



**DEPARTMENT OF CIVIL
ENGINEERING**

Scheme of Courses and Syllabus

M. Tech

Structural Engineering

[Effective from the Session: 2017-18]

Course Subject Code	Title of Course	MARKS				CREDITS			
		Theory	Practical	Internal Assessment	Total Marks	L	T	P	Total
SEMESTER – I									
CE560	Dynamics of Structures	60	-	40	100	3	1	0	4
CE561	Bridge Engineering	60	-	40	100	3	1	0	4
CE580	Construction & Maintenance Management	60	-	40	100	3	1	0	4
CE563	Pre Stressed Concrete Structures	60	-	40	100	3	1	0	4
CE564	Advanced Structural Analysis	60	-	40	100	3	1	0	4
CE605	Lab-1	-	20	30	50	0	0	4	2
SEMESTER – II									
CE566	Plastic Analysis and Design of Steel Structures	60	-	40	100	3	1	0	4
CE568	Industrial Structures	60	-	40	100	3	1	0	4
CE578	Finite Element Methods	60	-	40	100	3	1	0	4
	Elective-I	60	-	40	100	3	1	0	4
	Elective-II	60	-	40	100	3	1	0	4
CE606	Lab-2	-	20	30	50	0	0	4	2
SEMESTER – III									
	Elective III	60	-	40	100	3	1	0	4
	Elective IV	60	-	40	100	3	1	0	4
CE611	Project	60	-	40	100	0	0	12	6
CE569	Seminar		-		100	4	0	0	4
SEMESTER – IV									
CE570	Dissertation				450	0	0	36	18
TOTAL CREDITS = 80									

Elective-I		Elective-II	
CE572	Advanced Foundation Engineering	CE602	Advance Concrete Technology
CE573	Probability Methods in Structural Engineering	CE603	Optimization Methods
CE601	Neural Networks and Fuzzy Logic		
Elective-III		Elective-IV	
CE604	Theory and Design of Plate and Shells	CE581	High Rise Buildings
CE579	Composite materials	CE582	Disaster Reduction and Management

CE- 560 DYNAMICS OF STRUCTURES

UNIT-I

Introduction, Systems with single degree of freedom (SDOF) Equation of motion – Analysis of free vibration-response to harmonic, impulsive, periodic and general dynamic loadings.

UNIT-II

Forced and free vibration response of MDOF damp and undamped discrete systems-equation of motion- evaluation of natural frequencies and modes – approximate methods overview of dynamics of continuous elastic systems-flexural beams-shear beams-columns, base excited system-formulation of equations for SDOF & MDOF systems-concepts of spectral quantities and response spectrum-fundamental of earthquake engineering.

UNIT-III

Computational and numerical methods-solution of eigen value problems mode superposition method and modal truncation errors-modal acceleration method, direct integration method-explicit and implicit methods.

Text Books:

1. Dynamics of Structures by Clough and Penzien
2. Mechanical Vibrations by G.K. Grover
3. Dynamics of Structures by Walter C. Hurty & Moshe F. Rubinsten

CE-561 BRIDGE ENGINEERING

UNIT-I

Introduction-definition and components of bridges. Layout and planning of bridges-classification, investigations for bridges, preliminary data collection, choice of type of the bridges, hydraulic design of bridges, traffic design of bridges.

UNIT-II

Analysis and design of superstructure of straight and curved bridge decks-loadings details, specification-reinforced concrete and steel decks. Decks of various types like slab, hollow and voided slab, beam and slam, box girder etc.

UNIT-III

Design of substructure-piers and abutments of different types. Analysis and design of foundations- shallow foundations (open Foundations), deep foundations- well foundations and caisson.

UNIT-IV

Design and constructional aspects of foundations. Modern methods of construction of concrete and steel bridges- their impact on the analysis and the design. Introduction to analysis and design of long span bridges like suspension and cable stayed bridges.

UNIT-V

Special aspects in analysis and design, based on construction methodology. Inspection and maintenance and rehabilitation of bridges.

Text Books:

1. Bridge Deck analysis by Pama & Gusens
2. Bridge deck behavior by Edward V. Hambly
3. Essentials of bridge engineering by D. Johnson Vector

CE580 CONSTRUCTION & MAINTENANCE MANAGEMENT

UNIT-I

Services in Residential, Commercial and Medical buildings
Sanitation, water supply, electric wiring, rain water disposal, lighting & illumination, calculation methods for these services ,Air Conditioning & Ventilation: Natural ventilation, control cooling systems, modern systems of air conditioning, ducting systems, different mechanical means of air conditioning.

UNIT-II

CCD-CS: General principles of transmission and passage of sound reverberation, absorption, reflection, acoustic materials and their co-efficiency, principles of good acoustic design.

UNIT-III

Thermal Insulation: Behavior of various building materials & thermal conductivity. Thermal insulation for air conditioned interior spaces, working out air conditioning loads for different spaces. Fire Safety Dye.

UNIT-IV

Architectural controls and building byelaws : Role of building byelaws in a city, local byelaws and architectural controls, façade control and zoning plans.

UNIT-V

Regional planning: Understanding of physical, social and economical parameters for regional planning.

UNIT-VI

Landscaping: Forces of man and nature, their relationship and effect on shaping landscape, site analysis, site and.

Text Book :

1. Building Construction by B.C.Punmia.
2. Building Construction by Sushil Kumar

CE-563 PRESTRESSED CONCRETE STRUCTURES

UNIT-I

Limit state design of statically determinate pre-stressed beams- limit state of collapse by flexure, shear, torsion limit state of serviceability. Anchorage zone stresses for post-tensioned members.

UNIT-II

Statically indeterminate structures- analysis and design- continuous beams and frames. Choice of profile, linear transformation, concordancy, omically viable profile. Composite beam with precast prestressed beams and cast in situ RC slab-analysis and design

UNIT-III.

Time dependant effects such as creep, shrinkage etc. on composite construction inclusive of creep relaxation and relaxation creep- partial prestressing principles, analysis and design of simple beams, crack and crack width calculations. Analysis and design of prestressed pipes, tanks and spatial structures-slabs, grids, folded plates and shells.

Text Books:

1. Prestressed concrete structures – Lundy.
2. Prestressed concrete – T.Y. Lin.
3. Prestressed concrete – N. Krishna Raju.

CE-564 ADVANCED STRUCTURAL ANALYSIS

UNIT-I

Matrix methods in skeletal structural analysis, force and displacement methods including analysis using substructures.

UNIT-II

Nonlinear analysis due to plasticity of frames, analysis of plates, folded plates and singly curved shells, conventional and approximate methods.

Text Books:

1. Analysis of framed structures- J.M.Gere and W.Weaver.
2. Computer programming and engg. analysis – I.C.Syal and S.P.Gupta.

CE-566 PLASTIC ANALYSIS AND DESIGN OF STEEL STRUCTURES

UNIT-I

Ductility of metals: Concept of plastic design, over loaded factors, ultimate load as design criteria.

UNIT-II

Hinge formation in indeterminate structures, Redistribution of moments, Assumption made for structures subjected to bending only.

UNIT-III

Minimum weight design : concept, assumptions , Design of frame with prismatic measures, Elements of linear programming and its application to minimum weight design problems.

UNIT-IV

Deflections: Assumption, calculation of deflection at ultimate loads, permissible rotations.

UNIT-V

Secondary design considerations: Influence of direct load, shear, local buckling, lateral buckling, repeated loading and brittle fracture on moment capacity design of eccentrically loaded columns.

UNIT-VI

Problem of incremental: collapse, shake down analysis.

UNIT-VII

Special consideration for design of structures using light gauge metals.

Text Books: 1.Steel Structure Design by S.K. Duggal

2.Theory of Structures by Dr. B.C. Punmia

CE568-INDUSTRIAL STRUCTURES

UNIT-I

Planning of industrial structures :Design of single and multibay industrial structure in steel.

UNIT-II

Bunker and silos in steel

UNIT-III

Liquid retaining structure in steel

UNIT-IV

Pressure vessels and chimneys in concrete

UNIT-V

Colling tower in concrete

UNIT-VI

Structural aspects/design of machine, foundation in concrete

Text Books:

1. Planing of industrial structure by C.W.Dunham
2. Structural engineers handbook
3. Design of steel structure by-S.K.Duggal

CE-578 FINITE ELEMENT METHODS

UNIT-I

Basic equations of solid mechanics-review of equilibrium conditions, strain – displacement relations, stress – strain relations, principles of virtual work and stationary potential energy and various formulations.

UNIT-II

Approximate methods Rayleigh, Ritz weighted residual (Galerkin) and finite difference methods.

UNIT-III

Finite element method: displacement model-shape functions Lagrange and Serendipity elements. Element properties-isoperimetric elements-numerical integration technique assemblage of elements and solution technique for static analysis.

UNIT-IV

zAnalysis of framed structures-2D & 3D truss and beam element and applications.

UNIT-V

Analysis of plane stress/strain and axis symmetric problems -triangular, quadrilateral and isoperimetric elements, Conforming and non conforming elements: formation of continuous problems ,Different solution techniques for linear and non linear problems, Finite element programming and FEA softwares are:ANSYS,ABACUS

Text Books:

1. Finite Element Analysis – Theory and Programming by Krishanmurthy, C.S.
2. Numerical Method in Finite Element Analysis by Bathe, K.J. & Wilson, E.L.

ELECTIVE-1

CE-572 ADVANCED FOUNDATION ENGINEERING

UNIT-I

Criteria for foundation choice, bearing capacity, total and differential settlement, tolerance for various types of structures, Interpretation of soil profile for design parameters like modulus of compressibility, modulus of sub grade reaction, Poisson ratio etc.

UNIT-II

Raft foundations for buildings and tower structures including effects of soil structure interaction and non-linearity, different types of rafts and , methods of analysis , precautions for construction of shallow foundations.

UNIT-III

Pile foundations, types, method of installation codal practices for permissible loads under vertical and lateral loads, Diaphragm walls, design and construction, foundations for heavy structures, well and caisson foundations, Equipment foundation subjected to dynamic loads.

UNIT-IV

Underground structures, strategies for instrumentation and monitoring of foundation performance.

Text Books:

1. Foundation analysis and design- Bowles, J.E.
2. Foundation engg- Pech, Hansen and Thornburn.



ELECTIVE-1

CE-573 PROBABILITY METHODS IN STRUCTURAL ENGINEERING

UNIT-I

Application of basic probability concepts and standard probability distributions of random phenomenon in civil engg. systems- statistic of extremes, statistical estimation of parameters from experimental data point estimators and interval estimators.

UNIT-II

Hypothesis testing of civil engg. models, elements of quality assurance- acceptance sampling by attributes and by variables- multistage sampling, decision analysis concepts of utility theory posterior analysis –preposterior analysis, elements of reliability theory, applications to design and operations of civil engg. systems.

Text Books:

1. Linear Programming- G.Hardley.
2. Linear Programming by L. S. Shrinath.

ELECTIVE-1

CE601 NEURAL NETWORKS AND FUZZY LOGIC

UNIT-I

Neural Networks Characteristics: History of Development in neural networks, Artificial neural net terminology, model of a neuron, Topology, Types of learning. Supervised, Unsupervised learning. Basic Learning laws, Hebb's rule, Delta rule, widrow and Hoff LMS learning rule, correlation learning rule instar and ouster learning rules.

UNIT-II

Unsupervised Learning: Competitive learning, K-means clustering algorithm, Kohonen's feature maps. Radial Basis function neural networks- recurrent networks, Real time recurrent and learning algorithm. Introduction to Counter propagation Networks- CMAC Network, ART networks, Application of NN in pattern recognition, optimization, Control, Speech and decision making.

UNIT-III

Fuzzy Logic: Basic concepts of Fuzzy logic, Fuzzy vs Crisp set, Linguistic variables, membership functions, operations of Fuzzy sets, Fuzzy if-then rules, Variables inference techniques, defuzzification techniques, basic Fuzzy inference algorithm, application of fuzzy logic , Fuzzy system design implementation , useful tools supporting design.

Text Books:

- 1.** Berkin Riza C and Trubatch, " Fuzzy System design principles- Building Fuzzy IF-THEN rule bases", IEEE Press.
- 2.** Yegna Narayanan, "Artificial Neural Networks". 8th Printing. PHI(2003)
- 3.** Patterson Dan W, "Introduction to artificial Intelligence and Expert systems", 3rd Ed., PHI
- 4.** Simon Haykin, "Neural Networks" Pearson Education.

ELECTIVE- 2

CE-602 ADVANCE CONCRETE TECHNOLOGY

UNIT - I

Importance of Bogue's compounds, Structure of a Hydrated Cement Paste, Volume of hydrated product, porosity of paste and concrete, transition Zone, Elastic Modulus, factors affecting strength and elasticity of concrete, Rheology of concrete in terms of Bingham's parameter.

UNIT - II

Chemical Admixture: Mechanism of chemical admixture, Plasticizers and super Plasticizers and their effect on concrete property in fresh and hardened state, Marsh cone test for optimum dosage of super plasticizer, retarder, accelerator, Air-entraining admixtures, new generation superplasticizer.

UNIT - III

Mineral Admixture: Fly ash, Silica fume, GCBS, and their effect on concrete property in fresh state and hardened state.

UNIT - IV

Mix Design: Factors affecting mix design, design of concrete mix by BIS method using IS10262 and current American (ACI)/ British (BS) methods. Provisions in revised IS10262-2004.

UNIT - V

Durability of concrete: Introduction, Permeability of concrete, chemical attack, acid attack, efflorescence, Corrosion in concrete. Thermal conductivity, thermal diffusivity, specific heat. Alkali Aggregate Reaction, IS456-2000 requirement for durability.

Text Books: 1. *Concrete Technology* by M.S.Shetty

2. *Advanced Reinforced Concrete Design* by N.Krishna Raju

ELECTIVE- 2

CE-603 OPTIMIZATION METHODS

UNIT-I

Basics of engineering analysis and design, Need for optimal design, formulation of optimal design problems, basic difficulties associated with solution of optimal problems, Classical optimization methods.

UNIT-II

Necessary and sufficient optimality criteria for unconstrained and constrained problems, Kuhn-Tucker conditions, Global optimality and convex analysis, Linear optimal problems, Simplex method, Introduction to Karmarkar's algorithm. Numerical methods for nonlinear unconstrained and constrained problems, sensitivity analysis, Linear post optimal analysis, sensitivity analysis of discrete and distributed systems.

UNIT-III

Introduction to variational methods of sensitivity analysis., shape sensitivity, Introduction to integer programming, dynamic programming, stochastic programming and geometric programming, Introduction to genetic algorithm and simulated annealing.

Text Books:

1. Kalyanmov Deb, Optimization for engineering design: Algorithms and examples, PHI Pvt Ltd, 1998.
2. J.S. Arora. Introduction to optimum design, McGraw Hill International editions 1989.
3. R.T. Hafta and Z. Gurdal, Elements of structural optimization, third revised and expanded edition. Kluwer academic publishers 1996.

ELECTIVE- 3

CE-579-COMPOSITE MATERIALS

UNIT-I

Fibre Reinforced Concrete: Properties of Constituent Materials, Mix Proportions, Mixing and Casting Procedures, Properties of Freshly mixed FRC, Mechanics and properties of Fibre reinforced concrete, Composite Material approach, Application of fibre reinforced concrete.

UNIT-II

Fly Ash Concrete: Classification of Indian Flyashes, Properties of Flyash, Reaction Mechanism, Proportioning of Flyash concretes, Properties of Flyash concrete in fresh and hardened state, Durability of flyash concrete.

UNIT-III

Polymer Concrete: Terminology used in polymer concrete, Properties of constituent materials, Polymer impregnated concrete, Polymer modified concrete, Properties and applications of polymer concrete and polymer impregnated concrete.

UNIT-IV

Ferro Cement: Constituent materials and their properties, Mechanical properties of ferro cement, Construction techniques and application of ferro cement.

UNIT-V

High Performance Concrete: Materials for high performance concrete, Supplementary cementing materials, Properties and durability of high performance concrete, Introduction to silica fume concrete, Properties and applications of silica fume concrete.

UNIT-VI

Sulphur Concrete And Sulphur Infiltrated Concrete: Process technology, Mechanical properties, Durability and applications of sulphur concrete, Sulphur infiltrated concrete, Infiltration techniques, Mechanical properties, Durability and applications of sulphur infiltrated concrete.

UNIT-VII

Light Weight Concrete: Properties of light weight concretes, Pumice concrete, Aerated cement mortars, No fines concrete, Design and applications of light weight concrete.

Text Books:

1. Concrete Technology-A.M. Neville
2. Concrete Technology-M.L. Gambhir.

ELECTIVE-3

CE-604 THEORY AND DESIGN OF PLATE AND SHELLS

UNIT-I

Plate equation in Cartesian and Polar coordinates for isotropic plates Analysis of rectangular and circular plates with different boundary conditions and loadings Energy methods in analysis of Orthotropic plates, Plates on elastic foundation.

UNIT-II

Classification of shells Membrane and bending theory for singly curved and doubly curved shells Various approximations Design of cylindrical shells, HP shells, conoids Analysis of folded plates Design of diaphragms Detailing of reinforcements for shells Framework for shells and folded plates.

Text Books:

1. Theory of Plate and Shells by Timoshenco, S.
2. Theory and analysis of Plates by Szilard, R.
3. Concrete Shell Roofs by Ramaswamy.

ELECTIVE- 4
CE-581 HIGH RISE BUILDINGS

UNIT-I

Tall Building systems and Concepts: environmental systems. Service systems, construction system, foundation design, architectural- structural interaction.

Tall building criteria and loading gravity load. Earthquake loadings, wind loading and effects, fire and blast, quality control crib Structural safety.

UNIT-II

Structural design of tall steel buildings: commentary on structural standards, elastic analysis and design. Plastic analysis and design, stability. Design methods based on stiffness, fatigue and fracture, load factor(Limit State) design.

UNIT-III

Structural design of tall concrete and masonry buildings: commentary structural standards, plastic analysis-strength of members and correction, non-linear analysis and limit design, stability, stiffness and crack control creep shrinkage and temperature effects. Limit state design , masonry structures.

UNIT-IV

Frame-shear wall systems: Twist of frame. Analysis of shear wall, frame wall interaction, analysis of coupled shear wall, computation of earthquake load dynamic analysis of tall building.

Text Books:

1. Structural Analysis and design of Tall Buildings by Tara Nath Bungale
2. Advances in tall buildings by Beedle L.S.
3. Analysis of Shear walled buildings

ELECTIVE- 4

CE-582 DISASTER REDUCTION AND MANAGEMENT

UNIT-I

Disaster Reduction: Earthquake resistant design of structures, Response spectra and design earthquake parameters, Principles and philosophies, Codal provisions, Factors affecting damage to structures, Enforcement of codal provisions, Strong motion instrumentation and data processing, Effective rescue operation, General planning and design aspects.

UNIT-II

Conventional earthquake resistant design, Seismic base isolation method, retrofitting, Training and lecturing at various levels, Preparedness to meet earthquake disaster, Programmes for public awareness, demonstrations and exhibitions, Information management (Safety, emergencies, management and planning, design, response, user experience problems and case studies), Proper land use practices, long term disaster preparedness measures.

UNIT-III

Precautions after a major earthquake, Preparedness for medical supply Emergency care (First aid, Home remedies), Disposal of dead bodies (Human and Cattle) , Care for old and orphans.

Indirect Damages: Damage due to ground failures, Landslides, rockslides, liquefaction, fire, floods, Tsunamis, release of hazardous material like poisonous gas, nuclear radiation.

UNIT-IV

Disaster Management: Management cell, Central crisis management core group, damage reconnaissance, Management of relief and rehabilitation (Infrastructure rehabilitation, Housing rehabilitation, Social rehabilitation), Role of volunteers, Emergency operation centres, Information system, Danger zone restrictions, Cooperation with local authority, Coordination for international relief, Role of government, NGO's, Business and donors, Role of remote sensing in relief operations, Information management and related technologies in engineering and disaster management.

UNIT-V

The design and management of Disaster Information Resource Network, Asian Disaster Preparedness Centre, Regional data base, Contacts and Sources, CD - ROM Library for Natural Disaster Management, Regional Disaster Documentation Centre, Non Governmental Organisations.

Text Books:

1. Disaster reduction by Kurowa , Julio , Quebecor World
2. Disaster Management by Kapoor Mukesh

Lab-1

CE605 ADVANCED MATERIAL TESTING LAB

LIST OF EXPERIMENTS:

1. Concrete Mix Design as per IS codes for various grades of concrete mixes.
2. Special concretes.
3. Durability studies on concrete.
4. Effect of super plasticizer on properties of concrete in fresh and hardened stages.
5. Measurement of air content of concrete.
6. Fineness of cement by Air permeability method.
7. Non Destructive Testing of Concrete.
8. To determine the modulus of elasticity of concrete.
9. Effect of replacement of fly ash on properties of concrete.
10. Testing of structural steel reinforcement and steel sections.

Lab-2

CE606 COMPUTATIONAL LAB FOR STRUCTURAL ENGINEERING

LIST OF EXPERIMENTS:

1. Analysis and design of Multi-storey building frames
2. Analysis and design of Elevated water Tank.
3. Analysis and design of bridge decks and other structure



