3. Manser A.G.R and Keeling A.A, Practical Handbook of Processing and Recycling of Municipal solid Wastes, Lewis Publishers, CRC Press, 1996.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce77/preview
2. https://archive.nptel.ac.in/courses/120/108/120108005/

Course Code: 23CEE010		Course Title: Environmental Impact and Risk Assessment	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

This course is intended to expose the students to expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan, to provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting and managing human health risks.

Module I **23 Hours**

INTRODUCTION

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

ENVIRONMENTAL ASSESSMENT

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

SOCIAL IMPACT ASSESSMENT AND EIA DOCUMENTATION

Social impact assessment – Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition documentation of EIA findings – planning – organization of information and visual display materials.

Module II **22 Hours**

ENVIRONMENTAL MANAGEMENT PLAN

EIA Report preparation. Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment- Case Studies.

ENVIRONMENTAL RISK ASSESSMENT AND MANAGEMENT

Environmental risk assessment framework-Hazard identification -Dose Response Evaluation – Exposure Assessment – Exposure Factors, Tools for Environmental Risk Assessment– HAZOP and FEMA methods – Event tree and fault tree analysis – Multimedia and multipath way exposure modeling of contaminant- Risk Characterization Risk communication – Emergency Preparedness Plans –Design of risk management programs.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts and types of Environmental Impact Assessment (EIA) to various assessment processes.	Apply
CO2: Apply EIA methods to assess social impacts and develop sustainable management plans.	Apply
CO3: Prepare a report to for applying the tools for environmental risk	Apply

assessment and management for a real-world scenario.	

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Canter, L.W., “Environmental Impact Assessment”, McGraw Hill, New York. 1996.

T2. Cutter, S.L., “Environmental Risk and Hazards”, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.

T3. Raghavan K. V. and Khan A.A., “Methodologies in Hazard Identification and Risk Assessment”, Manual by CLRI, 1990.

Reference Book(s):

R.1 Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.

R.2 World Bank –Source book on EIA

R.3 Kolluru Rao, Bartell Steven, Pitblado, R., and Stricoff, “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York, 1996.

R4. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

Web References:

1. https://nptel.ac.in/courses/124107160

Course Code: 23CEE011		Course Title: Climate Change and Adaptation	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

Module I **23 Hours**

EARTH'S CLIMATE SYSTEM

Global, Regional and Local climates, Ocean Circulation, weather parameters - Role of ozone in environment - ozone layer - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Green House Gases and Global Warming – Carbon Cycle.

IMPACTS OF CLIMATE CHANGE

Impacts of Climate Change on various sectors – Agriculture, Forestry, and ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

OBSERVED CHANGES AND ITS CAUSES

Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India.

Module II **22 Hours**

CLIMATE CHANGE AND MITIGATION MEASURES

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices – Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

NATIONAL PLAN ON CLIMATE CHANGE

National and State Action Plan on Climate Change, Significance on Sustainable development of Natural resources – National Water Mission, Sustainable Agriculture Mission, Green India Mission, Coastal Conservation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge of the earth's climate system to analyze factors influencing climate change and apply protocols to address them.	Apply
CO2: Evaluate the impacts of climate change on various ecosystems and propose mitigation strategies.	Apply
CO3: Prepare a report to apply the strategies from the National Action Plan on Climate Change to mitigate its effects.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Jan, C., van Dam, "Impacts of Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

T2. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., "Climate Change and Water". Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.

T3. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Book(s):

R1. IPCC fourth assessment report - The AR4 synthesis report, 2007

R2. IPCC fourth assessment report –Working Group I Report, "The physical Science Basis", 2007

R3. IPCC fourth assessment report - Working Group II Report, "Impacts, Adaptation and Vulnerability", 2007

R4. IPCC fourth assessment report – Working Group III Report" Mitigation of Climate

Course Code: 23CEE012		Course Title: Disaster Mitigation and Management	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on concepts related to disaster, disaster risk reduction, disaster management, and to acquaint with the skills for planning and organizing disaster response.

Module I **23 Hours**

INTRODUCTION

Introduction to Disaster - Definition: Disaster, Hazard, Vulnerability, Resilience, Risks –Types of disasters – Earthquake, Landslide, Flood, Drought, Fire, Volcanic eruption, Tsunami, Avalanches and Pest infestation. Impacts including social, economic, political, environmental, health, psychosocial.

CONSEQUENCES AND CONTROL OF DISASTERS

Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

DISASTER MANAGEMENT CYCLE AND FRAMEWORK

Disaster Management: Capability-Vulnerability- risk- preparedness and mitigation- Disaster management cycle; Disaster Risk Reduction and Resilience; Disaster Management Act and Policy.

Module II **22 Hours**

DISASTER MANAGEMENT IN INDIA

Disaster Profile of India, Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES

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.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge to classify types of disasters and analyze their various impacts and implement appropriate control measures.	Apply
CO2: Apply the disaster management cycle and framework to develop effective disaster response strategies.	Apply
CO3: Prepare a report on application of the policies for effective disaster management for specific case studies.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Damon P. Coppola, “Introduction to International Disaster management”, Elsevier publication, 2015

T2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012.

T3. Gupta Anil K, Sreeja S. Nair. “Environmental Knowledge for Disaster Risk Management”, NIDM, New Delhi, 2011.

Reference Book(s):

R1. Brassard, Caroline, Giles, David W., Howitt, Arnold M., “Natural Disaster Management in the Asia-Pacific”, Policy and Governance.

R2. Jack Pinkowski, “Disaster Management Handbook”, CRC Press, January 22, 2008.

R3. “Disaster Management Guidelines”, GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

Course Code: 23CEE013		Course Title: Sustainable Engineering And Technology	
Course Category: Professional Elective		Course Level: Advanced	
L:T:P(Hours/Week) 3:0 :0	Credits:3	Total Contact Hours:45	Max Marks:100

COURSE OBJECTIVE

The course is intended to impart knowledge about the concepts of sustainable engineering and its various impacts on environment, construction and resources.

Module I Fundamentals of Sustainability and Global Environmental 22 Hours

Introduction to Sustainability:

Sustainability: Introduction, Need, and Concept - Social, Environmental, and Economic Sustainability Concepts, Sustainable Development and its Challenges. Nexus between Technology and Sustainable Development. Multilateral Environmental Agreements and Protocols - Clean Development Mechanism (CDM)

Global Environmental Issues

Air Pollution: Effects of Air Pollution, Water Pollution: Sources and Sustainable Wastewater Treatment. Solid Waste: Sources, Impacts, Zero Waste Concept, and 3R Concept. Global Environmental Issues: Resource Degradation, Climate Change, Global Warming, Ozone Layer Depletion, Regional and Local Environmental Issues, Carbon Credits, Carbon Trading, and Carbon Footprint.

Module II Sustainable Engineering Practices and Energy Sources 23 Hours

Sustainable Engineering Concepts

Key Concepts: Factor 4 and Factor 10, Goals of Sustainability, System Thinking, Life Cycle Thinking, and Circular Economy.

Sustainable Habitat

Basic Concepts of Sustainable Habitat, Green Buildings and Green Materials for Building Construction Material Selection for Sustainable Design - Green Building Certification

Methods for Increasing Energy Efficiency of Buildings - Sustainable Cities and Sustainable Transport.

Sustainable Energy Sources

Basic Concepts of Conventional and Non-Conventional Energy - Solar Energy, Fuel Cells, Wind Energy, Small Hydro Plants, Biofuels - Energy Derived from Oceans and Geothermal Energy.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of sustainability to assess environmental, social, and economic challenges, and implement sustainable development practices in various sectors, including technology, engineering, and urban planning.	Apply
CO 2: Utilize sustainable engineering concepts such as system thinking, life cycle thinking, and circular economy to design energy-efficient and resource-conscious systems, habitats, and technologies.	Apply
CO 3: Analyze global environmental issues such as air and water pollution, resource degradation, and climate change, and evaluate their impact on ecosystems and human society using sustainability frameworks and environmental protocols.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	3	2	2	-	-	2	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Allen, D. T. and Shonnard, D. R., “Sustainability Engineering: Concepts, Design and Case Studies”, Prentice Hall, 2011

T2. Twidell, J. W. and Weir, A. D.,“Renewable Energy Resources”, Taylor & Francis Ltd, 2015.

Reference Book(s):

R1. Bradley. A.S; Adebayo,A.O., Maria, P. “Engineering applications in sustainable design and development”, Cengage learning, 2015.

R2. ECBC Code 2007, “Bureau of Energy Efficiency”, New Delhi Bureau of Energy Efficiency Publications

R3. Ni bin Chang, “Systems Analysis for Sustainable Engineering: Theory and Applications”, McGraw-Hill Professional, 2010.

Course Code: 23CEE014	Course Title: Ground Improvement Techniques		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to impart knowledge on properly devising alternative solutions to the problematic soils in the field, especially before, during and after the construction of buildings, bridges, highways, tunnels and dams.

MODULE I **23 Hours**

PROBLEMATIC SOILS

Different types of problematic soils – Lateritic, Black cotton, Alluvial - Origin, formation, preloading -Engineering properties of soft, weak and compressible deposits - Need for ground improvement – Emerging trends in ground improvement. – Relative merits and demerits of different techniques - Selection of ground improvement techniques based on soil conditions

DRAINAGE AND DEWATERING METHODS

Drainage techniques - single, multi stage, vacuum well point, foundation drains, vertical drains, blanket drains - Electro-osmosis - Dewatering methods - Sumps and interceptor ditches - Design of dewatering systems, vacuum consolidation, Electro-kinetic dewatering -Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits

MODULE II **22 Hours**

EARTH REINFORCEMENT AND GROUTING TECHNIQUES

Mechanism and concept of earth reinforcement - Geosynthetics : Geotextiles- types, functions and applications of geogrids and geomembranes – Permeation grouting, compaction grouting, jet grouting, grouting in difficult conditions - Seepage control in soil under dams and for cut off walls - Stabilization grouting for under pinning - Soil nailing, rock anchoring, micro-piles.

INSITU TREATMENT OF COHESIVE AND COHESIONLESS SOILS

Consolidation of cohesive and densification of cohesionless soils – Mechanical stabilization, chemical stabilization, hydraulic modification – Stabilization with cement, lime and chemicals – Stabilization of expansive soils – Under reamed piles - Stone columns - Case studies of recent ground improvement projects on cohesive and cohesionless soils

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the characteristics of problematic soils and Identify the methods available in the design of dewatering and drainage process.	Apply
CO.2 Explain the concept of earth reinforcement (geosynthetics) and grouting techniques available and used in the current scenario	Apply
CO.3 Prepare the report of various ground improvement techniques based on the soil conditions	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Purushothama Raj, P., “Ground Improvement Techniques”, Laxmi Publications (P) Ltd.,New Delhi, 2005.

T 2. Nihar Ranjan Patra, Ground Improvement Techniques, Vikas Publishing House, First Edition, 2012.

T 3. Buddhima I. and Jian J.C., “Ground Improvement: Case Histories”, Elsevier Publications, 2005.

Reference Book(s):

R 1. Moseley, M.P and Kirsch. K., Ground Improvement, Spon Press, Taylor and Francis Group, London, 2nd Edition, 2004..

R 2. Mittal.S, An Introduction to Ground Improvement Engineering, Medtech Publisher, First Edition, 2013.

R 3. . Jones C.J.F.P. Earth Reinforcement and Soil Structure, Thomas Telford Publishing, 1996.

Course Code: 23CEE015	Course Title: SUBSURFACE INVESTIGATION AND INSTRUMENTATION		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective:

The course is intended to impart knowledge on preparation of soil exploration report based on laboratory, field exploration and testing techniques.

MODULE I **23 Hours**

EXPLORATION TECHNIQUES

Scope and objectives - planning an exploration program - location – spacing – depth of borings – sampling techniques - types of samplers - stabilization of bore holes–Methods of boring and drilling - non-displacement and displacement methods, drilling in difficult subsoil conditions - limitations of various drilling techniques - geophysical exploration methods and interpretation – soil profile – bore logs –– soil investigation and exploration reports.

IN-SITU TESTING

Field tests – importance - penetration testing – standard penetration test – static cone penetration test – dynamic cone penetration test – plate load test – field vane shear test – pressure meter test – field permeability test - procedure, limitations, correction and data interpretation.

MODULE II **22 Hours**

INSTRUMENTATION

Instrumentation in soil engineering – pore pressure – ground water table – strain gauges – resistance and induction type – load cells – earth pressure cells – settlement and heave gauges – piezometers and slope indications – inclinometer.

SPECIAL STRUCTURES

Challenges in special structures – bridges, airport runway, tunnels, transmission towers, offshore structures, underground structures – Design considerations – process of monitoring the investigation and construction activities – Report preparation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the various methods of soil exploration techniques with different soil conditions	Apply
CO.2. Explain the methods of instrumentation and special structures	Apply
CO.3 Prepare the soil investigation and construction progress report for the various geotechnical investigations.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	3	3	-	-	3	-

Text Book(s):

T1. Alam Singh and Chowdhary, G.R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical Testing and Instrumentation, CBS Publishers and Distributors, New Delhi, 2006.

T2. Hunt, R.E., "Geotechnical Engineering Investigation Manual, McGraw Hill,2005.

Reference Book(s):

R1. Hunt, R.E., "Geotechnical Engineering Investigation Manual, McGraw Hill,1984.

R2. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Hand Book, a Nostrand Reinhold 1994.

R3. Look, B. G, Handbook of Geotechnical Investigation and Design Tables: Second Edition. Netherlands: CRC Press, 2017

Course Code: 23CEE016	Course Title: ENGINEERING BEHAVIOUR OF SOILS		
Course Category: Elective		Course Level: Intermediate	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to gain the knowledge of the basic mechanics which governs the physio chemical, engineering, swell and shrinkage behavior of soil.

MODULE I **23 Hours**

SOIL DEPOSITS AND CLAY MINERALS of soils – different soil deposits and their engineering properties – composition and structure of clay minerals – classification and identification – anion and cation exchange capacity of clays – specific surface area – bonding in clays.

PHYSIO CHEMICAL BEHAVIOUR OF SOILS Physio chemical behaviour of soils – diffused double layer theory – computation of double layer distance – dielectric constant – temperature on double layer – ion exchange – cation exchange capacity – cause, fixation and determination of cation exchange effect– exchangeable cations - types of soil water – water interactions - soil structure.

ENGINEERING PROPERTIES OF SOILS

Compressibility, shear strength and permeability behaviour of fine and coarse grained soils – mechanisms - factors influencing engineering properties – liquefaction potential – causes and consequences - soil suction – determination of suction potential – collapsible soil – its identification – effect on foundation.

MODULE II **22 Hours**

SWELLING AND SHRINKAGE BEHAVIOUR OF SOILS

Problems associated with swelling and shrinkage behaviour of soils – causes, consequences and mechanisms – factors influencing swell – shrink characteristics – swell potential – swell pressure – volume changes and engineering problems in the field - soil fabric and measurement – sensitivity, thixotrophy of soils – soil suction – identification of expansive clays.

CONDUCTION PHENOMENA OF SOIL BEHAVIOUR

Conduction in soils – hydraulic, electrical, chemical and thermal flows in soils – applications - coupled flows – Electro-kinetic process – thermo osmosis - electro osmosis – prediction of engineering behaviour of soils using index properties – empirical equations and their applicability.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Examine the physio chemical properties and engineering properties with different soil.	Apply
CO.2 Interpret the swell behavior with different soil and describe the hydraulic, electrical, chemical and thermal flows in soils and its applications.	Apply
CO.3 Prepare the report of the tests conducted for engineering behavior of locally available soil deposits	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Mitchell, J. K., 2007. Fundamentals of soil Behaviour. Edition, John Wiley and sons, New York

T 2. Das, B.M., 2019. Advanced soil Mechanics. Taylor and Francis.

T 3. Gulhati, S. K. and Datta M. 2008. Geotechnical Engineering. Tata Mcgraw-Hill Company Ltd.

Reference Book(s):

R 1. Lambe, T.W. and Whitman, R.V., 1987. Soil Mechanics. John Wiley and Sons

R 2. Coduto, D. P. 2002. Geotechnical Engineering, Principles and Practices. Pearson Education International, New Jersey.

Course Code: 23CEE017	Course Title: SHALLOW FOUNDATIONS		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to understand the various aspects related to shallow foundations and its design in the field of Civil Engineering.

MODULE I **23 Hours**

TYPES AND SELECTION OF FOUNDATIOS

Types of foundations – types of shallow foundation – design concept - general requirements - additional consideration - selection of type of foundation - hostile environment - structural integrity – economy, foundation drainage and water proofing.

BEARING CAPACITY

Theories of bearing capacity – ultimate bearing capacity – factors affecting bearing capacity -evaluation of bearing capacity from in-situ tests – safe bearing capacity – bearing capacity of foundations in slope – effect of ground water table and eccentricity of foundations– codal provisions.

SETTLEMENT AND ALLOWABLE BEARING PRESSURE

Component of settlement - immediate, primary and secondary consolidation settlement-stress path method of settlement evaluation-layered soil - construction period correction - evaluation from in-situ tests – allowable settlement – allowable bearing pressure - codal provisions.

MODULE II **22 Hours**

DESIGN OF FOUNDATIONS

Analysis of foundation - isolated - strip - combined footings and mat foundations - conventional - elastic approach - soil structure interaction principles - application - numerical techniques - software applications.

FOUNDATION FOR SPECIAL CONDITIONS

Structural design of shallow foundations – limit state method-codal provisions- special foundations - foundation design in relation to ground movements - foundation on compressible fills – foundation for tower-design of foundation for seismic forces - codal provisions.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Classify and Identify the suitable type of foundation based on soil condition and estimate the safe bearing capacity.	Apply
CO.2 Design of isolated, strip, combined and mat foundation.	Apply
CO.3 Prepare a report of the design of shallow foundation for the existing building.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw Hill, New York, 1996.
T 2. Das, B.M., 'Principles of Foundation Engineering, Design and Construction", Fourth Edition, PWS Publishing, 2017
T 3. Donald P. Coduto, "Foundation Design Principles and Practices" - Prentice Hall, Inc., Englewood Cliffs, New Jersey, 2001.
T 4. Nainan P. Kurian, "Design of Foundation Systems, Principles and Practices, Narosa Publishing House, Third Edition, 2006.
T 5. Muni Budhu, "Soil Mechanics and Foundation, John Wiley and Sons, INC 2000.

Reference Book(s):

R 1. Poulos, H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980
R 2. Cernica, J.N. "Geotechnical Engineering Foundation Design", John Wiley and Sons, Inc. 1995.
R 3. Tomlinson, M.J. "Foundation engineering", ELBS, Longman Group, U.K. Ltd., England 1995.
R 4. Winterkorn, H.F. and Fang, Y.F., "Foundation Engineering Handbook", Van Nostrand Reinhold, 1994.
R 5. Day, R.W., "Geotechnical and Foundation Engineering, Design and Construction, McGraw Hill 1999.

Course Code: 23CEE018	Course Title: DEEP FOUNDATIONS		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objective

The course is intended to gain the knowledge in different types of deep foundations and to estimate the load carrying capacity on various soil conditions.

MODULE I **23 Hours**

CLASSIFICATIONS AND LOAD CAPACITY PILES

Necessity of pile foundation – classification of piles – factors governing choice of type of pile – load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition. Allowable load of piles and pile groups – static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – wave equation application – interpretation of field test and pile load test results – settlement of piles and pile group - codal provisions.

LATERAL AND UPLIFT LOAD EVALUATION OF PILES

Piles under lateral loads – broms method, elastic, p-y curve analyses – batter piles – response to moment – piles under uplift loads – under reamed piles – drilled shaft – lateral and pull out load tests – codal provision.

MODULE II **22 Hours**

STRUCTURAL DESIGN OF PILE AND PILE GROUPS

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- reinforcement details of pile and pile caps – pile raft system – basic interactive analysis – pile subjected to vibration – codal provision.

SHEET PILES

Sheet piles structures- cantilever sheet pile walls in granular and cohesive soils – anchored bulk head – free earth support method – fixed earth support method – lateral earth pressure on braced sheet piles.

WELL FOUNDATIONS

Well foundation - design and construction - bearing capacity, settlement and lateral resistance stability of well foundation - drilled shaft - construction procedures - design considerations - load carrying capacity and settlement analysis.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Classify the pile foundation and estimate the pile capacity and settlement of piles and pile group.	Apply
CO.2 Design of structural pile, pile cap, sheet piles and well foundation.	Apply
CO.3 Prepare a case study report of special foundation of existing monuments.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw Hill, New York, 1996.
T 2. Das, B.M., 'Principles of Foundation Engineering, Design and Construction", Fourth Edition, PWS Publishing, 2017
T 3. Donald P. Coduto, "Foundation Design Principles and Practices" - Prentice Hall, Inc., Englewood Cliffs, New Jersey, 2001.
T 4. Nainan P. Kurian, "Design of Foundation Systems, Principles and Practices, Narosa Publishing House, Third Edition, 2006.
T 5. Muni Budhu, "Soil Mechanics and Foundation, John Wiley and Sons, INC 2000.

Reference Book(s):

R 1. Poulos, H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980
R 2. Cernica, J.N. "Geotechnical Engineering Foundation Design", John Wiley and Sons, Inc. 1995.
R 3. Tomlinson, M.J. "Foundation engineering", ELBS, Longman Group, U.K. Ltd., England 1995.

Course Code: 23CEE019	Course Title: SOIL DYNAMICS AND MACHINE FOUNDATIONS		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to understand the theory of vibrations and behavior of soils under dynamic loads so that to design foundations for various types of machines.

MODULE I **22 Hours**

THEORY OF VIBRATION

Introduction – nature of dynamic loads – fundamentals of vibration - vibrations of single and multi degree freedom system – free vibrations of spring – mass systems – forced vibrations – resonance - viscous damping - Principles of vibration measuring instruments - effect of transient and pulsating loads.

DYNAMIC SOIL PROPERTIES

Dynamic stress-strain characteristics – principles of measuring dynamic properties – laboratory techniques – field tests – factors affecting dynamic properties - typical values - dynamic bearing capacity – dynamic earth pressure.

MODULE II **23 Hours**

MACHINE FOUNDATIONS

Types of Machines and Foundations – General requirements – Design approach for machine foundation - Vibration analysis – Elastic Half-Space theory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.

DESIGN OF MACHINE FOUNDATIONS

General requirements – evaluation of design parameters – analysis and design of block type and framed type machine foundations – modes of vibration of a rigid foundation – foundations for reciprocating machines, impact machines, two-cylinder vertical compressor, double-acting steam hammer – codal recommendations.

INFLUENCE OF VIBRATION AND REMEDIATION

Mechanism of liquefaction – influencing factors- vibration isolation – types of isolation - active and passive isolation – methods of isolation – use of springs and damping materials – properties of isolating materials – vibration control of existing machine foundation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Illustrate the importance of learning soil dynamics and the theory behind vibrations.	Apply
CO.2 Design of various types of machine foundation.	Apply
CO.3 Prepare a report of importance of design of a machine foundation	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Saran, S., 1999. Soil Dynamics and Machine Foundations. Galogotia Publications Pvt. Ltd, New Delhi.

T 2. Prakash, S and Puri, V.K., Foundations for Machines, McGraw Hill, 1987.McGraw Hill Book Company, New York.

T 3. Kameswara Rao, N.S.V., "Dynamics soil tests and applications", Wheeler Publishing , New Delhi, 2000

Reference Book(s):

R 1. Barken, D. D.,1962. Dynamics of bases and foundations. McGraw Hill, New York.

R 2. Krammer, S., 2003. Geotechnical Earthquake Engineering. Pearson Education Pvt. Ltd. New Delhi.

R 3. Moore, P.J., "Analysis & Design of Foundations for Vibrations", Oxford & IBH, 2006.

Course Code: 23CEE020	Course Title: REINFORCED SOIL STRUCTURES		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to gain the knowledge in the concept of geosynthetics, reinforced materials and their behavior and their applications in different civil engineering design.

MODULE I **23 Hours**

PRINCIPLES AND MECHANISMS

Historical background – initial and recent developments – principles – concepts and mechanisms of reinforced soil – factors affecting behaviour and performance of soil – reinforcement interactions.

REINFORCING MATERIALS

Materials used in reinforced soil structures – fill materials, reinforcing materials, metal strips, and geosynthetics – bamboo – timber – facing elements – properties methods of testing – advantages and disadvantages – influence of environmental factors on the performance of geosynthetic materials.

GEOSYNTHETICS AND APPLICATIONS

Geosynthetics in roads – geosynthetics in landfills – barrier walls - soil nailing – soil-nail interaction – behaviour in seismic conditions - case studies of reinforced dams, embankments, pavements, railroads, foundations

MODULE II **22 Hours**

DESIGN PRINCIPLES

Design aspects of reinforced soil – soil reinforcement function – separator, filtration, drainage, barrier function – design and applications of reinforced soil of various structures – retaining walls – foundations – embankments and slopes.

DESIGN FOR FUNCTIONS

Geotextiles - requirement for design of separation – filtration – general behaviour - filtration behind retaining wall, under drains, erosion control and silt fence – drainage design – liners for liquid containment – geo membrane and geosynthetic clay liners.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the concept and mechanism of reinforced soil structures and the factors affecting the performance.	Apply
CO.2 Design the structures for geosynthetics applications like separation, filtration, reinforcement and barrier.	Apply
CO.3 Prepare a report on the highway project to reinforce soil using strips, grids, anchors, chains, and other materials	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Sivakumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, University Press (India), Pvt. Ltd., Hyderabad, 2006.

T 2. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.

T 3. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.

Reference Book(s):

R 1. Jones, C.J.F.P., Earth Reinforcement and Soil Structures, Earthworks, London, 1982.

R 2. Ramanatha Ayyar , T.S., Ramachandran Nair, C.G. and Balakrishna Nair, N., Comprehensive Reference Book on Coir Geotextile, Centre for Development for Coir Technology, 2002.

R 3. Muller, W.W. HDPE Geomembranes in Geotechnics, Springer, New York 2007.

Course Code:	Course Title: HYDROLOGY		
Course Category: Elective		Course Level: Intermediate	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to define the key drivers on water resources, hydrological processes and their integrated behavior in catchments, apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and hydrograph, explain the concept of hydrological extremes such as flood and drought and its management strategies, describe the importance of spatial analysis of rainfall and design water storage reservoirs, apply the concepts of groundwater for water resources management.

23 Hours

Module I

PRECIPITATION AND ABSRACTIONS

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyetal methods - Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation - Infiltration-Horton's equation - double ring infiltrometer, infiltration indices.

RUNOFF

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical – Strange's table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH

22 Hours

Module II

FLOOD AND DROUGHT

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

RESERVOIRS

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

GROUNDWATER MANAGEMENT

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge of key drivers and hydrological processes to analyze their integrated behavior in catchments through hydrological models.	Apply
CO2: Apply management strategies to mitigate hydrological extremes such as floods and droughts.	Apply
CO3: Prepare a report on the development and implementation of rainwater harvesting (RWH) systems for rural and urban areas, integrating spatial rainfall analysis and reservoir design.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Subramanya, K., "Engineering Hydrology"- Tata McGraw Hill, 2010
T2. Jayarami Reddy, P., “Hydrology”, Tata McGraw Hill, 2008.

Reference Book(s):

R1. Garg. S. K., “Hydrology and Water Resources Engineering”, Khanna Publishers-Delhi, 2010.

R2. Ven Te Chow, Maidment, D.R., and Mays, L.W., "Applied Hydrology", McGraw Hill International Book Company, 1998.

R3. Raghunath. H.M., "Hydrology", Wiley Eastern Ltd., 1998.

Course Code: 23CEE022		Course Title: Groundwater Engineering	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to learn the basics of groundwater hydrology, outline the objectives of groundwater hydraulics, understand the various types of wells, its construction and maintenance, know about the different method of evaluation of aquifer parameters, and to study the concepts involved in modeling and recharge of groundwater.

Module I **23 Hours**

GROUNDWATER HYDROLOGY

Introduction- Water bearing formations- geological formation of water supply-subsurface distribution of water – hydrological cycle – sources of groundwater – types of aquifers – aquifer parameters – groundwater development and potential in India

GROUNDWATER HYDRAULICS

Groundwater flow- Permeability – Transmissibility – Darcy's law and its limitations – Properties of aquifer materials – Radial flow towards a well in a confined and unconfined aquifer – Relation of well size to yield – unsteady flow conditions – determination of aquifer constants – Theis method – Jacob's method – Chow's method – Theis recovery method – Conditions to check for steady state – Well losses and well efficiency

Module II **22 Hours**

WELLS AND EXPLORATION

Types of wells – water well design – drilling of tubewells – drilling methods – percussion drilling – rotary drilling – auger core drilling and water jet methods – construction of wells – collector wells and infiltration wells – construction of strainer type tube wells- types of strainers – Construction of cavity type tube wells – Construction of gravel packed wells – Construction of open wells - testing yield of tube wells

EVALUATION OF AQUIFER PARAMETERS

Pumping test analysis – Recuperation test – well characteristics – well capacity – confined and unconfined aquifer – groundwater investigation – subsurface geophysical methods

GROUNDWATER QUALITY AND CONSERVATION

Groundwater development – hydrological maps – groundwater quality standards – groundwater contamination – seawater intrusion – control measures – Groundwater recharge methods – Groundwater modelling

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of groundwater hydrology to analyze the movement of groundwater in various settings.	Apply
CO2: Classify different types of wells and implement appropriate methods for their construction, maintenance, and management.	Apply
CO3: Prepare a report on the methods for evaluating aquifer parameters, groundwater recharge, and modelling strategies.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Todd, D.K., Mays, L.W., “Groundwater Hydrology”, John Wiley and Sons, New York, 2005.
T2. Raghunath, H.M., “Groundwater Hydrology”, Wiley Eastern Ltd., Third edition, New Age International, 2007.
T3. R.N. Saxena, Gupta, D.C., “Elements and Hydrology and groundwater”, PHI Learning private limited, 2017.

Reference Book(s):

R1. Murthy, V.V.N., “Land and water management engineering”, Kalyani publishers, New Delhi, 1985.
R2. Delleur, J.W., “The Handbook of groundwater engineering”, CRC Press, Taylor and Francis Group, 2007.

Web References:

1. https://nptel.ac.in/courses/105105042
2. https://nptel.ac.in/courses/105101214

Course Code: 23CEE023		Course Title: Irrigation Management	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

This course is intended to expose the students to the irrigation development of India, understand the various systems of irrigation and their performance indicators, learn the various aspects of main system management, inculcate the principles of participatory irrigation management, outline the policies related to irrigation.

Module I **23 Hours**

IRRIGATION DEVELOPMENT IN INDIA

Importance of Irrigation in Agriculture - Historical evolution of irrigation in India – Irrigation development during pre-colonisation – Colonisation and post-colonization – Different types of Irrigation prevalent in India: Warabandi, Shejpali and South Indian systems - Focus of Irrigation in India – Command area development approach and farmers‟ participation.

IRRIGATION SYSTEMS AND PERFORMANCE INDICATORS

Systems classification - Institutions for irrigation management–Diagnostic Analysis of Irrigation Systems -Rehabilitation and modernization – Performance indicators – Improving system performance – Conjunctive management – constraints faced.

MAIN SYSTEM MANAGEMENT

Main system components – Reservoir allocation rule, Operating rule and optimization methods to improve main system performance - irrigation scheduling – Constraints.

Module II **22 Hours**

COMMAND AREA DEVELOPMENT AND PARTICIPATORY IRRIGATION MANAGEMENT

Command area development principles – Participatory Irrigation Management and Irrigation management transfer – Case studies – Constraints.

IRRIGATION POLICY

Present status of irrigation policy and institutions – Irrigation related conflicts – Institutional transformation needed – Constraints in effecting institutional transformation – Irrigation financing – Water pricing – Water market – Policy changes.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply principles of irrigation development in India to analyze its impact on agricultural and water management practices.	Apply
CO2: Apply principles of participatory irrigation management to resolve conflicts and enhance water use efficiency.	Apply
CO3: Prepare a report for the implementation of policies related to irrigation for sustainable water resource management.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Rakesh Hooja, “Management of Water for Agriculture: Irrigation, Water sheds and Drainage”, Rawat Publications, New Delhi, 2006.
T2. Kijne, J.W., Barker, R and Molden, D,”Water Productivity in Agriculture; Limits and Opportunities for improved”, CABI Publishing, Walling ford, U.K, 2003.

Reference Book(s):

R1. Giodano.M and Villbolth K.G, “The Agricultural Ground Water Revolution -Opportunities and threats to development”, CABI Publishing, Walling ford, U.K, 2007.

Web References:

1. https://nptel.ac.in/courses/105108081
2. **http://www.irrigationtoolbox.com/NEH/Part652_NationalIrrigationGuide/ch9.pdf**

Course Code: 23CEE024		Course Title: Irrigation Water Quality	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to understand the physical and chemical characteristics of irrigation water, study the role of salinity in irrigation water, learn the various sources of pollution, understand the recycling and reuse techniques adopted in irrigation, and discuss the water quality standards and models.

Module I **23 Hours**

WATER QUALITY

Physical and chemical properties of water – Suspended and dissolved solids – EC and pH – major ions –. Water quality investigation – Sampling design - Samplers and automatic samplers - Data collection platforms – Field kits – Water quality data storage, analysis and inference – Software packages

SALINITY

Water quality for irrigation – Salinity and permeability problem – Root zone salinity - Irrigation practices for poor quality water – Saline water irrigation – Future strategies

WATER POLLUTION

Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland.

Module II **22 Hours**

RECYCLING AND REUSE OF WATER

Multiple uses of water – Reuse of water in agriculture – Low-cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation.

WATER QUALITY MANAGEMENT

Principles of water quality – Water quality classification – Water quality standards - Water quality indices – TMDL Concepts – Water quality models.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge of the physical and chemical characteristics of irrigation water to evaluate its quality for agricultural purposes.	Apply
CO2: Identify sources of pollution affecting irrigation water and apply appropriate control and treatment methods.	Apply
CO3: Prepare a report on the implementation of recycling and reuse techniques in irrigation supported by water quality modelling tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, "Wastewater Engineering: Treatment and Reuse", McGraw-Hill, 2002.
T2. Vladimir Novonty, "Water Quality: Diffuse pollution and watershed Management", 2nd edition, John Wiley & Sons, 2003.

Reference Book(s):

R1. Mackenzie L Davis, David A Cornwell, "Introduction to Environmental Engineering", McGraw- Hill 2006.
R2. Stum, M and Morgan, A., "Aquatic Chemistry", Plenum Publishing company, USA, 1985.
R3. Lloyd, J.W. and Heathcote, J.A., "Natural inorganic chemistry" in relation to groundwater resources, Oxford University Press, Oxford, 1988.

Course Code: 23CEE025		Course Title: Watershed Conservation and Management	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to learn about the watershed concepts, understand the various soil conservation measures, become aware of the watershed harvesting techniques, develop a watershed management plan, and understand the role of remote sensing and GIS in watershed conservation.

Module I **23 Hours**

WATERSHED CONCEPTS

Watershed- Need for an integrated approach – Influencing factors; Geology – Soil – Morphological characteristics – Toposheet – Delineation – Codification – Prioritization of watershed

SOIL CONSERVATION MEASURES

Types of erosion – Water and wind erosion; Causes, factors, effects and control – Soil conservation measure: Agronomical and mechanical – Estimation of soil loss – Sedimentation

WATER HARVESTING AND CONSERVATION

Water harvesting techniques – Micro catchments – Design of small water harvesting structures – Farm ponds – Percolation Tanks – Yield of a catchment

Module II **22 Hours**

WATERSHED MANAGEMENT

Watershed development plan – Entry point activities – Estimation – Watershed economics – Agroforestry – Grassland management – Wasteland management – Watershed approach in government programmes – Developing collaborative know how – People's participation – Evaluation of watershed management

GIS FOR WATERSHED MANAGEMENT

Applications of Remote Sensing and Geographical Information System – Role of decision support system – Conceptual models and case studies

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of watersheds to analyze and manage watershed processes and their impact on water resources.	Apply
CO2: Evaluate causes and effects of soil erosion, and implement control measures for effective soil conservation.	Apply
CO3: Prepare a management plan for watershed conservation, integrating remote sensing and GIS tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Ghanashyam, D., “Hydrology and Soil Conservation engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.
T2. Glenn, O. S., “Soil and Water Conservation Engineering”, John Wiley and Sons, 1981.
T3. Gurmail, S., “A Manual on Soil and Water Conservation”, ICAR Publication, New Delhi, 1982.
T4. Suresh, R., “Soil and Water Conservation Engineering”, Standard Publication, New Delhi, 1982.

Reference Book(s):

R1. Brooks, K. N., P. F. Ffolliott, H. M. Joseph, Magner, A., “Hydrology and the Management of Watersheds”, Fourth Edition, 2013.
R2. Heathcote, I. W., “Integrated Watershed Management: Principles and Practice”, John Wiley and Sons, Inc., New York, 1998.
R3. Lal, Ruttan, “Integrated Watershed Management in the Global Ecosystem”, CRC Press, New York, 2000.
R4. Heathcote, I. W., “Integrated Watershed Management: Principles and Practice”, John Wiley and Sons, Inc., New York, 1988.
R5. Dhruva Narayana, G. Sastry, V. S. Patnaik, “Watershed Management”, CSWCTRI, Dehradun, ICAR Publications, 1997.

Web References:

1. https://nptel.ac.in/courses/105101010

Course Code: 23CEE026		Course Title: REMOTE SENSING AND GIS APPLICATIONS IN WATER RESOURCES	
Course Category: Professional Elective		Course Level: Advanced	
L:T:P(Hours/Week) 3:0 :0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to provide students with a comprehensive understanding of the principles and applications of remote sensing and GIS, and their integration for effective analysis and decision-making in water resources engineering and related fields.

Module I Fundamentals of Remote Sensing and Image 22 Hours

Introduction to Remote Sensing: Definition and Principle of Remote Sensing - Remote Sensing Systems - Remote Sensing from Space. Remote Sensing Sensors: Resolution, Imaging Sensors, Optical Infrared (OIR) Imagers, Optical Sensors, Thermal Sensors, Microwave Sensors, Active Microwave Sensors - Data Preprocessing - Remote Sensing in India

Introduction to Image Interpretation: Basic Principles and Elements of Image Interpretation - Techniques of Image Interpretation, Interpretation Keys - Introduction to Digital Image Processing: Image Rectification and Registration - Geometric Correction

Module II GIS, Terrain Analysis, and Applications 23 Hours

Geographic Information Systems (GIS): Definitions and Related Technology - GIS Operations, Elements, Concepts, and Practice - Map Projection and Coordinate System. Data Representation: Vector Data Representation: Geometric Objects, Topology. Raster Data Representation: Elements, Types, Satellite Imagery, Digital Elevation Models. Integration of Raster and Vector Data.

Terrain Mapping and Analysis: Data for Terrain Mapping and Analysis: DEM, TIN. Terrain Mapping Techniques: Contouring, Vertical Profiling, Hill Shading, Hypsometric Tinting, Perspective View. Terrain Analysis: Slope and Aspect, Surface Curvature, View shed Analysis, Grid versus TIN. GIS Applications in Water Resources. GIS Modeling: Binary Models, Index Models - Integration of Remote Sensing and GIS - Case Studies: Remote Sensing and GIS Applications in Water Resources Engineering

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply the principles of remote sensing and image interpretation to identify and analyze spatial information using	Apply

sensors	
CO 2: Utilize Geographic Information Systems (GIS) tools and data representations (vector and raster) to perform terrain mapping and generate thematic maps for slope, aspect, and elevation analysis.	Apply
CO 3: Analyze the integration of remote sensing and GIS techniques to evaluate and model water resource management scenarios, including case studies of terrain and hydrological features.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	3	2	2	-	-	2	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Fundamentals of Remote Sensing, George Joseph, C. Jeganathan, 3rd Edition, 2018, University Press, New Delhi.

T2. Introduction to Geographic Information systems – Kang tsung chang, 9th Edition, 2017, McGraw Hill publications, New Delhi.

Reference Book(s):

R1. Remote Sensing of the Environment – An earth resource perspective, John R. Jensen, 2nd Edition, 2013, Pearson Education, New Delhi.

R2. Principles of Geographical Information, Burrough Peter A., 2015, Oxford University Press.

R3. Lo, C.P., and Albert K.W. Young concepts and Technologies of Geographic Information Systems, 2007, Prentice hall of India (Pvt) Ltd, New Delhi.

Web References:

1. http://www.wamis.org/agm/pubs/agm8/Paper–1.pdf
2. http://ags.geography.du.ac.in/Study%20Materials_files/Punyatoya%20Patra_AM.pdf
3. http://hydrologie.org/hsj/410/hysj_41_04_0593.pdf
4. http://www.wiley.com/legacy/wileychi/gis/Volume1/BB1v1_ch14.pdf
5. http://gis–lab.info/docs/books/aerial–mapping/cr1557_15.pdf

Course Code: 23CEE027		Course Title: ADVANCED CONSTRUCTION TECHNIQUES	
Course Category: Major Core - Professional Elective		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to study the construction practices, erection and repair techniques followed in substructure and superstructure of various types of buildings such as skyscrapers, bridges, precast and prefabricated structures.

Module I **25 Hours**

SUB STRUCTURE

Box jacking – Pipe jacking – Launching and pushing of box decks - Diaphragm walls and basement – Tunneling techniques – Piling techniques – Caissons – Cofferdam – Cable anchoring and grouting – Shoring for deep cutting – Dewatering for underground open excavation.

SUPER STRUCTURE & SPECIAL STRUCTURES

Vacuum dewatered flooring – Continuous concreting operations for tall structures – Concrete paving technology – Slipform technique – Suspended formwork – Aerial transporting – Erection of light weight components on tall structures, lattice towers, articulated structures and space decks – Large span structures – launching techniques for heavy decks – Construction sequence in Cooling Towers, Silos, Chimney, Sky Scraper, Domes, Bow string bridges, Cable stayed bridges.

Module II **20 Hours**

PRECAST AND PREFABRICATION

Pre–casting techniques – handling techniques – transportation, storage and erection of structures – Curing techniques – steam curing, hot air blowing – Pre-cast and pre-fabricating technology for low cost and mass housing schemes – Ferro–cement in housing – quality control – Repairs and economical aspects on prefabrication.

REPAIR AND DEMOLITION

Mud Jacking and grouting for foundation – micro piling and underpinning for strengthening floor and shallow profile – Sub grade water proofing – Repair techniques for cracks in concrete – Demolition techniques – sequence of operation – Dismantling – Safety precaution in demolition and dismantling.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Summarize the construction and erection techniques followed for sub structure and super structure components of tall buildings, large span structures and special structures.	Apply
CO2. Suggest Suitable repair techniques for the substructure and superstructure components of various structures.	Apply
CO3. Prepare a report on the various erection and repair techniques adopted for heavy infrastructure buildings in Indian conditions.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Subir K. Sarkar and Subhajit Saraswati, “Construction Technology”, Oxford University Press, New Delhi, 2008.

T2. R. Chudley, Roger Greeno, "Advanced Construction Technology" Prentice Hall, 2006

Reference Book(s):

R1. Jerry Irvine, "Advanced Construction Techniques" CA Rockers, 1984.

R2. Peter.H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008

R3. Robertwade Brown, "Practical Foundation Engineering Hand Book", McGraw Hill Publications, 1995.

Web References:

1. http://nptel.ac.in/video.php?subjectId=105102088
2. https://sites.google.com/a/venusict.org/actech/lecture–notes

Course Code: 23CEE028		Course Title: BUILDING SERVICES	
Course Category: Major – Professional Elective		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to understand the different types of machineries, electrical systems, plumbing, sanitary fixtures, fire safety installations and their applications in buildings.

Module I **25 Hours**

MACHINERIES AND REFERIGERATION

Importance of building services in modern construction - Hot Water Boilers – Lifts and Escalators – Special features for physically handicapped and elderly – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity – Pressure temperature relationship for liquids – HVAC Systems – Air conditioning and Refrigeration systems - Protection against fire caused by A.C. Systems.

ELECTRICAL SYSTEMS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems – Main and distribution boards – Transformers and switch gears – Theory of light – Classification of lighting – Design concepts of modern lighting – Introduction to building automation - Control systems for HVAC, lighting, and security - Smart building technologies.

Module II **20 Hours**

PLUMBING AND SANITARY SYSTEMS

Plumbing system components – Water supply and distribution system – plumbing valves – plumbing fixtures – Piping systems – Valves – Sanitary piping systems – Soil piping system – Ventilation system – House drain.

FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non–combustible materials, construction of staircases and lift lobbies, fire escapes and A.C. systems. Special features for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder –Dry and wet risers – Automatic sprinklers.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Summarize the applications of various types of machineries, electrical systems used in the buildings.	Apply
CO2. Identify and suggest suitable plumbing and sanitary systems for various types of buildings.	Apply
CO3. Prepare a report on the various automation techniques used for the conventional building services in buildings.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Fred Hall and Roger Greeno, “Building Services Handbook”, Routledge and CRC Press, 2017.

T2. Subhash M. Patil, “Building services”, Standard publishers, 2014.

Reference Book(s):

R1. Thomas Everitt Coleman, “Sanitary House Drainage: Its Principles and Practice: A Handbook”, Wentworth Press publishers, 2019

R2. William Paul Gerhard, “House–Drainage and Sanitary Plumbing”, General Books publishers, 2012

R3. Udayakumar. R, “A text book on Building Services”, Eswar Press, Chennai, 2011

Web References:

1. https://www.scribd.com/doc/55417572/Building–Services–Notes
2. https://lecturenotes.in/download/material/47960–note–of–building–services–by–r–manoj–

Course Code: 23CEE034		Course Title: RAILWAYS, AIRPORT AND HARBOUR ENGINEERING	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to provide knowledge on the design, functions and maintenance of the various components of railways, airport and harbour.

Module I **22 Hours**

RAILWAY PLANNING AND DESIGN

Role of Indian Railways in National Development –Factors controlling Alignment – Engineering Surveys for Track Alignment –Elements of permanent way and its functions – Rails, Sleepers, Ballast, rail fixtures and fastenings – Coning of wheels – Creep in rails – Defects in rails – Geometric design of railway tracks – gradient, super elevation, widening of gauge on curves.

RAILWAY TRACK CONSTRUCTION, OPERATION AND MAINTENANCE

Earthwork – Stabilization of track on poor soil – Tunneling Methods - Working principles of Points and Crossing, Signaling, Interlocking and Track Circuiting –Railway Stations and Yards: Types and Layouts – Calculation of Materials required for track laying – Construction and maintenance of tracks – Track renewals - Passenger amenities - Drainage and ventilation.

Module II **23 Hours**

AIRPORT PLANNING AND DESIGN

Air Transport classification – Components of Airports – Airport Planning – Site Selection, Airport Obstructions and Zones – Runway Design – Orientation, Cross wind Component, Wind rose Diagram - Runway length corrections for Gradients, elevation and Temperature - Elements of Taxiway Design, Clearance over Highways and Railways.

AIRPORT LAYOUTS, VISUAL AIDS, AND AIR TRAFFIC CONTROL

Airport Layouts – Parking and Circulation Pattern–Airport Buildings – Primary functions, Planning Concept, Principles of Passenger Flow, Passenger Facilities – Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings – Air traffic control – primary functions, Air traffic control network.

HARBOUR AND DOCKS ENGINEERING

Classification of Harbour, Components of Harbour – Classification of Docks – Mooring accessories – Navigational Aids – Coastal Protection Structures - Waves and their actions on Coastal structures – Classifications of Coastal Regulation Zones.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Design the geometric elements for railway track and airport runway in different layouts.	Apply
CO2 Establish the functions of harbour components and coastal protection structures.	Apply
CO3 Present a case study on the design and amenities of an Indian airport.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Subramaniam K.P., “Railway, Airport and Harbour Engineering”, Scitech Publications (India) pvt Ltd. Chennai, 2018.

T2. Subhash C. Saxena, “Airport engineering Planning and Design”, CBS publications, New Delhi, 2020.

Reference Book(s):

R1. Saxena, S.C. Arora, S. P. “A text book of Railway Engineering”, Dhanpat Rai & Sons, New Delhi, 2015.

R2. Horonjeff, R. Mckelvey, F. X. “Planning & Design of Airports”, McGraw hill, New York, 2010.

R3. Gautam H. Oza, Hasmukh P. Oza, “Dock & Harbour Engineering”, Charotar Publishing House Pvt. Ltd, 2017.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce81

Course Code: 23CEE035		Course Title: ARCHITECTURE AND TOWN PLANNING	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on evolution of Western and Indian architecture, principles of design and town planning, focusing on historical, cultural and modern architectural practices, key architects and urban planning concepts.

Module I **25 Hours**

PRINCIPLES OF ARCHITECTURAL PLANNING AND DESIGN

History of Architecture- Western architecture: Egyptian, Greek, Roman architectures, Indian Architecture: Vedic age, Indus valley civilization – Buddhist period: Stambas, Stupa, Roranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan styles – Temple of Aihole, Madurai, Bhuvaneshwar, Mount Abu.

Principles of designing- Composition of plan – Relationship between plan and elevation – building elements, form, surface texture, mass, line, color, tone – Principles of Composition: Unity, contrast, proportion, scale, balance, circulation, rhythm, character, expression.

Principles of residence planning – Post classic architecture: Introduction, contribution of eminent architects to modern period- Laurie Baker, Charles Correa, B.V.Doshi, Edward Lutyens, Le Corbusier, Frank Lloyd Wright, Walter Gropius

Module II **20 Hours**

HISTORICAL BACKGROUND OF TOWN PLANNING

Town planning in India – Town plans of mythological Manasa – Ancient town plans: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis, Jerusalem, Mecca, Rome, London.

MODERN TOWN PLANNING

Components of planning – Surveys and maps – Neighbourhood planning – Planning standards – New town planning – National and regional planning – Town planning and legislation – garden cities and satellite towns – skyscrapers.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply architectural styles, design principles and contributions of key architects in history and modern planning.	Apply
CO2: Apply town planning concepts for historical, modern and regional urban planning and development.	Apply
CO3: Prepare a case study of historical and modern architectural styles, applying design principles to real-time contexts.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	1	-	-	-	-	-	3	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. G. K. Hiraskar, “The Great Ages of World Architecture” (With Introduction to Landscape Architecture) (2018-2019), Session Paperback-1 January 2018

T2. G. K. Haraskar, “Fundamentals of Town Planning”, Dhanpat Rai Publishing Co Pvt Ltd, 2018.

Reference Book(s):

R1. Hepler Drafting and Design for Architecture, Cengage Learning, 2012.

R2. John Patten Guthrie, Architecture’s Portable Handbook, Mc Graw Hill International Publications, 2010.

R3. R. S. Deshpande, Modern Ideal Homes for India, United book corporation digital library India, 2017.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_ar13/
2. https://nptel.ac.in/courses/124/105/124105001/
3. https://nptel.ac.in/courses/124/106/124106009/

Course Code: 23CEE036		Course Title: PAVEMENT ENGINEERING	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to provide knowledge on design of rigid and flexible pavements using IRC codal provisions and to assess the quality and serviceability conditions of roads.

Module I **25 Hours**

PAVEMENT MATERIALS AND SUBGRADE ANALYSIS

Pavement as layered structure – Pavement types - Rigid and Flexible-Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

DESIGN OF FLEXIBLE PAVEMENTS

Factors influencing design of flexible pavement – Methods for Flexible Pavement Design: Empirical, Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines

DESIGN OF RIGID PAVEMENTS

Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines.

Module II **20 Hours**

PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE

Construction Techniques of Flexible and Rigid pavement - Pavement Evaluation – Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance - Structural Evaluation by Deflection Measurements - Pavement Serviceability index - Pavement maintenance as per IRC Recommendations

STABILISATION OF PAVEMENTS

Stabilisation with special reference to highway pavements - Choice of stabilisers -Testing and field control – Stabilisation for rural roads in India - use of Geosynthetics (geotextiles & geogrids) in roads.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Design flexible pavement as per IRC codes.	Apply
CO2 Design rigid pavement as per IRC codes.	Apply
CO3 Present a case study on the existing highway road pavement construction and maintenance routines.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna Publications, New Delhi, 2019.

T2. Croney, D., Design and Performance of Road Pavements, HMO Stationary Office, 1993.

Reference Book(s):

R1. Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi, 2001.

List of Code Books:

1. Guidelines for the “Design of Flexible Pavements”, IRC:37 - 2018, The Indian roads Congress, New Delhi.

2. Guideline for the “Design of Rigid Pavements for Highways”, IRC:58 - 2015, The Indian Roads Congress, New Delhi.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce66
2. https://nptel.ac.in/courses/105105107

Course Code: 23CEE037		Course Title: TRAFFIC ENGINEERING AND MANAGEMENT	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to impart knowledge on traffic systems, their challenges, and methods for planning, managing, and controlling transportation.

Module I **22 Hours**

TRAFFIC SURVEY AND ANALYSIS

Traffic characteristics: Human, vehicular, and Pavement Characteristics - Presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume - Spot speed, presentation of spot speed data, Speed and Delay Studies, Methods Of Conducting Spot Speed Studies and Speed and Delay studies - 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.

TRAFFIC FLOW AND ROADWAY CAPACITY

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Relations between Speed, Flow and Density - 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 guidelines.

Module II **23 Hours**

COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES

Regulatory Techniques for Traffic System Management: One Way Street, Reversible Street, Reversible Lane, Turning Moment Restrictions, Closing Streets - Traffic Control Devices: Traffic Signs, Road Markings, Traffic Signals, Miscellaneous devices - Traffic Segregation - 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.

DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS

Parking: Needs, Classification, ill effects, Standards - 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, Standards.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Apply engineering principles to conduct traffic surveys, identify and address related challenges, and align the results with established standards.	Apply
CO2 Implement various traffic management measures to address demand, including pricing strategies and Intelligent Transportation System (ITS) applications.	Apply
CO3 Prepare and present a poster presentation on existing types of control and regulatory measures to meet an efficient traffic network.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Kadiyali, L.R., Traffic Engineering & Transport Planning, 9th edition, Khanna Publishers, New Delhi, 2021.

T2. Jotin Khisty, S.C. and Kent Lall B., Transportation Engineering – An Introduction, 3rd edition, Prentice-Hall, NJ, 2009.

T3. Saxena S.C., Traffic Planning And Design, Dhanpat Rai Publishers, New Delhi, 2019.

Reference Book(s):

R1. Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co. 2016.

R2. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing. Co., 2018.

R3. Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall, 2005.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_ce29
2. https://www.civil.iitb.ac.in/tvm/nptel/ceTseLn

Course Code: 23CEE038		Course Title: HOUSING PLANNING AND MANAGEMENT	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on concepts in housing, national policies, sustainable practices, housing programs, project formulation, construction techniques and evaluation methods for effective and affordable housing solutions.

Module I **22 Hours**

HOUSING PROGRAMME AND SLUM HOUSING POLICIES

Introduction to housing - 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.

Housing Programmes - Basic Concepts, Contents and Standards - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative 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.

Module II **23 Hours**

HOUSING PROJECTS AND FINANCE

Formulation of Housing Projects - Land Use and Soil suitability analysis -Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Procedure) - Housing Project Formulation.

New Constructions Techniques - Cost Effective Modern Materials and methods of Construction- Green building concept- Building centres - concept, function and performance evaluation.

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.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply housing concepts, policies and sustainable strategies in real-world projects.	Apply
CO2: Apply housing project formulation, design procedure, construction techniques, sustainability principles and financial analysis.	Apply
CO3: Prepare real-time case studies on housing theories, policies, project formulation and sustainability.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	2	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	2	-	-	-	-	-	2	-
CO3	3	-	1	-	-	-	-	-	3	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Meera Mehta and Dinesh Mehta, “Metropolitan Housing Markets”, Sage Publications Pvt. Ltd., New Delhi, 1999.

T2. Francis Cherunilam and Odeyar D Heggade, “Housing in India”, Himalaya Publishing House, Bombay, 1997.

Reference Book(s):

R1. Wiley- Blackwell, “Neufert Architects” Data, 4th Edition, Blackwell Publishing Ltd, 2012

R2. Donald Watson and Michael J.Crosbie, “Time Saver Standards for Architectural Design”, 8th Edition, Tata McGraw Hill Edition, 2011

R3. Walter Martin Hosack, “Land Development Calculations”, McGraw Hill 2nd Edition, USA 2010

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_ar14/
2. https://mohua.gov.in/upload/uploadfiles/files/MBBL
3. https://www.indiacode.nic.in/bitstream/123456789/1709/1/195696

Course Code: 24CEXXX	Course Title: Intelligent Transport System		
Course Category: Professional Elective		**Course Level: Intermediate**	
L:T:P(Hours/Week) - 3:0:0	**Credits: 3**	**Total Contact Hours:45**	**Max Marks: 100**

Course Objectives:

To learn the fundamentals of ITS, its functional areas and to have the overview of ITS implementation in developing countries.

Module I	**22 Hours**

INTRODUCTION TO INTELLIGENT TRANSPORT SYSTEM

Introduction to Intelligent Transportation Systems (ITS) -Definition – Role and Responsibilities – Advanced Traveller Information System – Fleet Oriented ITS Services – Electronic Toll Collection – Critical issues – Security – Safety.

ITS ARCHITECTURE AND HARDWARE

Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection – Techniques – Dynamic Message Sign – GPRS – GPS.

Module II	**23 Hours**

ADVANCED TRANSPORT MANAGEMENT SYSTEM

Video Detection – Virtual Loop - Cameras - ANPR – IR Lighting – Integrated Traffic Management – Control Centre – Junction Management Strategies- ATMS – Advanced Traveler Information Systems (ATIS)- Route Guidance – Issues -– Historical – Current – Predictive Guidance – Data Collection – Analysis – Dynamic Traffic Assignment (DTA) – Components – Algorithm.

ADVANCED TRAVELLER AND INFORMATION SYSTEM

Travel Information – Pre Trip and Enroute Methods- Basic ATIS Concepts – Smart Route System – Data Collection – Process – Dissemination to Travelers – Evaluation of Information – Value of Information – Business Opportunities.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Apply knowledge on data collection using sensors and its applications.	Apply
CO 2: Apply the ITS in Transportation Planning & Management.	Apply
CO 3: Prepare a report using ITS for transport planning & management for a city.	Apply

TEXT BOOKS:

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.
2. Sarkar, Pradip Kumar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning,

REFERENCES:

1. Parul Agarwal, Syed Imtiyaz Hassan and Jawed Ahmed, "Intelligent Transportation System: A Complete Insight", IGI Global Publishing, 2020.
2. Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, and Ignacio Julio García Zuazola "Intelligent Transport Systems: Technologies and Applications"

Course Code: 23CEE040		Course Title: URBAN PLANNING AND DEVELOPMENT	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on urban planning concepts, theories, methodologies, standards and processes including the impacts of urbanization and to apply them in project formulation, evaluation and urban development planning.

Module I **22 Hours**

URBAN PLANNING PROCESSES

Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas –Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept

Module II **23 Hours**

URBAN PLAN FORMULATION AND EVALUATION

Types of plans – Methodologies for the preparation of the Regional Plan, Master Plan, and Detailed Development Plan – ITS user needs and services and Functional area – 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.

Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation.

URBAN AND REGIONAL PLANNING LEGISLATIONS AND REGULATIONS

Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply urban planning concepts, theories and methodologies to analyze and design sustainable urban development plans.	Apply
CO2: Apply planning methodologies, transportation systems, project formulation and evaluation to develop urban development plans.	Apply
CO3: Prepare a report on case study analysis of comprehensive urban development plans and strategies by applying urban planning theories, methodologies.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	1	-	-	-	-	-	3	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002

T2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978

Reference Book(s):

R1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai

R2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005

R3. Urban & Regional Development Plans Formulation & Implementation(URDPFI) Guidelines, Vol I & II, Jan 2015, Govt of India, Ministry of Urban Development

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ar08/
2. https://onlinecourses.nptel.ac.in/noc21_ar12/

ELECTIVES

Course Code: 23CEE001		Course Title: ADVANCED CONCRETE STRUCTURES	
Course Category: Professional Elective		Course Level: ADVANCED	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is indented to impart knowledge on the design concepts of retaining wall, liquid retaining structures, bridges and portal frames.

Module I **22 Hours**

RETAINING WALL

Design of cantilever and counter fort retaining walls - Flat Slabs.

WATER TANK

Liquid Retaining structure - Water tanks - types - square, rectangular, circular- Design of underground and elevated tanks - design of staging.

Module II **23 Hours**

DECK SLAB BRIDGE

Introduction, Classification of bridges – IRC Loadings – Effective width of load dispersion – Design of solid slab Bridge – Box culverts.

PORTAL FRAME

Portal frames – Analysis of portal frames – substitute frame method – cantilever method – portal method (concept only) – Design of single bay portal frame by substitute frame method and cantilever method.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Design retaining walls, flat slabs and water tanks ensuring structural integrity, stability and compliance with relevant standards and codes.	Apply
CO 2: Design solid slab bridges and box culverts, single bay portal frames by substitute frame and cantilever methods using relevant standards.	Apply
CO 3: Develop a structural model for the given specifications ensuring relevant codes and safety standards.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	2	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	2	-	-	-	-	-	-
CO3	3	3	2	-	3	-	-	3	3	3	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Unnikrishna Pillai S, Devdas Menon, Reinforced Concrete Design, Fourth Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2021.

T2. Subramanian N, Design of Reinforced Concrete Structures, First edition, Oxford

Reference Book(s):

R1. Krishna Raju N, Design of Reinforced Concrete Structures, Fourth Edition, CBS Publishers & Distributors Pvt Ltd., New Delhi, 2016.

R2. Punmia B C, Ashok Kumar Jain, Arun Kumar Jain, R C C Designs, Tenth Edition, Laxmi Publications (P) Ltd., New Delhi, 2015.

R3. Gambhir A L, Design of Reinforced Concrete Structures, Prentice-Hall of India Pvt. Ltd., New Delhi, 2008.

List of Code Books:

1. IS 456-2000, Plain and Reinforced Concrete - Code of Practice, Bureau of Indian Standards.
2. IRC-6: 2017, Standard specifications and code of practice for road bridges - Loads and Load Combinations, Bureau of Indian Standards.
3. IRC-21: 2000, Standard specifications and code of practice for road bridges - Concrete Roads (Plain & Reinforced), Bureau of Indian Standards.
4. IS 3370 (Part-II & IV), Concrete structures for storage of liquids - code of practice, Bureau of Indian Standards.

Course Code: 23CEE002		Course Title: MAINTENANCE AND REHABILITATION OF STRUCTURES	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on maintenance, repair, and rehabilitation of structures, focusing on quality assurance, special concretes, strengthening techniques, and demolition planning.

Module I **24 Hours**

Maintenance – repair and rehabilitation, facets of maintenance, importance of maintenance – Various aspects of inspection – Assessment procedure for evaluating a damaged structure – Causes of deterioration.

Quality assurance for concrete construction – Concrete properties – strength, permeability, thermal properties and cracking – Effects due to climate, temperature, chemicals, corrosion – Design and construction errors – Effects of cover thickness and cracking.

Concrete chemicals, Special elements for accelerated strength gain – Expansive cement – polymers coating for rebars – Mortar and dry pack – Vacuum concreting- Epoxy injection – Mortar repair for cracks.

Module II **21 Hours**

Strengthening of super structures, sub structures – Increasing the load carrying capacity of footing – Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure – Methods of corrosion protection – Corrosion inhibitors – Corrosion resistant steels – Coatings and cathodic protection.

Introduction – planning, precautions and protective measures in demolition works –Sequences of operations – Demolition of structural elements – Engineered demolition techniques for dilapidated structures – Case studies.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply various maintenance and inspection techniques to evaluate and enhance the longevity of structures.	Apply
CO2: Apply quality assurance methods to concrete construction, considering the effects of environmental factors and design errors to prevent defects.	Apply
CO3: Apply strengthening techniques to enhance the performance and durability of structural elements.	Apply
CO4: Prepare a detailed report for structural maintenance, inspection, quality assurance, strengthening, corrosion protection and demolition techniques addressing real time problems.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	-	-	-	-	-	3	-	3	-	-	-	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Dr.R.P.Rethaliya, “Maintenance and Rehabilitation of Structures”, Atul Prakashan publications, 2019

T2. Dayarathnam. P and Rao. R,“Maintanence and Durability of Concrete Structures”, University Press,India 2015

Reference Book(s):

R1. Gambhir. M.L, “Concrete Technology”, Tata Mc–Graw Hill Company, New Delhi, 2013.

R2. Gupta B.L. and Amit Gupta, “Maintenance and Repair of Civil Structures”, Standard Publishers Distributors, 2009

R3. CPWD and Indian Building Concepts, Hand Book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.

Web References:

1. https://nptel.ac.in/courses/105/106/105106202/

Course Code: 24XXXX		Course Title: Prefabricated Structures	
Course Category: Professional Elective		**Course Level:** Intermediate	
L:T:P(Hours/Week) 3:0 : 0	**Credits:3**	**Total Contact Hours:45**	**Max Marks:100**

Course Objectives:

To study the design principles, analysis and design of Prefabricated structures.

Module I	**24 Hours**

Introduction

Need for prefabrication -Advantages and limitations – Principles of prefabrication – Modular coordination – Standarization– Loads and load combinations– Materials – Production – Transportation – Erection.

Prefabricated Components and Systems

Behaviour and types of structural components– roof and floor slabs – Walls panels - Shear walls - Beams - Columns – skeletal system- portal frame system - Large panel systems- block system

Design Principles

Design philosophy- Design of cross section based on efficiency of material used – Problems in design because of joint flexibility – Allowance for joint deformation - Demountable precast concrete systems- Design for stripping , stacking ,transportation and erection of elements.

Module II	**21 Hours**

Joints and Connections in Structural Members

Types of Joints – based on action of forces - compression joints - shear joints - tension joints – based on function - construction joints, contraction joints, expansion joints. Design of expansion joints - Dimensions and detailing - Types of sealants - Types of structural connections - Beam to Column - Column to Column - Beam to Beam - Column to foundation.

Design for Abnormal Loads

Progressive collapse – Codal provisions – Equivalent design loads for considering abnormal effects such as earthquakes, cyclones, etc., - Importance of avoidance of progressive collapse -case study.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply the concepts about principles of prefabrication, production, transportation, erection along with knowledge of panel systems, slabs, beams, shear walls and columns used in precast construction	Apply
CO 2: Apply the design principles for designing cross-sections, connections.	Apply
CO 3: Prepare an structural stability report on existing prefabricated structure.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	-	3	-	-	-	-	-	-	3	3	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

1. Bruggeling A.S. G and Huyghe G.F. "Prefabrication with Concrete", A.A. Balkema Publishers, USA,1991.
2. Lewitt,M. " Precast Concrete- Materials, Manufacture, Properties And Usage ,CRC Press, 2019.
3. Alfred Steinle, Hubert Bachmann, Mathias Tillmann, Philip Thrift, "Precast Concrete Structures",Ernst & Sohn, Berlin, 2019.

Reference Book(s):

1. Koncz T., "Manual of precast concrete construction", Vol. I, II and III, Bauverlag, GMBH, 1976.
2. "Handbook on Precast Concrete Buildings", Indian Concrete Institute, 2016
3. " Precast concrete connection details", Structural Design manual, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

Course Code: 23CEE004		Course Title: PRESTRESSED CONCRETE STRUCTURES	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to impart the knowledge on concept of prestressing, design of different beam elements, composite members and special structures.

Module I **22 Hours**

BASICS OF PRESTRESSING CONCEPTS

Principles of Prestressing – Classification and types – Methods of Prestressing – Freyssinet, Magnel Blaton, Lee Mc Call and Killick anchorage systems – Analysis of sections for stresses by stress concept, strength concept and load balancing concept – Losses of prestress.

DESIGN FOR FLEXURE AND SHEAR

Permissible stresses in steel and concrete– Design of sections of Type I and Type II post-tensioned beams (As per IS) –Factors influencing deflections – Short term deflections of uncracked members – Prediction of long-term deflections due to creep and shrinkage – Check for serviceability limit state of deflection. Determination of anchorage zone stresses in post-tensioned beams– design of anchorage zone reinforcement – Check for strength limit– Layout of cables in post-tensioned beams – Design for shear.

Module II **23 Hours**

COMPOSITE AND CIRCULAR PRESTRESSED STRUCTURES

Analysis and design of composite beams - Shrinkage strain and its importance. Partial prestressing – Definition, methods of achieving partial prestressing, merits and demerits of partial prestressing. Circular prestressing- Design of Prestressed Concrete Pipes and water tanks – Design of Tension members and Compression members.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Design pre-tensioned and post tensioned beams for flexure and shear and estimate deflection and losses of prestressing.	Apply
CO2: Apply the prestressing concepts to design the anchorage zone for post-tensioned members and analyse the composite beams, tension and compression members.	Apply
CO3: Prepare a design of the prestressed tension and compression member.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	-	-	-	-	-	-	-	2	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Krishna Raju N., "Prestressed concrete", 6th Edition, Tata McGraw Hill Company, New Delhi, 2018

T2. Pandit. G.S. and Gupta. S.P., "Prestressed Concrete", CBS Publishers and Distributers Pvt. Ltd, 2012.

Reference Book(s):

R1. Dayaratnam. P., "Prestressed Concrete Structures", Oxford and IBH, 2013.

R2. Karuna Moy Ghosh, “Prestressed Concrete: Analysis and Design Practice Of Members”, PHI Learning Pvt. Ltd.,2014.

R3. Lin T.Y. and Ned.H.Burns, "Design of prestressed Concrete Structures", 3rd Edition, Wiley India Pvt. Ltd., New Delhi, 2013.

IS Code Book:

1. IS 1343-2012: Code of practice for Pre-stressed concrete
2. IS 784-2001: Code of practice for Pre-stressed concrete pipes
3. IS 3370-1999: Code of practice for concrete structures for the storage of liquids

Web References:

1. http://www.nptel.ac.in/courses/105106118/

Course Code: 23CEE005		Course Title: SEISMIC DESIGN OF STRUCTURES	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to impart the knowledge on concept of engineering seismology and structural dynamics for the design and detailing of earthquake resistant buildings using Indian Standard codal provisions.

Module I **22 Hours**

ENGINEERING SEISMOLOGY

Internal structure of earth, Continental drift theory, Plate tectonics, Elastic Rebound theory - Earthquake: classification, causes and effects - Earthquake waves – Quantification of Earthquakes: Intensity and Magnitude, Recording Earthquakes - Seismotectonics and Seismic Zoning of India.

STRUCTURAL DYNAMICS

Laws of Equilibrium – Newton's Law of Motion – D'Alembert's Principle and Principle of virtual displacement - Types of Dynamic Loading - Degree of Freedom: Definition and Types - Formulation of equation of motion for various SDOF system – Free and forced vibration of damped and undamped structures - Formulation of equation of motion for multi degree of freedom (MDOF) system – Response to Free And Forced Vibration of Undamped and Damped MDOF systems – Determination of Natural frequencies and Mode shapes.

Module II **23 Hours**

EARTHQUAKE RESISTANT DESIGN AND DETAILING

General principles and design criteria for Earthquake resistant structures as per codal provisions - Assumptions – Design of imposed loads – Seismic weight – Analysis by Equivalent Static Method and Dynamic Method (Response Spectrum Method) – Storey drift limitation - General specifications for Beams, Columns, Shear walls as per codal provisions - Special confining reinforcement – Base Isolation Techniques and Seismic Dampers.

BUILDING CONFIGURATIONS

Plan Irregularities – Torsion Irregularity – Re-entrant corners - Floor slabs having excessive cut-outs or openings - Out of plane offsets in Vertical Elements – Non-parallel Lateral Force system - Vertical Irregularities – Stiffness Irregularity (soft storey) – Mass Irregularity – Vertical Geometric Irregularity – In-plane discontinuity in Vertical Elements resisting lateral force – strength Irregularity (weak storey) – Floating or stub columns – Irregular Modes of Oscillation in two Principle Plan Directions.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Determine the natural frequencies and mode shapes of various DOF systems using concepts of engineering seismology and structural dynamics.	Apply
CO2 Calculate design seismic force by static analysis method and dynamic analysis method and review the IS codal provisions for the seismic resistant design.	Apply
CO3 Present a case study on building irregularities during earthquakes.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Duggal S.K., “Earthquake Resistant Design of Structures”, Oxford University Press, 2nd Edition, 2014.

T2. Pankaj Agarwal & Manish Shrikhande, “Earthquake Resistant Design of Structures”, 5th Edition Prentice Hall of India, New Delhi, 2011.

Reference Book(s):

R1. Mario Paz, “Structural Dynamics - Theory and Computations”, 6thEdition, Pearson Education, 2005.

R2. David Dowrick, “Earthquake Resistant Design and Risk Reduction”, 2nd Edition, John Wiley & Sons Ltd., 2011.

List of Code Books:

1. IS 1893 (Part 1): 2016, Indian Standard “Criteria for Earthquake Resistant Design of Structures, Part 1, General provisions and Buildings (six revision) Bureau of Indian Standard, New Delhi. (or latest).
2. IS 13920: 2016 Indian Standard “Ductile Design and Detailing of Reinforced Concrete Structures, subjected to Seismic forces - Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).
3. IS 4326: 2013 Indian Standard “Earthquake Resistant Design and Construction of Buildings - Code of Practice, Bureau of Indian Standard, New Delhi. (or latest).

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce74
2. https://onlinecourses.nptel.ac.in/noc24_ce96

Course Code: 23CEE006		Course Title: EXPERIMENTAL TECHNIQUES	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on concepts of measurements and related instruments, theory and principles involved in model analysis.

Module I **24 Hours**

FORCE AND STRAIN MEASUREMENTS

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long term monitoring – vibrating wire sensors– Fibre optic sensors.

VIBRATION MEASUREMENTS

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – Digital data Acquisition systems.

DISTRESS MEASUREMENT

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete and measurements.

Module II **21 Hours**

DAMAGE ASSESSMENT

Controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring.

NON-DESTRUCTIVE TESTING METHODS

Load testing on structures – Rebound Hammer – acoustic emission – ultrasonic testing principles and application– Advanced NDT methods – Ultrasonic pulse velocity, Impact echo.

MODEL ANALYSIS

Model Laws – Laws of similitude – Model materials – Necessity for Model analysis – Advantages – Applications – Types of similitude – Scale effect in models – Indirect model study – Direct model study - Limitations of models – investigations.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of measurement to determine force, strain, vibration and distress of an element.	Apply
CO2: Apply the principle of non-destructive testing techniques for structural health monitoring of structural elements.	Apply
CO3: Prepare a structural health monitoring report of an existing building.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Sadhu Singh, Experimental Stress Analysis, Khanna Publishers, New Delhi, 2015

T2. Rangan C S et al., 'Instrumentation – Devices and Systems', Tata McGraw-Hill Publishing Co., Ltd., New Delhi, 2017

Reference Book(s):

R1. U.C. Jindal, Experimental Stress Analysis, Pearson Publication, Noida, 2012.

R2. Ravisankar.K. and Chellappan.A., "Advanced course on Non-Destructive Testing and Evaluation of Concrete Structures", SERC, Chennai, 2007.

R3. Gandhi.M.V and Thompson.B.S, "Smart Materials and Structures", Chapman and Hall, NewYork,1992.

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_me02/preview
2. https://nptel.ac.in/courses/112106198/

Course Code: 23CEE007	Course Title: AIR POLLUTION MANAGEMENT		
Course Category: Elective		Course Level: Intermediate	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to understand the sources and effects of air pollution, understand dispersion of pollutants, understand air pollution control, understand air quality management and also understand noise pollution.

Module I **23 Hours**

SOURCES AND EFFECTS OF AIR POLLUTANTS

Sources and classification of air pollution – Effects of air pollution on human beings, materials, vegetation, animals – Global warming– Ozone layer depletion, Sampling and Analysis – Basic principles of sampling – Source and ambient sampling – Stack sampling

DISPERSION OF POLLUTANTS

Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate – Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Inversion, Introduction to air quality modeling.

AIR POLLUTION CONTROL

Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment – gaseous pollutant control by adsorption, absorption, condensation, combustion – Biofiltration (Only theory and working of equipments only)

Module II **22 Hours**

AIR QUALITY MANAGEMENT

Air quality standards – Air quality monitoring – Preventive measures – Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement– National Ambient Air quality standards – Air quality management in India

NOISE POLLUTION

Sources of noise pollution-Effects-Assessment-Standards-Control methods (at the source and transmission) – Prevention – Protection for exposed people

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of air pollution to identify the sources of air pollutants and analyze their effects on human health and the environment.	Apply
CO2: Implement methods for controlling air pollution from various sources in practical applications.	Apply
CO3: Prepare a report on air quality standards and regulation for management of air quality in the Indian scenario.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Anjaneyulu, Y., “Air Pollution: Prevention and Control Technologies”, B.S. Publications, 2nd edition, 2020.

T2. Rao, C.S. “Environmental Pollution Control Engineering”, New Age International publishers, Third Edition, 2018.

T3. Rao M.N., and Rao H. V. N., “Air Pollution Control”, Tata McGraw Hill, New Delhi,

T4. Garg, S.K., “Environmental Engineering Vol. II”, Khanna Publishers, New Delhi, 2019.

Reference Book(s):

R 1. Heumann, W.L., "Industrial Air Pollution Control Systems", McGraw Hill, New Yark, 1997.

R 2. Mahajan, S.P., "Pollution Control in Process Industries", Tata Mc–Graw Hill Publishing Company, New Delhi, 2017.

R 3. Peavy, S.W., Rowe, D.R. and Tchobanoglous, G. "Environmental Engineering", Tata Mc-Graw Hill, New Delhi, 2017.

Web References:

1. https://metnet.imd.gov.in/imdetp/lecture_notes/course11/LN_11_61_Air%20Pollution%20\Measurment.pdf
2. https://web.iitd.ac.in/~arunku/files/CVL212_Y18/Airpollutioneffects.pdf

Course Code: 23CEE008		Course Title: Industrial Waste Management	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to learn the industrial pollution prevention, learn industrial wastewater treatment, learn zero liquid discharge concepts, learn sludge and hazardous waste management, and learn wastewater treatment process of selected industries.

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Module I **23 Hours**

INDUSTRIAL POLLUTION PREVENTION

Industrial scenario in India – Uses of water by Industry – sources, generation rates and characteristics of Industrial wastewaters – Toxicity of Industrial Effluents and Bioassay Tests – Environmental Impacts of Industrial Wastewaters – Regulatory requirements for Industrial wastewaters– Prevention Vs Control of Industrial Pollution – Benefits and Barriers – Waste Minimization Strategies – Evaluation of Pollution Prevention Options – Cost benefit analysis – Pay back period.

INDUSTRIAL WASTEWATER TREATMENT

Physico–Chemical Treatment Processes – Equalisation, Neutralisation, Oil Seperation, Flotation – Precipitation, Aerobic and Anaerobic Biological Treatment Processes – Sequencing batch reactors, membrane bioreactors, Advanced oxidation and Tertiary

Module II **22 Hours**

ZERO LIQUID DISCHARGE

Individual and Common Effluent Treatment Plants – Zero Effluent Discharge Systems and Management of RO Rejects, Quality requirements for wastewater reuse-Industrial reuse, Dispoal on water and land.

SLUDE AND HAZARDOUS WASTE MANAGEMENT

Residuals of Industrial Wastewater treatment – Quantification and Characteristics of Sludge – Thickening, Digestion, Conditioning, Dewatering and Disposal of Sludge – Solidification – Incineration – Secured Landfills – Hazardous waste management.

CASE STUDIES

Industrial manufacturing process description, Wastewater characteristics, Pollution Prevention Options and Treatment Flow sheets for selected Industries – Tanneries– Textiles– Pulp and Paper – Metal finishing – Sugar and Distilleries.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply principles of industrial pollution prevention to develop sustainable practices in real-life scenarios.	Apply
CO2: Apply the concept of zero effluent discharge and evaluate quality requirements for the disposal of effluents on land and water bodies.	Apply
CO3: Prepare a report on applying the techniques for sludge and hazardous waste management in an industrial setting.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Bhatia, S.C., “Handbook of Industrial Pollution and Control”, Volume I & II, CBS Publishers, New Delhi,2003.
T2. Mahajan, S.P., “Pollution Control in Process Industries”, Tata McGraw Hill Publishing Co., New Delhi, 2017.

Reference Book(s):

R1. Eckenfelder, W.W., “Industrial Water Pollution Control", Mc–Graw Hill,2000.
R2. Frank Woodard, “Industrial waste treatment Handbook", Butterworth Heinemann, New Delhi,2005.
R3. Wang L.K., Yung–Tse Hung, Howard H. Lo and Constantine Yapijakis, “Handbook of Industrial and Hazardous Wastes Treatment", Marcel Dekker, Inc., USA, 2004.

Web References:

1. http://nptel.ac.in/courses/105106119/36

Course Code: 23CEE009		Course Title: MUNICIPAL SOLID WASTE MANAGEMENT	
Course Category: Major		Course Level: MASTERY	
L:T:P(Hours/Week) 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart the knowledge on sources and types of municipal solid waste, its on-site and off-site storage and processing, collection and transfer methods, and various disposal techniques is essential for effective waste management.

Module I **22 Hours**

SOURCES AND TYPES

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 arid environmental effects. Elements of solid waste management - Municipal solid waste (M&H) rules- Integrated management - Social and Financial aspects; Public awareness; Role of NGO's.

SOURCE REDUCTION AND ON-SITE STORAGE

Source reduction of waste- Reduction, Reuse and Recycling - On-site storage methods- Effect of storage, materials used for containers- segregation of solid wastes - Public health and economic aspects of open storage - waste segregation and storage - case studies under Indian conditions -Critical Evaluations of Options.

Module II **23 Hours**

COLLECTION AND TRANSFER

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

PROCESSING OF WASTES

Objectives of waste processing - Physical Processing techniques and Equipment’s; Resource recovery from solid waste composting and bio-methanation composting, Thermal processing options-incineration, Pyrolysis; case studies under Indian conditions.

DISPOSAL

Disposal of solid waste; Sanitary landfills· site selection, design and operation of sanitary landfills -Landfill liners - Leachate collection & treatment-Management of leachate and landfill gas - Land fill bioreactor-Dumpsite Rehabilitation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply knowledge of the types and sources of municipal solid waste to categorize waste effectively, and implement on-site storage and processing techniques.	Apply
CO 2: Apply appropriate methods for the collection, transport, processing techniques and disposal methods of municipal solid waste to manage landfilling, composting, incineration and recycling.	Apply
CO 3: Prepare and present report on Municipal waste handling and disposal methods for Indian conditions.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	3	3	-	-	-	-	-	-	-
CO2	3	-	-	-	-	3	3	-	-	-	-	-	-	-
CO3	3	-	-	-	-	3	3	-	3	3	-	-	-	3

High-3; Medium-2;Low-1

Text Book(s):

T1. Cherry P M, Solid and Hazardous Waste Management, CBS publishers and distributors Pvt Ltd., 2018.

T2. Rao M.N, Razia Sultana, Sri Harsha Kota, Solid and Hazardous waste management - Science and Engineering, Butter Worth-Heinemann, 2016.

Reference Book(s):

R1. CPHEEO, Manual on Municipal Solid Waste Management, Vol I, II and III, Central Public Health and Environmental Engineering Organization, government of Inida, New Delhi, 2016.

R2. Bhide A.O and Sundaresan B.B, Solid Waste Management Collection, Processing and Disposal, 2001, ISBN 81-7525-282-0.

R3. Manser A.G.R and Keeling A.A, Practical Handbook of Processing and Recycling of Municipal solid Wastes, Lewis Publishers, CRC Press, 1996.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce77/preview
2. https://archive.nptel.ac.in/courses/120/108/120108005/

Course Code: 23CEE010		Course Title: Environmental Impact and Risk Assessment	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

This course is intended to expose the students to expose the students to the need, methodology, documentation and usefulness of environmental impact assessment and to develop the skill to prepare environmental management plan, to provide knowledge related to the broad field of environmental risk assessment, important processes that control contaminant transport and tools that can be used in predicting and managing human health risks.

Module I **23 Hours**

INTRODUCTION

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

ENVIRONMENTAL ASSESSMENT

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

SOCIAL IMPACT ASSESSMENT AND EIA DOCUMENTATION

Social impact assessment – Relationship between social impacts and change in community and institutional arrangements. Individual and family level impacts. Communities in transition documentation of EIA findings – planning – organization of information and visual display materials.

Module II **22 Hours**

ENVIRONMENTAL MANAGEMENT PLAN

EIA Report preparation. Environmental Management Plan - preparation, implementation and review – Mitigation and Rehabilitation Plans – Policy and guidelines for planning and monitoring programmes – Post project audit – Ethical and Quality aspects of Environmental Impact Assessment- Case Studies.

ENVIRONMENTAL RISK ASSESSMENT AND MANAGEMENT

Environmental risk assessment framework-Hazard identification -Dose Response Evaluation – Exposure Assessment – Exposure Factors, Tools for Environmental Risk Assessment– HAZOP and FEMA methods – Event tree and fault tree analysis – Multimedia and multipath way exposure modeling of contaminant- Risk Characterization Risk communication – Emergency Preparedness Plans –Design of risk management programs.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts and types of Environmental Impact Assessment (EIA) to various assessment processes.	Apply
CO2: Apply EIA methods to assess social impacts and develop sustainable management plans.	Apply
CO3: Prepare a report to for applying the tools for environmental risk	Apply

assessment and management for a real-world scenario.	

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Canter, L.W., “Environmental Impact Assessment”, McGraw Hill, New York. 1996.

T2. Cutter, S.L., “Environmental Risk and Hazards”, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.

T3. Raghavan K. V. and Khan A.A., “Methodologies in Hazard Identification and Risk Assessment”, Manual by CLRI, 1990.

Reference Book(s):

R.1 Lawrence, D.P., Environmental Impact Assessment – Practical solutions to recurrent problems, Wiley-Interscience, New Jersey, 2003.

R.2 World Bank –Source book on EIA

R.3 Kolluru Rao, Bartell Steven, Pitblado, R., and Stricoff, “Risk Assessment and Management Handbook”, McGraw Hill Inc., New York, 1996.

R4. Sam Mannan, Lees' Loss Prevention in the Process Industries, Hazard Identification, Assessment and Control, 4th Edition, Butterworth Heineman, 2012.

Web References:

1. https://nptel.ac.in/courses/124107160

Course Code: 23CEE011		Course Title: Climate Change and Adaptation	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on the global warming, the impact of climate change on society and the adaptation and mitigation measures to the students

Module I **23 Hours**

EARTH'S CLIMATE SYSTEM

Global, Regional and Local climates, Ocean Circulation, weather parameters - Role of ozone in environment - ozone layer - ozone depleting gases - Green House Effect, Radiative effects of Greenhouse Gases - Green House Gases and Global Warming – Carbon Cycle.

IMPACTS OF CLIMATE CHANGE

Impacts of Climate Change on various sectors – Agriculture, Forestry, and ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

OBSERVED CHANGES AND ITS CAUSES

Climate change and Carbon credits- CDM- Initiatives in India-Kyoto Protocol Intergovernmental Panel on Climate change- Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India.

Module II **22 Hours**

CLIMATE CHANGE AND MITIGATION MEASURES

Clean Development Mechanism –Carbon Trading- examples of future Clean Technology – Biodiesel – Natural Compost – Eco Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding Key Mitigation Technologies and Practices – Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

NATIONAL PLAN ON CLIMATE CHANGE

National and State Action Plan on Climate Change, Significance on Sustainable development of Natural resources – National Water Mission, Sustainable Agriculture Mission, Green India Mission, Coastal Conservation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge of the earth's climate system to analyze factors influencing climate change and apply protocols to address them.	Apply
CO2: Evaluate the impacts of climate change on various ecosystems and propose mitigation strategies.	Apply
CO3: Prepare a report to apply the strategies from the National Action Plan on Climate Change to mitigate its effects.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Jan, C., van Dam, "Impacts of Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003.

T2. Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., "Climate Change and Water". Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.

T3. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007.

Reference Book(s):

R1. IPCC fourth assessment report - The AR4 synthesis report, 2007

R2. IPCC fourth assessment report –Working Group I Report, "The physical Science Basis", 2007

R3. IPCC fourth assessment report - Working Group II Report, "Impacts, Adaptation and Vulnerability", 2007

R4. IPCC fourth assessment report – Working Group III Report" Mitigation of Climate

Course Code: 23CEE012		Course Title: Disaster Mitigation and Management	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to impart knowledge on concepts related to disaster, disaster risk reduction, disaster management, and to acquaint with the skills for planning and organizing disaster response.

Module I **23 Hours**

INTRODUCTION

Introduction to Disaster - Definition: Disaster, Hazard, Vulnerability, Resilience, Risks –Types of disasters – Earthquake, Landslide, Flood, Drought, Fire, Volcanic eruption, Tsunami, Avalanches and Pest infestation. Impacts including social, economic, political, environmental, health, psychosocial.

CONSEQUENCES AND CONTROL OF DISASTERS

Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

DISASTER MANAGEMENT CYCLE AND FRAMEWORK

Disaster Management: Capability-Vulnerability- risk- preparedness and mitigation- Disaster management cycle; Disaster Risk Reduction and Resilience; Disaster Management Act and Policy.

Module II **22 Hours**

DISASTER MANAGEMENT IN INDIA

Disaster Profile of India, Mega Disasters of India and Lessons Learnt, Disaster Management Act 2005, Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management, Role of Government, Non-Government and Inter-Governmental Agencies.

DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES

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.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge to classify types of disasters and analyze their various impacts and implement appropriate control measures.	Apply
CO2: Apply the disaster management cycle and framework to develop effective disaster response strategies.	Apply
CO3: Prepare a report on application of the policies for effective disaster management for specific case studies.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Damon P. Coppola, “Introduction to International Disaster management”, Elsevier publication, 2015

T2. Tushar Bhattacharya, “Disaster Science and Management”, McGraw Hill India Education Pvt. Ltd., 2012.

T3. Gupta Anil K, Sreeja S. Nair. “Environmental Knowledge for Disaster Risk Management”, NIDM, New Delhi, 2011.

Reference Book(s):

R1. Brassard, Caroline, Giles, David W., Howitt, Arnold M., “Natural Disaster Management in the Asia-Pacific”, Policy and Governance.

R2. Jack Pinkowski, “Disaster Management Handbook”, CRC Press, January 22, 2008.

R3. “Disaster Management Guidelines”, GOI-UNDP Disaster Risk Reduction Programme (2009-2012).

Course Code: 23CEE013		Course Title: Sustainable Engineering And Technology	
Course Category: Professional Elective		Course Level: Advanced	
L:T:P(Hours/Week) 3:0 :0	Credits:3	Total Contact Hours:45	Max Marks:100

COURSE OBJECTIVE

The course is intended to impart knowledge about the concepts of sustainable engineering and its various impacts on environment, construction and resources.

Module I Fundamentals of Sustainability and Global Environmental 22 Hours

Introduction to Sustainability:

Sustainability: Introduction, Need, and Concept - Social, Environmental, and Economic Sustainability Concepts, Sustainable Development and its Challenges. Nexus between Technology and Sustainable Development. Multilateral Environmental Agreements and Protocols - Clean Development Mechanism (CDM)

Global Environmental Issues

Air Pollution: Effects of Air Pollution, Water Pollution: Sources and Sustainable Wastewater Treatment. Solid Waste: Sources, Impacts, Zero Waste Concept, and 3R Concept. Global Environmental Issues: Resource Degradation, Climate Change, Global Warming, Ozone Layer Depletion, Regional and Local Environmental Issues, Carbon Credits, Carbon Trading, and Carbon Footprint.

Module II Sustainable Engineering Practices and Energy Sources 23 Hours

Sustainable Engineering Concepts

Key Concepts: Factor 4 and Factor 10, Goals of Sustainability, System Thinking, Life Cycle Thinking, and Circular Economy.

Sustainable Habitat

Basic Concepts of Sustainable Habitat, Green Buildings and Green Materials for Building Construction Material Selection for Sustainable Design - Green Building Certification

Methods for Increasing Energy Efficiency of Buildings - Sustainable Cities and Sustainable Transport.

Sustainable Energy Sources

Basic Concepts of Conventional and Non-Conventional Energy - Solar Energy, Fuel Cells, Wind Energy, Small Hydro Plants, Biofuels - Energy Derived from Oceans and Geothermal Energy.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of sustainability to assess environmental, social, and economic challenges, and implement sustainable development practices in various sectors, including technology, engineering, and urban planning.	Apply
CO 2: Utilize sustainable engineering concepts such as system thinking, life cycle thinking, and circular economy to design energy-efficient and resource-conscious systems, habitats, and technologies.	Apply
CO 3: Analyze global environmental issues such as air and water pollution, resource degradation, and climate change, and evaluate their impact on ecosystems and human society using sustainability frameworks and environmental protocols.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	3	2	2	-	-	2	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Allen, D. T. and Shonnard, D. R., “Sustainability Engineering: Concepts, Design and Case Studies”, Prentice Hall, 2011

T2. Twidell, J. W. and Weir, A. D.,“Renewable Energy Resources”, Taylor & Francis Ltd, 2015.

Reference Book(s):

R1. Bradley. A.S; Adebayo,A.O., Maria, P. “Engineering applications in sustainable design and development”, Cengage learning, 2015.

R2. ECBC Code 2007, “Bureau of Energy Efficiency”, New Delhi Bureau of Energy Efficiency Publications

R3. Ni bin Chang, “Systems Analysis for Sustainable Engineering: Theory and Applications”, McGraw-Hill Professional, 2010.

Course Code: 23CEE014	Course Title: Ground Improvement Techniques		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to impart knowledge on properly devising alternative solutions to the problematic soils in the field, especially before, during and after the construction of buildings, bridges, highways, tunnels and dams.

MODULE I **23 Hours**

PROBLEMATIC SOILS

Different types of problematic soils – Lateritic, Black cotton, Alluvial - Origin, formation, preloading -Engineering properties of soft, weak and compressible deposits - Need for ground improvement – Emerging trends in ground improvement. – Relative merits and demerits of different techniques - Selection of ground improvement techniques based on soil conditions

DRAINAGE AND DEWATERING METHODS

Drainage techniques - single, multi stage, vacuum well point, foundation drains, vertical drains, blanket drains - Electro-osmosis - Dewatering methods - Sumps and interceptor ditches - Design of dewatering systems, vacuum consolidation, Electro-kinetic dewatering -Seepage analysis for two dimensional flow-fully and partially penetrating slots in homogenous deposits

MODULE II **22 Hours**

EARTH REINFORCEMENT AND GROUTING TECHNIQUES

Mechanism and concept of earth reinforcement - Geosynthetics : Geotextiles- types, functions and applications of geogrids and geomembranes – Permeation grouting, compaction grouting, jet grouting, grouting in difficult conditions - Seepage control in soil under dams and for cut off walls - Stabilization grouting for under pinning - Soil nailing, rock anchoring, micro-piles.

INSITU TREATMENT OF COHESIVE AND COHESIONLESS SOILS

Consolidation of cohesive and densification of cohesionless soils – Mechanical stabilization, chemical stabilization, hydraulic modification – Stabilization with cement, lime and chemicals – Stabilization of expansive soils – Under reamed piles - Stone columns - Case studies of recent ground improvement projects on cohesive and cohesionless soils

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the characteristics of problematic soils and Identify the methods available in the design of dewatering and drainage process.	Apply
CO.2 Explain the concept of earth reinforcement (geosynthetics) and grouting techniques available and used in the current scenario	Apply
CO.3 Prepare the report of various ground improvement techniques based on the soil conditions	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Purushothama Raj, P., “Ground Improvement Techniques”, Laxmi Publications (P) Ltd.,New Delhi, 2005.

T 2. Nihar Ranjan Patra, Ground Improvement Techniques, Vikas Publishing House, First Edition, 2012.

T 3. Buddhima I. and Jian J.C., “Ground Improvement: Case Histories”, Elsevier Publications, 2005.

Reference Book(s):

R 1. Moseley, M.P and Kirsch. K., Ground Improvement, Spon Press, Taylor and Francis Group, London, 2nd Edition, 2004..

R 2. Mittal.S, An Introduction to Ground Improvement Engineering, Medtech Publisher, First Edition, 2013.

R 3. . Jones C.J.F.P. Earth Reinforcement and Soil Structure, Thomas Telford Publishing, 1996.

Course Code: 23CEE015	Course Title: SUBSURFACE INVESTIGATION AND INSTRUMENTATION		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective:

The course is intended to impart knowledge on preparation of soil exploration report based on laboratory, field exploration and testing techniques.

MODULE I **23 Hours**

EXPLORATION TECHNIQUES

Scope and objectives - planning an exploration program - location – spacing – depth of borings – sampling techniques - types of samplers - stabilization of bore holes–Methods of boring and drilling - non-displacement and displacement methods, drilling in difficult subsoil conditions - limitations of various drilling techniques - geophysical exploration methods and interpretation – soil profile – bore logs –– soil investigation and exploration reports.

IN-SITU TESTING

Field tests – importance - penetration testing – standard penetration test – static cone penetration test – dynamic cone penetration test – plate load test – field vane shear test – pressure meter test – field permeability test - procedure, limitations, correction and data interpretation.

MODULE II **22 Hours**

INSTRUMENTATION

Instrumentation in soil engineering – pore pressure – ground water table – strain gauges – resistance and induction type – load cells – earth pressure cells – settlement and heave gauges – piezometers and slope indications – inclinometer.

SPECIAL STRUCTURES

Challenges in special structures – bridges, airport runway, tunnels, transmission towers, offshore structures, underground structures – Design considerations – process of monitoring the investigation and construction activities – Report preparation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the various methods of soil exploration techniques with different soil conditions	Apply
CO.2. Explain the methods of instrumentation and special structures	Apply
CO.3 Prepare the soil investigation and construction progress report for the various geotechnical investigations.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	3	3	-	-	3	-

Text Book(s):

T1. Alam Singh and Chowdhary, G.R., "Soil Engineering in Theory and Practice, Volume-2, Geotechnical Testing and Instrumentation, CBS Publishers and Distributors, New Delhi, 2006.

T2. Hunt, R.E., "Geotechnical Engineering Investigation Manual, McGraw Hill,2005.

Reference Book(s):

R1. Hunt, R.E., "Geotechnical Engineering Investigation Manual, McGraw Hill,1984.

R2. Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Hand Book, a Nostrand Reinhold 1994.

R3. Look, B. G, Handbook of Geotechnical Investigation and Design Tables: Second Edition. Netherlands: CRC Press, 2017

Course Code: 23CEE016	Course Title: ENGINEERING BEHAVIOUR OF SOILS		
Course Category: Elective		Course Level: Intermediate	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to gain the knowledge of the basic mechanics which governs the physio chemical, engineering, swell and shrinkage behavior of soil.

MODULE I **23 Hours**

SOIL DEPOSITS AND CLAY MINERALS of soils – different soil deposits and their engineering properties – composition and structure of clay minerals – classification and identification – anion and cation exchange capacity of clays – specific surface area – bonding in clays.

PHYSIO CHEMICAL BEHAVIOUR OF SOILS Physio chemical behaviour of soils – diffused double layer theory – computation of double layer distance – dielectric constant – temperature on double layer – ion exchange – cation exchange capacity – cause, fixation and determination of cation exchange effect– exchangeable cations - types of soil water – water interactions - soil structure.

ENGINEERING PROPERTIES OF SOILS

Compressibility, shear strength and permeability behaviour of fine and coarse grained soils – mechanisms - factors influencing engineering properties – liquefaction potential – causes and consequences - soil suction – determination of suction potential – collapsible soil – its identification – effect on foundation.

MODULE II **22 Hours**

SWELLING AND SHRINKAGE BEHAVIOUR OF SOILS

Problems associated with swelling and shrinkage behaviour of soils – causes, consequences and mechanisms – factors influencing swell – shrink characteristics – swell potential – swell pressure – volume changes and engineering problems in the field - soil fabric and measurement – sensitivity, thixotrophy of soils – soil suction – identification of expansive clays.

CONDUCTION PHENOMENA OF SOIL BEHAVIOUR

Conduction in soils – hydraulic, electrical, chemical and thermal flows in soils – applications - coupled flows – Electro-kinetic process – thermo osmosis - electro osmosis – prediction of engineering behaviour of soils using index properties – empirical equations and their applicability.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Examine the physio chemical properties and engineering properties with different soil.	Apply
CO.2 Interpret the swell behavior with different soil and describe the hydraulic, electrical, chemical and thermal flows in soils and its applications.	Apply
CO.3 Prepare the report of the tests conducted for engineering behavior of locally available soil deposits	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Mitchell, J. K., 2007. Fundamentals of soil Behaviour. Edition, John Wiley and sons, New York

T 2. Das, B.M., 2019. Advanced soil Mechanics. Taylor and Francis.

T 3. Gulhati, S. K. and Datta M. 2008. Geotechnical Engineering. Tata Mcgraw-Hill Company Ltd.

Reference Book(s):

R 1. Lambe, T.W. and Whitman, R.V., 1987. Soil Mechanics. John Wiley and Sons

R 2. Coduto, D. P. 2002. Geotechnical Engineering, Principles and Practices. Pearson Education International, New Jersey.

Course Code: 23CEE017	Course Title: SHALLOW FOUNDATIONS		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to understand the various aspects related to shallow foundations and its design in the field of Civil Engineering.

MODULE I **23 Hours**

TYPES AND SELECTION OF FOUNDATIOS

Types of foundations – types of shallow foundation – design concept - general requirements - additional consideration - selection of type of foundation - hostile environment - structural integrity – economy, foundation drainage and water proofing.

BEARING CAPACITY

Theories of bearing capacity – ultimate bearing capacity – factors affecting bearing capacity -evaluation of bearing capacity from in-situ tests – safe bearing capacity – bearing capacity of foundations in slope – effect of ground water table and eccentricity of foundations– codal provisions.

SETTLEMENT AND ALLOWABLE BEARING PRESSURE

Component of settlement - immediate, primary and secondary consolidation settlement-stress path method of settlement evaluation-layered soil - construction period correction - evaluation from in-situ tests – allowable settlement – allowable bearing pressure - codal provisions.

MODULE II **22 Hours**

DESIGN OF FOUNDATIONS

Analysis of foundation - isolated - strip - combined footings and mat foundations - conventional - elastic approach - soil structure interaction principles - application - numerical techniques - software applications.

FOUNDATION FOR SPECIAL CONDITIONS

Structural design of shallow foundations – limit state method-codal provisions- special foundations - foundation design in relation to ground movements - foundation on compressible fills – foundation for tower-design of foundation for seismic forces - codal provisions.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Classify and Identify the suitable type of foundation based on soil condition and estimate the safe bearing capacity.	Apply
CO.2 Design of isolated, strip, combined and mat foundation.	Apply
CO.3 Prepare a report of the design of shallow foundation for the existing building.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw Hill, New York, 1996.
T 2. Das, B.M., 'Principles of Foundation Engineering, Design and Construction", Fourth Edition, PWS Publishing, 2017
T 3. Donald P. Coduto, "Foundation Design Principles and Practices" - Prentice Hall, Inc., Englewood Cliffs, New Jersey, 2001.
T 4. Nainan P. Kurian, "Design of Foundation Systems, Principles and Practices, Narosa Publishing House, Third Edition, 2006.
T 5. Muni Budhu, "Soil Mechanics and Foundation, John Wiley and Sons, INC 2000.

Reference Book(s):

R 1. Poulos, H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980
R 2. Cernica, J.N. "Geotechnical Engineering Foundation Design", John Wiley and Sons, Inc. 1995.
R 3. Tomlinson, M.J. "Foundation engineering", ELBS, Longman Group, U.K. Ltd., England 1995.
R 4. Winterkorn, H.F. and Fang, Y.F., "Foundation Engineering Handbook", Van Nostrand Reinhold, 1994.
R 5. Day, R.W., "Geotechnical and Foundation Engineering, Design and Construction, McGraw Hill 1999.

Course Code: 23CEE018	Course Title: DEEP FOUNDATIONS		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objective

The course is intended to gain the knowledge in different types of deep foundations and to estimate the load carrying capacity on various soil conditions.

MODULE I **23 Hours**

CLASSIFICATIONS AND LOAD CAPACITY PILES

Necessity of pile foundation – classification of piles – factors governing choice of type of pile – load transfer mechanism – piling equipments and methods – effect of pile installation on soil condition. Allowable load of piles and pile groups – static and dynamic methods – for cohesive and cohesionless soil – negative skin friction – group efficiency – pile driving formulae - limitation – wave equation application – interpretation of field test and pile load test results – settlement of piles and pile group - codal provisions.

LATERAL AND UPLIFT LOAD EVALUATION OF PILES

Piles under lateral loads – broms method, elastic, p-y curve analyses – batter piles – response to moment – piles under uplift loads – under reamed piles – drilled shaft – lateral and pull out load tests – codal provision.

MODULE II **22 Hours**

STRUCTURAL DESIGN OF PILE AND PILE GROUPS

Structural design of pile – structural capacity – pile and pile cap connection – pile cap design – shape, depth, assessment and amount of steel – truss and bending theory- reinforcement details of pile and pile caps – pile raft system – basic interactive analysis – pile subjected to vibration – codal provision.

SHEET PILES

Sheet piles structures- cantilever sheet pile walls in granular and cohesive soils – anchored bulk head – free earth support method – fixed earth support method – lateral earth pressure on braced sheet piles.

WELL FOUNDATIONS

Well foundation - design and construction - bearing capacity, settlement and lateral resistance stability of well foundation - drilled shaft - construction procedures - design considerations - load carrying capacity and settlement analysis.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Classify the pile foundation and estimate the pile capacity and settlement of piles and pile group.	Apply
CO.2 Design of structural pile, pile cap, sheet piles and well foundation.	Apply
CO.3 Prepare a case study report of special foundation of existing monuments.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Bowles, J.E., "Foundation Analysis and Design", 5th Edition, McGraw Hill, New York, 1996.
T 2. Das, B.M., 'Principles of Foundation Engineering, Design and Construction", Fourth Edition, PWS Publishing, 2017
T 3. Donald P. Coduto, "Foundation Design Principles and Practices" - Prentice Hall, Inc., Englewood Cliffs, New Jersey, 2001.
T 4. Nainan P. Kurian, "Design of Foundation Systems, Principles and Practices, Narosa Publishing House, Third Edition, 2006.
T 5. Muni Budhu, "Soil Mechanics and Foundation, John Wiley and Sons, INC 2000.

Reference Book(s):

R 1. Poulos, H.G., Davis, E.H., "Pile foundation analysis and design", John Wiley and Sons, New York, 1980
R 2. Cernica, J.N. "Geotechnical Engineering Foundation Design", John Wiley and Sons, Inc. 1995.
R 3. Tomlinson, M.J. "Foundation engineering", ELBS, Longman Group, U.K. Ltd., England 1995.

Course Code: 23CEE019	Course Title: SOIL DYNAMICS AND MACHINE FOUNDATIONS		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to understand the theory of vibrations and behavior of soils under dynamic loads so that to design foundations for various types of machines.

MODULE I **22 Hours**

THEORY OF VIBRATION

Introduction – nature of dynamic loads – fundamentals of vibration - vibrations of single and multi degree freedom system – free vibrations of spring – mass systems – forced vibrations – resonance - viscous damping - Principles of vibration measuring instruments - effect of transient and pulsating loads.

DYNAMIC SOIL PROPERTIES

Dynamic stress-strain characteristics – principles of measuring dynamic properties – laboratory techniques – field tests – factors affecting dynamic properties - typical values - dynamic bearing capacity – dynamic earth pressure.

MODULE II **23 Hours**

MACHINE FOUNDATIONS

Types of Machines and Foundations – General requirements – Design approach for machine foundation - Vibration analysis – Elastic Half-Space theory – Mass-spring-dashpot model – Permissible amplitudes – Permissible bearing pressures.

DESIGN OF MACHINE FOUNDATIONS

General requirements – evaluation of design parameters – analysis and design of block type and framed type machine foundations – modes of vibration of a rigid foundation – foundations for reciprocating machines, impact machines, two-cylinder vertical compressor, double-acting steam hammer – codal recommendations.

INFLUENCE OF VIBRATION AND REMEDIATION

Mechanism of liquefaction – influencing factors- vibration isolation – types of isolation - active and passive isolation – methods of isolation – use of springs and damping materials – properties of isolating materials – vibration control of existing machine foundation.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Illustrate the importance of learning soil dynamics and the theory behind vibrations.	Apply
CO.2 Design of various types of machine foundation.	Apply
CO.3 Prepare a report of importance of design of a machine foundation	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
CO2	-	3	2	-	-	2	-	-	-	-	-	-	3	2
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Saran, S., 1999. Soil Dynamics and Machine Foundations. Galogotia Publications Pvt. Ltd, New Delhi.

T 2. Prakash, S and Puri, V.K., Foundations for Machines, McGraw Hill, 1987.McGraw Hill Book Company, New York.

T 3. Kameswara Rao, N.S.V., "Dynamics soil tests and applications", Wheeler Publishing , New Delhi, 2000

Reference Book(s):

R 1. Barken, D. D.,1962. Dynamics of bases and foundations. McGraw Hill, New York.

R 2. Krammer, S., 2003. Geotechnical Earthquake Engineering. Pearson Education Pvt. Ltd. New Delhi.

R 3. Moore, P.J., "Analysis & Design of Foundations for Vibrations", Oxford & IBH, 2006.

Course Code: 23CEE020	Course Title: REINFORCED SOIL STRUCTURES		
Course Category: Elective		Course Level: Advanced	
L: T:P (Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objective

The course is intended to gain the knowledge in the concept of geosynthetics, reinforced materials and their behavior and their applications in different civil engineering design.

MODULE I **23 Hours**

PRINCIPLES AND MECHANISMS

Historical background – initial and recent developments – principles – concepts and mechanisms of reinforced soil – factors affecting behaviour and performance of soil – reinforcement interactions.

REINFORCING MATERIALS

Materials used in reinforced soil structures – fill materials, reinforcing materials, metal strips, and geosynthetics – bamboo – timber – facing elements – properties methods of testing – advantages and disadvantages – influence of environmental factors on the performance of geosynthetic materials.

GEOSYNTHETICS AND APPLICATIONS

Geosynthetics in roads – geosynthetics in landfills – barrier walls - soil nailing – soil-nail interaction – behaviour in seismic conditions - case studies of reinforced dams, embankments, pavements, railroads, foundations

MODULE II **22 Hours**

DESIGN PRINCIPLES

Design aspects of reinforced soil – soil reinforcement function – separator, filtration, drainage, barrier function – design and applications of reinforced soil of various structures – retaining walls – foundations – embankments and slopes.

DESIGN FOR FUNCTIONS

Geotextiles - requirement for design of separation – filtration – general behaviour - filtration behind retaining wall, under drains, erosion control and silt fence – drainage design – liners for liquid containment – geo membrane and geosynthetic clay liners.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO.1 Explain the concept and mechanism of reinforced soil structures and the factors affecting the performance.	Apply
CO.2 Design the structures for geosynthetics applications like separation, filtration, reinforcement and barrier.	Apply
CO.3 Prepare a report on the highway project to reinforce soil using strips, grids, anchors, chains, and other materials	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	2	2	-	-	3	-

Text Book(s):

T 1. Sivakumar Babu, G.L., An Introduction to Soil Reinforcement and Geosynthetics, University Press (India), Pvt. Ltd., Hyderabad, 2006.

T 2. Jewell, R.A., Soil Reinforcement with Geotextile, CIRIA, London, 1996.

T 3. Koerner, R.M., Designing with Geosynthetics, Third Edition, Prentice Hall, 1997.

Reference Book(s):

R 1. Jones, C.J.F.P., Earth Reinforcement and Soil Structures, Earthworks, London, 1982.

R 2. Ramanatha Ayyar , T.S., Ramachandran Nair, C.G. and Balakrishna Nair, N., Comprehensive Reference Book on Coir Geotextile, Centre for Development for Coir Technology, 2002.

R 3. Muller, W.W. HDPE Geomembranes in Geotechnics, Springer, New York 2007.

Course Code:	Course Title: HYDROLOGY		
Course Category: Elective		Course Level: Intermediate	
L:T:P (Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives

The course is intended to define the key drivers on water resources, hydrological processes and their integrated behavior in catchments, apply the knowledge of hydrological models to surface water problems including basin characteristics, runoff and hydrograph, explain the concept of hydrological extremes such as flood and drought and its management strategies, describe the importance of spatial analysis of rainfall and design water storage reservoirs, apply the concepts of groundwater for water resources management.

23 Hours

Module I

PRECIPITATION AND ABSRACTIONS

Hydrological cycle - Meteorological measurements – Requirements, types and forms of precipitation - Rain gauges - Spatial analysis of rainfall data using Thiessen and Isohyetal methods - Interception - Evaporation. Horton's equation, pan evaporation measurements and evaporation - Infiltration-Horton's equation - double ring infiltrometer, infiltration indices.

RUNOFF

Watershed, catchment and basin - Catchment characteristics - factors affecting runoff - Run off estimation using empirical – Strange's table and SCS methods – Stage discharge relationships flow measurements- Hydrograph – Unit Hydrograph – IUH

22 Hours

Module II

FLOOD AND DROUGHT

Natural Disasters-Flood Estimation- Frequency analysis- Flood control- Definitions of droughts Meteorological, hydrological and agricultural droughts- IMD method-NDVI analysis- Drought Prone Area Programme (DPAP)

RESERVOIRS

Classification of reservoirs, General principles of design, site selection, spillways, elevation – area - capacity - storage estimation, sedimentation - life of reservoirs – rule curve

GROUNDWATER MANAGEMENT

Origin- Classification and types - properties of aquifers- governing equations – steady and unsteady flow - artificial recharge - RWH in rural and urban areas

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge of key drivers and hydrological processes to analyze their integrated behavior in catchments through hydrological models.	Apply
CO2: Apply management strategies to mitigate hydrological extremes such as floods and droughts.	Apply
CO3: Prepare a report on the development and implementation of rainwater harvesting (RWH) systems for rural and urban areas, integrating spatial rainfall analysis and reservoir design.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Subramanya, K., "Engineering Hydrology"- Tata McGraw Hill, 2010
T2. Jayarami Reddy, P., “Hydrology”, Tata McGraw Hill, 2008.

Reference Book(s):

R1. Garg. S. K., “Hydrology and Water Resources Engineering”, Khanna Publishers-Delhi, 2010.

R2. Ven Te Chow, Maidment, D.R., and Mays, L.W., "Applied Hydrology", McGraw Hill International Book Company, 1998.

R3. Raghunath. H.M., "Hydrology", Wiley Eastern Ltd., 1998.

Course Code: 23CEE022		Course Title: Groundwater Engineering	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to learn the basics of groundwater hydrology, outline the objectives of groundwater hydraulics, understand the various types of wells, its construction and maintenance, know about the different method of evaluation of aquifer parameters, and to study the concepts involved in modeling and recharge of groundwater.

Module I **23 Hours**

GROUNDWATER HYDROLOGY

Introduction- Water bearing formations- geological formation of water supply-subsurface distribution of water – hydrological cycle – sources of groundwater – types of aquifers – aquifer parameters – groundwater development and potential in India

GROUNDWATER HYDRAULICS

Groundwater flow- Permeability – Transmissibility – Darcy's law and its limitations – Properties of aquifer materials – Radial flow towards a well in a confined and unconfined aquifer – Relation of well size to yield – unsteady flow conditions – determination of aquifer constants – Theis method – Jacob's method – Chow's method – Theis recovery method – Conditions to check for steady state – Well losses and well efficiency

Module II **22 Hours**

WELLS AND EXPLORATION

Types of wells – water well design – drilling of tubewells – drilling methods – percussion drilling – rotary drilling – auger core drilling and water jet methods – construction of wells – collector wells and infiltration wells – construction of strainer type tube wells- types of strainers – Construction of cavity type tube wells – Construction of gravel packed wells – Construction of open wells - testing yield of tube wells

EVALUATION OF AQUIFER PARAMETERS

Pumping test analysis – Recuperation test – well characteristics – well capacity – confined and unconfined aquifer – groundwater investigation – subsurface geophysical methods

GROUNDWATER QUALITY AND CONSERVATION

Groundwater development – hydrological maps – groundwater quality standards – groundwater contamination – seawater intrusion – control measures – Groundwater recharge methods – Groundwater modelling

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the principles of groundwater hydrology to analyze the movement of groundwater in various settings.	Apply
CO2: Classify different types of wells and implement appropriate methods for their construction, maintenance, and management.	Apply
CO3: Prepare a report on the methods for evaluating aquifer parameters, groundwater recharge, and modelling strategies.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Todd, D.K., Mays, L.W., “Groundwater Hydrology”, John Wiley and Sons, New York, 2005.
T2. Raghunath, H.M., “Groundwater Hydrology”, Wiley Eastern Ltd., Third edition, New Age International, 2007.
T3. R.N. Saxena, Gupta, D.C., “Elements and Hydrology and groundwater”, PHI Learning private limited, 2017.

Reference Book(s):

R1. Murthy, V.V.N., “Land and water management engineering”, Kalyani publishers, New Delhi, 1985.
R2. Delleur, J.W., “The Handbook of groundwater engineering”, CRC Press, Taylor and Francis Group, 2007.

Web References:

1. https://nptel.ac.in/courses/105105042
2. https://nptel.ac.in/courses/105101214

Course Code: 23CEE023		Course Title: Irrigation Management	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

This course is intended to expose the students to the irrigation development of India, understand the various systems of irrigation and their performance indicators, learn the various aspects of main system management, inculcate the principles of participatory irrigation management, outline the policies related to irrigation.

Module I **23 Hours**

IRRIGATION DEVELOPMENT IN INDIA

Importance of Irrigation in Agriculture - Historical evolution of irrigation in India – Irrigation development during pre-colonisation – Colonisation and post-colonization – Different types of Irrigation prevalent in India: Warabandi, Shejpali and South Indian systems - Focus of Irrigation in India – Command area development approach and farmers‟ participation.

IRRIGATION SYSTEMS AND PERFORMANCE INDICATORS

Systems classification - Institutions for irrigation management–Diagnostic Analysis of Irrigation Systems -Rehabilitation and modernization – Performance indicators – Improving system performance – Conjunctive management – constraints faced.

MAIN SYSTEM MANAGEMENT

Main system components – Reservoir allocation rule, Operating rule and optimization methods to improve main system performance - irrigation scheduling – Constraints.

Module II **22 Hours**

COMMAND AREA DEVELOPMENT AND PARTICIPATORY IRRIGATION MANAGEMENT

Command area development principles – Participatory Irrigation Management and Irrigation management transfer – Case studies – Constraints.

IRRIGATION POLICY

Present status of irrigation policy and institutions – Irrigation related conflicts – Institutional transformation needed – Constraints in effecting institutional transformation – Irrigation financing – Water pricing – Water market – Policy changes.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply principles of irrigation development in India to analyze its impact on agricultural and water management practices.	Apply
CO2: Apply principles of participatory irrigation management to resolve conflicts and enhance water use efficiency.	Apply
CO3: Prepare a report for the implementation of policies related to irrigation for sustainable water resource management.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Rakesh Hooja, “Management of Water for Agriculture: Irrigation, Water sheds and Drainage”, Rawat Publications, New Delhi, 2006.
T2. Kijne, J.W., Barker, R and Molden, D,”Water Productivity in Agriculture; Limits and Opportunities for improved”, CABI Publishing, Walling ford, U.K, 2003.

Reference Book(s):

R1. Giodano.M and Villbolth K.G, “The Agricultural Ground Water Revolution -Opportunities and threats to development”, CABI Publishing, Walling ford, U.K, 2007.

Web References:

1. https://nptel.ac.in/courses/105108081
2. **http://www.irrigationtoolbox.com/NEH/Part652_NationalIrrigationGuide/ch9.pdf**

Course Code: 23CEE024		Course Title: Irrigation Water Quality	
Course Category: Elective		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to understand the physical and chemical characteristics of irrigation water, study the role of salinity in irrigation water, learn the various sources of pollution, understand the recycling and reuse techniques adopted in irrigation, and discuss the water quality standards and models.

Module I **23 Hours**

WATER QUALITY

Physical and chemical properties of water – Suspended and dissolved solids – EC and pH – major ions –. Water quality investigation – Sampling design - Samplers and automatic samplers - Data collection platforms – Field kits – Water quality data storage, analysis and inference – Software packages

SALINITY

Water quality for irrigation – Salinity and permeability problem – Root zone salinity - Irrigation practices for poor quality water – Saline water irrigation – Future strategies

WATER POLLUTION

Sources and Types of pollution – Organic and inorganic pollutants - BOD – DO relationships – impacts on water resources – NPS pollution and its control – Eutrophication control - Water treatment technologies - Constructed wetland.

Module II **22 Hours**

RECYCLING AND REUSE OF WATER

Multiple uses of water – Reuse of water in agriculture – Low-cost waste water treatment technologies - Economic and social dimensions - Packaged treatment units – Reverse osmosis and desalination in water reclamation.

WATER QUALITY MANAGEMENT

Principles of water quality – Water quality classification – Water quality standards - Water quality indices – TMDL Concepts – Water quality models.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply knowledge of the physical and chemical characteristics of irrigation water to evaluate its quality for agricultural purposes.	Apply
CO2: Identify sources of pollution affecting irrigation water and apply appropriate control and treatment methods.	Apply
CO3: Prepare a report on the implementation of recycling and reuse techniques in irrigation supported by water quality modelling tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. George Tchobanoglous, Franklin Louis Burton, Metcalf & Eddy, H. David Stense, "Wastewater Engineering: Treatment and Reuse", McGraw-Hill, 2002.
T2. Vladimir Novonty, "Water Quality: Diffuse pollution and watershed Management", 2nd edition, John Wiley & Sons, 2003.

Reference Book(s):

R1. Mackenzie L Davis, David A Cornwell, "Introduction to Environmental Engineering", McGraw- Hill 2006.
R2. Stum, M and Morgan, A., "Aquatic Chemistry", Plenum Publishing company, USA, 1985.
R3. Lloyd, J.W. and Heathcote, J.A., "Natural inorganic chemistry" in relation to groundwater resources, Oxford University Press, Oxford, 1988.

Course Code: 23CEE025		Course Title: Watershed Conservation and Management	
Course Category: Major		Course Level: Intermediate	
L:T:P(Hours/Week) : : 3:0:0	Credits: 3	Total Contact Hours: 45	Max Marks:100

Course Objectives:

The course is intended to learn about the watershed concepts, understand the various soil conservation measures, become aware of the watershed harvesting techniques, develop a watershed management plan, and understand the role of remote sensing and GIS in watershed conservation.

Module I **23 Hours**

WATERSHED CONCEPTS

Watershed- Need for an integrated approach – Influencing factors; Geology – Soil – Morphological characteristics – Toposheet – Delineation – Codification – Prioritization of watershed

SOIL CONSERVATION MEASURES

Types of erosion – Water and wind erosion; Causes, factors, effects and control – Soil conservation measure: Agronomical and mechanical – Estimation of soil loss – Sedimentation

WATER HARVESTING AND CONSERVATION

Water harvesting techniques – Micro catchments – Design of small water harvesting structures – Farm ponds – Percolation Tanks – Yield of a catchment

Module II **22 Hours**

WATERSHED MANAGEMENT

Watershed development plan – Entry point activities – Estimation – Watershed economics – Agroforestry – Grassland management – Wasteland management – Watershed approach in government programmes – Developing collaborative know how – People's participation – Evaluation of watershed management

GIS FOR WATERSHED MANAGEMENT

Applications of Remote Sensing and Geographical Information System – Role of decision support system – Conceptual models and case studies

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply the concepts of watersheds to analyze and manage watershed processes and their impact on water resources.	Apply
CO2: Evaluate causes and effects of soil erosion, and implement control measures for effective soil conservation.	Apply
CO3: Prepare a management plan for watershed conservation, integrating remote sensing and GIS tools.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	-	-	-	-	-	-	-	2	2	-	-	2	-

High-3; Medium-2; Low-1

Text Book(s):

T1. Ghanashyam, D., “Hydrology and Soil Conservation engineering”, Prentice Hall of India Private Limited, New Delhi, 2000.
T2. Glenn, O. S., “Soil and Water Conservation Engineering”, John Wiley and Sons, 1981.
T3. Gurmail, S., “A Manual on Soil and Water Conservation”, ICAR Publication, New Delhi, 1982.
T4. Suresh, R., “Soil and Water Conservation Engineering”, Standard Publication, New Delhi, 1982.

Reference Book(s):

R1. Brooks, K. N., P. F. Ffolliott, H. M. Joseph, Magner, A., “Hydrology and the Management of Watersheds”, Fourth Edition, 2013.
R2. Heathcote, I. W., “Integrated Watershed Management: Principles and Practice”, John Wiley and Sons, Inc., New York, 1998.
R3. Lal, Ruttan, “Integrated Watershed Management in the Global Ecosystem”, CRC Press, New York, 2000.
R4. Heathcote, I. W., “Integrated Watershed Management: Principles and Practice”, John Wiley and Sons, Inc., New York, 1988.
R5. Dhruva Narayana, G. Sastry, V. S. Patnaik, “Watershed Management”, CSWCTRI, Dehradun, ICAR Publications, 1997.

Web References:

1. https://nptel.ac.in/courses/105101010

Course Code: 23CEE026		Course Title: REMOTE SENSING AND GIS APPLICATIONS IN WATER RESOURCES	
Course Category: Professional Elective		Course Level: Advanced	
L:T:P(Hours/Week) 3:0 :0	Credits:3	Total Contact Hours:45	Max Marks:100

Course Objectives:

The course is intended to provide students with a comprehensive understanding of the principles and applications of remote sensing and GIS, and their integration for effective analysis and decision-making in water resources engineering and related fields.

Module I Fundamentals of Remote Sensing and Image 22 Hours

Introduction to Remote Sensing: Definition and Principle of Remote Sensing - Remote Sensing Systems - Remote Sensing from Space. Remote Sensing Sensors: Resolution, Imaging Sensors, Optical Infrared (OIR) Imagers, Optical Sensors, Thermal Sensors, Microwave Sensors, Active Microwave Sensors - Data Preprocessing - Remote Sensing in India

Introduction to Image Interpretation: Basic Principles and Elements of Image Interpretation - Techniques of Image Interpretation, Interpretation Keys - Introduction to Digital Image Processing: Image Rectification and Registration - Geometric Correction

Module II GIS, Terrain Analysis, and Applications 23 Hours

Geographic Information Systems (GIS): Definitions and Related Technology - GIS Operations, Elements, Concepts, and Practice - Map Projection and Coordinate System. Data Representation: Vector Data Representation: Geometric Objects, Topology. Raster Data Representation: Elements, Types, Satellite Imagery, Digital Elevation Models. Integration of Raster and Vector Data.

Terrain Mapping and Analysis: Data for Terrain Mapping and Analysis: DEM, TIN. Terrain Mapping Techniques: Contouring, Vertical Profiling, Hill Shading, Hypsometric Tinting, Perspective View. Terrain Analysis: Slope and Aspect, Surface Curvature, View shed Analysis, Grid versus TIN. GIS Applications in Water Resources. GIS Modeling: Binary Models, Index Models - Integration of Remote Sensing and GIS - Case Studies: Remote Sensing and GIS Applications in Water Resources Engineering

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1: Apply the principles of remote sensing and image interpretation to identify and analyze spatial information using	Apply

sensors	
CO 2: Utilize Geographic Information Systems (GIS) tools and data representations (vector and raster) to perform terrain mapping and generate thematic maps for slope, aspect, and elevation analysis.	Apply
CO 3: Analyze the integration of remote sensing and GIS techniques to evaluate and model water resource management scenarios, including case studies of terrain and hydrological features.	Analyze

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	3	3	-	-	3	2	2	-	-	2	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Fundamentals of Remote Sensing, George Joseph, C. Jeganathan, 3rd Edition, 2018, University Press, New Delhi.

T2. Introduction to Geographic Information systems – Kang tsung chang, 9th Edition, 2017, McGraw Hill publications, New Delhi.

Reference Book(s):

R1. Remote Sensing of the Environment – An earth resource perspective, John R. Jensen, 2nd Edition, 2013, Pearson Education, New Delhi.

R2. Principles of Geographical Information, Burrough Peter A., 2015, Oxford University Press.

R3. Lo, C.P., and Albert K.W. Young concepts and Technologies of Geographic Information Systems, 2007, Prentice hall of India (Pvt) Ltd, New Delhi.

Web References:

1. http://www.wamis.org/agm/pubs/agm8/Paper–1.pdf
2. http://ags.geography.du.ac.in/Study%20Materials_files/Punyatoya%20Patra_AM.pdf
3. http://hydrologie.org/hsj/410/hysj_41_04_0593.pdf
4. http://www.wiley.com/legacy/wileychi/gis/Volume1/BB1v1_ch14.pdf
5. http://gis–lab.info/docs/books/aerial–mapping/cr1557_15.pdf

Course Code: 23CEE027		Course Title: ADVANCED CONSTRUCTION TECHNIQUES	
Course Category: Major Core - Professional Elective		Course Level: Intermediate	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to study the construction practices, erection and repair techniques followed in substructure and superstructure of various types of buildings such as skyscrapers, bridges, precast and prefabricated structures.

Module I **25 Hours**

SUB STRUCTURE

Box jacking – Pipe jacking – Launching and pushing of box decks - Diaphragm walls and basement – Tunneling techniques – Piling techniques – Caissons – Cofferdam – Cable anchoring and grouting – Shoring for deep cutting – Dewatering for underground open excavation.

SUPER STRUCTURE & SPECIAL STRUCTURES

Vacuum dewatered flooring – Continuous concreting operations for tall structures – Concrete paving technology – Slipform technique – Suspended formwork – Aerial transporting – Erection of light weight components on tall structures, lattice towers, articulated structures and space decks – Large span structures – launching techniques for heavy decks – Construction sequence in Cooling Towers, Silos, Chimney, Sky Scraper, Domes, Bow string bridges, Cable stayed bridges.

Module II **20 Hours**

PRECAST AND PREFABRICATION

Pre–casting techniques – handling techniques – transportation, storage and erection of structures – Curing techniques – steam curing, hot air blowing – Pre-cast and pre-fabricating technology for low cost and mass housing schemes – Ferro–cement in housing – quality control – Repairs and economical aspects on prefabrication.

REPAIR AND DEMOLITION

Mud Jacking and grouting for foundation – micro piling and underpinning for strengthening floor and shallow profile – Sub grade water proofing – Repair techniques for cracks in concrete – Demolition techniques – sequence of operation – Dismantling – Safety precaution in demolition and dismantling.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Summarize the construction and erection techniques followed for sub structure and super structure components of tall buildings, large span structures and special structures.	Apply
CO2. Suggest Suitable repair techniques for the substructure and superstructure components of various structures.	Apply
CO3. Prepare a report on the various erection and repair techniques adopted for heavy infrastructure buildings in Indian conditions.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Subir K. Sarkar and Subhajit Saraswati, “Construction Technology”, Oxford University Press, New Delhi, 2008.

T2. R. Chudley, Roger Greeno, "Advanced Construction Technology" Prentice Hall, 2006

Reference Book(s):

R1. Jerry Irvine, "Advanced Construction Techniques" CA Rockers, 1984.

R2. Peter.H.Emmons, “Concrete repair and maintenance illustrated”, Galgotia Publications Pvt. Ltd., 2001.Press, 2008

R3. Robertwade Brown, "Practical Foundation Engineering Hand Book", McGraw Hill Publications, 1995.

Web References:

1. http://nptel.ac.in/video.php?subjectId=105102088
2. https://sites.google.com/a/venusict.org/actech/lecture–notes

Course Code: 23CEE028		Course Title: BUILDING SERVICES	
Course Category: Major – Professional Elective		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to understand the different types of machineries, electrical systems, plumbing, sanitary fixtures, fire safety installations and their applications in buildings.

Module I **25 Hours**

MACHINERIES AND REFERIGERATION

Importance of building services in modern construction - Hot Water Boilers – Lifts and Escalators – Special features for physically handicapped and elderly – DC/AC motors – Generators – Laboratory services – Gas, water, air and electricity – Pressure temperature relationship for liquids – HVAC Systems – Air conditioning and Refrigeration systems - Protection against fire caused by A.C. Systems.

ELECTRICAL SYSTEMS

Basics of electricity – Single / Three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI specifications – Types of wires, wiring systems – Main and distribution boards – Transformers and switch gears – Theory of light – Classification of lighting – Design concepts of modern lighting – Introduction to building automation - Control systems for HVAC, lighting, and security - Smart building technologies.

Module II **20 Hours**

PLUMBING AND SANITARY SYSTEMS

Plumbing system components – Water supply and distribution system – plumbing valves – plumbing fixtures – Piping systems – Valves – Sanitary piping systems – Soil piping system – Ventilation system – House drain.

FIRE SAFETY INSTALLATION

Causes of fire in buildings – Safety regulations – NBC – Planning considerations in buildings like non–combustible materials, construction of staircases and lift lobbies, fire escapes and A.C. systems. Special features for physically handicapped and elderly in building types – Heat and smoke detectors – Fire alarm system, snorkel ladder –Dry and wet risers – Automatic sprinklers.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1. Summarize the applications of various types of machineries, electrical systems used in the buildings.	Apply
CO2. Identify and suggest suitable plumbing and sanitary systems for various types of buildings.	Apply
CO3. Prepare a report on the various automation techniques used for the conventional building services in buildings.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	-	-	-	-	-	-	-	3	-	-	3	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Fred Hall and Roger Greeno, “Building Services Handbook”, Routledge and CRC Press, 2017.

T2. Subhash M. Patil, “Building services”, Standard publishers, 2014.

Reference Book(s):

R1. Thomas Everitt Coleman, “Sanitary House Drainage: Its Principles and Practice: A Handbook”, Wentworth Press publishers, 2019

R2. William Paul Gerhard, “House–Drainage and Sanitary Plumbing”, General Books publishers, 2012

R3. Udayakumar. R, “A text book on Building Services”, Eswar Press, Chennai, 2011

Web References:

1. https://www.scribd.com/doc/55417572/Building–Services–Notes
2. https://lecturenotes.in/download/material/47960–note–of–building–services–by–r–manoj–

Course Code: 23CEE034		Course Title: RAILWAYS, AIRPORT AND HARBOUR ENGINEERING	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to provide knowledge on the design, functions and maintenance of the various components of railways, airport and harbour.

Module I **22 Hours**

RAILWAY PLANNING AND DESIGN

Role of Indian Railways in National Development –Factors controlling Alignment – Engineering Surveys for Track Alignment –Elements of permanent way and its functions – Rails, Sleepers, Ballast, rail fixtures and fastenings – Coning of wheels – Creep in rails – Defects in rails – Geometric design of railway tracks – gradient, super elevation, widening of gauge on curves.

RAILWAY TRACK CONSTRUCTION, OPERATION AND MAINTENANCE

Earthwork – Stabilization of track on poor soil – Tunneling Methods - Working principles of Points and Crossing, Signaling, Interlocking and Track Circuiting –Railway Stations and Yards: Types and Layouts – Calculation of Materials required for track laying – Construction and maintenance of tracks – Track renewals - Passenger amenities - Drainage and ventilation.

Module II **23 Hours**

AIRPORT PLANNING AND DESIGN

Air Transport classification – Components of Airports – Airport Planning – Site Selection, Airport Obstructions and Zones – Runway Design – Orientation, Cross wind Component, Wind rose Diagram - Runway length corrections for Gradients, elevation and Temperature - Elements of Taxiway Design, Clearance over Highways and Railways.

AIRPORT LAYOUTS, VISUAL AIDS, AND AIR TRAFFIC CONTROL

Airport Layouts – Parking and Circulation Pattern–Airport Buildings – Primary functions, Planning Concept, Principles of Passenger Flow, Passenger Facilities – Visual Aids – Runway and Taxiway Markings, Wind Direction Indicators, Runway and Taxiway Lightings – Air traffic control – primary functions, Air traffic control network.

HARBOUR AND DOCKS ENGINEERING

Classification of Harbour, Components of Harbour – Classification of Docks – Mooring accessories – Navigational Aids – Coastal Protection Structures - Waves and their actions on Coastal structures – Classifications of Coastal Regulation Zones.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Design the geometric elements for railway track and airport runway in different layouts.	Apply
CO2 Establish the functions of harbour components and coastal protection structures.	Apply
CO3 Present a case study on the design and amenities of an Indian airport.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Subramaniam K.P., “Railway, Airport and Harbour Engineering”, Scitech Publications (India) pvt Ltd. Chennai, 2018.

T2. Subhash C. Saxena, “Airport engineering Planning and Design”, CBS publications, New Delhi, 2020.

Reference Book(s):

R1. Saxena, S.C. Arora, S. P. “A text book of Railway Engineering”, Dhanpat Rai & Sons, New Delhi, 2015.

R2. Horonjeff, R. Mckelvey, F. X. “Planning & Design of Airports”, McGraw hill, New York, 2010.

R3. Gautam H. Oza, Hasmukh P. Oza, “Dock & Harbour Engineering”, Charotar Publishing House Pvt. Ltd, 2017.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce81

Course Code: 23CEE035		Course Title: ARCHITECTURE AND TOWN PLANNING	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on evolution of Western and Indian architecture, principles of design and town planning, focusing on historical, cultural and modern architectural practices, key architects and urban planning concepts.

Module I **25 Hours**

PRINCIPLES OF ARCHITECTURAL PLANNING AND DESIGN

History of Architecture- Western architecture: Egyptian, Greek, Roman architectures, Indian Architecture: Vedic age, Indus valley civilization – Buddhist period: Stambas, Stupa, Roranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan styles – Temple of Aihole, Madurai, Bhuvaneshwar, Mount Abu.

Principles of designing- Composition of plan – Relationship between plan and elevation – building elements, form, surface texture, mass, line, color, tone – Principles of Composition: Unity, contrast, proportion, scale, balance, circulation, rhythm, character, expression.

Principles of residence planning – Post classic architecture: Introduction, contribution of eminent architects to modern period- Laurie Baker, Charles Correa, B.V.Doshi, Edward Lutyens, Le Corbusier, Frank Lloyd Wright, Walter Gropius

Module II **20 Hours**

HISTORICAL BACKGROUND OF TOWN PLANNING

Town planning in India – Town plans of mythological Manasa – Ancient town plans: Harappa, Mohenjodaro, Pataliputra, Delhi, Acropolis, Jerusalem, Mecca, Rome, London.

MODERN TOWN PLANNING

Components of planning – Surveys and maps – Neighbourhood planning – Planning standards – New town planning – National and regional planning – Town planning and legislation – garden cities and satellite towns – skyscrapers.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply architectural styles, design principles and contributions of key architects in history and modern planning.	Apply
CO2: Apply town planning concepts for historical, modern and regional urban planning and development.	Apply
CO3: Prepare a case study of historical and modern architectural styles, applying design principles to real-time contexts.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-	2	-
CO3	3	-	1	-	-	-	-	-	3	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. G. K. Hiraskar, “The Great Ages of World Architecture” (With Introduction to Landscape Architecture) (2018-2019), Session Paperback-1 January 2018

T2. G. K. Haraskar, “Fundamentals of Town Planning”, Dhanpat Rai Publishing Co Pvt Ltd, 2018.

Reference Book(s):

R1. Hepler Drafting and Design for Architecture, Cengage Learning, 2012.

R2. John Patten Guthrie, Architecture’s Portable Handbook, Mc Graw Hill International Publications, 2010.

R3. R. S. Deshpande, Modern Ideal Homes for India, United book corporation digital library India, 2017.

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_ar13/
2. https://nptel.ac.in/courses/124/105/124105001/
3. https://nptel.ac.in/courses/124/106/124106009/

Course Code: 23CEE036		Course Title: PAVEMENT ENGINEERING	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to provide knowledge on design of rigid and flexible pavements using IRC codal provisions and to assess the quality and serviceability conditions of roads.

Module I **25 Hours**

PAVEMENT MATERIALS AND SUBGRADE ANALYSIS

Pavement as layered structure – Pavement types - Rigid and Flexible-Subgrade analysis- Stress and deflections in pavements- Pavement Materials and Testing- Modified Binders.

DESIGN OF FLEXIBLE PAVEMENTS

Factors influencing design of flexible pavement – Methods for Flexible Pavement Design: Empirical, Mechanistic empirical and theoretical methods – Design procedure as per IRC guidelines

DESIGN OF RIGID PAVEMENTS

Factors influencing CC pavements – Modified Westergaard approach – Design procedure as per IRC guidelines.

Module II **20 Hours**

PAVEMENT CONSTRUCTION, EVALUATION AND MAINTENANCE

Construction Techniques of Flexible and Rigid pavement - Pavement Evaluation – Causes of distress in rigid and flexible pavements – Evaluation based on Surface Appearance, Cracks, Patches and Pot Holes, Undulations, Raveling, Roughness, Skid Resistance - Structural Evaluation by Deflection Measurements - Pavement Serviceability index - Pavement maintenance as per IRC Recommendations

STABILISATION OF PAVEMENTS

Stabilisation with special reference to highway pavements - Choice of stabilisers -Testing and field control – Stabilisation for rural roads in India - use of Geosynthetics (geotextiles & geogrids) in roads.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Design flexible pavement as per IRC codes.	Apply
CO2 Design rigid pavement as per IRC codes.	Apply
CO3 Present a case study on the existing highway road pavement construction and maintenance routines.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Kadiyali, L.R., “Principles and Practice of Highway Engineering”, Khanna Publications, New Delhi, 2019.

T2. Croney, D., Design and Performance of Road Pavements, HMO Stationary Office, 1993.

Reference Book(s):

R1. Design and Specification of Rural Roads (Manual), Ministry of rural roads, Government of India, New Delhi, 2001.

List of Code Books:

1. Guidelines for the “Design of Flexible Pavements”, IRC:37 - 2018, The Indian roads Congress, New Delhi.

2. Guideline for the “Design of Rigid Pavements for Highways”, IRC:58 - 2015, The Indian Roads Congress, New Delhi.

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ce66
2. https://nptel.ac.in/courses/105105107

Course Code: 23CEE037		Course Title: TRAFFIC ENGINEERING AND MANAGEMENT	
Course Category: ELECTIVE		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course aims to impart knowledge on traffic systems, their challenges, and methods for planning, managing, and controlling transportation.

Module I **22 Hours**

TRAFFIC SURVEY AND ANALYSIS

Traffic characteristics: Human, vehicular, and Pavement Characteristics - Presentation of traffic volume data, Annual Average Daily Traffic, Average Daily Traffic, Design hourly traffic volume - Spot speed, presentation of spot speed data, Speed and Delay Studies, Methods Of Conducting Spot Speed Studies and Speed and Delay studies - 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.

TRAFFIC FLOW AND ROADWAY CAPACITY

Traffic Flow Characteristics – Basic traffic manoeuvres, Traffic stream flow characteristics, Relations between Speed, Flow and Density - 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 guidelines.

Module II **23 Hours**

COST – EFFECTIVE TRAFFIC MANAGEMENT TECHNIQUES

Regulatory Techniques for Traffic System Management: One Way Street, Reversible Street, Reversible Lane, Turning Moment Restrictions, Closing Streets - Traffic Control Devices: Traffic Signs, Road Markings, Traffic Signals, Miscellaneous devices - Traffic Segregation - 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.

DESIGN OF PARKING AND PEDESTRIAN FACILITIES AND CYCLE TRACKS

Parking: Needs, Classification, ill effects, Standards - 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, Standards.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1 Apply engineering principles to conduct traffic surveys, identify and address related challenges, and align the results with established standards.	Apply
CO2 Implement various traffic management measures to address demand, including pricing strategies and Intelligent Transportation System (ITS) applications.	Apply
CO3 Prepare and present a poster presentation on existing types of control and regulatory measures to meet an efficient traffic network.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	-	-	-	-	-	-
CO2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	3	-	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Kadiyali, L.R., Traffic Engineering & Transport Planning, 9th edition, Khanna Publishers, New Delhi, 2021.

T2. Jotin Khisty, S.C. and Kent Lall B., Transportation Engineering – An Introduction, 3rd edition, Prentice-Hall, NJ, 2009.

T3. Saxena S.C., Traffic Planning And Design, Dhanpat Rai Publishers, New Delhi, 2019.

Reference Book(s):

R1. Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co. 2016.

R2. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Publishing. Co., 2018.

R3. Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall, 2005.

Web References:

1. https://onlinecourses.nptel.ac.in/noc23_ce29
2. https://www.civil.iitb.ac.in/tvm/nptel/ceTseLn

Course Code: 23CEE038		Course Title: HOUSING PLANNING AND MANAGEMENT	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on concepts in housing, national policies, sustainable practices, housing programs, project formulation, construction techniques and evaluation methods for effective and affordable housing solutions.

Module I **22 Hours**

HOUSING PROGRAMME AND SLUM HOUSING POLICIES

Introduction to housing - 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.

Housing Programmes - Basic Concepts, Contents and Standards - Sites and Services, Neighborhoods- Plotted land development programs, Open Development Plots, Apartments, Gated communities, Townships, Rental Housing, Co-operative 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.

Module II **23 Hours**

HOUSING PROJECTS AND FINANCE

Formulation of Housing Projects - Land Use and Soil suitability analysis -Building Byelaws and Rules and Development Control Regulations - Site Analysis, Layout Design, Design of Housing Units (Procedure) - Housing Project Formulation.

New Constructions Techniques - Cost Effective Modern Materials and methods of Construction- Green building concept- Building centres - concept, function and performance evaluation.

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.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply housing concepts, policies and sustainable strategies in real-world projects.	Apply
CO2: Apply housing project formulation, design procedure, construction techniques, sustainability principles and financial analysis.	Apply
CO3: Prepare real-time case studies on housing theories, policies, project formulation and sustainability.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	2	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	2	-	-	-	-	-	2	-
CO3	3	-	1	-	-	-	-	-	3	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Meera Mehta and Dinesh Mehta, “Metropolitan Housing Markets”, Sage Publications Pvt. Ltd., New Delhi, 1999.

T2. Francis Cherunilam and Odeyar D Heggade, “Housing in India”, Himalaya Publishing House, Bombay, 1997.

Reference Book(s):

R1. Wiley- Blackwell, “Neufert Architects” Data, 4th Edition, Blackwell Publishing Ltd, 2012

R2. Donald Watson and Michael J.Crosbie, “Time Saver Standards for Architectural Design”, 8th Edition, Tata McGraw Hill Edition, 2011

R3. Walter Martin Hosack, “Land Development Calculations”, McGraw Hill 2nd Edition, USA 2010

Web References:

1. https://onlinecourses.nptel.ac.in/noc20_ar14/
2. https://mohua.gov.in/upload/uploadfiles/files/MBBL
3. https://www.indiacode.nic.in/bitstream/123456789/1709/1/195696

Course Code: 24CEXXX	Course Title: Intelligent Transport System		
Course Category: Professional Elective		**Course Level: Intermediate**	
L:T:P(Hours/Week) - 3:0:0	**Credits: 3**	**Total Contact Hours:45**	**Max Marks: 100**

Course Objectives:

To learn the fundamentals of ITS, its functional areas and to have the overview of ITS implementation in developing countries.

Module I	**22 Hours**

INTRODUCTION TO INTELLIGENT TRANSPORT SYSTEM

Introduction to Intelligent Transportation Systems (ITS) -Definition – Role and Responsibilities – Advanced Traveller Information System – Fleet Oriented ITS Services – Electronic Toll Collection – Critical issues – Security – Safety.

ITS ARCHITECTURE AND HARDWARE

Architecture – ITS Architecture Framework – Hardware Sensors – Vehicle Detection – Techniques – Dynamic Message Sign – GPRS – GPS.

Module II	**23 Hours**

ADVANCED TRANSPORT MANAGEMENT SYSTEM

Video Detection – Virtual Loop - Cameras - ANPR – IR Lighting – Integrated Traffic Management – Control Centre – Junction Management Strategies- ATMS – Advanced Traveler Information Systems (ATIS)- Route Guidance – Issues -– Historical – Current – Predictive Guidance – Data Collection – Analysis – Dynamic Traffic Assignment (DTA) – Components – Algorithm.

ADVANCED TRAVELLER AND INFORMATION SYSTEM

Travel Information – Pre Trip and Enroute Methods- Basic ATIS Concepts – Smart Route System – Data Collection – Process – Dissemination to Travelers – Evaluation of Information – Value of Information – Business Opportunities.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO 1: Apply knowledge on data collection using sensors and its applications.	Apply
CO 2: Apply the ITS in Transportation Planning & Management.	Apply
CO 3: Prepare a report using ITS for transport planning & management for a city.	Apply

TEXT BOOKS:

1. R. Srinivasa Kumar,"Intelligent Transportation Systems", Universities Press P Ltd, Telangana, 2022.
2. Sarkar, Pradip Kumar, Amit Kumar Jain, "Intelligent Transport Systems", PHI Learning,

REFERENCES:

1. Parul Agarwal, Syed Imtiyaz Hassan and Jawed Ahmed, "Intelligent Transportation System: A Complete Insight", IGI Global Publishing, 2020.
2. Asier Perallos, Unai Hernandez-Jayo, Enrique Onieva, and Ignacio Julio García Zuazola "Intelligent Transport Systems: Technologies and Applications"

Course Code: 23CEE040		Course Title: URBAN PLANNING AND DEVELOPMENT	
Course Category: Major – Professional Elective		Course Level: INTERMEDIATE	
L:T:P(Hours/Week) 3:0:0	Credits:3	Total Contact Hours: 45	Max Marks: 100

Course Objectives:

The course is intended to impart knowledge on urban planning concepts, theories, methodologies, standards and processes including the impacts of urbanization and to apply them in project formulation, evaluation and urban development planning.

Module I **22 Hours**

URBAN PLANNING PROCESSES

Definition of Human settlement, Urban area, Town, City, Metropolitan City, Megalopolis, Urbanisation, Urbanism, Suburbanisation, Urban sprawl, Peri-urban areas, Central Business District (CBD), Urban Agglomeration, Census definition of urban settlements, Classification of urban areas –Positive and negative impacts of urbanisation, - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)

Principles of Planning –Stages in Planning Process – Goals, Objectives, Delineation of Planning Areas, Draft Plans, Evaluation, Final Plan. Planning Theories - Garden City Concept, Geddesian Triad by Patrick Geddes, Modernism Concept by Le-Corbusier, Radbun Concept, Neighbourhoods, Theories of Ekistics, Bid-rent Theory by William Alonso, Green Belt Concept

Module II **23 Hours**

URBAN PLAN FORMULATION AND EVALUATION

Types of plans – Methodologies for the preparation of the Regional Plan, Master Plan, and Detailed Development Plan – ITS user needs and services and Functional area – 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.

Planning Standards, Project Formulation and evaluation; Project Report preparation and presentation; Legal, Financial and Institutional constraints – Problems due to multiple laws, rules and institutions; Financing of Urban Development Projects; Urban planning agencies and their functions in the plan formulation and implementation.

URBAN AND REGIONAL PLANNING LEGISLATIONS AND REGULATIONS

Town and Country Planning, Local Bodies and Land Acquisition Acts, Development and Building Rules, Site analyses, Layouts and Buildings Design.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Apply urban planning concepts, theories and methodologies to analyze and design sustainable urban development plans.	Apply
CO2: Apply planning methodologies, transportation systems, project formulation and evaluation to develop urban development plans.	Apply
CO3: Prepare a report on case study analysis of comprehensive urban development plans and strategies by applying urban planning theories, methodologies.	Apply

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	1	-	-	-	-	-	3	3	-	-	2	-

High-3; Medium-2;Low-1

Text Book(s):

T1. Goel, S.L Urban Development and Management, Deep and Deep publications, New Delhi 2002

T2. George Chadwick, A Systems view of planning, Pergamon press, Oxford 1978

Reference Book(s):

R1. Tamil Nadu Town and Country Planning Act 1971, and Rules made thereunder, Government of Tamil Nadu, Chennai

R2. Thooyavan, K.R., Human Settlements – A Planning Guide to Beginners, M.A Publications, Chennai, 2005

R3. Urban & Regional Development Plans Formulation & Implementation(URDPFI) Guidelines, Vol I & II, Jan 2015, Govt of India, Ministry of Urban Development

Web References:

1. https://onlinecourses.nptel.ac.in/noc24_ar08/
2. https://onlinecourses.nptel.ac.in/noc21_ar12/