MEWAR UNIVERSITY CHITTORGARH (RAJASTHAN)
Faculty of Engineering and Technology

Three – Year (Part-time) M Tech: (Structural Engineering)

Eligibility for Admission: A candidate for being eligible for admission to the Master of Technology in *Structural Engineering* in the faculty of engineering and technology should have passed B.Sc. (Engg.)/ B.Tech/ B.E. or any other equivalent degree in the relevant discipline / branch from any recognized Indian or foreign University.

A candidate should have at least 55% marks or equivalent CGPA in the qualifying examination (50% marks or equivalent CGPA for Scheduled Caste/Scheduled Tribes Candidates) on the basis of which the admission is being sought.

Overview of the Programme: The normal duration of programme shall be Six Semesters for part-time students. A part time candidate shall mean a person employed in any government/ semi-government/ private organisation. The duration of the programme is extendable upto five years. However, in exceptional circumstances one-year extension may be granted with approval of the Vice-Chancellor of the University.

The complete programme comprises of 13 theory courses (09 Core and 04 elective) and 02 Lab courses followed by the dissertation in two phases. Student has to obtain at least 40 % marks to pass the examination (both internal and external examination separately) for all the courses specified in the scheme of the programme. The degree will be awarded on the basis of cumulative marks obtained in all the six semesters and the division obtained will be as under:

MEWAR UNIVERSITY CHITTORGARH (RAJASTHAN)
Scheme of Three – Year (Part-time) M Tech (Structural Engineering)

First Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Examination		External Examination /Viva-voce	Total Marks
		L	P		Assignments /Lab Record	Teacher's Evaluation		
SE-611	Structural Dynamics	4	-	4	30	10	60	100
SE-613	Design of Concrete structures	4	-	4	30	10	60	100
SE-711/713/715	Elective-I	3	-	3	20	10	45	75
SE-617	Structural Engineering Lab	-	2	2	15	10	25	50
Total Semester Credits = 13					**Total Semester Marks = 325**			

Second Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Examination		External Examination /Viva-voce	Total Marks
		L	P		Assignments /Lab Record	Teacher's Evaluation		
SE-612	Advanced Design of Steel Structures	4	-	4	30	10	60	100
SE-614	Finite Element Method in Structural Engineering	4	-	4	30	10	60	100
SE-712/714/716	Elective-II	3	-	3	20	10	45	75
SE-618	Software Based Structural Design Lab	-	2	2	15	10	25	50
Total Semester Credits = 13					**Total Semester Marks = 325**			

Third Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Examination		External Examination /Viva-voce	Total Marks
		L	P		Assignments /Lab Record	Teacher's Evaluation		
SE-615	Advanced Structural Analysis	4	-	4	30	10	60	100
SE-621	Earthquake Analysis and Design	4	-	4	30	10	60	100
SE-721/723/725	Elective-III	3	-	3	20	10	45	75
Total Semester Credits = 11					**Total Semester Marks = 275**			

Fourth Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Examination		External Examination /Viva-voce	Total Marks
		L	P		Assignments	Teacher's Evaluation		
SE-616	Design of Plates and Shells	4	-	4	30	10	60	100
SE-624	Design of Bridges	4	-	4	30	10	60	100
SE-722/724/726	Elective-IV	3	-	3	20	10	45	75
Total Semester Credits = 11					**Total Semester Marks = 275**			

Fifth Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Examination		External Examination /Viva-voce	Total Marks
		L	P		Assignments / Report	Teacher/ Committee Evaluation		
SE – 627	Research Methodology	2	-	2	15	05	30	50
SE – 629	Dissertation (Phase-I)	-	6	6	75	75	-	150
Total Semester Credits = 08					**Total Semester Marks = 200**			

Sixth Semester

Course Code	Course Title	Contact Hours per week		Credit Hours	Internal Assessment/Examination		External Examination /Viva-voce	Total Marks
		L	P		Report	Teacher(s) Evaluation		
SE – 630	Dissertation (Phase-II)	-	10	10	50	-	200	250
Total Semester Credits = 10					**Total Semester Marks = 250**			

LIST OF ELECTIVES

ELECTIVE – I

1.	SE-711	Advanced Concrete Technology
2.	SE-713	Pre Stressed Concrete Structure
3.	SE-715	Masonary Structures

ELECTIVE – II

1.	SE-712	Reliability Based Structural Design
2.	SE-714	Design of Tall Building
3.	SE-716	Wind Resistance Design of Structures

ELECTIVE – III

1.	SE-721	Stability Theory and Structural Mechanics
2.	SE-723	Soil Structure Interaction
3.	SE-725	Maintenance and Rehabilitation of Structures

ELECTIVE – IV

1.	SE-722	Artificial Intelligence in Structural Engineering Applications
2.	SE-724	Fracture and Fatigue Mechanics
3.	SE-726	Advanced Numerical Methods

Internal Assessment/Examination: The internal evaluation for all theory courses (40% of the total marks) will be based on the evaluation of **three assignments** provided during the semester and assessment of the teacher concerned. Similarly, the internal evaluation for all Lab courses (50% of the total marks) will be based on the evaluation of lab record and assessment of the teacher concerned.

External Examination/Viva -voce: For all the theory courses, there will be **08 (Eight)** questions to be set by the external paper setter (nominated /approved by the competent authority) out of which the candidate will have to attempt **05 (Five)** questions all carrying equal marks. Duration of each external examination will be three hours. Similarly, the external evaluation for all Lab courses (50% of the total marks) will be based on the evaluation/viva-voce conducted by an external examiner (from the relevant field) nominated/approved by the competent authority.

Submission and Evaluation of Dissertation:

a) A dissertation supervisor (s) having at least post- graduate qualification, from industry/research organization shall be assigned to the student approved by the competent authority. *In no case, the candidate can have more than two dissertation supervisors.*
b) Dissertation work (Phase-I) in 5^{th} semester shall comprise of literature survey, problem formulation, finalization of goals to be achieved, outlines of the methodology to be used for achieving the targeted goals and final decision about S/W, H/W tools to be used for dissertation work in 6^{th} semester. The entire work will be documented in the form of report.
c) Internal assessment of dissertation (Phase-I) in 5^{th} semester will be made by the committee evaluating the report (50% weightage), oral presentation and response of the student in the discussion / presentation (50% weightage). The dissertation supervisor (s) shall be the member (s) of the committee.
d) The submission of dissertation (Phase-II) in 6^{th} semester shall be allowed only after ensuring that the research work carried out by the candidate has attained the level of satisfaction of the 'Dissertation Supervisor (s)' and proof of communication/acceptance of the research paper (if any, and certified in the report) in the relevant refereed journal/ conference.
e) The final dissertation external examination in 6^{th} semester shall be taken by a panel of examiners comprising of concerned Supervisor (s), one external examiner (from the relevant field) nominated/approved by the competent authority. Hard copies of dissertation, one for each supervisor (s), examiner and the university/ department, are required to be submitted by the student before the final dissertation external examination. The candidate shall appear before the examining committee for oral examination and presentation on the scheduled date.

M TECH: STRUCTURAL ENGINEERING

SE – 611 STRUCTURAL DYNAMICS

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Difference between Static and Dynamic analysis, Loading, Essential characteristics of a dynamic problem, Principles of dynamics, Formulation of equation of motion, Nature of exciting forces, Degrees of freedom and mathematical modeling of dynamic systems.

Single Degree of Freedom (SDOF) Systems: Damped and undamped free vibrations, Viscous and Coulomb's damping, Undamped and damped Forced Vibrations to harmonic excitations, Fourier analysis of periodic forces. Response to unit impulse and arbitrary loading by Duhamel's integral, Step and Ramp forces, Pulse loadings, Response to ground motion and Transmissibility, Non-linear analysis by step-by-step method with linear acceleration.

Multiple Degrees of freedom (MDOF) Systems: Free vibrations of a shear building, fundamental frequencies and mode shapes, Orthogonality of mode shapes, Stodalla-Vinaello, Modified Reyleigh's method, Holzer's method, Holzer Myklested method, Matrix method, Energy method, Lagrange's equation, Modal analysis, Concept of Tuned Mass Dampers, Forced Vibrations of shear building, transformation of coordinates and mode superposition method, Response to ground motion, Non-linear analysis by Wilson-Theta method.

Continuous systems: Free transverse vibrations of beams for various boundary conditions. Free vibration analysis of a cantilever beam by Rayleigh Ritz and Finite Element Method.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Mario Paz – Structural Dynamics Theory and Computation, CBS Publications
- Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering,Prentice-Hall Publications
- R.W Clough and J Penzin – Dynamics of Structures, McGraw Hill Publications
- Madhujit Mukhopadhyay – Structural Dynamics Vibrations and Systems, Ane Books India Publishers

M TECH: STRUCTURAL ENGINEERING

SE – 613 DESIGN OF CONCRETE STRUCTURES

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Limit state design concepts in flexure, Shear, Torsion and combined stresses, Introduction to limit state design of beams and frames.

Slender columns and walls, Effective length, Unbraced and braced columns, Stability index, Columns subjected to combined axial and biaxial bending, Braced and unbraced walls, Slenderness of walls, Design of walls for vertical and in-plane horizontal forces.

Yield line analysis of slabs, Simply supported, flat and ribbed slabs, Design of slabs by strip method, equivalent frame method, shear and opening in flat slabs, Slab fixed along edges and skew slabs.

Approximate Analysis of grid floors by Timoshenko's plate theory, Stiffness method and equating joint deflections.

Design of deep beams by Indian standard codes and ACI methods, Design of edge beams, Shear strength and forces acting on joints, Design procedure of beam column joint including corner joints, anchorage.

Control and computational of cracks and deflections, Short and long term deflection and cracks of Beams and slabs including shrinkage and thermal cracks, Computation of deflection and cracks as per Indian standard code, Factors affecting crack-width in beams.

Classification of shear walls, Design of rectangular and flanged shear walls, Yield line analysis of slabs: Work and equilibrium methods, Design of statically determinate prestressed concrete structures for flexure and shear.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Varghese, P.C. (2001),"Advanced Reinforced Concrete Design", Prentice Hall of India, New Delhi.
- Jain, A.K. (1999), "Reinforced Concrete Limit State Design", Nem chand & Bros., Roorkee
- Krishna Raju (1986), "Advanced Reinforced Concrete Design", C.B.S. Publication, New Delhi

M TECH: STRUCTURAL ENGINEERING

SE – 617 STRUCTURAL ENGINEERING LAB

Internal Assessment/Evaluation: 25 Marks
External Examination: 25 Marks
Duration of Examination: 03 Hours

List of experiments:

1. Concrete Mix design: Study of the effect of water/cement ratio on workability and strength of concrete, Effect of aggregate/cement ratio on strength of concrete, Effect of fine aggregate/coarse aggregate ratio on strength and permeability of concrete.

2. Study of stress-strain curve of concrete - correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture

3. Non-Destructive testing of concrete

4. Study of behavior of Beams under flexure – Under Reinforced, Balanced and Over-reinforced beams

5. Study of Shear- Effect of Shear Span to Depth ratio

Recommended Books:

- Concrete technology by A M Nevelli and J J Brooks, Pearsons.
- Concrete Technology by M.S. Shetty
- Concrete Technology by M L Gambhir, Tata McGraw Hills, New Delhi

M TECH: STRUCTURAL ENGINEERING

SE – 612 ADVANCED DESIGN OF STEEL STRUCTURES

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Introduction to Limit State design of steel, Limit state of strength and serviceability, Standardization, Allowable stress design, Partial safety factors, Concept of section classification- Plastic, Compact, Semi-compact and slender.

Design of column, Strength curve for an ideal strut, Strength of column members, Effect of eccentricity of applied loading and residual stresses on the design of column, Concept of effective lengths, Sway and no-sway columns, Torsional and torsional-flexural buckling of columns, Robertson's design curve, Modification to Robertson approach, Design of columns using Robertson approach.

Flexural & shear behavior of laterally restrained beams, Web buckling and crippling, Effect of local buckling in laterally restrained beams, Combined bending and shear, Unsymmetrical bending.

Similarity of column buckling and lateral buckling of unrestrained beams, Lateral torsional buckling of symmetric section, Factors affecting lateral stability, Buckling of real beams, Design of cantilever beams, Continuous beams.

Long and short beam columns, Stability Consideration for long Beam-Columns, Beam column failure- effect of slenderness ratio and axial force, local and overall member failure, Interaction Formula, Design approach to Beam-Columns under biaxial bending, Design of Beams subjected to Torsion and Bending, pure torsion and warping, combined bending and torsion and lateral torsional buckling, Capacity and buckling check.

Design of beams with Web opening, Force distribution, Analysis of beams with perforated thick webs, Analysis of plate girder with web openings, Guidelines for web opening and stiffeners.

Composite beams, Floors and columns, Elastic behavior of composite beams, Shear connectors, Characteristics and load bearing mechanism, ultimate load behaviour and design of composite beams, Profile sheet decking, Bending and shear resistance of composite slabs, Design of composite columns for axial loads, combined compression and uniaxial bending, combined compression and biaxial bending.

Steel connections and their complexities, Types and design approaches to connections, truss, Portal frame, Beam and column splice, Beam to beam and beam to column connections.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Arya A.S. and Ajmani, J.L., 1974, Design of Steel Structures, Nemchand.
- G. Q. Li, Jin-Jun Li, Advanced analysis and design of steel frames, John Wiley and Sons, 2007
- Dennis Lam, Paul Ang, Thien-Cheong Ang, Structural steelwork: design to limit state theory, Elsevier, 2004
- Morsis L.J., Plum, D.R. 1996, Structural Steel Work Design, Longman.
- Wei-Wen Yu, Roger A. LaBoube, 2010, Cold Formed Steel Structures Design. John Wiley and Sons
- Sihna D.A. Design of Steel Structures.

M TECH: STRUCTURAL ENGINEERING

SE – 614 FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Basic Equations of Solid Mechanics-Review of equilibrium conditions, Strain displacement relations, Stress Strain relations, Principle of Virtual work, Stationery potential energy and variational formulation.

Introduction to FEM, Governing equation and its solution approximations-Approximate methods, RayleighRitz, Weighted residual (Galerkin) and finite difference methods, Displacement model- Shape functions- Lagrange and serendipity elements, Element properties- Isoparametric elements- numerical integration, Technique, Assemblage of elements and solution techniques for static analysis.

Analysis of framed Structures, 2D and 3D truss and beam elements and applications, Analysis of plane stress/strain and axisymmetric solids triangular, Quadrilateral and isoparametric elements, Incompatible models.

Three dimensional stress analysis- Isoparametric eight and twenty noded elements, Analysis of plate bending Basic equations of thin plate theory, Reissner-Mindlin theory- Plate elements and applications. Analysis of shells, Degenerated shell elements.

Finite element programming and FEA Software.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- J.N. Reddy, An Introduction to the Finite Element Method, Tata McGraw Hill, 2nd Ed, 2003.
- C.S. Krishnamoorthy, Finite Elements Analysis: Theory and Programming, Tata McGraw Hill, 2nd Ed, 1994.
- R.D. Cook, D.S. Malkus and M.E. Plesha, Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 4th Ed, 2002.
- O.C. Zienkiewicz, R.L. Taylor and J.Z. Zhu, Finite Element Method Its Basis and Fundamentals, Elsevier, 6th Ed, 2005.
- S.S. Rao, Finite Element Method in Engineering, Butterworth Heinemann, 3rd Ed,1999.
- M.B. Kanchi, Matrix Method of Structural Analysis, Wiley Eastern Limited, 2nd Ed, 1993.
- K.J. Bathe, Finite Element Procedures, Prentice Hall of India Pvt. Ltd., 2002.

M TECH: STRUCTURAL ENGINEERING

SE – 618 SOFTWARE BASED STRUCTURAL DESIGN LAB

Internal Assessment/Evaluation: 25 Marks
External Examination: 25 Marks
Duration of Examination: 03 Hours

List of Experiments:

1. Excel spread sheets for the design of
   i) Structural elements like slabs, beams, columns, isolated, combined and raft footings, steel connections and members
   ii) Structures like water tank, retaining walls, Portal frame, Gantry girder, Plate girder etc

2. Software Usage Modeling, analysis and design using professional software like STAAD, STRAP, STRUDS, RISA 3D etc.

3. Application of Drafting software like AutoCAD, CADLAB and Microstation

M TECH: STRUCTURAL ENGINEERING

SE – 615 ADVANCED STRUCTURAL ANALYSIS

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Static and kinematic Indeterminacy, Stiffness and flexibility, Stiffness and flexibility matrices for prismatic and non-prismatic members.

Coordinate transformations, Transformation to Global System, Assembly of global matrices-Stiffness matrix, Load matrix, Boundary conditions and solution techniques.

Generation of stiffness matrix for continuous beam, Internal hinges, Hinged and guided-fixed end supports, Accounting for shear deformations, Beam element stiffness, Moment releases, force transformation matrix, Element flexibility matrix, Solutions techniques, 3 D truss Element & 3 D beam element.

Stiffness method for grids- Torsional stiffness of grid element, Advantage of torsion release, Analysis by conventional stiffness method using grid element, Analysis by reduced stiffness method, Stiffness Matrices for plane and space truss element, Joint equilibrium equations, Member force, transformation matrix for 3 D truss.

Introduction to plastic analysis and mechanism, Non-linear stiffness matrix analysis- Iterative and incremental method, Hysteresis loops, Assumptions, Member stiffness matrix, Modification of the structural stiffness matrix, Incremental displacement and load vector, Step by step Incremental Analysis Method.

Geometric stiffness Matrix - 2D Truss Element, Non-linear solution algorithms- Iterative Method, Incremental Method, Convergence criteria.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Devdas Menon, Advanced Structural Analysis, Narosa Publishing House, 2009.
- McGuire, W., Gallagher, R.H. and Ziemian, R.D., Matrix Structural Analysis, Second Edition, John Wiley and Sons, Inc., 2000.
- Przemieniecki, J.S., Theory of Matrix Structural Analysis, Tata McGraw Hill Book Co.
- Martin, H.C., Introduction to Matrix Methods of Structural Analysis, McGraw Hill Book Co.
- A. S. Meghre & S. K. Deshmukh, Matrix Methods of Structural Analysis, Charotar Publishing House Pvt. Ltd.

M TECH: STRUCTURAL ENGINEERING

SE – 621 EARTHQUAKE ANALYSIS AND DESIGN

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Basic terms of Seismology, Seismic waves, Earthquake magnitude and intensity, Ground motion, Dynamic response of structures, Normalized response spectra, Response spectrum analysis, Seismic coefficients and seismic zone coefficients.

Rigid Diaphragms, Torsional moment, Center of mass and center of rigidity, Torsional effects, Lateral load distribution with rigid floor diaphragms, Moment resisting frames, Shear walls, Lateral stiffness of shear walls, Shear wall-Frame combination, Examples.

Objectives of Seismic Design, Earthquake design philosophy, Ductility, Hysteric response & energy dissipation, Response modifications factor, Design spectrum, Capacity design, classification of structural system, IS Codal provisions for seismic design of structures, Multi-storeyed buildings, Design criteria, P-Δ effects, Storey drift, Design examples, Ductile detailing of RCC structures.

Seismic design of elevated liquid storage tanks, Hydrodynamic pressure in tanks, Stack like structures, IS-1893 codal provisions for bridges; Superstructure, Sub-structure, submersible bridges, Dams, Hydrodynamic effects due to reservoir, Concrete gravity dams.

Case histories- Learning from earthquakes, Seismic retrofitting and strengthening procedures. Causes of soil liquefaction, liquefaction potential, Measures to reduce liquefaction potentials.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Chopra A.K., Dynamics of Structures-Theory & Applications to Earthquake Engineering, Prentice Hall, India.
- Ray W. Clough, Joseph Penzien, Dynamics of Structures,1975, McGraw Hill Co.

- Paz, M, Structural Dynamics, Van Nostrand Reinhold, New York
- Paz, M, International Handbook of Earthquake Engineering, Chapman & Hall, New York.
- IS-1893-1984-Indian Standard Criteria for Earthquake Resistant Design of Structures, B.I.S., New Delhi.
- IS 4326-1993-Indian Standard Code of Pracice for Earthquake Resistant Design and Construction of Buildings, B.I.S.,New Delhi.
- I.S. 13920-1993 –Code of Practice for Ductile Detailing of R.C.C. Structures Subjected to Sesmic Forces. B.I.S.,New Delhi

M TECH: STRUCTURAL ENGINEERING

SE – 616 DESIGN OF PLATES AND SHELLS

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Bending of thin plates, Assumptions, Governing differential equations in Cartesian coordinate system, Boundary conditions, Analytical solutions for rectangular plates by Navier and Levy's methods, Distributed and concentrated loads.

Circular plates, Governing differential equations in polar coordinate system, Annular plate, rotationally symmetric loading, Eccentric concentrated load, Simultaneous bending and stretching of thin plates, Energy methods in analysis of plates, Orthotropic plates, Plates on elastic foundation, Introduction to large deflection theory of plates.

Shear Deformation Theories, First order shear deformation plate theory, higher order shear deformation plate theory, Effect of shear deformation on bending of thin plates.

Bending Analysis of Laminated Composite Plates, Strain displacement relations, governing differential equation of equilibrium, Lamination configuration types, Analysis of symmetric and anti-symmetric laminated plates, Cylindrical bending of laminated plates.

Shells, Geometry and classifications, Stress resultants, Membrane theory and its applications to shells of surface of revolutions, membrane theory for cylindrical shell, General theory in bending of singly curved and doubly curved shells, Design method for cylindrical shell, HP shells, Conoids analysis of folded plates, Design of diaphragms, Reinforcements for shells, Framework for shells and folded plates.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- G. S. Ramaswami, Design and Construction of Concrete Shell Roofs, CBS Publishers, New Delhi, 2004.
- M. L. Gambhir, Stability Analysis and Design of Structure, Springer, 2009.
- S. P. Timoshenko and W. W. Krieger, Theory of Plates and Shells, McGraw Hill, 2nd Ed, 1964.
- R. Szilard, Theory and Analysis of Plates - Classical and Numerical Methods, John Wiley and Sons, 2004.
- Zingoni, Shell Structures in Civil and Mechanical Engineering, Thomas Telford, 1997.

M TECH: STRUCTURAL ENGINEERING

SE – 624 DESIGN OF BRIDGES

Internal Assessment/Evaluation: 40 Marks
External Examination: 60 Marks
Duration of Examination: 03 Hours

Types of bridges, Structural configurations, Bridge loading standards in India and other countries (IRC, IRS and AASHTO guidelines), Impact effect, Standard specifications for road and railway bridges; analysis of bridge deck.

Reinforced concrete bridges, Design of deck slab, T-beam bridge, Balanced cantilever type, Design and details of articulation, Design of bearings and connections, Long span bridges.

Prestressed Concrete bridges, Pretensioned and post tensioned concrete bridges, Analysis of section for flexure, Shear and bond, Losses in prestress, Deflection of girder, Partial prestressing, Analysis and design of anchorage block, Box girder bridge.

Steel bridges, Steel-concrete composite constructions, Shear connectors and their design, Types of bearings and layout.

Abutment and piers, Scour at abutment and piers, Types of foundations, Analysis for stresses and design, Introduction to soil-structure interaction.

Numerical modeling and analysis, Introduction to earthquake resistant design of bridges, Maintenance of bridges, Evaluation of existing bridges.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- D. J. Victor, Essentials of Bridge Engineering, Oxford IBH, 1980.
- V. K. Raina, Concrete Bridge Practice Analysis Design and Economics, Tata McGraw Hill, 2nd Ed, 1994.
- N. Rajagopalan, Bridge Superstructure, Narosa Publishing House, 2006.
- W. F. Chen and L. Duan, Bridge Engineering Handbook, CRC press, 2003.
- B. Bakht and L.G. Jaeger, Bridge Analysis Simplified, McGraw Hill, 1987.
- E. J. O'Brien, and D. L. Keogh, Bridge Deck Analysis, Taylor and Francis, 1999.
- H. Eggert and W. Kauschke, Structural Bearings, Ernst & Sohn, 2002.
- T. Y. Lin and N. H. Burns, Design of Prestressed Concrete Structures, John Wiley and
- Sons, 1981.
- L. Fryba, Dynamics of Railway Bridges, Thomas Telford, 1996.

M TECH: STRUCTURAL ENGINEERING

SE – 627 RESEARCH METHODOLOGY

Internal Assessment/Evaluation: 50 Marks

Introduction to Educational Research: Concept; types – basic; applied and action; Need for educational research; Reviewing Literature; Need; Sources – Primary and Secondary; Purposes of Review; Scope of Review; steps in conducting review.

Identifying and defining research problem: Locating; analyzing stating and evaluating problem. Generating different types of hypotheses and evaluating them.

Methods of Research: Descriptive research design - survey; case study; content analysis; Ex-post Facto Research; Co relational and Experimental Research; Design and development of measuring instruments; Tests; questionnaires; checklists; observation schedules; evaluating research instruments; selecting a standardized test.

Data Collection: Procedure of data collection; Aspects of data collection; coding data for analysis; Statistical Methods of Analysis.

Descriptive statistics: Meaning; Graphical representations; mean; Range and standard deviation; characteristics and uses of normal curve; Inferential statistics: t-test; Chi-square tests; correlation (rank difference and product moment); ANOVA (one way); Selecting appropriate methods.

Procedure for writing a research proposal: Purpose; types and components of research proposal; Procedure for writing a research report; Audiences and types of research reports; Format of research report and journal articles.

Strategies for evaluating; Research disseminating and utilizing research – An Overview

Practice Tasks:

- *Define a research problem in engineering education/industry after studying problem situation and literature*
- *Given the purpose, objectives of research, write hypotheses*
- *Select research designs for the given research objectives*
- *Identify the measuring instruments for the given research objectives/hypotheses*
- *Identify the appropriate statistical methods of analysis for the given research proposal.*
- *Critically analyse the given research reports on various aspects such as hypothesis, design, measuring tools, statistical analysis, interpretation etc. to identify the gaps or weaknesses in the study.*

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Kothari, C. R., Research Methodology: Methods and Techniques, New age International publication.

- Borg; W and Gall; M. Educational Research: An Introduction; New York; Longman.2003
- Cohen; L. Educational Research in Classrooms and Schools! A Manual of Materials and Methods NY: Harper and Row Publishers.2000

M TECH: STRUCTURAL ENGINEERING

SE – 629 DISSERTATION (PHASE -I)

Internal Assessment/Evaluation: 100 Marks

The primary objective of this course is to enhance the student ability to analyze and carry out independent investigations etc. Each student will carry out independent work which should involve creativity; innovation and ingenuity. A dissertation supervisor (s) having at least post- graduate qualification; from industry/research organization shall be assigned to the student approved by the competent authority. *In no case; the candidate can have more than two dissertation supervisors.* Industry oriented projects may be encouraged for the purpose.

The whole Dissertation work will be carried out and reported in two phases in 5^{th} semester and 6^{th} semester. Dissertation work (Phase-I) in 5^{th} semester shall comprise of literature survey; problem formulation; finalization of goals to be achieved; outlines of the methodology to be used for achieving the targeted goals and final decision about S/W; H/W tools to be used for dissertation work in 6^{th} semester. The entire work will be documented in the form of report.

Internal assessment of dissertation (Phase-I) in 5^{th} semester will be made by the committee evaluating the report (50% weightage); oral presentation and response of the student in the discussion / presentation (50% weightage). The dissertation supervisor (s) shall be the member (s) of the committee.

M TECH: STRUCTURAL ENGINEERING

SE – 630 DISSERTATION (PHASE-II)

Internal Assessment/Evaluation: 50 Marks
External Examination: 250 Marks

The complete dissertation work shall comprise of literature survey; problem formulation; methodology used; S/W; H/W tools used; Results and discussion followed by the conclusions & further scope of work in that area. The submission of dissertation in 6th semester shall be allowed only after ensuring that the research work carried out by the candidate has attained the level of satisfaction of the 'Dissertation Supervisor (s)' and proof of communication/acceptance of the research paper (if any; and certified in the report) in the relevant refereed journal/ conference.

The final dissertation external examination in 6th semester shall be taken by a panel of examiners comprising of concerned Supervisor (s); one external examiner (from the relevant field) nominated/approved by the competent authority. Hard copies of dissertation; one for each supervisor (s); examiner and the university/ department; are required to be submitted by the student before the final dissertation external examination. The candidate shall appear before the examining committee for oral examination and presentation on the scheduled date.

M TECH: STRUCTURAL ENGINEERING

SE – 711 ADVANCED CONCRETE TECHNOLOGY

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Concrete as a composite material, Rheological properties of concrete, Microstructure studies in concrete, techniques for measurement of porosity.

Reinforcement Corrosion, Electrochemical process, Techniques for corrosion monitoring, Corrosion protection measures, Application of coatings on rebar, Corrosion inhibitors in concrete.

Use of industrial waste and their influence on physical, Mechanical and durability properties of concrete.

Fiber reinforced concrete, Mechanism of fiber reinforcement, Types of fibers, Properties of fiber reinforced concrete.

High strength concrete, Constituents, Mix proportioning, Properties at fresh and hardened state, Reactive powder concrete, Macro Defect Free (MDF) cement.

Self compacting concrete, roller compacted concrete, ferrocement composites.

Polymers in construction, polymer concrete composites, Chemical testing of concrete, Non-destructive evaluation of reinforced concrete by surface hardness techniques, Wave propagation techniques, Penetration resistance techniques, Electrochemical and electromagnetic techniques.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- P. K. Mehta and P. J. M. Monteiro, Concrete: Microstructure, Properties and Materials,McGraw-Hill, 3rd Ed., 2006.
- J. Newman and B. S. Choo, Advanced Concrete Technology: Processes, Elsevier, Butterworth-Heinemann, 2003.
- M., Neville and J. J. Brooks, Concrete Technology, Pearson Education, 4th Indian ` reprint, 2004.
- M. S. Mamlouk and J. P. Zaniewski, Materials for Civil and Construction Engineers, Pearson, Prentice Hall, 2nd Ed., 2006.
- Pierre-Claude Aïtcin, High Performance Concrete, E & FN Spon, 1998.
- J. Newman and B. S. Choo, Advanced Concrete Technology: Concrete properties, Elsevier, Butterworth-Heinemann, 2003.
- E. G. Nawy, Fundamentals of High-Performance Concrete, John Wiley & Sons Inc., 2nd Ed.,2001.

M TECH: STRUCTURAL ENGINEERING

SE – 713 PRESTRESSED CONCRETE STRUCTURES

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Introduction to prestressed concrete, Types of prestressing, Systems and devices, materials, Losses in prestress, Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, Code provisions in IS 1343.

Statically determinate PSC beams, Design for ultimate and serviceability limit states for flexure, and flexure combined with axial compression or tension, Analysis and design for shear and torsion, Code provisions.

Transmission of prestress in pretensioned members, Anchorage zone stresses for posttensioned members. Statically indeterminate structures Analysis and design - continuous beams and frames, Choice of cable profile, Linear transformation and concordancy.

Composite construction with precast PSC beams and cast in-situ RC slab - analysis and design, Creep and shrinkage effects.

Partial prestressing - principles, Analysis and design concepts, Crackwidth calculations Analysis and design of prestressed concrete pipes, Tanks and spatial structures - slabs, Grids, folded plates and shells.

Need of composite construction; Design methods for composite beams, Slabs, columns and Box–girders.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- N.Krishna Raju, Prestressed Concrete, Tata-McGraw Hill, Delhi, 2006.
- P. Dayaratram, Prestressed Concrete structures, Oxford & IBH Co., Delhi, 1985.
- Jain & Jai Krishna, Plain & Reinforced Concrete, Vol- II, Nem Chand & Co., Roorkee.
- IS 1343-1980 code of Practice for Prestressed Concrete, Bureau of indian standards, New Delhi.
- T. Y. Lin and N. H. Burns, Design of Prestressed Concrete Structures, John Wiley and Sons, 1981.

M TECH: STRUCTURAL ENGINEERING

SE – 715 MASONARY STRUCTURES

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Properties of constituents- burnt clay, concrete blocks, mortar, grout, reinforcement, Masonry bonds and properties, patterns, shrinkage, differential movement,

Masonry properties - compression strength, Stresses in masonry walls - vertical loads, Vertical loads and moments - Eccentricity & kern distance, lateral loads in-plane, out-of-plane.

Behaviour of masonry walls and piers: axial and flexure, axial- shear and flexure.

Behaviour of Masonry Buildings, Unreinforced masonry buildings, Importance of bands and corner & vertical reinforcement.

Reinforced Masonry Buildings - Cyclic loading & ductility of masonry walls.

Behaviour of masonry infills in RC frames - Strut action, Structural design of masonry in buildings - Methods of design, Working Stress Design, Ultimate strength design, seismic design, seismic loads, code provisions, infills, connectors, ties.

Seismic evaluation and strengthening of masonry buildings - Methods, in-situ, non-destructive testing; Construction practices and new materials.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Narendra Taly, 2010, Design of Reinforced Masonry Structures, McGraw Hills
- James Ambrose, 1997, Simplified design of Masonry structures, John Wily
- David Dowrick, 2003, Earthquake resistant design and risk reduction, Wiley
- Miha Tomaževič, 1999, Earthquake-resistant design of masonry buildings, Imperial College Press
- Arnold William Hendry, B. P. Sinha, S. R. Davies, 1996, Design of Masonry Structures.

M TECH: STRUCTURAL ENGINEERING

SE – 712 RELIABILITY BASED STRUCTURAL DESIGN

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Concepts of structural safety, Basic statistics and probability, Resistance parameters and distributions, Probabilistic analysis of loads, Live load and wind load determination of reliability, Monte-Carlo study of structural safety, Level 2 reliability methods including advanced level 2 method.

Reliability analysis of components, Reliability based design determination of partial safety factors, Code calibration, Reliability structural systems, applications to steel and concrete structures, Offshore structures etc.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- P. Thoft-Christensen and M.J. Baker, Structural Reliability theory and its applications, Springer Verlag, 1982.
- R.E. Melchers and Ellis Horwood, Structural Reliability and Prediction, John Wiley and Sons Ltd., 1987.
- A.H.S. Ang and W. H. Tang, Probability Concepts in Engineering Planning and Design, Vol. II, John Wiley and Sons, New York, 1984.
- P. Thoft-Christensen and Y. Murotsu, Applications of Structural Systems Reliability Theory, Springer Verlag, 1986.

M TECH: STRUCTURAL ENGINEERING

SE – 714 DESIGN OF TALL BUILDINGS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Tall Building - Why tall building, Structural systems and concepts, Design criteria, Matrix and approximate methods, Loading, wind, Gravity and earthquake, Combination of loading, limit state, working stress, Plastic design.

Interaction of frames, shear walls. Twist of frames, Analysis of coupled shear walls, Effect of openings, large panel construction, Foundation-superstructure interaction, Earthquake effects and design for ductility.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Bungale S. Taranath, 2009, Reinforced concrete design of tall buildings, CRC Press.
- Bryan Stafford Smith and Alex Coull, 1991, Tall building structures: analysis and design, John Wily.
- Bungale S. Taranath, 1998, Steel, Concrete, and Composite design of tall buildings, McGraw-Hill.

M TECH: STRUCTURAL ENGINEERING

SE – 716 WIND RESISTANT DESIGN OF STRUCTURES

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Causes and types of wind, Atmospheric boundary layer and turbulence, Wind velocity measurements and distribution, Bluff-body aerodynamics, Random vibrations and spectral analysis, Along-wind and across-wind response of tall buildings, Towers and slender structures, Aero-elastic phenomena, Vibration of cable supported bridges and power lines due to wind effects, Wind pressure on cooling towers, Design of cladding and wind damping devices, Wind tunnel simulations and tornado effects.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- E. Siniu and R. H. Scanlan, Wind effects on structures: fundamentals and applications to design, John Wiley and Sons, 1997.
- John D. Holmes, 2007, Wind loading of structures,Taylor and Francis.
- Theodore Stathopoulos, Ted Stathopoulos, C. C. Baniotopoulos, 2007, Wind effects on buildings and design of wind-sensitive structures. Springer Wien, New York
- S K Aggarwal and lakshmy P., 1997, Wind effects on structures, Allied Publishers Limited.

M TECH: STRUCTURAL ENGINEERING

SE – 721 STABILITY THEORY AND STRUCTURAL ANALYSIS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Finite deformation of Structures, Elastic buckling of columns, Statical, Dynamical and energy-based approaches.

Eccentric loading, Nonlinear viscoelastic and elasto-plastic buckling, Flexural-torsional and lateral bucking of beams, Imperfection sensitivity, Post-buckling and Catastrophe theories, Stability of non-conservative structures, Nonlinear dynamical systems theory, Chaos theory, Recent trends.

Finite element formulation, Buckling of frames, Imperfection sensitivity and post critical behavior, Buckling of beams on elastic foundations, arches and plates, Inelastic buckling. Dynamic analysis of stability, Parametric instabilities and stability under non-conservative forces, Divergence and flutter.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Clive L. Dym, 2002, Stability Theory and Its Applications to Structural Mechanics. Noordhoff international publication, UK
- George J. Simitses, Dewey H. Hodges, 2006, Fundamentals of structural stability, Elsevier.
- Jan Awrejcewicz, Vadim Anatolevich Krysko, 2008, Chaos in structural mechanics, Springer.
- M F Rubinstein, 1970, Structural systems- statics, dynamics and stability, Prentice-Hall.
- M S El Naschie, 1990, Stress, stability and chaos, McGraw Hill, London.
- H H E Leipholz, 1978, Stability of elastic structures, Springer Verlag, Wiey.

M TECH: STRUCTURAL ENGINEERING

SE – 723 SOIL STRUCTURE INTERACTION

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Soil Foundation interaction, Soil foundation-structure interaction, Soil-fluid structure interaction, Idealization of soil by various linear and non-linear, isotropic and anisotropic models, Soil-parameters, Interpretation of parameters encountered in various idealized soil models, Experimental investigations.

Finite difference solution to problems of beams on linear and non-linear winkler models, Soil -structure Interaction in framed structure, Soil-pile Interaction- Laterally loaded single piles- concept of coefficient of horizontal sub grade reaction, Soil-structure interaction of framed structures with pile foundations.

Interaction of other Structures with Soil-foundation System, Tanks with annular ring foundations, Chimneys, Silos, Cooling towers, Underground subways and tunnels.

FEM Modeling, Use of appropriate software packages, Introduction to dynamic soil structure interaction as well as non linear soil/concrete behavior.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Jhang C and J. P. Wolf, Current research in Dynamic Soil-Structure Interaction, Elsevier 1998
- John, P. Wolf, Soil-Structure Interaction analysis in Time Domain, 1988, Prentice Hall
- Pierre-Yves Hicher, Jian-Fu Shao, Constitutive Modeling of Soils and Rocks,Wiley, 2008.
- John W. Bull, Soil structure interaction: numerical analysis and modelling, Chapman a& Hall, 1994

M TECH: STRUCTURAL ENGINEERING

SE – 725 MAINTENANCE AND REHABILITATION OF STRUCTURES

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Quality assurance for concrete construction, As built concrete properties, Strength, permeability, volume changes, thermal properties, cracking.

Influence on serviceability and Durability, Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, Corrosion mechanism, Effects of cover thickness and cracking methods of corrosion protection, Inhibitors, Resistant steels, Coatings, Cathodic protection.

Maintenance and Repair Strategies, Inspection, Structural Appraisal, Economic appraisal, Components of quality assurance, Conceptual bases for quality assurance schemes.

Materials for Repair, Special concretes and mortar, Concrete chemicals, Special elements for accelerated strength gain, Expansive cement, Polymer concrete, Sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete.

Techniques for Repair, Rust eliminators and polymers coating for rebars during repair, foamed concrete, Mortar and dry pack, Vacuum concrete, Gunite and shotcrete, Epoxy injection, Mortar repair for cracks, Shoring and underpinning.

Examples of repairs to structures, Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, Weathering, Wear, fire, leakage, Marine exposure.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Dension Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical, U.K, 1991.
- RT. Allen and S.C. Edwards, Repair of concrete Structures, Blakie and sons, UK, 1987.
- MS. Shetty, Concrete Technology – Theory and practice, S.Chand and company, New Delhi, 1992.
- Santhakumar, S.R. Training course notes on damage assessment and Repair in low cost housing RHDC-NBO Anna University, Madras, July, 1992.
- Raikar, R.N. learning from failures – deficiencies in Design, construction and service– R & D centre (SDCPL), Raikar Bhavan, Bombay, 1987.
- N. Palaniappan, Estate Management, Anna Institute of Management, Madras Sep. 1992.
- F.K. Garas, J.L. Clarke, GST Armer, Structural Assessment, Butterworths, UK April 1987.
- A.R. Santhakumar, Concrete chemicals – Theory and applications, Indian society for construction Engineering and

Technology, Madras. 1993.

M TECH: STRUCTURAL ENGINEERING

SE – 722 ARTIFICIAL INTELLIGENCE IN STRUCTURAL ENGINEERING APPLICATIONS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Introduction, Classification of artificial intelligence. Artificial Neural Network, Basic concepts, various learning algorithms, training, testing of network, network topology, network parameters, uses in functional approximation and optimization, Applications in the design and analysis, Building construction.

Expert system, Overview, knowledge acquisition, Knowledge representations, Expert system development tools.

Fuzzy logic, Basic concepts, Problem formulation using fuzzy logic, Applications.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- Introduction of Artificial Intelligence - Patterson D. W.
- An introduction to artificial intelligence, Janet Finlay, Alan Dix, UCL Press, 1996
- D.E. Rumelhart and J.L. McClelland, Parallel Distributed Processing, Vol. 1, MIT Press,
- 1986.
- M.J. Patyra and D.J. Mlynek, Fuzzy Logic Implementation and Applications, Wiley
- Teubner, 1996.
- Artificial Neural Networks, B. Yegnanarayana, Prentice Hall of India, 2004.

M TECH: STRUCTURAL ENGINEERING

SE – 724 FRACTURE AND FATIGUE MECHANICS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Historical perspective, linear elastic fracture mechanics, elastic-plastic fracture mechanics, interface fracture mechanics, metal fracture mechanics, non-metal fracture mechanics, fracture testing of metals and non-metals, fracture of structures, computational fracture mechanics, and fatigue crack propagation, crack closure, variable amplitude fatigue loading.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, 1999.
- T.L. Anderson, Fracture Mechanics – Fundamentals and Applications, CRC press, 1995.
- M.F. Kanninen and C.H. Popelar, Advanced Fracture Mechanics, Oxford Engineering Science Series, 1985.
- S.P. Shah, S.E. Swartz, Fracture Mechanics of Concrete: Applications of Fracture Mechanics to Concrete, rock and Other Quasi-Brittle Materials, John Wiley and Sons Inc., 1995.S. Suresh, Fatigue of Materials, Cambridge University Press, 1998.
- D.R.J. Owen, and A.J. Fawkes, Engineering Fracture Mechanics: Numerical Methods and Applications, Pineridge Press Ltd., 1983.

M TECH: STRUCTURAL ENGINEERING

SE – 726 ADVANCED NUMERICAL METHODS

Internal Assessment/Evaluation: 30 Marks
External Examination: 45 Marks
Duration of Examination: 03 Hours

Programming fundamentals, Introduction to algorithm development, Interpolation & extrapolation.

Integration (central difference method, the Houbolt method, Newmark's method, Wilson – θ method), Newton-Gauss Quadrature method.

Solution of linear algebraic equations, Gauss elimination, Cholesky, Gauss Cholesky Methods, Given's, Householder methods, solution errors.

Solution of non linear Equation (Newton Raphson scheme, BFGS (Broyden et al) methods, Introduction to line search algorithms.

Eigen values problems (Jacobi, QR Method, LR Method, Introduction to Determinant search method, Subspace Iteration, Householder & Given's algorithms).

Initial & two point boundary value problem, Euler's, Runge-Kutta, Milne's Methods, Computer oriented algorithms.

Note: *The examiner is required to set EIGHT questions in all carrying equal marks covering the entire syllabus. The candidate is required to attempt FIVE questions.*

Recommended Books:

- J. B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co. Pvt. Ltd., 2000.
- K. K. Jain, S. R. K Iyengar and R. K. Jain, Numerical Methods - Problem and Solutions, Wiley India Pvt. Ltd, 2001.
- R.W. Hamming, Numerical Methods for Scientist and Engineers, McGraw Hill, 1998.
- J. H. Mathews and K.D. Fink, Numerical Methods using MATLAB, Pearson Education, 2004.

M TECH: STRUCTURAL ENGINEERING

SE – 611 STRUCTURAL DYNAMICS

Recommended Books:

- Anil K Chopra – Dynamics of Structures Theory and Applications to Earthquake Engineering,Prentice-Hall Publications
- R.W Clough and J Penzin – Dynamics of Structures, McGraw Hill Publications
- Madhujit Mukhopadhyay – Structural Dynamics Vibrations and Systems, Ane Books India Publishers

SE – 613 DESIGN OF CONCRETE STRUCTURES

Recommended Books:

- Varghese, P.C. (2001),"Advanced Reinforced Concrete Design", Prentice Hall of India, New Delhi.
- Jain, A.K. (1999), "Reinforced Concrete Limit State Design", Nem chand & Bros., Roorkee
- Krishna Raju (1986), "Advanced Reinforced Concrete Design", C.B.S. Publication, New Delhi

SE – 617 STRUCTURAL ENGINEERING LAB

Recommended Books:

- Concrete technology by A M Nevelli and J J Brooks, Pearsons.
- Concrete Technology by M L Gambhir, Tata McGraw Hills, New Delhi

SE – 612 ADVANCED DESIGN OF STEEL STRUCTURES

Recommended Books:

- Arya A.S. and Ajmani, J.L., 1974, Design of Steel Structures, Nemchand.
- G. Q. Li, Jin-Jun Li, Advanced analysis and design of steel frames, John Wiley and Sons, 2007
- Dennis Lam, Paul Ang, Thien-Cheong Ang, Structural steelwork: design to limit state theory, Elsevier, 2004

SE – 614 FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

Recommended Books:

- J.N. Reddy, An Introduction to the Finite Element Method, Tata McGraw Hill, 2nd Ed, 2003.
- C.S. Krishnamoorthy, Finite Elements Analysis: Theory and Programming, Tata McGraw Hill, 2nd Ed, 1994.
- O.C. Zienkiewicz, R.L. Taylor and J.Z. Zhu, Finite Element Method Its Basis and Fundamentals, Elsevier, 6th Ed, 2005.

SE – 615 ADVANCED STRUCTURAL ANALYSIS

Recommended Books:

- Devdas Menon, Advanced Structural Analysis, Narosa Publishing House, 2009.
- Martin, H.C., Introduction to Matrix Methods of Structural Analysis, McGraw Hill Book Co.
- A. S. Meghre & S. K. Deshmukh, Matrix Methods of Structural Analysis, Charotar Publishing House Pvt. Ltd.

SE – 621 EARTHQUAKE ANALYSIS AND DESIGN

Recommended Books:

- Chopra A.K., Dynamics of Structures-Theory & Applications to Earthquake Engineering, Prentice Hall, India.
- Ray W. Clough, Joseph Penzien, Dynamics of Structures,1975, McGraw Hill Co.
- Paz, M, Structural Dynamics, Van Nostrand Reinhold, New York

Codes

- IS-1893-1984-Indian Standard Criteria for Earthquake Resistant Design of Structures, B.I.S., New Delhi.
- IS 4326-1993-Indian Standard Code of Pracice for Earthquake Resistant Design and Construction of Buildings, B.I.S.,New Delhi.
- I.S. 13920-1993 –Code of Practice for Ductile Detailing of R.C.C. Structures Subjected to Sesmic Forces. B.I.S.,New Delhi

SE – 616 DESIGN OF PLATES AND SHELLS

Recommended Books:

- G. S. Ramaswami, Design and Construction of Concrete Shell Roofs, CBS Publishers, New Delhi, 2004.
- S. P. Timoshenko and W. W. Krieger, Theory of Plates and Shells, McGraw Hill, 2nd Ed, 1964.
- Zingoni, Shell Structures in Civil and Mechanical Engineering, Thomas Telford, 1997.

SE – 624 DESIGN OF BRIDGES

Recommended Books:

- D. J. Victor, Essentials of Bridge Engineering, Oxford IBH, 1980.
- V. K. Raina, Concrete Bridge Practice Analysis Design and Economics, Tata McGraw Hill, 2nd Ed, 1994.
- N. Rajagopalan, Bridge Superstructure, Narosa Publishing House, 2006.

SE – 627 RESEARCH METHODOLOGY

Recommended Books:

- Kothari, C. R., Research Methodology: Methods and Techniques, New age International publication.
- Borg; W and Gall; M. Educational Research: An Introduction; New York; Longman.2003
- Cohen; L. Educational Research in Classrooms and Schools! A Manual of Materials and Methods NY: Harper and Row Publishers.2000

SE – 711 ADVANCED CONCRETE TECHNOLOGY

Recommended Books:

- P. K. Mehta and P. J. M. Monteiro, Concrete: Microstructure, Properties and Materials,McGraw-Hill, 3rd Ed., 2006.
- J. Newman and B. S. Choo, Advanced Concrete Technology: Processes, Elsevier, Butterworth-Heinemann, 2003.
- M., Neville and J. J. Brooks, Concrete Technology, Pearson Education, 4th Indian ` reprint, 2004.

SE – 713 PRESTRESSED CONCRETE STRUCTURES

Recommended Books:

- N.Krishna Raju, Prestressed Concrete, Tata-McGraw Hill, Delhi, 2006.
- P. Dayaratram, Prestressed Concrete structures, Oxford & IBH Co., Delhi, 1985.
- Jain & Jai Krishna, Plain & Reinforced Concrete, Vol- II, Nem Chand & Co., Roorkee.

Code

- IS 1343-1980 code of Practice for Prestressed Concrete, Bureau of indian standards, New Delhi.

SE – 715 MASONARY STRUCTURES

Recommended Books:

- Narendra Taly, 2010, Design of Reinforced Masonry Structures, McGraw Hills
- James Ambrose, 1997, Simplified design of Masonry structures, John Wily
- Arnold William Hendry, B. P. Sinha, S. R. Davies, 1996, Design of Masonry Structures.

SE – 712 RELIABILITY BASED STRUCTURAL DESIGN

Recommended Books:

- P. Thoft-Christensen and M.J. Baker, Structural Reliability theory and its applications, Springer Verlag, 1982.
- R.E. Melchers and Ellis Horwood, Structural Reliability and Prediction, John Wiley and Sons Ltd., 1987.
- P. Thoft-Christensen and Y. Murotsu, Applications of Structural Systems Reliability Theory, Springer Verlag, 1986.

SE – 714 DESIGN OF TALL BUILDINGS

Recommended Books:

- Bungale S. Taranath, 2009, Reinforced concrete design of tall buildings, CRC Press.
- Bryan Stafford Smith and Alex Coull, 1991, Tall building structures: analysis and design, John Wily.
- Bungale S. Taranath, 1998, Steel, Concrete, and Composite design of tall buildings, McGraw-Hill.

SE – 716 WIND RESISTANT DESIGN OF STRUCTURES

Recommended Books:

- E. Siniu and R. H. Scanlan, Wind effects on structures: fundamentals and applications to design, John Wiley and Sons, 1997.
- Theodore Stathopoulos, Ted Stathopoulos, C. C. Baniotopoulos, 2007, Wind effects on buildings and design of wind-sensitive structures. Springer Wien, New York
- S K Aggarwal and lakshmy P., 1997, Wind effects on structures, Allied Publishers Limited.

SE – 721 STABILITY THEORY AND STRUCTURAL ANALYSIS

Recommended Books:

- Clive L. Dym, 2002, Stability Theory and Its Applications to Structural Mechanics. Noordhoff international publication, UK
- George J. Simitses, Dewey H. Hodges, 2006, Fundamentals of structural stability, Elsevier.
- M F Rubinstein, 1970, Structural systems- statics, dynamics and stability, Prentice-Hall.

SE – 723 SOIL STRUCTURE INTERACTION

Recommended Books:

- Jhang C and J. P. Wolf, Current research in Dynamic Soil-Structure Interaction, Elsevier 1998
- John, P. Wolf, Soil-Structure Interaction analysis in Time Domain, 1988, Prentice Hall
- Pierre-Yves Hicher, Jian-Fu Shao, Constitutive Modeling of Soils and Rocks,Wiley, 2008.

SE – 725 MAINTENANCE AND REHABILITATION OF STRUCTURES

Recommended Books:

- Dension Campbell, Allen and Harold Roper, Concrete Structures, Materials, Maintenance and Repair, Longman Scientific and Technical, U.K, 1991.
- RT. Allen and S.C. Edwards, Repair of concrete Structures, Blakie and sons, UK, 1987.
- MS. Shetty, Concrete Technology – Theory and practice, S.Chand and company, New Delhi, 1992.

SE – 722 ARTIFICIAL INTELLIGENCE IN STRUCTURAL ENGINEERING APPLICATIONS

Recommended Books:

- An introduction to artificial intelligence, Janet Finlay, Alan Dix, UCL Press, 1996
- Artificial Neural Networks, B. Yegnanarayana, Prentice Hall of India, 2004.

SE – 724 FRACTURE AND FATIGUE MECHANICS

Recommended Books:

- D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, 1999.
- S.P. Shah, S.E. Swartz, Fracture Mechanics of Concrete: Applications of Fracture Mechanics to Concrete, rock and Other Quasi-Brittle Materials, John Wiley and Sons Inc., 1995.S. Suresh, Fatigue of Materials, Cambridge University Press, 1998.

SE – 726 ADVANCED NUMERICAL METHODS

Recommended Books:

- J. B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Publishing Co. Pvt. Ltd., 2000.
- K. K. Jain, S. R. K Iyengar and R. K. Jain, Numerical Methods - Problem and Solutions, Wiley India Pvt. Ltd, 2001.
- R.W. Hamming, Numerical Methods for Scientist and Engineers, McGraw Hill, 1998.