Sardar Vallabhbhai National Institute of Technology

Teaching Scheme and Syllabus

for

Bachelor of Technology

In

Civil Engineering with Honors

Department of Civil Engineering

Code	Course Name	Scheme	Credi	Semester
1	Structural Dynamics and Earthquake Engineerin	3-1-0	4	4th
2	Occupational Health Safety and Environment	3-1-0	4	4th
3	Special Concrete	3-1-0	4	5th
4	Urban Design and Landscape Development	3-1-0	4	5th
5	Application of FEM in Structural Engineering	3-1-0	4	6th
6	Hydraulics of Alluvial rivers	3-1-0	4	6th
7	Design of Special Structures	3-1-0	4	7th
8	Environmental Ethics Law and Policy	3-1-0	4	7th
9	Project for Honors	0-0-4	2	7th

CE 266 Structural Dynamics and Earthquake Engineering

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

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

CO1	Determine response of a single degree of freedom system subjected to vibrations
CO2	Conduct vibration analysis of multi degree of freedom system problem
CO3	Describe about different elements of seismology
CO4	Calculate lateral load distribution on RCC buildings
CO5	Design Earthquake Resistant Buildings

2. Syllabus

- **THEORY OF VIBRATIONS (12 hours)**

  Characteristics of a dynamic problem; single degree of freedom (SDOF) systems; dynamic equation of motion, damped and undamped systems, free vibration tests to determine damping; response to harmonic loading; dynamic magnification factor, resonant response, forced vibration tests to determine damping, response to impulsive loads, approximate analysis of impulsive load response; response to general dynamic loading, Duhamel integral.

- **MULTIPLE DEGREE OF FREEDOM SYSTEM (08 hours)**

  Analysis of non-linear structural response, formulation of multi-degree-of-freedom (MDOF) systems, approximate methods for vibration analysis of MDOF systems; time history analysis, response spectrum analysis, equivalent static force method.

- **ELEMENTS OF SEISMOLOGY (06 hours)**

  Elements of Engineering Seismology - Causes of Earthquake, Plate Tectonic theory, Elastic rebound Theory, Characteristic of earthquake, Estimation of earthquake parameters, Magnitude and intensity of earthquakes.

- **LATERAL LOAD ON BUILDINGS (07 hours)**

  Lateral load on Buildings: Rigid diaphragm effect, Centre of mass and centre of stiffness, Torsional coupled and uncoupled systems, Distribution of lateral force for One storey and Multiple stories building

- **DESIGN METHODOLOGY FOR EARTHQUAKE RESISTANT BUILDING (12 hours)**

  Structural Configuration of Buildings: Structural Configuration for earthquake resistant design, Concept of plan irregularities, Soft storey, Torsion in buildings, Design provisions as per IS-1893. The effect of infill masonry walls on frames, Modelling concepts of infill masonry walls, Behavior of masonry building during earthquake, failure patterns.

(Total Lectures: 45 hours, Tutorials: 15 hours)

3. Tutorial

The theoretical questions and numerical will be given as assignment to the students based on theory topics

4. Books Recommended

1. Chopra, A.K., "Dynamics of Structures – Theory and Applications to Earthquake Engineering", 4th Edition, Pearson Education, 2011.
2. Agrawal Pankaj & Shrinkhande Manish, Earthquake Resistant Design of Structures 1st Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2004.
3. Ashok K.Jain, "Dynamics of Structure with MATLAB Applications", Pearson, 2017.
4. Paz Mario, "Structural Dynamics ", 2nd edition Tata MacGraw Hill inc., 2004.
5. Datta, T. K. "Seismic analysis of structures". John Wiley & Sons, 2010.

5. Mapping of COs and POs

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

-Not related 1-Low 2-Moderate 3-High

6. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	2	1	3
CO4	3	1	3
CO5	3	1	3

1-Low 2-Moderate 3-High

CE238 Occupational Health, Safety and Environment

L	T	P	C
3	0	0	3

1. Course Outcomes (COs

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

CO1	Being able to document and execute Health Safety and Environment (HSE) policy and Environmental Management Systems like ISO-14001, Environment Audit.
CO2	Interlinking productivity with better safety practices and healthy environment.
CO3	Safety management by applying knowledge of accident theories and HAZOP.
CO4	Identify the hazards in industrial operations & processes and propose prevention measures.
CO5	Apply professional safety & environmental management skills while performing jobs.

2. Syllabus

- **OCCUPATIONAL ERGONOMICS (06 Hours)**
  Ergonomics – Human-body – Health – Posture – Workplace or office ergonomics – Ergonomics for women at work – physical work and environment – Anthropometry.

- **OCCUPATIONAL HEATH (08 Hours)**
  Dynamics of major systems relevant to environmental and occupational health - Impacts of these systems and their dynamics on health - Work related stress – Causes of stress – Signs of stress – Measurement of stress – Stress management systems – Prevention – Stress health and productivity – Occupational Safety and Health Act (OSHA) – Health program – First Aid.

- **HAZARDS (06 Hours)**
  Introduction to chemical hazards - Dangerous properties of chemical, dust, gases, fumes, mist, vapours, smoke and aerosols - Routes of entry to human system - Recognition, evaluation and control of basic hazards - Concepts of dose response relationship - Bio-chemical action of toxic substances.

- **ACCIDENTS (06 Hours)**
  Types of Incident – Accident: Causation and prevention - Definition of Accidents, Classification of Accidents, need for the Analysis of Accidents, Methods Adopted for Reducing Accidents, Investigation of Accidents.

- **SAFETY MANAGEMENT (09 Hours)**

Emergency rescue equipment - Safety aids - First aid health care - Introduction to Hazard, Causes & Identification - Vulnerability analysis - Risk analysis - Evaluation & Control of Hazard - HAZOP Analysis - Failure mode effect analysis (FMEA) - Importance of training and education - Safety audit and inspection education – SHE policies.

- **ENVIRONMENTAL MANAGEMENT (10 Hours)**
  Environmental pollution - causes, effects and control measures of air, water, noise and soil pollution – EIA: purpose, procedure and benefits – Environmental Audit – Life Cycle Analysis – ISO-14001 - Corporate Environmental Responsibility – Environment, Social & Governance.

(Total Lectures: 45 hours)

3. Books Recommended

1. R E Levitt and N M Samelson, "*Construction Safety Management*", John Wiley and Sons, New York, 1993.
2. Anupama Prashar & Bansal, "*Industrial Safety and Environment*", S.K. Kataria & sons, New Delhi, 2005.
3. H Lingard and S M Rowlinson, "*Occupational Health and Safety*" Routledge, Oxford, 2004.
4. C D Reese and J V Eidson, "*Handbook of OSHA Construction Safety and Health*", CRC Press, New York,2006.
5. R. K. Jain and Sunil S. Rao , "*Industrial Safety , Health and Environment Management Systems*", Khanna Publishers, New Delhi (2006)

2. Mapping of COs and POs

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

-Not related 1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	1	0	3
CO2	1	0	3
CO3	2	1	2
CO4	2	1	3
CO5	3	2	3

0-Not related 1-Low 2-Moderate 3-High

CE369 Special Concrete

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

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

CO1	Assess the role of cement chemistry in determining concrete properties such as strength and durability
CO2	Evaluate the effects of chemical admixtures on the rheology and performance of concrete, such as workability, setting time, and shrinkage
CO3	Develop and design high-strength concrete, ultra-high-performance concrete (UHPC), self-compacting concrete (SCC), lightweight, and high-density concrete based on project-specific requirements.
CO4	Propose sustainable solutions in concrete design through the use of mineral and chemical admixtures.
CO5	Demonstrate the ability to optimize concrete mix designs for different structural and environmental conditions

2. Syllabus

- **INTRODUCTION TO CONCRETE (06 Hours)**
  Cement chemistry – Role in concrete, Cement composition, types of cement, impact of Cement types on Concrete performance, Cement production and properties, hydration of Cement and its effect on Concrete, Concrete performance – strength and durability.

- **ADMIXTURES IN CONCRETE (09 Hours)**
  Introduction to admixtures in concrete – importance, classification, dosage, practical applications and case studies, Chemical Admixtures – Water reducers, Set controllers, Air entraining agents, Viscosity modifying agents, Shrinkage reducing admixtures, & Other specialty admixtures
  Mineral Admixtures – classification, pozzolanic activity, Fly ash, Silica fume, GGBFS, Metakaolin, LC3, agricultural ashes.

- **SPECIAL CONCRETES 1 (09 Hours)**
  High strength concrete – characteristics, mechanical properties, performance, applications of HSC, case studies, Ultra High-Performance Concrete – characteristics, importance, historical development, applications in modern construction.

- **SPECIAL CONCRETES 2 (09 Hours)**
  Self-Compacting Concrete - characteristics, mechanical properties, performance, applications of SCC, Mass Concreting - characteristics, mechanical properties, performance, applications, challenges and innovations, Concrete for 3D printing –

introduction, materials, techniques, mechanical properties.

- **SPECIAL CONCRETES 3 (09 Hours)**
  Light Weight Concrete - characteristics, materials used, mechanical properties, performance, applications, benefits, history, case studies, High Density Concrete - characteristics, materials used, mechanical properties, performance, applications, benefits, history, case studies.

- **SPECIAL CONCRETES 4 (03 Hours)**
  Applications, future trends.

(Total Lectures: 45 hours, Tutorials: 15 hours)

3. Tutorials:

Tutorials will be based on the above curriculum which will give the field exposure to students.

4. Books Recommended

1. Neville A.M, "Properties of Concrete" Pearson Education Asia, 2016
2. P. Kumar Mehta, Paul J.N. Monterio, CONCRETE: Microstructure, Properties and Materials", Tata McGraw Hill, 2018
3. A. R. Santhakumar, (2021) "Concrete Technology" Oxford University Press, New Delhi, 2021
4. M L Gambhir "Concrete Technology" TMH. Publishing house, 2018
5. Short A and Kinniburgh. W, "Light Weight Concrete" Asia Publishing House, 2006

5. Mapping of COs and POs

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

1-Low 2-Moderate 3-High

6. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	1	1	3
CO3	2	3	1
CO4	2	1	3
CO5	1	2	3

1-Low 2-Moderate 3-High

CE347 URBAN DESIGN & LANDSCAPE DEVELOPMENT

L	T	P	C
3	0	0	3

1. Course Outcomes (COs)

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

CO1	Understand the components of Urban Design.
CO2	Understand the concept of Landscape Planning in urban context.
CO3	Implement sustainable and balanced urban planning with beauty, convenience and health with the use of dynamic architectural techniques.
CO4	Design using strategies like concept planning, designing, development; zoning by function tobalance urban area.
CO5	Develop Revenue generation techniques.

2. Syllabus

- **SCOPE AND OBJECTIVES OF URBAN DESIGN (04 Hours)**

  Its relation with architecture and urban planning, scale of various urban design projects, regional and city level, urban design survey, inventories, techniques/approaches to urban design. Concepts and theories in landscape architecture/city planning urban design in the historical perspective, origin of forms, organization of space, relationship of activity with buildings.

- **BEHAVIORAL ISSUES IN URBAN DESIGN (04 Hours)**

  Principals of urban spatial organization, urban scale, urban spaces, urban massing, quality of urban enclosure. Image ability, townscape and elements of urban design (Gordon, Cullen, Kevin Lynch) Urban conservation with historic preservation and integrated approach to conservation, urban renewal, its purpose, economics and planning issues.

- **URBAN DESIGN AT MICRO LEVEL (06 Hours)**

  Campus planning, city centers, transportation corridors, residential neighborhood, water fronts. Urban landscape in relation to topography.

- **DEVELOPMENT CONTROL GUIDELINES (06 Hours)**

  Zoning, Historical examples of urban design projects. Evaluation/ feasibility study of urban design projects.

- **OBJECTIVES AND SCOPE OF LANDSCAPE PLANNING (06 Hours)**

  Behavioral issues landscape design, principles and aesthetic theory in landscape

design, Land from design and elements of geomorphology, hydrology, paedology, drainage in landscape planning. Spatial organization of selected cities, emphasizing landscape assessment.

Site and resources inventory Methods, analyses and appraisal, landscape suitability analysis, Plant characteristics and planting design, environmental factors in landscape planning.

- **OUTDOOR RECREATION AND TOURISM (02 Hours)**

  Planning and design issues.

- **LANDSCAPE PLANNING (08 Hours)**

  Urban and regional level open spaces, residential neighborhoods, urban roads and regional highways, coastal area landscape planning. Landscape Urbanism, sustainable landscape, streetscape Waterfronts, evolution of different landscape philosophies.

- **OPEN SPACE SYSTEM (06 Hours)**

  Concept for opens space and park system in urban area. Open space development in urban design context. Evolution of Public Park as a major component of urban landscape. Open space development in new towns. Park systems, water fronts. Green infrastructure. Urban ecology, urban water sheds.

- **EVALUATION PROCESS IN LANDSCAPE PLANNING (03 Hours)**

  Critical appraisal of historical examples of landscape plans. Relevance of Social forestry in urban and regional landscape planning.

(Total Lectures: 45 Hours)

3. Books Recommended

1. Paul, Spreiregen D., "Urban Design: The Architecture of Town and Cities", New York: McGraw HillBook Company,2020.
2. Shimizu H. and Murayama A., "Clinical Environmental Approaches in Landscape Planning", Urbanand Landscape Perspectives, 2014.
3. John.F., "Urban Landscape Design",Teneues Media Gmbh& Co, 2008.
4. Grazia.C, "Human Smart Cities: Rethinking the Interplay between Design and Planning", Springer, 2018.
5. Nigel D. "The Dynamic Landscape: Design, Ecology and Management of Naturalistic Urban Planting",Taylor & Francis.

4. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	2	2	2	3	3	2	3	2
CO2	2	1	1	1	3	1	0	1	2	2	1	1
CO3	3	1	2	3	3	1	1	2	3	3	2	2
CO4	2	2	2	2	3	1	1	1	3	2	2	1
CO5	1	1	1	1	2	2	2	2	2	2	1	1

0-Not related 1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	3
CO2	3	2	3
CO3	3	3	3
CO4	3	2	2
CO5	3	2	3

0-Not related 1-Low 2-Moderate 3-High

CE 396 Application of FEM in Structural Engineering

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

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

CO1	Understand the fundamental concepts and principles underlying finite element (FE) analysis
CO2	Derive the formulas for different FE elements based on Cartesian coordinate system.
CO3	Evaluate the formulas for different FE elements (including special) based on Natural coordinate system.
CO4	Identify the appropriate elements for meshing and obtain a converged-optimised solution for structural applications.
CO5	Create 1D, 2D, and 3D FE models to determine displacements, strains, stresses and design quantities

2. Syllabus

- **INTRODUCTION (05 hours)**

  Matrix algebra, Fundamentals of continuum mechanics, Stresses displacements and strains in solids. Classical and numerical methods, Finite difference method (FDM) and finite element method (FEM), basics and historical development of FEM, Plane stress and plane strain concepts.

- **CLASSICAL METHODS FOR FE ANALYSIS (07 hours)**

  Beam and frame elements, Overview of Direct stiffness-matrix method, Formulations for Potential energy and Rayleigh-Ritz methods.

- **CARTESIAN COORDINATE BASED FORMULATIONS (14 hours)**

  Formulation for Line (1D) elements: spring and bar element, formulation for Shell (2D) elements: triangular and quadrilateral, Formulation for 2D axisymmetric element, Formulation for solid (3D) elements: tetrahedral and hexahedral, Polynomial functions and their feasibility, Lagrangian Interpolation functions.

- **NATURAL COORDINATE BASED FORMULATIONS (12 hours)**

  Isoparametric Formulation for Line (1D), Shell (2D) and solid (3D) elements, Natural Shape functions, formulations, Numerical Integration: Gauss Quadrature.

- **ASSEMBLY AND FEM BASED SOLUTION TECHNIQUES (04 hours)**

  Selection of appropriate elements, Meshing and its refinement, Practical considerations, convergence requirements, expected errors.

- **SPECIAL ELEMENTS (03 hours)**

  Overview of Infinite elements, Joint elements, Serendipity elements, Transition elements

(Total Lectures: 45 Hours)

- **TUTORIAL: STRUCTURAL APPLICATIONS (08 hours)**
  Linear Analysis of Spring assemblies, Trusses, Beams, Frames, Heat transfer and Thermal stresses, Vibration and Buckling.

- **TUTORIAL: COMPUTER-AIDED FINITE ELEMENT ANALYSIS (07 hours)**
  Pre-processing and Post-processing, Modeling of structural components and assemblies using 1D, 2D and 3D elements, Linear and Non-Linear Analysis considering material and geometric nonlinearities.

(Total Tutorials: 15 Hours)

3. Books Recommended

1. Desai YM, Eldho TI, Shah AH, Finite Element Method with Applications in Engineering, Pearson Education India, New Delhi, 2011.
2. Hutton DV, Fundamentals of Finite Element Analysis, McGraw-Hill, New Delhi, 2017.
3. Logan DL, A First Course in the Finite Element Method, Cengage-Learning, New Delhi, 2012.
4. Reddy JN, An Introduction to the Finite Element Method, McGraw-Hill, New Delhi, 2017.
5. Zienkiewicz OC, Taylor RL and Zhu JZ, The Finite Element Method Its Basis and Fundamentals, Elsevier, Amsterdam, 2013.

4. Mapping of COs and POs

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

-Not related 1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	1	3
CO3	3	1	3
CO4	2	1	2
CO5	3	3	3

1-Low 2-Moderate 3-High

CE 368 HYDRAULICS OF ALLUVIAL RIVERS

L	T	P	C
3	1	0	4

1. Course Outcomes (COs)

At the end of the Course the students will be able to:

CO1	Classify and estimate bed forms and flow resistance in alluvial rivers
CO2	Estimate incipient motion conditions and sediment loads in alluvial rivers
CO3	Design of lined and unlined channels using sediment transport concepts
CO4	Analyse Hydraulic geometry of Alluvial Rivers
CO5	Predict bed level variations in alluvial rivers

2. Syllabus

- **PROPERTIES AND INCIPIENT MOTION OF SEDIMENTS (6 Hours)**

  Nature of sediment problems, Origin and formation of sediments, individual and bull properties of sediments, competent velocity, lift force and critical tractive stress concep on cohesion less and cohesive soils; regimes of flow.

- **FLOW RESISTANCE (5 Hours)**

  Resistance to flow in alluvial streams, resistance relations based on total resistance and division of resistance into grain and form resistance, preparation of stage discharge curves for alluvial streams, velocity distribution in alluvial channel, sedimen Petrography (Sediment sampling)

- **BED LOAD TRANSPORTATION (08 Hours)**

  Bed load computation by empirical equations, dimensional considerations and sem theoretical equations for uniform and non-uniform sediments, saltation.

- **SUSPENDED LOAD TRANSPORTATION (07 Hours)**

  Mechanism of suspension, general equations of diffusion. Integration of sedimen distribution equation, Differences between actual and theoretical exponents, predictio of reference concentration, Method of integrating curves of concentration and velocity Simple relations for suspended load, Effect of temperature on suspended load, Wash load, Non-equilibrium transport of suspended load, Computation of total loads.

- **STABLE CHANNEL DESIGN (07 Hours)**

  Design of lined and unlined channels for carrying clear and sediment laden water.

- **ALLUVIAL RIVER MODELS** **(12 Hours)**

  Hydraulic geometry of alluvial streams, bed level variation of alluvial streams aggradations and degradation models, reservoir sedimentation, local scours.

[Total Hours: 45 Hours, Tutorial: 15 hours]

3. References

1. Shen, H. W.,"River Mechanics", Vol. I & II, Water Resources Publication, Colorado, 1971.
2. Garde, R. J., and Ranga Raju, K. G., "Mechanics of Sediment transportation and Alluvial Stream Problems", New Age International (P) Limited, New Delhi, 2000 (Third edition).
3. Garde, R. J., "River Morphology", New Age International Publisher, New Delhi, 2006.
4. Raudkivi, A. J., "Loose boundary hydraulics", Pergamon Press, Oxford (U. K.), 2nd edition, 1976.
5. Yalin, M.S., "Mechanics of Sediment Transport", Pergamon Press, Oxford (U K), 1977.

4. Mapping of COs and POs

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

1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	2	1	2
CO3	2	2	2
CO4	1	3	3
CO5	1	3	2

1-Low 2-Moderate 3-High

CE 485 Design of Special Structures

L	T	P	C
3	1	0	4

1. Course Outcomes (COs):

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

CO1	Understanding the basic principles and background for structural design and its practica applications.
CO2	Design concept and techniques of special reinforced concrete structures and members
CO3	Design and evaluation techniques of steel space structures with grid systems
CO4	Design of composite bridge with IRC loading conditions, including culvert systems
CO5	Design of reinforced concrete and steel members for fire resistance as per codes and standar practices

2. Syllabus

- **FIRE RESISTANCE DESIGN OF RC MEMBERS** **(12Hours)**
  Introduction - Standard heating conditions - Effect of temperature on steel and concrete properties - Fire resistance design from codes and standard practices i.e., NBC, ACI, ASCE, EU, AU – Design concepts - Performance-based desigı RC beam and column.

- **DESIGN OF OVERHEAD SERVICE RESERVOIRS** **(12Hours)**
  Introduction - Types of overhead reservoirs – Circular, Intz, Conical funnel shaped tank.

- **DESIGN OF SPACE STRUCTURES** **(12Hours)**
  Space structure principle and practice - Type of space structures - Single and multi-layer grids - Approximate Evaluation - Design of space frame members.

- **DESIGN OF COMPOSITE BRIDGE SUPERSTRUCTURES** **(09Hours)**
  Introduction - Composite bridge girder – Composite action – Shear connectors - Design requirements - Composite transformed section

[Total Theory Hours: 45]

3. Tutorial

- Assignment for designing a special structure on a given syllabus. **(15 Hours)**
- Computer-aided modeling, analysis, and design practices.

[Total Theory Hours: 15]

4. Recommended Books

1. Venkatesh K R Kodur and M Z Naser, “Structural Fire Engineering”, McGraw Hill; 1st edition, 2020.
2. Krishna Raju N. “Design of Bridges” – Oxford IBH Publication House, New Delhi, 2006.
3. Subramanian Narayanan, “Space Structures: Principle and Practice” Multi-Science Publishing Co. Ltd., 5 Wates Way, Brentwood, Essex CM15 9TB, UK.
4. Varghese, P. C., “Advanced reinforced concrete design”, 2nd Edition, PHI Learning Private Limited, New Delhi, 2009.
5. Punmia, B. C., Jain, A. K., and Jain, A. K., “Comprehensive Design of Steel Structures,” 2nd Edition, Laxmi Publications Private Limited, New Delhi, 2009.

5. Mapping of COs and POs

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

6. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	1	3
CO3	3	1	3
CO4	2	1	2
CO5	3	3	3

1-Low 2-Moderate 3-High

CE475 Environmental Ethics, Law and Policy	L	T	P	C
	3	1	0	4

1. Course Outcomes (COs)

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

CO1	Analyse local and global environmental impact issues.
CO2	Explain the significance of environmental ethics in today scenario.
CO3	Analyse different national environmental policy and guidelines.
CO4	Explain the concepts of environmental auditing, monitoring and reporting.
CO5	Evaluate important Indian and global environmental protection acts and protocols.

2. Syllabus

- **CURRENT PERSPECTIVES OF ENVIRONMENTAL PROTECTION (06 Hours)**

  Present perspectives on practical environmental issues; Current practices of environmental solutions through engineering, technology, legislation etc; Need for environmental ethics in today's scenario; Introduction to Environmental Ethics; Pollution - the scientific vs. philosophical view

- **ENVIRONMENTAL MANAGEMENT (09 Hours)**

  Moral Psychology, the environment and ethics; Religious and cultural views; ethics and law; Important Indian environmental legislation and acts such as Water Act-1974, Air Act-1981; Important rules under Environment Protection Act (EPA) – 1986 such as Biomedical Waste Rules-1998, EIA Rules-1994, Coastal Regulation Zone-1999, Municipal Solid waste rules, Hazardous Waste Rules-2008 etc.

- **ENVIRONMENTAL POLICY (10 Hours)**

  Sustainability and sustainable development; Environmental management plan; Disaster management; Environmental Audit; Life cycle assessment; National environmental policy; Beyond environmentalism and sustainability issues.

- **INTERNATIONAL ISSUES AND ETHICS AND LAWS (10 Hours)**

  Solution of international global and local issues through environmental ethics; Ethics & Social Responsibility; Global Ecology and the Shadow of Development; The Global Ecological Crisis; Holistic Environmental Ethics; Towards Global Justice and Planetary Health International environmental laws and protocols such as Stockholm Conference,

Montreal Protocol, Rio Earth Summit, Kyoto Summit; Role of UN authorities in protection of global environment; Global environmental issues and environmental laws to control global warming, ozone depletion, acid rain, hazardous waste.

- **ENVIRONMENTAL POLICY (05 Hours)**

National Environmental policy; environmental guidelines and regulations; environmental auditing, monitoring and reporting, environmental labeling studies by Central / State bodies; theory of corporate strategies; beyond environmentalism and sustainability issues.

(Total Lectures: 45 hours)

3. Books Recommended

1. G Singh, Environmental law in India, Macmillan India, New Delhi, 2005.
2. K Thakur, Environmental protection law and policy in India, Deep and Deep publishers, New Delhi, 1997.
3. Relevant MoEF Notifications and CPCB / GPCB Acts & Rules.
4. H Rolston, A New Environmental Ethics: The Next Millennium for Life on Earth, Routledge, London, 2011.
5. P Pojman and L P Pojman, Environmental Ethics, Cengage Learning, New York, 2011.

4. Mapping of COs and POs

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

0-Not related 1-Low 2-Moderate 3-High

5. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	1	0	3
CO2	1	0	3
CO3	2	1	2
CO4	2	1	3
CO5	3	2	3

0-Not related 1-Low 2-Moderate 3-High

CE 499 Project for Honors

L	T	P	C
0	0	4	2

1. Course Outcomes (COs)

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

CO1	Identify problems that have relevance to the current industrial needs and be aware about current innovative practices and technology.
CO2	Conduct literature survey in the chosen field and discover research gap from the existing literature.
CO3	Apply various engineering and management topics according to real site conditions
CO4	Identify the problems which can occur during the execution of the project and find solutions to the problems using various construction management tools and techniques.
CO5	Develop technical writing, presentation and communication skills.

2. Syllabus

Project is aimed at identification of the research area and formulation of the research objectives for a particular study. Students are expected to carry out independent research work on the chosen topic and submit duly computer typed reports, present and participate in subject wise group discussion. The work at this stage may involve extensive review of literature, identify research gaps, case study, identify research problems, field data collection and analysis and be aware of current technologies.

3. Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

-Not related 1-Low 2-Moderate 3-High

4. Mapping of COs and PSOs

	PSO1	PSO2	PSO3
CO1	3	3	3
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	3	3

-Not related 1-Low 2-Moderate 3-High