Scheme & Syllabus

As per

(CBCS Scheme)

For

M. Tech. (Structural Engineering)

Specialization

(w.e.f. session 2024-25)

UNIVERSITY INSTITUTE OF ENGINEERING AND TECHNOLOGY
FACULTY OF ENGINEERING AND TECHNOLOGY
MAHARSHI DAYANAND UNIVERSITY
ROHTAK -124001(HARYANA)

M. Tech (Structural Engineering)

Program Outcomes (POs):

After completion of the program graduates will be able to

- **A.** Apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude
- **B.** Identify, formulate and solve engineering problems in the domain of structural engineering field.
- **C.** Use different software tools for Analysis and Design structural engineering domain.
- **D.** Design and conduct experiments, analyse and interpret data, for development of simulation experiments.
- **E.** Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

COURSE CODE AND DEFINITIONS:

Course Code	**Definit**
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
Foundation Elcetive	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
Open elective	Open elective course
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar
TH	Theory
PR	Practical

M.D. UNIVERSITY

SCHEME OF STUDIES AND EXAMINATION

M.Tech (Structural Engineering)

CBCS Scheme effective from 2024-25

Semester 1st

Sr. No.	Category	Coarse Code	Course Name	Teaching Scheme			Total Contact Hrs. per week	Credit	Examination schedule (marks)				
				L	T	P			Internal Assessment	External Examination	Practical	Total	Duration of Exam (Hours)
1.	Program core course	**24MTSE21C1**	Advanced Structural Analysis	4	0	0	4	**4**	50	100	-	150	3
2.	Program core course	**24MTSE21C2**	Advanced Solid Mechanics	4	0	0	4	**4**	50	100	-	150	3
3.	Program core course	**24MTSE21C3**	Theory of Thin Plates and Shells	4	0	0	4	**4**	50	100	-	150	3
4.	Program core course	**24MTSE21C4**	Analytical and Numerical Methods for Structural Engineering	4	0	0	4	**4**	50	100	-	150	3
5.	Program core course	**24MTSE21C5**	Advanced Steel Design	4	0	0	4	**4**	50	100	-	150	3
6.	Program Core Lab	**24MTSE-LC-101**	Structural Design Lab	0	0	2	2	**2**	50	-	50	100	3
7.	Program Core Lab	**24MTSE-LC-103**	Advanced Concrete Lab	0	0	2	2	**2**	50	-	50	100	3
Total Credit				**24**									

M.D. UNIVERSITY

SCHEME OF STUDIES AND EXAMINATION

M.Tech (Structural Engineering)

CBCS Scheme effective from 2024-25

Semester 2nd									Examination schedule (marks)				
Sr. No.	**Category**	**Coarse Code**	**Course Name**	**Teaching Scheme**			**Total Contact Hrs. per week**	**Credit**	**Internal Assessment**	**External Examination**	**Practical**	**Total**	**Duration of Exam (Hours)**
				L	T	P							
1.	Program core course	**24MTSE22C1**	FEM in Structural Engineering	4	0	0	4	**4**	50	100	-	150	3
2.	Program core course	**24MTSE22C2**	Structural Dynamics	4	0	0	4	**4**	50	100	-	150	3
3.	Program Core Lab	**24MTSE22-LC-102**	Model Testing Lab	0	0	2	2	**2**	50	-	50	100	3
4.	Program Core Lab	**24MTSE22-LC-104**	Numerical Analysis Lab	0	0	2	2	**2**	50	-	50	100	3
5.	Program core Elcetive course	*	Elective – I	4	0	-	4	**4**	50	100	-	150	3
6.	Open Elcetive course	**	Open Elective				3	**3**					3
7.	Foundation Elective	***	Foundation Elective				2	**2**					2
Total Credits				**21**									

Note:

1. * Choose any one subject from Elective-I. (List given)
2. ** Choose any one subject from the pool of open electives subjects provided by the university.
3. *** Choose any one subject from the pool of Foundation electives subjects provided by the university.

Elective -I	1.	Soil Structure Interaction	**24MTSE 22D1**
	2.	Design of Formwork	**24MTSE 22D2**
	3.	Design of High-Rise Structures	**24MTSE 22D3**
	4.	Design of Masonry Structures	**24MTSE 22D4**

M.D. UNIVERSITY

SCHEME OF STUDIES AND EXAMINATION

M.Tech (Structural Engineering)

CBCS Scheme effective from 2025-26

Semester 3rd									Examination schedule (marks)				
Sr. No.	**Category**	**Coarse Code**	**Course Name**	**Teaching Scheme**			**Total Contact Hrs. per week**	**Credit**	**Internal Assessment**	**External Examination**	**Practical**	**Total**	**Duration of Exam (Hours)**
				L	T	P							
1.	Program core course	**24MTSE23C1**	Design of Advanced Concrete Structures	4	0	0	4	**4**	50	100	-	150	3
2.	Program core course	**24MTSE23C2**	Design of Prestressed Concrete Structures	4	0	0	4	**4**	50	100	-	150	3
3.	Dissertation	**24MTSE23C3**	Literature Survey (Dissertation Phase – I)	-	-	2	4	**2**	100	-	-	100	-
4.	Seminar	**24MTSE23C4**	Seminar	-	-	2	2	**2**	50			50	-
5.	Program Core Lab.	**24MTSE23-LC-201**	Computer applications lab	-	-	2	2	**2**	50	-	50	100	-
6.	Open elective course		Open elective	-	-	-	3	**3**					3
Total Credit				**17**									

*Note: Choose any one subject from the pool of open electives subjects provided by the university.

M.D. UNIVERSITY

SCHEME OF STUDIES AND EXAMINATION

M.Tech (Structural Engineering)

CBCS Scheme effective from 2025-26

Semester 4th

Sr. No.	Category	Coarse Code	Course Name	Teaching Scheme			Credit	Examination schedule (marks)			
				L	T	P		Internal Assessment	External Examination	Practical	Total
1.	Dissertation	**24MTSE24C1**	Dissertation and viva (Dissertation Phase – II)	-	-	-	**20**	250	-	500	750
Total Credits				**20**							

Total Credits for the Programme = 24+21+17+20=82

Note: The student has to publish atleast one research paper related to his/her research work in peer reviewed/Refereed/UGC/ SCOPUS/SCI Journal/Proceeding of National/ International conference before the final viva of Dissertation Phase-II.

Advanced Structural Analysis			
Course Code	**24MTSE21C1**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Analyze the skeleton structures using stiffness analysis code.
2. Use direct stiffness method understanding its limitations.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Influence Coefficients: Physical Significance, Effects of Settlements, Temperature Change and Lack of Fit, Member Approach and Structure Approach.

Stiffness Method applied to Large Frames: Local Coordinates and Global Coordinates.

UNIT-2

Stiffness Matrix Assembly of Structures: Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations, Calculation of Reactions and Member Forces.

Applications to Simple Problems: Beams, Plane Trusses, Plane Rigid Jointed Frames and Grids by Structure Approach and Member Approach.

UNIT-3

Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method.

UNIT-4

Linear Element: Shape Functions, Solution for Poisson's Equation, General One-Dimensional Equilibrium Problem.

References:

- Matrix Analysis of Framed Structures, Weaver and Gere.
- The Finite Element Method, Lewis P. E. and WardJ. P., Addison-Wesley Publication Co.
- Computer Methods in Structural Analysis, MeekJ. L., E and FN, Span Publication.
- The Finite Element Method, Desai and Able, CBS Publication.
- Wang, C.K., 'Matrix Method of Structural Analysis', International Text Book, Pasadena.

- Martin, H.C., Introduction to Matrix Method of Structural Analysis, McGraw Hill Book Co.
- Jain, A.K., Advanced Structural Analysis with Computer Applications, Nem Chand & Bros, Roorkee.
- Majeed, K.I., Non-Linear Structural Analysis, Butterworth Ltd. London.

Advanced Solid Mechanics			
Course Code	**24MTSE21C2**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course outcomes: At the end of the course, students will be able to

1. Solve simple problems of elasticity and plasticity understanding the basic concepts.
2. Apply numerical methods to solve continuum problems.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.
Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

UNIT-2

Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement and Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.
Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates.

UNIT-3

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of prismatic, circular, elliptical sections, Torsion of Thin Tubes.

UNIT-4

Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

References:

- Elasticity, Sadd M.H., Elsevier,2005.
- Engineering Solid Mechanics, Ragab A.R., Bayoumi S.E., CRC Press,1999.
- Computational Elasticity, Ameen M., Narosa,2005.
- Solid Mechanics, KazimiS. M. A., Tata McGraw Hill,1994.

- Advanced Mechanics of Solids, SrinathL.S., Tata McGraw Hill,2000.
- Theory of Elasticity, S. Timoshenko and J.N. Goodier, McGraw Hill Education, New York (2001).
- Continuum Mechanics, D.S Chandra sekharaiah and L. Debnath, Prism Books Pvt. Ltd, Bangalore (1994).
- Advanced solid Mechanics, LS Srinath, McGraw Hill Education, New York (2010).
- Elastic and Inelastic Stress Analysis, I.H. Shames and F.A. Cozzarellie, Prentice Hall, New Jersey (1997).

Theory of Thin Plates and Shells			
Course Code	**24MTSE21C3**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Use analytical methods for the solution of thin plates and shells.
2. Use analytical methods for the solution of shells.
3. Apply the numerical techniques and tools for the complex problems in thin plates.
4. Apply the numerical techniques and tools for the complex problems in shells.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

UNIT-2

Static Analysis of Plates: Governing Equation for a Rectangular Plate, Navier Solution for Simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

UNIT-3

Circular Plates: Analysis under Axi- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.

UNIT-4

Static Analysis of Shells: Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells,
Shells of Revolution: with Bending R**esistance** - Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels. Thermal Stresses in Plate/ Shell

References:

- Theory of Plates and Shells, Timoshenko S. and KriegerW., McGraw Hill.
- Stresses in Plates and Shells, Ugural Ansel C., McGraw Hill.

- Thin Elastic Shells, KrausH., John Wiley and Sons.
- Theory of Plates, ChandrashekharaK., Universities Press.
- Design and Construction of Concrete Shells, RamaswamyG.S.

Analytical and Numerical Methods for Structural Engineering			
Course Code	**24MTSE21C4**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Solve ordinary and partial differential equations in structural mechanics using numerical methods.
2. Write a program to solve a mathematical problem.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Fundamentals of Numerical Methods: Error Analysis, Polynomial Approximations andInterpolations, **Curve Fitting;** Interpolation and extrapolation.

UNIT-2

Solution of Nonlinear Algebraic and Transcendental Equations

Elements of Matrix Algebra: Solution of Systems of Linear Equations, Eigen Value Problems.

UNIT-3

Numerical Differentiation & Integration: Solution of Ordinary and Partial Differential Equations.

Finite Difference scheme: Implicit & Explicit scheme.

UNIT-4

Computer Algorithms: Numerical Solutions for Different Structural Problems, Fuzzy Logic andNeural Network.

Reference Books:

- An Introduction to Numerical Analysis, AtkinsonK.E., J. Wiley and Sons, 1989.
- Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (ShaumSeries), 1988.
- Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India, 1998.

Advanced Steel Design			
Course Code	**24MTSE 21C5**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Design steel structures/ components by different design processes.
2. Analyze and design beams and columns for stability and strength, and drift.
3. Design welded and bolted connections.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Properties of Steel: Mechanical Properties, Hysteresis, Ductility.
Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.
Design of Steel Structures: Inelastic Bending Curvature, Plastic Moments, Design CriteriaStability, Strength, Drift.

UNIT-2

Stability of Beams: Local Buckling of Compression Flange &Web, Lateral Torsional Buckling.
Stability of Columns: Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Columnabout Weak Axis.

UNIT-3

Method of Designs: Allowable Stress Design, Plastic Design, Load and Resistance Factor Design.
Connections: Welded, Bolted, Location Beam Column, Column Foundation, Splices.

UNIT-4

Strength Criteria: Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor,Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.
Drift Criteria: P Effect, Deformation Based Design.

Reference Books:

- Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
- Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee.
- The Steel Skeleton- Vol. II, Plastic Behaviour and Design - Baker J. F., Horne M. R.,

HeymanJ., ELBS.
- Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.
- IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.
- SP – 6 - Handbook of Structural Steel Detailing, BIS,1987.

Structural Design Lab			
Course Code	**24MTSE-LC-101**	**Practical marks:**	**25**
Credits	**2**	**Internal marks:**	**25**
L-T-P	**0:0:2**	**Total marks:**	**50**
		Duration of Examination:	**2 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Design and Detail all the Structural Components of Frame Buildings.
2. Design and Detail complete Multi-Storey Frame Buildings.

Syllabus Content:

Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

Advanced Concrete Lab			
Course Code	**24MTSE-LC-103**	**Practical marks:**	**25**
Credits	**2**	**Internal marks:**	**25**
L-T-P	**0:0:2**	**Total marks:**	**50**
		Duration of Examination:	**2 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Design high grade concrete and study the parameters affecting its performance.
2. Conduct Non-Destructive Tests on existing concrete structures.
3. Apply engineering principles to understand behavior of structural/ elements.

List of Experiments/Assignments:

1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinderstrength, split tensile strength and modulus of rupture.
2. Effect of cyclic loading on steel.
3. Non-Destructive testing of existing concrete members.
4. Behavior of Beams under flexure, Shear and Torsion.

Reference Books:

- Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
- Concrete Technology, Shetty M. S., S. Chand and Co., 2006.

Finite Element Method in Structural Engineering			
Course Code	**24MTSE22C1**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Use Finite Element Method for structural analysis.
2. Execute the Finite Element Program/ Software.
3. Solve continuum problems using finite element analysis.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Introduction: History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.

UNIT-2

Beam Elements: Flexure Element, Element Stiffness Matrix, Element Load Vector.

Method of Weighted Residuals: GalerkinFinite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility andCompleteness Requirements, Polynomial Forms, Applications.

UNIT-3

Types: Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.

Application to Solid Mechanics: Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.

UNIT-4

Computer Implementation of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

Reference Books:

- Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.
- Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.
- Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, 1991.
- Krishnamoorthy, C. S, Finite Element Analysis - Theory and Programming, McGrawHill, 1995.
- R. T. Chandrupatla and A. D. Belegundu, Introduction to Finite Elements in Engineering, PHI Learning Pvt Ltd, New Delhi, 1997.
- S. S. Bhavikatti, Finite Element Analysis, New Age Publishers, 2007.Chennakesava R. Alavala Finite Element Methods: Basic Concepts and Applications, Prentice Hall Inc., 2010.

Structural Dynamics			
Course Code	**24MTSE22C2**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Analyze and study dynamics response of single degree freedom system using fundamental theory and equation of motion.
2. Analyze and study dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
3. Use the available software for dynamic analysis.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Introduction: Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems.

Single Degree of Freedom System: Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier Analysis for Periodic Loading, State Space Solution for Response.

UNIT-2

Numerical Solution to Response using Newmark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration.

Multiple Degree of Freedom System (Distributed Mass and Load): Single Span Beams, Free and Forced Vibration, Generalized Single Degree of Freedom System.

UNIT-3

Multiple Degree of Freedom System (Lumped parameter): Two Degree of Freedom System, Multiple Degree of Freedom System, Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

UNIT-4

Special Topics in Structural Dynamics (Concepts only): Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Base Isolation.

Earthquake Motion and Response: Strong motion earthquake, Numerical method for spectra, Elastic spectra, Ground velocity and displacement, Inelastic spectra.

Reference Books:

- Dynamics of Structures, Clough R. W. and Penzien J., Mc Graw Hill.
- Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K.
- Vibration of Structures - Application in Civil Engineering Design, Smith J. W., Chapman and Hall.
- Dynamics of Structures, Humar J. L., Prentice Hall.
- Structural Dynamics - Theory and Computation, Paz Mario, CBS Publication.
- Dynamics of Structures, Hart and Wong.

Model Testing Lab			
Course Code	**24MTSE22-LC-102**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Outcomes: At the end of the course, students will be able to

1. Understand the response of structures.
2. Prepare the models.
3. Conduct model testing for static loading
4. Conduct model testing for free and forced vibrations

Syllabus Content:

- Response of structures and its elements against extreme loading events.
- Model Testing: Static - testing of plates, shells, and frames models.
- Model Testing: Free and forced vibrations, Evaluation of dynamic modulus.
- Beam vibrations, Vibration isolation, Shear wall building model, Time and frequency-domain study, Vibration Characteristics of RC Beams using Piezoelectric Sensors etc.

Numerical Analysis Lab			
Course Code	**24MTSE22-LC-104**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**

Course Outcomes: At the end of the course, students will be able to

1. Find Roots of non-linear equations by Bisection method and Newton's method.
2. Do curve fitting by least square approximations
3. Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/ Gauss - Jorden Method
4. To Integrate Numerically Using Trapezoidal and Simpson's Rules
5. To Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge- Kutta Method.

Syllabus Contents:

1) Find the Roots of Non-Linear Equation Using Bisection Method.
2) Find the Roots of Non-Linear Equation Using Newton's Method.
3) Curve Fitting by Least Square Approximations.
4) Solve the System of Linear Equations Using Gauss - Elimination Method.
5) Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6) Solve the System of Linear Equations Using Gauss - Jorden Method.
7) Integrate numerically using Trapezoidal Rule.
8) Integrate numerically using Simpson's Rules.
9) Numerical Solution of Ordinary Differential Equations By Euler's Method.
10) Numerical Solution of Ordinary Differential Equations By Runge- Kutta Method.

Soil Structure Interaction			
Course Code	**24MTSE 22D1**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Understand soil structure interaction concept and complexities involved.
2. Evaluate soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.
3. Prepare comprehensive design-oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.
4. Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.
5. Evaluate action of group of piles considering stress-strain characteristics of real soils.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction.
Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.

UNIT-2

Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics.

Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits with Linear and Non-Linear Stress-Strain Characteristics.

UNIT-3

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems, Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts etc.

UNIT-4

Determination of Pile Capacities and Negative Skin Friction, Action of Group of Piles Considering Stress-Strain Characteristics of Real Soils, Anchor Piles and Determination of Pullout Resistance.

Reference Books:

- Analytical and Computer Methods in Foundation, Bowels J.E., McGraw Hill Book Co., NewYork, 1974.
- Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.
- Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers.
- Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.
- Elastic Analysis of Soil-Foundation Interaction, Selvadurai A.P.S., Elsevier Scientific Publishing Company.
- Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.
- Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing.

Design of Formwork			
Course Code	**24MTSE 22D2**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Select proper formwork, accessories and material.
2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
3. Design the form work for Special Structures.
4. Understand the working of flying formwork.
5. Judge the formwork failures through case studies.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Introduction: Requirements and Selection of Formwork.
Formwork Materials- Timber, Plywood, Steel, Aluminum, Plastic, and Accessories. Horizontal and Vertical Formwork Supports.

UNIT-2

Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

UNIT-3

Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower, Bridges.

UNIT-4

Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.
Formwork Failures: Causes and Case studies in Formwork Failure, Formwork Issues in Multi-Story Building Construction.

Reference Books:

- Formwork for Concrete Structures, Peurify, Mc Graw Hill India, 2015.
- Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.
- IS 14687: 1999, False workfor Concrete Structures - Guidelines, BIS.

Design of High-Rise Structures			
Course Code	**24MTSE22D3**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.
2. Analyse, design and detail the RC and Steel Chimney.
3. Analyse. design and detail the tall buildings subjected to different loading conditions using relevant codes.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

UNIT-2

Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

UNIT-3

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions.

UNIT-4

Application of software in analysis and design.

Reference Books:

- Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., SouthAsian Publishers, New Delhi, 2002.
- Structural Analysis and Design of Tall Buildings, Taranath B. S., Mc Graw Hill, 1988.
- Illustrated Design of Reinforced ConcreteBuildings(GF+3storeyed), Shah V. L. &Karve S. R., Structures Publications, Pune, 2013.
- Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.
- Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India. 1991.
- Tall Chimneys, Manohar S. N., Tata Mc Graw Hill Publishing Company, New Delhi.

Design of Masonry Structures			
Course Code	**24MTSE 22D4**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course outcomes: At the end of the course, students will be able to

1. Understand the masonry design approaches.
2. Analyse Reinforced Masonry Members.
3. Determine interactions between members.
4. Determine shear strength and ductility of Reinforced Masonry members.
5. Check the stability of walls
6. Perform elastic and Inelastic analysis of masonry walls.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

Introduction: Historical Perspective, Masonry Materials, Masonry Design Approaches, Overviewof Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

UNIT-2

Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane Loading.
Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation.

UNIT-3

Shear Strength and Ductility of Reinforced Masonry Members.
Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns, Beams.

UNIT-4

Elastic and Inelastic Analysis, Modeling Techniques, Static Push Over Analysis and use ofCapacity Design Spectra.

Reference Books:

1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,
2. Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., 1994.
3. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.
4. Earthquake-resistant Design of Masonry Buildings,Toma evi Miha, Imperial College Press, 1999.

Design of Advanced Concrete Structures			
Course Code	**24MTSE 23C1**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Outcomes: At the end of the course, students will be able to

1. Analyze the special structures by understanding their behaviour.
2. Design and prepare detail structural drawings for execution citing relevant IS codes.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

Syllabus Contents

UNIT-1

Design philosophy, Modeling of Loads, Material Characteristics.Reinforced Concrete - P-M, M-phi Relationships, Strut-and- Tie Method.

UNIT-2

Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456, Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels , Design of Procedure of Corbels, Design of Nibs.

UNIT-3

Design of Shear Walls, Compression Field Theory for Shear Design. Design against Torsion; IS, ACI and Euro code. steel Structures - Stability Design, Torsional Buckling - Pure, Flexural and Lateral.

UNIT-4

Design of Beam-Columns, Fatigue Resistant Design, IS code, AISC Standards and Euro code.

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.

References Books:

- Reinforced Concrete Design, Pillai S. U. and MenonD., Tata McGraw-Hill, 3rd Ed, 1999.
- Design of Steel Structures, SubramaniamN., Oxford University Press, 2008.
- Reinforced Concrete Structures, Park R.and PaulayT. , John Wiley & Sons, 1995.
- Advanced Reinforced Concrete Design, Varghese P. C., Prentice Hall of India, New Delhi.
- Unified Theory of Concrete Structures, Hsu T. T. C. and Mo Y. L., John Wiley & Sons, 2010.
- Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design, Salmon C. G., Johnson J. E. and Malhas F. A., Pearson Education, 5th Ed, 2009.
- Design ofSteel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
- Plastic Methods of Structural Analysis, Neal B.G., Chapman and Hall London.

Design of Prestressed Concrete Structures			
Course Code	**24MTSE 23C2**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course outcomes: At the end of the course, students will be able to

1. Find out losses in the prestressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.
2. Analyse prestressed concrete deck slab and beam/ girders.
3. Design prestressed concrete deck slab and beam/ girders.
4. Design of end blocks for prestressed members.

NOTE: Examiner will set nine question in total. Question One will be compulsory & will comprise short answer type questions from all sections & remaining eight questions to be set by taking two questions from each unit. The students have to attempt five question in total, first being compulsory & selecting one from each Unit.

SYLLABUS

UNIT-1

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.

UNIT-2

Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.

UNIT-3

Transmission of prestress in pre tensioned members; Anchorage zone stresses for post tensioned members.

UNIT-4

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, crack-width calculations

References:

- Design of Prestressed Concrete Structures, Lin T.Y., Asia Publishing House, 1955.

- Prestressed Concrete, Krishnaraju N., Tata McGraw Hill, New Delhi, 1981.
- Limited State Design of Prestressed Concrete, Guyan Y., Applied Science Publishers, 1972.
- IS: 1343- Code of Practice for Prestressed Concrete
- IRC: 112.

Literature Survey (Dissertation Phase –I)			
Course Code	24MTSE23C3	**Practical marks:**	**-**
Credits	**2**	**Internal marks:**	**100**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**------**

Course Outcomes: At the end of the course, the student will be able to:

- Identify structural engineering problems reviewing available literature.
- Identify appropriate techniques to analyze complex structural systems.
- Apply engineering and management principles through efficient handling of project

SYLLABUS

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals' contribution. The marks will be given on the basis of a report prepared covering the above said contents, contents of the presentation, communication and presentation skills.

Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem and End Sem will be monitored by the departmental committee.

Seminar			
Course Code	**24MTSE23C4**	**Practical marks:**	**-**
Credits	**2**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**50**
		Duration of Examination:	**-**

A candidate has to present a seminar on a recent topic/ technology/ research advancement and has to submit a seminar report. The marks will be given on the basis of seminar report, contents of the presentation, communication and presentation skills.

Computer Application Lab.			
Course Code	**24MTSE23-LC-201**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**------**

Course Objectives:

To give the Student:-

1. To study and practice computer aided software to solve real life engineering problems.
2. To study and understand practical application of advanced software to meet industrial requirements.

Course Outcome:

Students who successfully complete this course will be able to analyse/ design different types of structure using advanced software.

Syllabus

Application of Computer Aided design software to analyze structures like ETAB, STAAD PRO, SAP. The student has to practice the packages by working out different types of problems.

M.Tech (Structural Engineering)
4th Semester

Dissertation & Viva (Dissertation Phase – II)			
Course Code	**24MTSE24C1**	**Practical marks:**	**500**
Credits	**20**	**Internal marks:**	**250**
L-T-P	**0-0-0**	**Total marks:**	**750**
		Duration of Examination:	**------**

Course Outcomes: At the end of the course, the student will be able to:

1. Solve complex structural problems by applying appropriate techniques and tools.
2. Exhibit good communication skill to the engineering community and society.
3. Demonstrate professional ethics and work culture.

Syllabus Content

Dissertation – II will be extension of the work on the topic identified in Dissertation – I.

Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.