OPJS UNIVERSITY, CHURU
SYLLABUS
M. Tech. (Structural Engineering): Civil Engineering Department
Year 2013-14

FIRST SEMESTER
MSE101 : Advanced Structural Analysis
MSE102 : Numerical Methods & Analysis
MSE103 : Advanced Design of Concrete Structures
MSE104 : Advanced Design of Steel Structures
MSE105 : Computer Aided Design Lab

SECOND SEMESTER
MSE201 : Structural Dynamics
MSE202 : Advanced Strength of Materials
MSE203 : Advanced Concrete Technology
MSE204 : Elective-I
MSE205 : Material Testing, Experimental Methods & Quality Control

THIRD SEMESTER
MSE301 : Finite Element Analysis
MSE302 : Elective-II
MSE303 : Seminar
MSE304 : Dissertation Part I

FOURTH SEMESTER
MSE404 : Dissertation Part II

List of Electives & Detailed Syllabus

LIST OF ELECTIVES

MSE204 : ELECTIVE – I
MSE204.1 : Theory of Elasticity and Plasticity
MSE204.2 : Earthquake Engineering
MSE204.3 : Analysis & Design of Bridge Superstructure

MSE302 : ELECTIVE – II
MSE302.1 : Repair and Rehabilitation of Structures
MSE302.2 : Advanced Foundation Design
MSE302.3 : Tall Buildings
SYLLABUS

MSE-101: ADVANCED STRUCTURAL ANALYSIS

1. Static and kinematic indeterminacy,
2. Principle of virtual work, Stiffness & Flexibility Matrices,
3. Force-displacement methods, element approach. Application to continuous beams, plane and space frame problems.
4. Formulation of stiffness matrix for a typical multistory apartment building and industrial structure.
5. Nonlinear analysis, material and geometrical nonlinearities, large deformation elasto-plastic analysis of frames, introduction to incremental procedure.

MSE-102: NUMERICAL METHODS AND ANALYSIS

1. Error Analysis, Significant Figures, Absolute and Relative Errors, Accuracy and Precision,
2. Computational Errors, Stability in Numerical Analysis.
3. Interpolation and Integration, General Interpolation Formulae, Polynomial Interpolation, Lagrange Interpolation, Newton’s Interpolation and Gaussian Interpolation.
4. Introduction to Gauss and Hermite quadratures, Quadrature rules for multiple integrals. Least square approximation of functions, linear regression & its algorithm, polynomial regression, fitting exponential and trigonometric functions, weighted least square approximation, their use through MS Excel.

MSE-103: ADVANCED DESIGN OF CONCRETE STRUCTURES

1. Revision of basic concepts of Limit State Design of prismatic members in flexure, shear & bond.
2. Redistribution of Moments in Fixed & Two span continuous beams. Calculation of deflection due to load, shrinkage & creep and calculation of crack width as per IS code.
3. Analysis & Design of axially loaded Short column & analysis with uniaxial and biaxial bending, Column interaction diagram, its construction & use. Introduction to design and analysis of selender columns.
4. Introduction to Analysis & Design of folded plates & circular shells.
5. Yield line theory for slabs, yield line mechanisms, equilibrium and virtual work methods, special aspects, Hillerborg’s strip method.

MSE-104 : ADVANCED DESIGN OF STEEL STRUCTURES

2. Light gauge steel sections, design of Structural elements with such sections.
3. Different types of steel and metallic alloys. Moment resistance connections. Behavior of material under fatigue and temperature effects including fire.
4. Applications of steel cables in large span roofs, non-linearity.

SECOND SEMESTER

MSE-201: STRUCTURAL DYNAMICS

1. Dynamics of Structures: Objectives and importance. Types of dynamic loads, Dynamic degree of freedom, Mathematical modeling, Damping and stiffness, Torsional stiffness, Equivalent stiffness, Free and forced vibrations.

MSE-202: ADVANCED STRENGTH OF MATERIAL

Elastic and plastic behavior of materials creep and fatigue, bending of bars with initial curvature, rings hoops etc. Torsion of non circular section, unsymmetrical bending, beams on elastic foundation, shear centre, shear flow, shear lag. Fracture mechanics, Analysis of laminates.
MSE-203: ADVANCED CONCRETE TECHNOLOGY

1. Microstructure of concrete, deterioration mechanisms, assessment and control of corrosion in concrete structures,
2. Introduction to Special concretes, their specific properties & applications: Ready Mixed Concrete, Reactive powder concrete, Bacterial concrete, Light Weight concrete, High density concrete & its application for Radiation shielding.
3. Fibre reinforced concrete - Fibre materials, mix content, distribution and orientation, interfacial bond, properties in fresh state, strength and behavior in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications.
5. High performance concrete and self compacting concrete: Materials, mix design, techniques for performance measurement

MSE-204.1: THEORY OF ELASTICITY AND PLASTICITY


MSE-204.2: EARTHQUAKE ENGINEERING

1. Engineering seismology: Structure of the earth, causes of earthquakes/tsunami: plate tectonics, types of faults and basic terms related with earthquakes. Seismic waves; surface waves, body waves & their characteristics.
2. Characteristics & types of earthquake. Magnitude of earthquake, local magnitude, body wave magnitude, surface wave magnitude, seismic moment magnitude.
4. Intensity of earthquake, seismicity and seismic zoning.
response spectrum in earthquake resistant design, IS codal provisions for seismic analysis using given modes/coefficients and simple cases by static and dynamic analysis as per code.

MSE-204.3: ANALYSIS & DESIGN OF BRIDGE SUPERSTRUCTURES


THIRD SEMESTER

MSE-301: FINITE ELEMENT ANALYSIS

1. Finite element techniques: One dimensional Problems, FEM modeling, coordinates & shape functions, discretization, energy and variational approaches, basic theory, use of parametric and local coordinates, convergence criteria, numerical integration.
2. Element formulations, 2-D elements, plate bending elements, introduction to three dimensional elements. Applications, plane stress and plain strain problems, axi-symmetric solids, plates and shell structures, temperature problems.
3. Finite element equation treatment & boundary conditions, quadratic shape function, effect of temperature.
4. Nonlinear problems: Review of iterative and incremental procedures for material and geometrically nonlinear problems examples from plane stress and plane strain.
5. Introduction to programming, organization of FEM programs, equation solving techniques, input/output plotting and mesh generation aspects.

MSE-302.1: REPAIR AND REHABILITATION OF STRUCTURES

1. Introduction to Repair, Restoration and rehabilitation/strengthening of existing buildings.
2. Causes of deterioration/decay and flexural & shear distress of concrete structures.
3. Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods.
5. Corrosion mechanism: corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.
6. Strengthening of existing walls & RCC members, stitching, routing & Sealing, Jacketing

MSE-302.2: ADVANCED FOUNDATION DESIGN

1. Critical study of conventional methods of foundation design,
2. Analysis of settlement of soil and foundations, foundations of in expensive and swelling soils,
3. Dynamic soil properties, dynamic bearing capacity of shallow foundations, liquefaction of soils,
5. Raft foundations, well foundations, special footings and beams on elastic foundations.

MSE-302.3: TALL BUILDINGS
Structural systems of tall buildings; Moment resistant. frames, braced frames, eccentrically braced frames, shear walls, coupled shear walls, frame shear wall interaction, tubular structures; approximate and matrix oriented methods of design of tall buildings;