## RAJASTHAN TECHNICAL UNIVERSITY
Teaching Scheme: M.Tech. (Structural Engineering) | Civil Engineering Department
---|---
FULL TIME (4 semester)/PART TIME (6 semester) | Self Financed Course w.e.f. 2008-09

### FULL TIME

<table>
<thead>
<tr>
<th>SUBJECT/ SEMESTER</th>
<th>Teaching Hrs/week</th>
<th>Examination Scheme</th>
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<tr>
<td><strong>FIRST SEMESTER</strong></td>
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<tr>
<td>MSE101 : Advanced Structural Analysis</td>
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<tr>
<td>MSE102 : Numerical Methods &amp; Analysis</td>
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<td>MSE103 : Advanced Design of Concrete Structures</td>
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<td>MSE203 : Advanced Concrete Technology</td>
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<td>MSE204 : Elective-I</td>
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<td>MSE205 : Material Testing, Experimental Methods &amp; Quality Control</td>
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<td>MSE301 : Finite Element Analysis</td>
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<td>MSE302 : Elective-II</td>
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<td>MSE304 : Dissertation Part I</td>
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List of Electives & Detailed Syllabus are Enclosed.
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PART TIME

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**FIRST SEMESTER**

- MSE101 : Advanced Structural Analysis  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE102 : Numerical Methods & Analysis  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE103 : Advanced Design of Concrete Structures  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125

**TOTAL** 09 03 300 75 375

**SECOND SEMESTER**

- MSE104 : Advanced Design of Steel Structures  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE201 : Structural Dynamics  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE202 : Advanced Strength of Materials  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125

**TOTAL** 09 03 300 75 375

**THIRD SEMESTER**

- MSE203 : Advanced Concrete Technology  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE204 : Elective-I  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE205 : Material Testing, Experimental Methods & Quality Control  
  Hrs/week: - 3  
  Max. Marks: 40 60 100

**TOTAL** 06 05 240 110 350

**FOURTH SEMESTER**

- MSE301 : Finite Element Analysis  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE302 : Elective-II  
  Hrs/week: 3 1  
  Max. Marks: 100 25 125
- MSE105 : Computer Aided Design Lab  
  Hrs/week: - 3  
  Max. Marks: 40 60 100

**TOTAL** 06 05 240 110 350

**FIFTH SEMESTER**

- MSE303 : Seminar  
  Hrs/week: - 4  
  Max. Marks: 60 90 150
- MSE304 : Dissertation Part I  
  Hrs/week: - 4  
  Max. Marks: - 100 100

**TOTAL** - 8 60 190 250

**SIXTH SEMESTER**

- MSE404 : Dissertation Part II  
  Hrs/week: - 16  
  Max. Marks: - 500 500
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List of Electives & Detailed Syllabus are Enclosed.

**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
MSE-101 : ADVANCED STRUCTURAL ANALYSIS
Static and kinematic indeterminacy,
Principle of virtual work, Stiffness & Flexibility Matrices,
Force-displacement methods, element approach. Application to continuous beams, plane and space frame problems.
Formulation of stiffness matrix for a typical multistory apartment building and industrial structure.
Nonlinear analysis, material and geometrical nonlinearities, large deformation elasto-plastic analysis of frames, introduction to incremental procedure.

MSE-102: NUMERICAL METHODS AND ANALYSIS
Error Analysis, Significant Figures, Absolute and Relative Errors, Accuracy and Precision, Computational Errors, Stability in Numerical Analysis.
Interpolation and Integration, General Interpolation Formulae, Polynomial Interpolation, Lagrange Interpolation, Newton’s Interpolation and Gaussian Interpolation.
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.
Solution of linear simultaneous equations, algorithm based on Gauss elimination, Decomposition method, Gauss-Seidel Method. Introduction to Solution of large system of linear simultaneous equations for symmetric banded equations.

MSE-103 : ADVANCED DESIGN OF CONCRETE STRUCTURES
Revision of basic concepts of Limit State Design of prismatic members in flexure, shear & bond.
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.
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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.
Introduction to Analysis & Design of folded plates & circular shells.
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
Light gauge steel sections, design of Structural elements with such sections.
Different types of steel and metallic alloys. Moment resistance connections. Behavior of material under fatigue and temperature effects including fire.
Applications of steel cables in large span roofs, non-linearity.
Tubular sections, Design of elements with tubular sections. Orthotropic decks. Plastic design of continuous beams, portal and gable Frames.

MSE-201 : STRUCTURAL DYNAMICS
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.
Forced vibration response of SDoF damped and undamped systems to harmonic loading, rotating and reciprocating unbalance, support motion and impulsive type forcing function. Vibration isolation and transmissibility. Seismic Instruments.
Vibrations of two degree of freedom systems, matrix formulation of equations of motion, principal modes of vibrations. Extension of the concept to MDoF systems. Introduction to Rayleigh’s principle, modal analysis.
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
Microstructure of concrete, deterioration mechanisms, assessment and control of corrosion in concrete structures,
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.
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.
High strength concrete – constituents, mix proportioning, properties in fresh and hardened states, applications and limitations.
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
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.
Characteristics & types of earthquake. Magnitude of earthquake, local magnitude, body wave magnitude, surface wave magnitude, seismic moment magnitude.
Energy release, Relationship between magnitude & Energy.
Intensity of earthquake, seismicity and seismic zoning.
Effect of earthquake on structures in general. Planning/architectural concepts: size & plan of building,
vertical layout & adjacency of buildings.
Seismic damages: Typical seismic behaviour & damages of masonry structures: in plane & out of
plane failure, lack of integrity. Earthquake resistance provisions as per IS 4326.
Typical seismic behaviour & damages of R.C. structures. Soft storey effect & short column effect.
Earthquake resistant design philosophy: Torsion in buildings, calculation of centre of mass & centre of
rigidity. Basic concepts of structural dynamics, Response spectrum concept, Construction of response
spectrum. Use of 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.
Codal provisions for Ductile detailing in RC constructions.

MSE-204.3: ANALYSIS & DESIGN OF BRIDGE SUPERSTRUCTURES
Types of bridges, choice of bridge type, longitudinal arrangement and economic spans. Load
distribution theories: Courbons method, Hendry Jaeger method, Morice Little method, Grillage
analogy, Design of T-type bridges. Introduction to Box girder bridges, steel bridges & Cable stayed

MSE-301 : FINITE ELEMENT ANALYSIS
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.
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.
Finite element equation treatment & boundary conditions, quadratic shape function, effect of
temperature.
Nonlinear problems: Review of iterative and incremental procedures for material and geometrically
nonlinear problems examples from plane stress and plane strain.
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
Introduction to Repair, Restoration and rehabilitation/strengthening of existing buildings.
Causes of deterioration/decay and flexural & shear distress of concrete structures.
Diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods.
Cracks: structural & surface cracks, their identification & causes, methods of repair of small & large cracks: Gunite and Shot Crete, Epoxy injection, Mortar repair for cracks
Corrosion mechanism: corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.
Strengthening of existing walls & RCC members, stitching, routing & Sealing, Jacketing

MSE-302.2 : ADVANCED FOUNDATION DESIGN
Critical study of conventional methods of foundation design,
Analysis of settlement of soil and foundations, foundations of in expensive and swelling soils,
Dynamic soil properties, dynamic bearing capacity of shallow foundations, liquefaction of soils,
Machine foundations for reciprocating and rotary type machines, vibration isolation.
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;