Department of Civil Engineering

SCHEME OF INSTRUCTION & SYLLABUS
FOR

M.Tech. (STRUCTURAL ENGINEERING)

(with effect from 2019-20 Admitted Batch)

Department of Civil Engineering
A.U. College of Engineering
Visakhapatnam

Department of Civil Engineering
M.Tech. (STRUCTURAL ENGINEERING)
Scheme of Instruction and Examination
(with effect from 2019-20 Admitted Batch)

I – SEMESTER

Code No.	Course Title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec.	Tut.	Total	Exam (hrs)	Ext.	Sess.		
ST1.1	Theory of Elasticity	4	--	4	3	70	30	100	3
ST1.2	Advanced Reinforced Concrete Design	4	--	4	3	70	30	100	3
ST1.3	Matrix Methods of Structural Analysis	4	--	4	3	70	30	100	3
Program Elective –I ST1.4	(a) Advanced Foundation Engineering (b) Experimental Stress Analysis (c) Wind Analysis and Design of Tall Structures	4	--	4	3	70	30	100	3
Program Elective –II ST1.5	(a) Advanced Concrete Technology (b) Structural Dynamics	4	--	4	3	70	30	100	3
ST1.6	Computer Applications in Structural Engineering	-	3	3	Viva	50	50	100	1.5
ST1.7	Design of Structures	-	3	3	Viva	50	50	100	1.5
Total		**20**	**6**	**26**		**450**	**250**	**700**	**18**

II – SEMESTER

Code No.	Course title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec.	Tut.	Total	Exam. (hrs)	Ext.	Sess.		
ST2.1	Theory of Plates and Shells	4	--	4	3	70	30	100	3
ST2.2	Finite Element Method of Analysis	4	--	4	3	70	30	100	3
ST2.3	Earthquake Engineering	4	--	4	3	70	30	100	3
Program Elective –III ST2.4	(a) Optimization Techniques (b) Ground Improvement Techniques (c) Reliability Analysis and Design	4	--	4	3	70	30	100	3
Program Elective –IV ST2.5	(a) Prestressed Concrete (b) Design of Steel Bridges (c) Inelastic Design of Slabs	4	--	4	3	70	30	100	3
ST2.6	Repair and Rehabilitation of Structures	--	3	3	Viva	50	50	100	1.5
ST2.7	Advanced Design of Structures	--	3	3	Viva	50	50	100	1.5
ST2.8	Seminar	--	3	3	Viva	50	50	100	2
Total		**20**	**9**	**29**		**500**	**300**	**800**	**20**

III SEMESTER

Code No.	Course title	Scheme of Instruction			Scheme of Examination			Total	Credits
		Lec	Tut	Total	Exam (hrs)	Ext	Sess		
Program Elective –V ST3.1	(a) Industrial Structures (b) Design of Concrete Bridges	4	--	4	3	70	30	100	3
Program Elective–VI ST3.2	(a) Structural Stability (b) Numerical Methods for Structural Engineering	4	--	4	3	70	30	100	3
ST3.3	Dissertation (Preliminary)	--	--	--	Viva	--	100	100	8
Total		**8**	--	**8**		**140**	**160**	**300**	**14**

IV SEMESTER

Code No.	Course title	Scheme of Examination			Total	Credits
		Exam. (hrs)	Ext.	Sess.		
ST4.1	Dissertation (Final)	Viva	100	--	100	16
Total						**16**

M.Tech. (Structural Engineering)

Programme Educational Objectives:

PEO 1: To impart students with strong knowledge base that make them develop into proficient resources in advanced aspects of engineering with analytical and quantitative reasoning and design abilities.

PEO 2: To develop students' analytical, computational and research skills to formulate, analyse and solve the societal problems of sustainable development related to Structural Engineering along with maintaining the professional integrity and ethics.

Programme Outcomes:

PO1: An ability to independently carry out research /investigation and develop confidence solve practical problems faced by the construction industry.

PO2: An ability to prepare and present a comprehensive technical inspection/investigation report.

PO3: An ability to demonstrate a degree of mastery for designing and solving structural engineering issues.

PO4: An ability to use appropriate modern tools in structural engineering by demonstrating sufficient knowledge of computing tools and their relative merits and demerits.

PO5: An ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO6: An ability to refine and fine tune his knowledge to be a responsible engineer adhering to all professional practices.

Program Specific Outcomes (PSOs)

PSO 1: Ability to apply principles of Civil Engineer ing for the entire life cycle of the project ranging from initial design to the closure of the project.

PSO 2: Demonstrate proficiency in one the following specialized areas of Civil Engineering Construction Materials an Management, Structural and Geotechnical Engineering, Environmental and Water Resources Engineering,Transportation Engineering and Remote Sensing & Geographic Information Systems

COURSE OUTCOMES

ST 1.1 Theory of Elasticity

On successful completion of this course, students will be able to

- critically describe the mathematical and physical foundations of the continuum mechanics of solids, including deformation, stress measures and constitutive relations.
- apply the principles to evaluate the problems related to torsion of non-circular cross-sections.
- analyse the structural members by various energy methods
- describe the basic concepts on the theory of plasticity.

ST 1.2 Advanced Reinforced Concrete Design

On successful completion of these modules, students will be able to

- describe the behaviour of reinforced concrete structural members and compute serviceability response of structural elements.
- employ the Indian code of practice for the design the slender RC columns.
- design the special structural elements such as RC walls, deep beams and corbels
- appropriately choose and design the two-way slab system for buildings.

ST 1.3 Matrix Methods of Structural Analysis

On successful completion of these modules, students will be able to

- explain the transformation of forces and displacement through matrix method.
- compute reactions, internal forces and deflections for planar trusses, beams, and frames using matrix stiffness method.
- analyse the matrix displacement method for symmetry and anti-symmetryof structures using various techniques.
- analyse the direct stiffness method for three dimensional framed structure.

ST 1.4 Experimental Stress Analysis (Elective I)

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

- employ load cell, sensitive dial gauges and LVDT for different application areas and interpret the results.
- acquire load-deflection and load-strain behaviour using data acquisition systems.
- employ NDT techniques such as rebound hammer, UPV test, half-cell potential

technique and interpret the test results.

- describe the importance of model analysis in predicting structural behaviour of large scale structures.

ST 1.5 Structural Dynamics(Elective II)

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

- analyze the dynamic response of multi degree of freedom systems
- analyze the free and forced vibration of bars and beams
- find the dynamic response of structures using numerical integration procedure
- design the buildings for blast and impact forces using BIS codes of practice.

ST 1.5 Advanced Concrete Technology (Elective II)

On completion of these modules, students will be able to

- conduct tests to assess the properties of concrete constituent materialsand its validation for the desired application.
- perform mix design for normal concrete, self compacting concrete and highperformance concrete as per specified standards.
- carryout durability studies on different types of concrete.
- suggest type of concrete based on application and durability requirements.

ST 1.7 Design of Structures

At the end of the course students will be able to

- interpret subsurface information to report soil properties.
- determine bearing capacity and design shallow foundations for various types of structures.
- recommend a suitable type of pile foundation and determine the load carrying capacity of pile foundations.
- design foundations for bridges
- design a suitable type of machine foundation for a machine

ST 2.1 Theory of Plates and Shells

Upon successful completion of this course, students will be able to

- describe the behaviour of thin and thick plates.
- solve and establish classical solutions for various types of plates.

- illustrate the characteristics on different types of shells and develop equilibrium equations and force displacement relations.
- analyse the various types of shells under different loading conditions

ST 2.2 Finite Element Method of Analysis

On the successful completion of these modules, students will be able to

- solve the boundary value problems using approximate methods.
- derive and elemental equations and shape function for one and two dimensional elements.
- perform the mesh refinement and error evaluation for various elements.
- model and analyse 2D and 3D systems using finite element software.

ST 2.3 Earthquake Engineering

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

- evaluate the natural frequencies and modes shapes for structures.
- identify the types of seismic waves and measure the magnitude of earthquake.
- perform seismic analysis of structures using various methods.
- describe and design the ductile detailing for structures.

ST 2.4 Ground Improvement Techniques (Elective III)

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

- explain the properties of problematic soil and necessity of different ground modification techniques.
- describe the improvement of soil by compaction, and preloading techniques suitable for specific site conditions
- describe the improvement of soil by consolidation and method of dewatering
- assess the suitable chemicals and admixtures for stabilisation based on soil types and to implement the grouting techniques in the field condition for soil stabilization

ST 2.5 Prestressed Concrete (Elective IV)

On successful completion of the course, students will be able to

- establish appropriate approaches to calculate the design strength for flexure, shear & torsion and design the PSC members.

- analyse the indeterminate PSC structures
- apply the principles and techniques for the design of circular prestressingand demonstrate the various structures such as poles, piles.
- analyse and design the composite structural members.

ST 2.7 Advanced Design of Structures

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

- design connections for the expected shear force and bending moment
- design components of industrial building such as roof truss, purlins, columns, bracing based on application requirement.
- analyse and design cold formed flexural members, compression membersand wall studs.
- describe the concepts of plastic design, methods of plastic analysis andplastic collapse mechanism.

ST 2.5 Design of Steel Bridges (Elective IV)

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

- design slab culverts and T-beam bridge superstructure for the IRC loadingconditions.
- design post tensioned prestressed T-beam bridge superstructure for the IRC loading.
- design steel plate girder bridge superstructure based on IRS loading conditions.
- design steel rocker cum roller bearing and substructure for pile foundationand well foundation as per IRC.
- describe the design principles of continuous bridges, box girder and balanced cantilever bridges for its use in real time conditions.

ST 2.6 Repair and Rehabilitation of Structures

At the end of course work students will be able to

- Specify the various causes for distress in reinforced concrete structures.
- Conduct systematic condition assessment of damaged structures using conventional and non-destructive testing methods.
- Suggest suitable materials for repair based on damage level, deterioration mechanism and durability requirements of the distressed structures.
- Recommend repair techniques for rehabilitation of damaged structural

elements based on deterioration level, serviceability and durability requirements.

- Specify rehabilitation procedure for fire affected, corrosion affected and other structurally distressed members and engineered demolition techniques

ST 3.1 Industrial Structures (Elective V)

Upon successful completion of the course, students will be able to

- plan for general requirements in an industry and prepare a layout on buildings and structural components for various industries
- make an appropriate lighting & ventilation and identify a suitable measuresto control fire as per factories act in an industrial structure.
- design an industrial building with bents along with crane girder; describe suitable foundations for the various types of machines/equipment in an industry.
- analyse and design a RC structure such as corbels, bunkers, silos, chimneys and cooling towers in an industry.
- identify suitable tower configurations for power transmission, analyse and design a lattice tower with suitable foundations.

Department of Civil Engineering

M. Tech. (STRUCTURAL ENGINEERING)

Syllabus

(with effect from 2019-2020 Admitted Batch)

I – SEMESTER

ST1.1 THEORY OF ELASTICITY

Plane Stress and Plane Strain: Components of stress, Strain, Hooke's law, Stress and strain at a point. Plane stress, Plane strain, Equations of equilibrium, Boundary conditions, Compatibility equations stress foundation.

Two Dimensional Problems in Rectangular Coordinates: Solution by polynomials, St. Vanant's principle determination of displacements, Bending of cantilever loaded at the end, Bending of a beam by uniform load.

Two Dimensional Problem in Polar Coordinates: General equations of equilibrium, Stress function and equation of compatibility with zero body forces. Analysis of thick cylindrical shells with symmetrical leading about the axis, Pure bending of curves bars, Strain components in polar coordinates, Rotating disks.

Three Dimensional State of Stress: Differential equations of equilibrium – Boundary conditions for compatibility – Displacements – Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution.

Torsion: Torsion of straight bars – St.Venant solution – Stress function, Warp function – Elliptic cross section – Membrane analogy torsion of bar of narrow rectangular cross section.
Analysis of Stress and Strain in Three Dimensions: Introduction – Principal stresses-Determination of principal stress – Stress invariants – Maximum sheering stress strain at point.

Text Book

1. *Theory of Elasticity by Timoshenko and Goodier, McGraw Hill Company.*

Reference Books

1. *Theory of Elasticity by Sadhu Singh, Khanna publishers*
2. *Applied Elasticity by C.T. Wang. Mcgraw Hill*
3. *Advanced Strength of Materials by Den Hartog, Dover Publications, Inc.*

ST1.2 ADVANCED REINFORCED CONCRETE DESIGN

Deflection of Reinforced Concrete Beams and Slabs: Introduction, Short-term deflection of beams and slabs, Deflection due to imposed loads, Short-term deflection of beams due to applied loads, Calculation of deflection by IS 456, Deflection of continuous beams by IS 456, Deflection of slabs.

Estimation of Crack width in Reinforced Concrete Members: Introduction, Factors affecting crack width in beams, Mechanisms of flexural cracking, Calculation of crack width, Simple empirical method, Estimation of crack width in beams by IS 456, Shrinkage and thermal cracking.

Redistribution of Moments in Reinforced Concrete Beams: Introduction, Redistribution of moments in fixed beam, Positions of points of contra flexure, Conditions for moment redistribution, Final shape of redistributed bending moment diagram, Moment redistribution for a two-span continuous beam, Advantages and disadvantages of moment redistribution, Modification of clear distance between bars in beams (for limiting crack width) with redistribution, Moment-curvature (M - ψ), Relation of reinforced concrete sections.

Approximation Analysis of Grid Floors: Introduction, Analysis of flat grid floors, Analysis of rectangular grid floors by Timoshenko's plate theory. Analysis of grid by stiffness matrix method, Analysis of grid floors by equating joint deflections, Comparison of methods of analysis, Detailing of steel in flat grids.

Design of Flat Slabs: Introduction, Proportioning of Flat Slabs, Determination of Bending moment and Shear Force, Direct Design method, Equivalent Frame method, Slab Reinforcement. Design and Detailing of Reinforced Concrete Deep Beams

Design of Reinforced Concrete Members for Fire Resistance: Introduction, ISO 834 standard heating conditions, Grading or classifications, Effect of high temperature on steel and concrete, Effect of high temperatures on different types of structural members, Fire resistance by structural detailing from tabulated data, Analytical determination of the ultimate bending moment, Capacity of reinforced concrete beams under fire, Other considerations.

Text Book

Advanced Reinforced Concrete Design by P.C. Varghese. PHI Learning Private Limited.

Reference Book

Reinforced Concrete by Park and Paulay, John Wiley & Sons.

ST1.3 MATRIX METHODS OF STRUCTURAL ANALYSIS

Introduction to Matrix methods: Introduction, coordinate systems, displacement and force transformation matrices, element and structure stiffness matrices, Element and structure flexibility matrices, equivalent joint loads, stiffness and flexibility approaches.

Matrix methods for beams: Analysis of beams, fixed and continuous beams by flexibility method. Analysis of beams, fixed and continuous beams by stiffness method.

Matrix methods for Plane truss problems: Analysis of 2-D trusses by flexibility method. Analysis of 2-D trusses by stiffness method

Matrix methods for Plane Frames: Analysis of 2-D frames by Flexibility matrix methods. Analysis of 2-D frames by Stiffness matrix methods.

Text Books

1. *Matrix methods of Structural Analysis by G.S.Pandit and S.P.Gupta, Tata McGraw Hill Co..*
2. *Matrix Analysis of framed Structures by W Weaver and Gere, Van Nostrand Reinhold.*

Reference Books

1. *Advanced Structural Analysis by Devdas Menon, Narosa Publishing House, 2009.*
2. *Matrix Analysis of Structures by Asslam Kassimali, Brooks/Cole Publishing Co., USA, 1999.*
3. *Analysis of Indeterminate Structures by C.K Wang, McGraw-Hill.*

ST1.4(a) ADVANCED FOUNDATION ENGINEERING

Common Syllabus for SMFE1.2, CTPM1.4(a), TE1.4(a) and ST1.4(a)

Introduction -Principles of Design of Foundations, Types of shear failures in foundation soils, Types of foundations, Design Loads, Basic Concepts of safe and allowable bearing capacity.
Shallow Foundations

Bearing Capacity Analysis: Bearing capacity theories – Terzaghi, Meyerhof, Skempton, Hansen, Vesic and IS Methods, Bearing capacity evaluation from Standard Penetration test and Plate load test.

Settlement Analysis: Uniform and Differential Settlements, Elastic and Consolidation Settlements, Settlement analysis in cohesionless soils by Schemartmann and Hartman method, Penetration tests; Permissible settlements as per IS 1904-1978, causes of settlement, settlement Control.

Proportioning of footings: Isolated column footings, Strip, combined Footings and Strap Footing. Raft Foundations: Bearing capacity of raft foundation, floating raft, Types of rafts, Beam on Elastic foundation and Conventional methods of Design, determination of modulus of subgrade reaction.

Deep Foundations - Pile Foundations: Types, load capacity- dynamic formulae, static formula; pile load tests- Vertical load test, lateral load test, Cyclic load test; settlement of piles and pile groups, negative skin friction on single pile and pile groups; laterally loaded piles - Broom's Analysis, IS Code method; Under reamed piles – Load capacity, design and construction.

Well Foundations: Types, Bearing Capacity of well foundations, Construction of pneumatic caissons, Tilts and Shifts: precautions, Remedial measures; Lateral stability analysis by Terzaghi's Method, Design aspects of Components of well foundation.

Foundations in Expansive Solis Introduction, Identification of expansive soils, Swell potential and swelling pressure, Active depth, Foundation Problems, Foundation practices in expansive soils, Soil Replacement and 'CNS' concepts.

Foundations of Transmission Line Towers - Introduction, Necessary information, Forces on tower foundations, General design criteria, Choice and type of foundation, Design procedure.

Text Books

1. *Analysis and Design of Substructures by Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.*
2. *Basic and Applied Soil Mechanics by Gopal Ranjan and A.S.R. Rao, New Age International Publications*

Reference Books

1. *Foundation Analysis and Design by J.E. Bowles, Mc Graw Hill Publishing Co.*
2. *Foundation Design by W.C. Teng, John Wiley, New York.*
3. *Analysis and Design of Substructures by Swami Saran, Oxford &IBH Publishing Co.*
4. *Foundation Engineering by P.C. Vargheese, Prentice Hall of India*

ST1.4(b) EXPERIMENTAL STRESS ANALYSIS

Analysis of Stress, strain, Stress- Strain relation and theories of failure.

Electrical Resistance Strain Gauges: Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation, cross sensitivity,

Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

Photoelasticity: Two dimensional photo elasticity, Concept of light – photoelastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

Brittle Coating And Moire Methods : Introduction to Moire techniques, brittle coating methods and holography.

Text Books

1. *Experimental Stress Analysis by Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., , Tata McGraw-Hill, New Delhi, 1984.*
2. *Experimental Stress Analysis by Dally, J.W., and Riley, W.F., McGraw-Hill Inc.*

ST1.4(c) WIND ANALYSIS AND DESIGN OF TALL STRUCTURES

Introduction: Basic wind speed, Design wind speed, Design wind pressure, offshore wind velocity, wind pressures and forces in buildings/structures, External pressure coefficients for various roofs, dynamic effects.

Lateral load Analysis of Multistory Building Frames: Analysis of Multistory Building Frames for lateral loads, Cantilever method, Portal method and Factor method.

Design of Shear Wall: Introduction, Types of shear walls, Behaviour of cantilever wall with rectangular cross-section, flange cantilever shear walls, Moment-Axial load interaction for shear wall section, Interaction of shear walls and rigid joined frames, Shear walls with openings, Coupled shear walls.

Design of Chimneys (RCC): Introduction, Wind pressure, Stress in chimney shaft due to self weight and wind, Stress in horizontal reinforcement due to wind shear, Stresses due to temperature difference, Design of RC chimney.

Bunkers and Silos: Introduction, Differences between bunker and silo, Design of square or rectangular bunkers, Design of circular bunkers, Design of silos, Silos for storage of cement.

Multistory Building Frames: Analysis of multistory frames, Method of substitute frames, Bending moments in beams and columns.

Text Books

1. *Advanced Reinforced Concrete Design ,by N.Krishna Raju, CBS*
2. *Reinforced Concrete Structures by Punmia, Jain & Jain, Laxmi Publications (P) Ltd.*
3. *Tall Chimneys by Manohar, S.N., Mcgraw-Hill Book Comp.*

Reference Books

4. *Reinforced Concrete Structures by Park, R. & Paulay, T., John Wiley & Sons.*
5. *Design of Steel Structures by N.Subramanian, OUP India.*

ST1.5(a) ADVANCED CONCRETE TECHNOLOGY

Common Syllabus for ST1.5(a), CTPM1.5(a) and SMFE1.5(a)

Durability of concrete and concrete construction: Durability concept, pore structure and transport processes, reinforcement corrosion, fire resistance, frost damage, sulphate attack, alkali silica reaction, delayed ettringite formation, methods of providing durable concrete, short-term tests to assess long-term behavior.

Mix design: Review of methods and philosophies of IS, BS and ACI methods, mix design for special purposes, Acceptance criteria for compressive strength of concrete.

Special concretes: Lightweight concrete, autoclaved aerated concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete, High strength concrete, refractory concrete, high density and radiation-shielding concrete, polymer concrete, fibre-reinforced concrete, mortars, renders, recycled concrete, Ferro Cement, Self Compacting Concrete.

Special processes and technology for particular types of structure: Sprayed concrete, underwater concrete, grouts, grouting and grouted concrete, mass concrete, slip form construction, pumped

concrete, concrete for liquid retaining structures, vacuum process, concrete coatings and surface treatments.

Test methods: Analysis of fresh concrete, Accelerated testing methods, Tests on hardened concrete, Core cutting and testing, partially destructive testing, Non-destructive testing of concrete structures

Text Book

1. *Properties of Concrete, A.M.Neville, Longman 1995.*
2. *Concrete Technology Theory and Practice, M.S.Shetty, S.Chand & Company Ltd, New Delhi.*

Reference

1. *Concrete micro-structure, Properties and Materials, P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw Hill, USA.*

ST1.5(b) STRUCTURAL DYNAMICS

Common Syllabus for ST1.5(b) and HCH1.5(b)

One Degree Systems: Undamped systems, Various forcing functions damped systems, Response to pulsating force, Support motion.

Lumped Mass Multidegree System: Direct determination of natural frequencies, Characteristic shapes, Stodola-Vianelle method, Modified Rayleigh-Ritz method, Lagrange's equation, Model analysis of multi degree systems, Multistorey rigid frames subjected to lateral loads, Damping in multi degree systems.

Structures with distributed mass and load, Single span beams, Normal modes of vibration, Forced vibrations of beams, Beams with variable cross-section and mass.

Approximate design methods, Idealized system, Transformation factors, Dynamic reactions response calculations, Design example (RC beam, Steel beam and RC slab), and approximate design of multi degree systems.

Matrix Approach: Coordinates and lumped masses, Consistent mass matrix, Undamped force vibration of a system with one degree freedom, Response of single degree freedom undamped system, Viscous damped vibration of a single degree freedom system, Undamped vibration of multi degree freedom system, Orthogonality of natural nodes, Normal coordinates.

Text Books

1. *Structural Dynamics by John M. Biggs. McGraw-Hill*
2. *Dynamics of Structures, Theory and Applications to Earthquake Engineering by Anil K. Chopra, Prentice Hall of India.*

Reference Books

1. *Structural Analysis by A. Ghali & A.M. Neville, CRC Press.*

ST1.6 COMPUTER APPLICATIONS IN STRUCTURAL ENGINEERING

Application of software's in Structural Engineering (by using STAAD Pro, ETABS, STRAP, STRUDS etc) for the following problems.

1. Analysis and Design of Beams.
2. Analysis and Design of Footings.
3. Analysis and Design of Trusses.
4. Analysis and Design of Two Dimensional Frames.
5. Analysis and Design of Three Dimensional Frames.
6. Analysis and Design of Water Tanks.
7. Analysis and Design of Steel Members.
8. Implementation of Concepts of FEM using a Computer Language.

ST1.7 DESIGN OF STRUCTURES (VIVA-VOCE)

Any **THREE** of the following:

1. Design of Folded Plates
2. Elevated Service Reservoirs
3. Retaining walls
4. Grid floor
5. Flat slab
6. Pressed steel tank
7. Buried pipes

Department of Civil Engineering

M.Tech. (STRUCTURAL ENGINEERING)

Syllabus

(with effect from 2019-2020 Admitted Batch)

II – SEMESTER

ST2.1 THEORY OF PLATES AND SHELLS

Bending of Long Rectangular Plates to a Cylindrical Surface: Differential equation for cylindrical bending of plates – Uniformly leaded rectangular plates with simple supported edges and with built in edges. Pure bending of plates slopes – Curvatures of bent plates – Relations between bending moments and curvature – Particular cases – Strain energy in pure bending – Limitations.

Symmetrical Bending of Circular Plates: Differential equation – Boundary conditions. Simply supported rectangular plates under sinusoidal loading – Navier's solution and its application to concentrated load – Levy's solution for uniformly distributed load or hydrostatic pressure – Bending of rectangular plates by moments distributed along the edges – Differential equation of rectangular plate within plane and lateral forces.

Membrane analysis:

a) Shells of revolution (axi-symmetrical loading), Spherical shells, Conical shells, Elliptical shell of revolution, Torus, Hyperboloid of revolution of one sheet, Shells of uniform strength membrane deformation.

b) Membrane analysis of shells of translation, Circular cylinder, Diretrix, Parabola, Cycloid, Catenary and Membrane deformations.

c) Membrane analysis of shells of general shape: Anticlastic, Synclastic shells, Hyperbolic paraboloid, Candella shells, Conoid, Elliptic paraboloid, Rotational paraboloid.

Bending analysis of cylindrical shell: Beam method, Schorer method, Finsterwalder method. Classification analysis.

Text Books

1. *Theory of Plates and Shells by Timoshenko, S. and Wernewsky, Kriegar.*

Reference Books

1. *Design of Reinforced Concrete Shells and Folded Plates by P.C.Varghese, PHI*
2. *Stresses in Shells by Flugge, Springer.*
3. *Design and Construction of Shells by Ramaswamy, G.S, McGraw-Hill.*

ST2.2 FINITE ELEMENT METHOD OF ANALYSIS

Common Syllabus for ST2.2, SMFE2.5(b), WRE2.5(b), HCH2.5(b) and TE2.5(b)

Introduction: A brief history of F.E.M. Need of the method, Review of basic principles of solid mechanics- Equations of equilibrium, Boundary conditions, Compatibility, Strain displacement relations, Constitutive relationship in matrix form, plane stress & plane strain and axisymmetric bodies of revolution with axi-symmetric loading, Energy principles - Raleigh - Ritz method of functional approximation.

Theory relating to the formulation of the finite element method, Coordinate system (local and global), generalized coordinates, Concept of the element, Various element shapes, Discretisation of a structure, Mesh refinement Vs. Higher order element, Interconnections at nodes of displacement models, inter element compatibility, -shape functions.

Basic component – One dimensional FEM single bar element, Beam element : Derivation of stiffness matrix, Assembly of stiffness, Matrix boundary conditions, shape functions for 1 D elements, Initial strain and temperature effects, and trusses under axial forces.

Two dimensional FEM**:** Different types of elements for plane stress and plane strain analysis – Displacement models Generation of element stiffness and nodal load matrices –static condensation.

Isoparametric representation and its formulation for 2d analysis. Formulation of 4-noded and 8-noded isoparametric quadrilateral elements – Lagrangian elements-serendipity elements.

Text Books

1. *Finite Element Analysis by C.S.Krishnamoorthy, (2002), Tata McGraw Hill Publishing Co. Ltd.*
2. *Introduction to Finite Element Method by Desai,C.S.and Abel, J.F.,Van Nostrand, 1972.*

Reference Books

1. *Introduction to Finite element Method by Tirupathi chandra Patla and Belugundu*
2. *The Finite Element Method in Engineering Science" by Zienkiewicz, P., McGraw Hill, 1971.*

ST2.3 EARTHQUAKE ENGINEERING

One Degree Systems: Undamped systems, Various forcing functions damped systems, Response to pulsating force, Support motion. Lumped Mass Multidegree System: Direct determination of natural frequencies, Characteristic shapes, Stodola-Vianelle method, Modified Rayleigh-Ritz method, Lagrange's equation, Model analysis of multi degree systems, Multistorey rigid frames subjected to lateral loads, Damping in multi degree systems.

Matrix Approach: Coordinates and lumped masses, Consistent mass matrix, Undamped force vibration of a system with one degree freedom, Response of single degree freedom undamped system, Viscous damped vibration of a single degree freedom system, Undamped vibration of multi degree freedom system, Orthogonality of natural nodes, Normal coordinates.

Earthquakes, Epicenter, Hypocenter and earthquake waves, Measurement of ground motion, Seismic regions, Intensity and Isoseismals of an earthquake, Magnitude and energy of an earthquake, Consequences of earthquakes, Seismic zoning.

Earthquake Response of Linear Systems: Earthquake excitation, Equation of motion, Response quantities, Response history, Response spectrum concept, Deformation, Pseudo-velocity, and Pseudo-acceleration, Response spectra, Peak structural response from the response spectrum, Response spectrum characteristics, Elastic design spectrum, Comparison of design and response spectra, Distinction between design and response spectra.

Earthquake analysis of Multistorey buildings: By seismic coefficient method and Response spectrum method, Base shear, Fundamental period of buildings, Distribution of forces along the height.

Earthquake analysis of Water towers: Introduction, Behaviour under earthquake loads, Design features, Water tower as a rigid jointed space frame, Hydrodynamic pressures in tanks.

Earthquake analysis of Stack like structures: Introduction, Fundamental period of vibration, Dynamic bending moment, Shear diagram

Earthquake analysis of dams: Hydrodynamic pressures on dams, Zanger's method, Vertical component of reservoir load, Concrete or masonry gravity dams

Text Books

1. *Dynamics of Structures, Theory and Applications to Earthquake Engineering by Anil K. Chopra, Prentice Hall of India.*
2. *Structural Dynamics by John M. Biggs.*
3. *Elements of Earthquake Engineering by Jaikrishna and Chandrasekharan, Saritha Prakasham, Meerut.*

Reference Books

1. *Earthquake resistant design of structures by S.K.Duggal, Oxford University Press.*
2. *Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India Pvt. Ltd.*

ST2.4(a) OPTIMIZATION TECHNIQUES

Introduction: Need and scope of optimization, Historical development, Statement of an optimization problems, Objective function and its surface, design variables, constraints and constraint surface. Classification of optimization problems, various functions (continuous, discontinuous, and discrete) and Function behaviour (Monotonic, Non-Monotonic and Uni-modal)

Classical Optimization Techniques: Differential calculus method, Multivariable optimization by method of constrained variation and Lagrange multipliers (generalized problem). Kuhn-Tucker conditions for optimality.

Fully stressed design and optimally criterion based algorithms, Introduction, Characteristics of fully stressed design theoretical basis – Examples.

Non-linear Programming: Unconstrained minimization – Fibonacci, Golden section, Quadratic and Cubic interpolation methods for a one-dimensional minimization and Univariate Method, Powel's method, Newton's method and Davidon Fletcher Powell's method for multivariable optimization. Constrained minimization – Cutting plane method, Zoutendijk's method and penalty function methods.

Linear programming – Definitions and theorems – Simplex method – Duality in linear programming. Plastic analysis and minimum weight design and rigid frame.

Introduction to quadratic programming, Geometric programming and Dynamic programming. Design of beams and frame using dynamic programming technique.

Text Books

1. *Optimization Theory and Applications by Rao, S.S., Wiley Eastern Ltd., New Delhi, 1978.*
2. *Optimum Design of Structures by Majid, K.I., Newnes-Butter Worths, London, 1974.*

Reference Books

1. *Mathematical Foundations for Design: Civil Engineering Systems by Robert, M. Stark and Robert L. Nicholls, McGraw Hill Book Company, New York, 1972.*
2. *Optimum Structural Design, Theory and Applications by Gallegher, R.H. and Zienkiewiez, O.C., John Wiley and Sons, New York, 1973.*

ST2.4(b) GROUND IMPROVEMENT TECHNIQUES

Common Syllabus for SMFE2.4(b), CTPM2.4(b), ST2.4(b) and TE2.4(a)

Compaction: Theory of compaction, Shallow Surface Compaction - Equipment, Placement water content, factors affecting shallow compaction; Deep compaction: Methods - Vibrofloatation, Terra probe method, Pounding, Blasting, Compaction piles; Compaction Control.

Vertical Drains: Sand drains, Sand wicks, Rope drains, Design of vertical drains, Stone columns, application of the techniques to Marine clays.

Stabilization: Introduction, objectives, Methods of stabilization – Mechanical, Cement, Lime, Bituminous, Calcium chloride; construction methods, factors affecting stabilization of soils; Deep Mixing methods – Soil lime Columns and Cement Lime Columns, applications.

Dewatering: Definition, necessity, Methods of dewatering – Interceptor ditch, Single, Multistage and Vacuum well points, Horizontal wells, Electro-osmosis. Permanent drainage by Foundation drains and Blanket drains.

Grouting: Definition, Objectives of grouting, Grouts and their properties, Categories of Grouting, Grouting methods: Asending, Descending and Stage Grouting in Soils, Hydrofracture, Grouting Equipment, Post grouting tests.

In-situ Reinforcement: Ground Anchors, Tiebacks and Soil Nailing, Micropiles.

Text Book

1. Ground Improvement Techniques by P. Purushothama Raj, Laksmi Publications, New Delhi.

Reference Books

1. *Engineering Principles of Ground Modification by Monfred R Hausmann, Mc Graw Hill Publishing Co.*
2. *Reinforced Soil and Its Engineering Applications by Swami Saran, I.K. International Pvt. Ltd.*

ST2.4(c) RELIABILITY ANALYSIS AND DESIGN

Common Syllabus for ST2.4(c) and SMFE2.4(c)

Concepts of Structural Safety: General, Design methods.

Basic Statistics: Introduction, Data reduction, Histograms, Sample correlation.

Probability Theory: Introduction, Random events, Random variables, Functions of random variables, Moments and expectation, Common probability distribution, Extremal distribution.

Resistance Distributions and Parameters: Introduction, Statistics of properties of concrete, Statistics of properties of steel, Statistics of strength of bricks and mortar, Dimensional variations, Characterization of variables, Allowable stresses based on specified reliability.

Probabilistic Analysis of Loads: Gravity loads, Wind load.

Basic Structural Reliability: Introduction, Computation of structural reliability. Monte Carlo Study of Structural Safety: General, Monte Carlo method, Applications.

Level 2 Reliability Methods: Introduction, Basic variables and failure surface, First-order second-moment methods (FOSM).

Reliability Based Design: Introduction, Determination of partial safety factors, Safety checking formats, Development of reliability based design criteria, Optimal safety factors, Summary of results of study for Indian standard – RCC design. Reliability of Structural Systems: Preliminary concepts as applied to simple structures.

Text Book

1. *Structural Reliability Analysis and Design by R.Ranganatham, Jaico Publishing House.*

Reference Book

1. *Structural Reliability by R.EMelchers, John Wiley and Sons Ltd.*

ST2.5(a) PRESTRESSED CONCRETE

Common Syllabus for ST2.5(a) and CTPM2.5(a)

Introduction: Basic concepts of prestressing need for high strength steel and concrete, advantages of prestressed concrete. Materials for prestressed concrete, high strength concrete and high strength steel.

Prestressing systems and losses of prestress: (1) Freyssinet Anchorage System (2) Gifford Udall System (3) Magnel-Blaton System, Tensioning devices, anchoring devices. (d) Pretensioning and Post tensioning. Prestressing losses, Elastic shortening, loss due to shrinkage, loss due to creep, loss due to friction, loss due to slip etc. I.S.code provisions.

Analysis of prestressed Concrete Beams: Assumptions, Analysis of prestress, Resultant stresses at a section, pressure or thrust line, concept of load balancing, cable profile, kern distance, stress in tendons as per IS 1343, cracking moment.

Shear and Torsional Resistance of Prestressed Concrete Members: Shear and Principal Stresses, Ultimate Shear Resistance of Prestressed Concrete Members, Design of Shear Reinforcements, Prestressed Concrete members In Torsion, Design of Reinforcements for Torsion, Shear and Bending.

Transfer of prestress in Pretensioned members: Transmission length, bond stress, Transverse tensile stress, End Zone reinforcement, flexural bond stress, I.S. Code Provisions.

Anchorage zone in post tensioned members: Introduction, stress distribution in End block, Investigation on Anchorage Zone Stresses- Magnel's method, Guyon's method of approach of analysis of end block (Not more than 2 cables).

Deflection of Prestressed Concrete Members: Importance of Control of Deflections, Factors Influencing Deflections, Short-Term Deflection of Uncracked members, Prediction of Long Time Deflections, Deflection of Cracked Members, Requirements of various Codes of Practice.

Text Book

1. *Prestressed Concrete by N.Krishna Raju, Tata McGraw-HillPublishing Company Limited.*

Reference Books

1. *Prestressed Concrete by N.Rajagopalan, Alpha Science.*
2. *Prestressed Concrete Structures by P. Dayaratnam, Oxford & Ibh*
3. *Design of Prestressed Concrete Structures by T.Y. Lin and Ned. H. Burns, John Wiley and Sons.*

ST2.5(b) DESIGN OF STEEL BRIDGES

Steel Bridges: Introduction, classification of steel bridges, economical span, clearance requirements, dimensions of rolling stock, width of roadway and footway.

Loads: Live load for Railway, Highway and combined rail cum road bridges, Impact effect, wind load, lateral force (racking force), longitudinal forces, centrifugal forces, seismic forces, temperature effects.

Plate girder bridges: Introduction, types, general arrangement, wind load effects, analysis and design of Deck type plate girder bridge for railways, analysis and design of Half-through plate girder bridge for railways, analysis and design of Through type plate girder bridge for railways.

Truss girder bridges: Introduction, general arrangement of components of truss girder bridge, self-weight of Truss girder bridge, wind load and wind effects, analysis of portal bracing, analysis and design of through type truss girder bridge.

Bearings : Introduction, IS code requirements for bearings, Types of bearings, plate bearing, Rocker bearing, Roller bearing, Knuckle pin bearing, Railway board roller bearing.

Text Books

1. *Comprehensive design of steel structures-B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi Publications (P) Ltd.*

Reference Books

1. *Design of Steel structures by N. Subramanian, Oxford University Press.*
2. *Limit State Design of steel structures – Ramchandra and Virendra Gehlot, Scientific Publishers (India)*

ST2.5(c) INELASTIC DESIGN OF SLABS

Basic elastic theory Analysis: Classical plate theory, Lagrange's equation, moment-deformation, shear-deformation relationships. Examples on square and rectangular plates carrying uniformly distributed load for different edge conditions.

Principles of yield line theory: slab reinforcement, section behavior and conditions at ultimate load. Yield lines as axes of rotation and basic rules for the determination of the pattern of yield lines. Different yield line patterns for rectangular and non rectangular slabs supported on three and four sides with different edge conditions.

Analysis by principle of virtual work: Derivation of virtual work equations for Isotropic and Orthotropic two-way Square/ Rectangular slabs supported on four sides for different edge conditions.

Analysis of rectangular/Square slabs supported on three sides with different edge conditions and one edge is free (Balcony slabs) using virtual work principle.

Analysis of rectangular/Square slabs supported on three (Balcony slabs) and four sides with different edge conditions using equilibrium method.

Design of rectangular/Square slabs supported on three (Balcony slabs) and four sides for different edge conditions.

Derivation of virtual work equations only, for two-way slabs supported on four sides with different edge conditions having openings at centre, central eccentric, corner, central short side and central long side.

Text Books

1. *Reinforced Concrete Slabs, Robert Park, William L Gamble, John Wiley & Sons.*
2. *Ultimate Strength Design for Structural Concrete. V.Ramakrishnan, P.D.Arthur. Wheeler books.*

Reference Books

1. *R H Wood and LL Jones "Yield line Analysis of Slabs. Thames and Hudson, Chatto & Windus, London,1967*

ST2.6 REPAIR AND REHABILITATION OF STRUCTURES

Materials: Construction chemicals, Mineral admixtures, Composites, Fibre reinforced concrete, High performance concrete, Polymer-impregnated concrete.

Techniques to Test the Existing Strengths: Destructive and non-destructive tests on concrete.

Repairs of Multi-storey Structures: Cracks in concrete, Possible damages to the structural element beams, Slab, Column, Footing, etc., Repairing techniques like Jack Chu, Grouting, External pre-stressing, Use of chemical admixtures, Repairs to the fire damaged structure.

Repairs to Masonry Structures & Temples: Damages to masonry structures – Repairing techniques, Damages to temples – Repairing techniques.

Foundation Problems: Settlement of soils – Repairs, Sinking of piles – Repairs.

Corrosion of Reinforcement: Preventive measures – Coatings – Use of SBR modified cementitious mortar, Epoxy resin mortar, Acrylic modified cementitious mortar, Flowing concrete.

Temporary Structures: Need for temporary structures under any Hazard, Various temporary structures, Case-studies.

Case Studies: At least 2 case studies per each student.

Text Book

1. *Deterioration, Maintenance and Repair of Structures by Johnson, McGraw Hill.*

ST2.7 ADVANCED DESIGN OF STRUCTURES (VIVA-VOCE)

Any **THREE** of the following:

1. Design of blast resistant structures
2. Design of berth structures
3. Design of Quay Walls
4. Pre-engineered buildings
5. Bow string girder bridge
6. Balanced cantilever bridge
7. Raft design
8. Design of Piles and pile caps

ST2.8 SEMINAR

Each student has to select a topic and collect about 10 papers with at least 5 journal papers and prepare a report and give a seminar at the end of the semester

Department of Civil Engineering
M.Tech. (STRUCTURAL ENGINEERING)
Scheme of Instruction and Examination
(with effect from 2019-20 Admitted Batch)

III SEMESTER

ST3.1(a) INDUSTRIAL STRUCTURES

Plastic Analysis: Introduction, Limit analysis of steel structures, Mechanical properties of structural steel, Plastic hinge, Moment curvature relations, Limit load, Coplanar load, Upper lower bound theorems. Redistribution of moments continuous beams: Relevant or irrelevant mechanisms, Types of mechanisms method for performing moment check. Portal frame, Mechanisms, Combination of mechanisms, Moment check, Partial complete and over complete collapse.

Light gauge steel structures: Local buckling of thin sections, Post packing of thin elements, Light gauge steel columns and compression members, Form factor for columns and compression members, Stiffened compression elements, Multiple stiffened compression elements, Unstiffened compression elements effective length of light gauge steel compression members, Basic design stress, Allowable design stress, Light gauge steel beams, Laterally supported light gauge steel beams web crippling. Allowable design stress in beams, Beams subjected to combined axial end bending stress, connections.

Analysis of Communication Towers: Analysis of Transmission line Towers: Loads on towers, Sag (dip) and Tension in uniformly loaded conductors, Analysis of towers (analysis as coplanar assembly), Design of members in towers, Design of foundation of towers. Design of Steel Chimneys for wind and gravity loads.Design of gantry girder

Text Book

1. *Comprehensive Design of Steel Structures by B.C.Punmia,Ashok Kumar Jain, Arun Kumar Jain, Laxmi Publications (P) Ltd*

Reference Books

1. *Plastic Design of Steel Frames by Beedle, Wiley.*
2. *Design of Steel Structures by Arya & Ajmani, Nem Chand Publishers.*

ST 3.1(b) DESIGN OF CONCRETE BRIDGES

Introduction to bridge engineering. Historical background of bridges and types. Bridge aesthetics and proportioning. Design process. Review of applicable design codes. Loads on bridges and force distribution. Bridge geometry.

Analysis and design of Slab Bridge, Skew slab bridge.

Analysis and design of T-beam bridge: Deck slab considering IRC loads, longitudinal girders(Interior, Exterior), Cross girder.

Analysis and design of prestressed concrete girder and box girder bridges considering only primary torsion, Design of end block.

Bridge Bearing: Types of bearings, Rocker bearing, Elastomeric bearing.

Text book

1. *Essentials of Bridge Engineering, D. Jhonson Victor, Oxford University Press.*

Reference Book

1. *Design of Bridges, N.Krishna Raju, Oxford & IBH Publishing Co.Pvt.Ltd, New Delhi*

ST3.2(a) STRUCTURAL STABILITY

Buckling of Columns: Method of neutral equilibrium, Critical load of the Euler column, Linear column theory – An eigen value problem, Effective length concept, Higher order differential equation for columns initially bent columns, Effect of shear stress on buckling, eccentrically loaded columns, beam columns (Beam columns with concreted lateral load, distributed, load end

moment), Inelastic buckling of columns, Double modulus theory, Tangent modulus theory, Shanley theory of inelastic column behaviour.

Approximate Methods of Analysis: Conservation of energy principles, Calculation of critical loads using approximate deflection curve, Principle of stationary potential energy, Raleigh-Ritz method, Buckling load of column with variable cross-section, Galerkin's method, Calculation of critical load by finite differences, Unevenly spaced pivot points, Matrix stiffness method, Effect of axial load on bending stiffness-slope deflection equations, Buckling of column loaded along the length using energy methods.

Buckling of Frames: Modes of buckling, Critical load of a simple frame using neutral equilibrium, Slope deflection equations and matrix analysis. Lateral buckling of cantilever and simply supported beams of rectangular and I-sections and use of energy method and finite differences.

Buckling of Plates: Differential equation, Strain energy of bending, Critical load, Finite difference approach inelastic buckling of plates.

Matrix approach for Frames: Criterion for determination of critical loads, Stiffness influence coefficients for members without axial load, Derivation of stability functions, Problem involving Non-sways, Modified stiffness of beams, Frames with sway, Multi-bar frames.

Text Book

1. *Principles of Structural Stability Theory by Alexander Chajes, Waveland Pr Inc*

Reference Book

1. *Theory of Elasticity Stability by Timoshenko and Gere. Dover Publications*

ST3.2(b) NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

Solutions of linear equations: Direct method – Cramer's rule, Gauss – Elimination method- Gauss – Jordan elimination method– Triangulation (LU Decomposition) method – Iterative methods - Jacobi – Iteration method –Gauss – Siedel iteration, Successive over –relaxation method.

Eigen values and Eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices-Householder's method for symmetric matrices-Rutishauser method of arbitrary matrices – Power method.

Interpolation: Linear Interpolation - Higher order Interpolation - Lagrange Interpolation – Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation.

Finite Difference and their Applications: Introduction- Differentiation formulas by Interpolating parabolas –Backward and forward and central differences- Derivation of Differentiation formulas using Taylor series-Boundary conditions- Beam deflection – Solution of characteristic value problems- Richardson's extrapolation- Use of unevenly spaced pivotal points- Integration formulae by interpolating parabolas-Numerical solution to spatial differential equations – Application to Simply Supported Beams, Columns & rectangular Plates.

Numerical Differentiation: Different methods based on undetermined coefficients- optimum choice of step length– Partial differentiation.

Numerical Integration: Newton-Cotes integration formulas- Double integration using Trapezoidal Rule – Romberg Integration -Simpson's method Gaussian quadrature- Errors in integration formulas- Multiple integration with variable limits.

Ordinary Differential Equation: Euler's method – Backward Euler method – Midpoint method – single step method, Taylor's series method- Boundary value problems and characteristics- Shooting method- Solution through a set of equations.

Text books

1. *Numerical Methods For Scientific and Engineering Computations. M.K.Jain-S.R.K.Iyengar – R.K.Jain Willey Eastern Limited. New Age International (p) Ltd., Publishers.*
2. *Numerical Methods for Engineers StevanC.Chopra, Raymond P.Canal Mc. Graw Hill Book Company..*
3. *Numerical Methods for Engineering Problems by N. Krishna Raju and K.U. Muthu, M.C. Millan Publishers, New Delhi.*

Reference Books

1. *C Language and Numerical methods by C.Xavier – New Age International Publisher. Reprint March 2012 ISBN:978-81-224-1174-4.*
2. *Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers*

ST3.3 DISSERTATION (Preliminary)

The student shall submit a brief report on the selected topic of his/her thesis work and attend for a formal viva-voce examination before a committee comprising the Chairman, BOS, Head of the Department and the Guide.

Department of Civil Engineering
M.Tech. (STRUCTURAL ENGINEERING)
Scheme of Instruction and Examination
(with effect from 2019-20 Admitted Batch)

IV – SEMESTER

ST4.1 DISSERTATION (Final)

The student shall submit his/her thesis work and attend for a formal viva-voce examination before a Committee comprising the Chairman, BOS, Head of the Department, the Guide and the External Examiner.