Scheme & Syllabus

As per

(CBCS Scheme)

For

M. Tech. CIVIL ENGINEERING (Computer Aided Structural Engineering)

Specialization

(w.e.f. session 2022-24)

DEPARTMENT OF CIVIL ENGINEERING
MAHARSHI DAYANAND UNIVERSITY
ROHTAK -124001(HARYANA)

M. Tech CIVIL ENGINEERING (Computer Aided 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 using advanced software's.
- **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 Elective	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 Civil Engineering (Computer Aided Structural Engineering)
CBCS Scheme effective from 2022-23

Semester1st									**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	22MTCASE21C1	Advanced Methods of Structural Analysis	4	0	0	4	**4**	50	100	-	150	3
2.	Program core course	22MTCASE21C2	Computer aided Reinforced Concrete Design	4	0	0	4	**4**	50	100	-	150	3
3.	Program core course	22MTCASE21C3	Theory of Elasticity	4	0	0	4	**4**	50	100	-	150	3
4.	Program core course	22MTCASE21C4	Numerical Methods for Structural Engineering	4	0	0	4	**4**	50	100	-	150	3
5.	Program core course	22MTCASE21C5	Advanced Concrete Technology	4	0	0	4	**4**	50	100	-	150	3
6.	Seminar	22MTCASE21C6	Seminar	0	0	2	2	**2**	50	-	-	50	-
7.	Program Core Lab	22MTCASE21CL1	Structural Engineering Lab	0	0	2	2	**2**	50	-	50	100	3
8.	Program Core Lab	22MTCASE21CL2	Computer Aided Design Lab	0	0	2	2	**2**	50	-	50	100	3
Total Credit				**26**									

M.D. UNIVERSITY
SCHEME OF STUDIES AND EXAMINATION
M.Tech Civil Engineering (Computer Aided Structural Engineering)
CBCS Scheme effective from 2022-23

Semester 2nd

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	22MTCASE 22C1	Finite Element Analysis	4	0	0	4	**4**	50	100	-	150	3
2.	Program core course	22MTCASE 22C2	Structural Dynamics & Earthquake Engineering	4	0	0	4	**4**	50	100	-	150	3
3.	Seminar	22MTCASE 22C3	Seminar	-	-	2	2	**2**	50	-	-	50	3
4.	Program Core Lab	22MTCASE 22CL1	Advanced Concrete Lab	0	0	2	2	**2**	50	-	50	100	3
5.	Program CoreLab	22MTCASE 22CL2	Computer Application Lab	0	0	2	2	**2**	50	-	50	100	3
6.	Program core Elective course	*	Elective– I	4	0	-	4	**4**	50	100	-	150	3
7.	Open Elective course	**	Open Elective				3	**3**					3
8.	Foundation Elective	***	Foundation Elective				2	**2**					2
Total Credits				**23**									

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.	Pre Stressed Concrete	**22MTCASE 22D1**
	2.	Advanced Design of Steel Structures	**22MTCASE 22D2**
	3.	Green Building	**22MTCASE 22D3**
	4.	Design of Steel Concrete Composite Structures	**22MTCASE 22D4**

M.D. UNIVERSITY
SCHEME OF STUDIES AND EXAMINATION

M.Tech Civil Engineering (Computer Aided Structural Engineering)

CBCS Scheme effective from 2023-24

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	22MTCASE23C1	Structural Health Monitoring	4	0	0	4	**4**	50	100	-	150	3
2.	Program core course	22MTCASE23C2	Bridge Engineering	4	0	0	4	**4**	50	100	-	150	3
3.	Dissertation	22MTCASE23C3	Literature Survey (Dissertation Phase–I)	-	-	2	4	**2**	100	-	-	100	-
4.	Seminar	22MTCASE23C4	Seminar	-	-	2	2	**2**	50			50	-
5.	Program Core Lab.	22MTCASE23CL1	Computational Lab	-	-	2	2	**2**	50	-	50	100	-
6.	Project	22MTCASE23CL2	Project	-	-	2	2	**2**	50		50	100	-
Total Credit				**16**									

M.D. UNIVERSITY
SCHEME OF STUDIES AND EXAMINATION

M.Tech Civil Engineering (Computer Aided Structural Engineering)

CBCS Scheme effective from 2023-24

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	22MTCASE24C1	Dissertation and viva (Dissertation Phase–II)	-	-	-	**20**	250	-	500	750
Total Credits				**20**							

Total Credits for the Programme = 26 + 23 +16 +20 = 85

Advanced Methods of Structural Analysis			
Course Code	**22MTCASE21C1**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

1. Study about Fundamental concepts of flexibility and stiffness matrices for the single and two-coordinate system.

2. Study about Indeterminate structures and transformation of stiffness and flexibility matrices from system coordinate to element coordinate

3. Study about Computer Aided Structural Design for Analysis of structures.

NOTE: Examiner will set nine questions 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 questions in total, first being compulsory & selecting one from each Unit.All questions carry equal marks.

SYLLABUS

UNIT -1

Introduction: Objective, scope and outcome of the course. Static and kinematic indeterminacy, Principle of virtual work, Force-displacement relationship and methods, Element approach. Axial stiffness and flexibility.

UNIT – 2

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

UNIT - 3

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

UNIT - 4

Boundary Value Problems (BVP): Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional BVP, Matrix Formulation of the Modified Galerkin Method. Methods of structural analysis; flexibility and stiffness matrices; analysis of trusses, beams and frames.

Course Outcome: After completion of this course students will be able to

1. Understand the basic concept of flexibility & stiffness, principle of superposition and methods of structural analysis

2. They will be Able to transform the unknown from system coordinates to element coordinates.
3. Student will be able to use advanced tools/software for structural analysis.

TEXT BOOK:

1. W. Weaver Jr. and J.M Gere, Matrix analysis of Frames and Structures, CBS Pub and Distributors
2. GS Pandit& SP Gupta, Structural Analysis- A Metrix Approach, Mc. Graw Hill Publication

Computer Aided Reinforced Concrete Design			
Course Code	**22MTCASE21C2**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objective:

1. To study Computer aided structural designing to analysis/ design building Frames.
2. To learn how to prepare detail structural drawings for various structures as per relevant IS codes.

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

SYLLABUS

UNIT-1

General features, Design influencing parameters, Design provisions of IS456, Checking for local failures in beams, Estimation of crack width and deflection of reinforced concrete beams. Detailing of reinforcement in beams.

UNIT-2

Analysis and design of building frames subjected to wind load; Earthquake forces and structural response. Ductile detailing of RCC frames.

UNIT-3

Design of beam-column joints; Design of deep beam, detailing of reinforcement in deep beams, flexural bending & shear stresses in deep beam, Strut & tie analysis of deep beam, Design of shear walls & its applications.

UNIT-4

Elements of flat slab, codal procedure for design of flat slab, behavior of flat slab in shear, equivalent frame method, openings in flat slab, effect of pattern loading in flat slab, Complete analysis and design of building frames using advanced software/tools (ETAB/STAAD PRO/SAP).

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

1. Analyze concrete structures by understanding their behavior.
2. Calculate various types of load acting on the structure using softwares.
3. Design and prepare detail structural drawings for various structures as per relevant IS codes.

Text Books:

1. R. Park and T. Pauley, Reinforced concrete structures, John Wiley and sons

2. A. K. Jain, Reinforced Concrete: Limit State design, NemChand and Bros. 1999.

Reference Books:

1. J. Krishna and OP Jain, Plain and Reinforced Concrete, Vol. I I, Roorkee, Nem Chand and Bros.

2. H. Nilson, D. Darwin and C. W. Dolar, Design of Concrete structures, Tata McGraw Hill

3. T. Paulay and M.J.N. Priestley , Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons Inc.

Theory of Elasticity			
Course Code	**22MTCASE21C3**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

The Student will be able to:-

1. Understanding the general concepts of plasticity, asymmetric problems.
2. Understanding the basic concepts of forces, stresses, strain etc.

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

SYLLABUS

UNIT-1

Introduction to the mathematical theory of elasticity: Elasticity, stress, strain, Hooke's law, two-dimensional idealisations, plane stress and plane strain problems, equations of equilibrium, strain-displacement relations, constitutive relations, compatibility conditions, displacement and traction boundary conditions.

UNIT-2

Introduction to Cartesian Tensors: Transformation laws of Cartesian tensors, special tensors and tensor operations, the Kronecker's delta, the permutation tensor, the e-d identity, symmetry and skew-symmetry, contraction, derivatives and the comma notation, Gauss' theorem, the base vectors and some special vector operations, eigenvalue problem of a symmetric second order tensor, equations of elasticity using index notation.

UNIT-3

Two-dimensional problems in rectangular coordinates: Stress function, solution by polynomials, Saint Vénant's principle, bending of a cantilever, determination of displacements. Two-dimensional problems in polar coordinates: General equations, problems of axisymmetric stress distribution, pure bending of curved bars, effect of circular hole on stress distribution in plates, concentrated force at a point on a straight boundary. Stress and strain problems in three dimensions: Principal stresses, principal strains, three dimensional problems.

UNIT-4

Energy Theorems and Variational Principles of Elasticity: Strain energy and complementary energy, Clapeyron's theorem, virtual work and potential energy principles, principle of complementary potential

energy, Betti's reciprocal theorem, principle of linear superposition, uniqueness of elasticity solution.

Course Outcome:

1. The student will be able to execute the stress state, stresses and strains analysis.
2. Students will be able to use the numerical methods for the problem of the theory of elasticity in practice.

References

1. Timoshenko, S.P. and Goodier, J.N., Theory of Elasticity, McGraw Hill, Singapore,1982.
2. Leipholz, H., Theory of Elasticity, Noordhoff International Publishing, Layden,1974.
3. Sokolnikoff, I.S., Mathematical Theory of Elasticity, Tata McGraw Hill, India,1974.
4. Xu, Z., Applied Elasticity, Wiley Eastern Ltd, India, 1992.
5. Srinath, L.S., Advanced Mechanics of Solids, Second Edition, Tata McGraw Hill,India,2003.
6. Ameen, M., Computational Elasticity

Numerical Methods for Structural Engineering			
Course Code	**22MTCASE21C4**	**Externalmarks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

1. To introduce the principles of numerical techniques to students.
2. To review and implement the basic principles of interpolation and polynomial approximation, numerical integration, solving simple ordinary differential equations and partial differential Equation

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

SYLLABUS

UNIT-1

Fundamentals of Numerical Methods: Error Analysis, Polynomial Approximations and Interpolations, Curve Fitting; Interpolation and extrapolation. Solution of Nonlinear Algebraic and Transcendental Equations

UNIT-2

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

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 and Neural Network.

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.

Reference Books:

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

Advanced Concrete Technology			
Course Code	**22MTCASE21C5**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

• To study the properties of concrete making materials such as cement, aggregates and admixtures

• To study the properties and tests on fresh and hardened concrete

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

SYLLABUS

UNIT-1

Introduction to Advanced concrete technology, Aggregate classification, Cement, grade of Cement, Hydration of Cement. Additions to concrete, admixtures, fresh concrete, settling & hardening of concrete & its properties.

UNIT-2

Principles of Concrete mix design, methods of Concrete mix design, Design of high strength and high performance concrete. Review of methods & philosophies of mix design.

UNIT-3

Non destructive testing and quality control, Durability, corrosion protection and fire resistance. Types characteristics, calibration & maintenance.

UNIT-4

Modern trends in concrete manufacture and placement techniques, different types of concrete, ready mixed concrete, repairing concrete, exposed concrete & precast concrete.

Course Outcome:

Students who successfully complete this course can execute and test the concrete made with cement, aggregates and admixtures and also describe the properties and durability of fresh and hardened concrete and their testing methods.

Text Books:

1. Nevile, A. M., “Concrete Technology”, Prentice Hall, New York, 1985.

References:

1. Krishnaraju, N., ”Advanced Concrete Technology”, CBS Publishers.
2. Santhakumar A.R. –“Concrete Technology”
3. M.L. Gambhir, “Concrete Technology”

Seminar			
Course Code	**22MTCASE21C6**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
L-T-P	**0-0-2**	**Total marks:**	**50**
		Duration of Examination:	**-**

Course Objectives:

1. To emphasize the need for energy efficient buildings
2. To understand the considerations for an Energy Efficient building design.
3. To have an insight into the existing Green Rating Systems in India.
4. To illustrate various techniques that can be applied in buildings to make them green.

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.

Structural Engineering Lab			
Course Code	**22MTCASE21CL1**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
L-T-P	**0-0-2**	**Total marks:**	**50**
		Duration of Examination:	**-**

Course Objective

1. To teach students how to design the concrete mix and cast RCC and PSC beams.
2. Calculate the theoretical loads and conduct experiments on the beams.

Syllabus

1. Mix design of concrete of different grades & using admixtures.
2. Tensile and Flexural strength of concrete of different grades.
3. Tensile strength of different types of steel rebars, rolled steel sections.
4. Testing of simply supported RCC beams for flexural failure.
5. Testing of simply supported RCC beams for shear failure.
6. Testing of RCC column.
7. Non-destructive testing of concrete including rebound hammer and ultrasonic pulse method.
8. Permeability of concrete.
9. Vibration analysis of beams and plates.
10. Buckling load of struts.

Course outcome

Students are able to design the concrete mix and cast RCC and PSC beams. Measure load, deformation and strain and plot load- deformation curve and moment-curvature

Essential Reading:

1. A.M. Neville & J.J. Brooks, Concrete Technology, Pearson Education, Delhi, 2004.
2. A.R. Santhakumar, Concrete Technology, Oxford University Press, 2007, New Delhi.

Supplementary Reading:

1. Structural Engineering laboratory manual.
2. Relevant BIS Codes of practice for mix design, rebar testing, concrete design etc.

Computer Aided Design Lab			
Course Code	**22MTCASE21CL2**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
L-T-P	**0-0-2**	**Total marks:**	**50**
		Duration of Examination:	**-**

Course Objectives:

1. To familiarize with graphic primitives, transformations and 2-D drafting of computer graphics.
2. To get practiced with computer methods of structural analysis

Syllabus

Introduction: History and overview of CAD, Advantages of CAD over manual drafting and design, Popular CAD designs.

Construction activities:- The critical path method- General application software's- Civil engineering packages

Course Outcome:

The student will be familiarized with 2 D drafting and can use drafting software. And they can perform structural analysis using analysis package

References:

1. Sujith Kumar Roy & Subrata Chakrabarty, "Fundamentals of Structural Analysis", S Chand $ Company Ltd., New Delhi.
2. B.Sengupta & H. Guha, "Construction Management and Planning", Tata McGraw Hill Publishing Co. Ltd, New Dehi.
3. R.L Peurifoy, "Constuction Planning, Equipment and methods", Tata McGraw Hill Publishing Co. Ltd, Kogakusha.
4. Mikell P. Groover&Emroy W Zimmers,Jr, "CAD/CAM Computer Aided Design and Computer Aided Manufacturing"
5. L S Sreenath, CPM – PERT.
6. C.S. Krishnamoorthy, S.Rajeev, A Rajaraman, "Computer Aided Design – Software and Analytical Tools",Narosa Publishing House, New Delhi

Finite Element Analysis			
Course Code	**22MTCASE22C1**	**Practical marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hr**

Course Objectives:

1. Obtain an understanding of the fundamental theory of FEA.
2. Understand the general plate bending theories.
3. To make the Student able to develop the ability to generate the governing differential equations

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

SYLLABUS

UNIT-1

Introduction- Basic concept of analysis, introduction of elasticity, Equations of Equilibrium, Strain displacement relations, Stress strain Relations, Plane stress and plane Strain problems.

UNIT-2

Basics of finite element method (FEM), different steps involved in FEM, Different approaches of FEM, Direct method, Energy approach, weighted residual Method.

UNIT-3

Natural coordinates, triangular elements & rectangular elements and quadrilateral elements, Finite Element modeling of one and two dimensional problems, Stiffness matrix of Iso-parametric elements, four node, eight node elements.

UNIT-4

Numerical integration, order of integration; Bending of plates, Numerical evaluation of element stiffness, FEM of 2 dimensional &3 dimensional solids, FEM of Plates & shells, Concept of 3D modeling, additional application of FEM.

Course Outcome:

Students who successfully complete this course will have demonstrated an ability to understand the fundamental concepts of theory of FEA and will be able use the basic finite elements for structural applications using truss, beam, frame and plane elements.

Essential Reading:

1. R. D. Cook, Concepts and Applications of Finite Element Analysis, John Wiley, NewYork, 2004.
2. O. C. Zienkiewicz and R. L. Taylor, Finite Element Method, Butterworth Heinemann publication, 2000.

Supplementary Reading:

1. C.S. Krishnamoorty, Finite element methods, Tata-McGraw Hill, Second Edition, New Delhi, 2002.
2. T. R. Chandupatla& A. D. Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall of India Pvt. Ltd., New Delhi, 5th Reprint, 1999
3. J. N. Reddy, An introduction to Linear Finite Element Method, Oxford University Press, Oxford, 2004.

Structural Dynamics & Earthquake Engineering			
Course Code	**22MTCASE22C2**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

1. Learn how to model discrete single-degree and multiple-degree vibratory systems.
2. The Student will be able to:- Also, calculate the mode shapes and frequencies for the free response of continuous.
3. Calculate the free and forced response of these systems. systems and use modal methods to calculate their response

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

SYLLABUS

UNIT-1

Single degree of freedom system: Equation of motion, Damped and undamped free vibration, Response to harmonic, periodic, impulse load and general dynamic load.

UNIT-2

Multi-degrees of freedom system: Equation of motion, Free vibration analysis, Dynamic response and modal analysis. Free and Forced vibration of distributed mass system in beams.

UNIT-3

Introduction to Seismology, Response & design spectrum for elastic & inelastic systems, lateral load analysis of the buildings, method & model analyses of buildings.

UNIT-4

Analysis of structural response to Earthquakes: Seismological background, Deterministic analysis of Earthquake. Earthquake design of reinforced concrete structural elements, Earthquake design of masonry structures.

Course Outcome:

The student will be able to understand the principles associated with effective project management and application of these principles in avoiding common difficulties associated with project management

Textbooks-

1. M. Paz, Structural Dynamics - Theory and Computation, Van Nostrand, 1985.

2. R. W. Clough and J Penzien, Dynamics of structures , McGraw-Hill, Inc,
3. A K Chropra ,Dynamics of Structures: Theory and Applications to Earthquake Engineering, Prentice Hall of India

Reference Books

1. IS: 1893 - 2002 Criteria for Earthquake Resistant Design of Structures.
2. L. Meirovitch, Elements of Vibration Analysis, 2nd Ed., McGraw-Hill, 1986.

Seminar			
Course Code	**22MTCASE22C3**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
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.

Advanced Concrete Lab			
Course Code	**22MTCASE22CL1**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
L-T-P	**0-0-2**	**Total marks:**	**50**
		Duration of Examination:	**-**

List of Experiments:

1. Determination of bond strength of specimens with M25 Grade and M50 Grade concrete.
2. Preparation of M40 Grade pumpable concrete with super plasticizer and supplementary cementitious materials
3. Preparation of M60 Grade self- compacting concrete and testing it for properties in fresh and hardened states.
4. Determine stress-strain curve of high strength concrete specimens (M60 or higher grade).
5. Determine correlation between cube strength, cylinder strength, split tensile strength and modulus ofrupture with normal strength concrete and high strength concrete mixes
6. Non-Destructive testing of existing concrete members through rebound hammer, Ultrasonic pulse velocity meter, resistivity meter, carbonation test and core test.
7. Behavior of Reinforced Concrete Beam specimen- measurement of strains at various levels through LVDTs, strain Gages- determination of moment curvature relationship

TEXT BOOKS:

1. Concrete Technology, Shetty M. S., S. Chand and Co.,2006.

REFERENCE BOOKS:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall,2012.
2. Reinforced Concrete Structures, R.Park And T.Paulay Willey &Sons , INC.

Computer Application Lab			
Course Code	**22MTCASE22CL2**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
L-T-P	**0-0-2**	**Total marks:**	**50**
		Duration of Examination:	**-**

Course Objectives:

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.

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.

Course Outcome:

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

Pre Stressed Concrete			
Course Code	**22MTCASE 22D1**	**Practical marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3hrs.**

Course Objectives:

1. To Explain the effects of prestress on the behavior of concrete beams and identify situations when prestress is needed
2. To determine the combined stresses induced by prestress and applied loads
3. To define and determine the different types of losses of pre-stressed concrete

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

SYLLABUS

UNIT-1

Different systems of prestressing, Characteristics of concrete and steel, other suitable design of section for flexure, shear and torsion. Design of compression member. Limit state design as per IS code. Comparison of design with respect to British, Australian and American code.

UNIT-2

Partial prestressing. Stress distribution in end-block of post tensioned of prestressed structures- short term as well as long term deflections of uncracked and cracked members.

UNIT-3

Indeterminate structures- Principles of design of prismatic continuous beams of two and three equal, unequal spans with variable moments of inertia, Cap cable, prestressed and in-situ concrete .

UNIT-4

Design of special structures- Circular tanks, Pipes, Mast and materials, Losses in prestress. Analysis of Railway sleepers.

Course Outcome:

The students will be familiar the concepts of pre-stressed concrete, dealing with load analysis.

Essential Reading:

1. Y. Guyen, Prestressed concrete Vol-I & Vol.-II, John Willey & Sons, New York-1960.
2. N. Krishnaraju, Prestressed concrete, Tata McGraw-Hill, New Delhi-2004.

Supplementary Reading:

1. T. Y. Lin and H. Burns Ned, Design of Prestressed concrete structures, John Willey & Sons, New York-1982.
2. S. K. Mallik and A. P. Gupta, Prestressed concrete, Oxford & IBH, New Delhi-1982.
3. E. W. Bennet, Prestressed concrete theory & design, Chapman & Hall, London-1962.

Advanced Design of Steel Structures			
Course Code	**22MTCASE 22D2**	**Externalmarks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

1. To focus on the study and design of various steel towers and steel chimneys

2. To study and design members subjected to lateral loads and axial loads & light gauge steel structures.

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

SYLLABUS

UNIT-1

Properties of Steel- Mechanical Properties, Hysteresis, Ductility. Connections: Welded, Bolted, Location Beam Column, Column Foundation, Splices.Hot Rolled Sections: compactness and non-compactness, slenderness, residual stresses.

UNIT-2

Design of Steel Structures: Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift. Drift Criteria: P Effect, Deformation Based Design.

UNIT-3

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 Column about Weak Axis.

UNIT-4

Method of Designs: Allowable Stress Design, Plastic Design, Load and Resistance Factor Design; Strength Criteria : Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.

Course Outcome:

Students who successfully complete this course will gain knowledge of designing different types of steel members. Also designing light gauge steel structures

Reference Books:

1. Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
2. Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee.
3. J., ELBS. Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.
4. IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.
5. SP – 6 - Handbook of Structural Steel Detailing, BIS, 1987

Green Buildings			
Course Code	**22MTCASE 22D3**	**Externalmarks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

1. To emphasize the need for energy efficient buildings
2. To understand the considerations for an Energy Efficient building design.
3. To have an insight into the existing Green Rating Systems in India.
4. To illustrate various techniques that can be applied in buildings to make them green.

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

SYLLABUS

UNIT-1

Introduction to green buildings: Concept of green building design. Need for energy and resource efficient design. Factors affecting the Energy use in Buildings – Pre-Building Stage, Construction Stage & Post Occupancy stages. Building life cycle analysis. Need for Green Building rating Systems. Brief introduction to green rating systems in India.

Sustainable site construction and management – Selection of site, preserving and protecting landscape during construction, Top soil conservation, reducing hard paving on site, provide sanitation and safety facilities for construction workers Efficient design of services – water management: water supply and treatment methods, rain water harvesting, water recycling, reuse of water and installation of water efficient fixtures. Waste management: reduction of waste during construction, efficient segregation of waste, resource recovery from waste.

UNIT-2

Building physics: heat transfer in buildings (conduction, convection and radiation) and importance material selection for building envelope. Specification of materials for walls and roofs in different climates.

Building materials and resources: Sustainable Building Materials– Biodegradable & Non-Biodegradable Materials, resource reuse, recyclable materials, recycled content, Regional materials. Energy Efficient Construction Technology – Filler Slab, Rat trap Bond. Technologies developed by CBRI. Contemporary and future trends, Nanotechnology, smart materials.

UNIT-3

Energy conservation: Optimizing building design to reduce conventional energy demand, reducing material usage and time of construction by adopting efficient technologies, conserving energy through selection energy efficient equipment.

Alternative sources of energy: Renewable energy sources, Photo Voltaic Cells, small scale hydro and wind systems, photovoltaic cells.

UNIT-4

Indoor environmental quality: Need to improve indoor air quality-sick building syndrome, building related illness, multiple chemical sensitivity. Reducing indoor air pollutants- lowVOC paints / adhesives /sealants, Minimize ozone depleting substances, required levels of indoor ventilation.Indoor and outdoor noise levels.

Case Study/Desktop Study: Case study of a live project on Green Buildings or a desktop study of a Green building

Course Outcomes:

1. The students will understand the importance of green building design.
2. The students will simultaneously learn efficient techniques of optimizing resource usage in the process of building construction, building operation and post demolition.
3. The students will be able to analyze the sustainability any building and check for green features.

Text Book(s):

1. Abridged Version reference guide for New Buildings (IGBC rating system)
2. ECBC reference guide.
1. New buildings reference guide
2. Heather L. Venhaus, Designing the Sustainable Site: Integrated Design Strategies for Small Scale Sites and Residential Landscapes
3. Faisal Zia, VasudevanRajaram, Solid and liquid waste management,
4. Siddiqui, Sanjeev Agrawal, Mohammed Emran Khan, Introduction to Architectural Science
5. S. V. Szokolay, The Basis of Sustainable Design
6. Sustainable Construction Techniques. From structural design to interior fit-out:
7. Sebastian / John, Viola / Zeumer, Martin Assessing and improving the environmental impact of buildings by El khouli.

Design of Steel Concrete Composite Structures			
Course Code	**22MTCASE 22D4**	**Externalmarks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objective:

1. To get introduced to composite construction and composite behaviour of steel concrete composite structures.
2. To obtain the knowledge to conceptualize and design the composite beams, columns, floors, slabs and concrete filled steel tubes.
3. To possess practical knowledge on the skills of composite construction and seismic behaviour of composite structures through case studies.

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

SYLLABUS

UNIT-1

Theory Of Composites - Introduction to steel, concrete composite construction, Behavior of composite structures &composite structures applications.

UNIT-2

Composite Construction - Design of composite beams, Design of composite slabs, design of composite columns and design of composite trusses.

UNIT-3

Types of connections - Design of connections in the composite structures, Shear connections - Degree of shear connection, Partial shear interaction. Introduction - Behavior of box girder bridges, Design concepts.

UNIT-4

Case Studies: Steel-Concrete composite construction in buildings, Seismic behavior of composite structures, sandwich structure – Behavior and applications.

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

1. Illustrate the behaviour of composite structures.

2. Design various composite structural elements such as beams, columns, floors, slabs and concrete filled steel tubes.

3. Analyse the connection behaviour and design.

4. Assess the behaviour of box girder bridges and design concepts of the same.

5. Evaluate the concepts of various structural elements and design concepts through case studies

Reference Book:

1. Johnson R.P., “Composite Structures of Steel and Concrete”, Blackwell Scientific Publications, UK 2008.

2. Oehers D.J. and Bradford M.A., “Composite Steel and Concrete Structural Members, Fundamental Behaviour”, Permagon Press, Oxford, 1999.

3. Course material of workshop on “Steel Concrete Composite structures” conducted by Anna University, 2007.

4. INSDAG Materials, Volume I and II. 2000.

Structural Health Monitoring			
Course Code	**22MTCASE 23C1**	**Externalmarks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objective:

1. To understand the importance of Structural health and need for monitoring structural health.
2. To understand the safe techniques for structural health monitoring.
3. Application of appropriate measure for different structural conditions.

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

SYLLABUS

UNIT-1

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance. Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.

UNIT-2

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.

UNIT-3

Dynamic Field Testing: Types of Dynamic Field Test, Stress History Data, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT-4

Introduction to Repairs and Rehabilitations of Structures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro– mechanical impedance (EMI) technique, adaptations of EMI technique.

Course Outcomes:

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

1. Diagnosis the distress in the structure understanding the causes and factors.
2. Assess the health of structure using static field methods.

3. Assess the health of structure using dynamic field tests.

4. Suggest repairs and rehabilitation measures of the structure

TEXT BOOKS:

1. Repair and Rehabilitation of concrete Structures by Modi, PoonamIpatel, Chirag N.PHI Publication.

2. Concrete Structures Repair, Rehabilitation and Rettrofitting by J.Bhattacharjee CBS Publication.

REFERENCE BOOKS:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons, 2006.

2. HealthMonitoringofStructuralMaterialsandComponentsMethodswithApplications, Douglas E Adams, John Wiley and Sons, 2007.

Bridge Engineering			
Course Code	**22MTCASE 23C1**	**External marks:**	**100**
Credits	**4**	**Internal marks:**	**50**
L-T-P	**4-0-0**	**Total marks:**	**150**
		Duration of Examination:	**3 hrs**

Course Objectives:

1. To study the various bridge forms and typical loadings on the bridges.
2. To get familiarized with the design of short span bridges.

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

SYLLABUS

UNIT-1

Introduction, historical review, Engineering and aesthetic requirements in bridge design. Introduction to bridge codes. Economic evaluation of a bridge project. Site investigation and planning, Scour - factors affecting and evaluation.

UNIT-2

Bridge foundations - open, pile, well and caisson. Piers, abutments and approach structures; Superstructure - analysis and design of right, skew and curved slabs. Girder bridges - types, load distribution, design. Orthotropic plate analysis of bridge decks.

UNIT-3

Introduction to long span bridges - cantilever, arch, cable stayed and suspension bridges. Methods of construction of R.C Bridges.

UNIT-4

Prestressed concrete bridges and steel bridges Fabrication, Lounching & creation. Design and construction of construction joints (use of relevant codes of practice are permitted in the examination).

Course Outcome:

The student will understand the design theories for super structure and substructure of bridges and able to design Culvert, R.C.C T beam bridge

Essential Reading:

1. V. K. Raina, Concrete Bridges Practice Analysis, Design and Economics, Shroff Publications, New

Delhi 2nd Ed. 2005.

2. Vazirani, Ratwani and Aswani, Design of Concrete Bridges, KhannaPublishers , 2nd Ed. 2008.

Supplementary Reading:

1. IRC codes for Road bridges- IRS Sec I , II, III

2. IRS Codes of Practice for Railway bridges.

3. B. M. Das, Principles of Foundation Engineering, Thomson, Indian Edition, 2003.

Literature Survey (Dissertation Phase –I)			
Course Code	22MTCASE23C3	**Practical marks:**	**-**
Credits	**2**	**Internal marks:**	**100**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**------**

Syllabus Content

Dissertation-I will have mid semester presentation and end semester presentation. Mid semesterpresentation will include identification of the problem based on the literature review on the topicreferringtolatestliterature available.

End semester presentation should be done alongwith the report on identification of topic for thework and the methodology adopted involving scientific research, collection and analysis of data,determiningsolutionsandmustbringoutindividuals' 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 bemonitoredbythedepartmentalcommittee.

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.

Seminar			
Course Code	**22MTCASE23C4**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
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.

Computational Lab			
Course Code	**22MTCASE23CL1**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**-**
L-T-P	**0-0-2**	**Total marks:**	**50**
		Duration of Examination:	**-**

Course Objective

1. Students are required to know at least one high-level language.
2. They will be learning instructions for using available computer system.

Syllabus

Introduction to Engineering Softwares - Introduction to O/S–storage and time optimization - General purpose packages in Civil Engineering – Program Implementation

Course Outcome:

Students who successfully complete this course will be able to develop an application program.

Project			
Course Code	**22MTCASE23CL2**	**Practical marks:**	**50**
Credits	**2**	**Internal marks:**	**50**
L-T-P	**0-0-2**	**Total marks:**	**100**
		Duration of Examination:	**--------**

Syllabus Contents

Project 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 topicreferringtolatestliterature 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 highlighting individuals' contribution.
Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the departmental committee.

Course Outcomes:

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

1. Identifystructuralengineeringproblemsreviewingavailableliterature.
2. Studydifferenttechniquesusedtoanalyzecomplexstructuralsystems.
3. Work on the solutions given and present solution by using his/her technique applyingengineeringprinciples.

M.Tech(Computer Aided Structural Engineering)
4thSemester

Dissertation & Viva (Dissertation Phase – II)			
Course Code	**22MTCASE24C1**	**Practical marks:**	**500**
Credits	**20**	**Internal marks:**	**250**
L-T-P	**0-0-0**	**Total marks:**	**750**
		Duration of Examination:	**------**

SyllabusContents:

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.

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.