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Master of Technology (Structural Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 1201	DCS	THEORY AND DESIGN OF METAL STRUCTURES	60	20	20	30	20	3	1	2	5

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
The students (A) will be able to design the different Steel Structures (B) according to IS codal specification(C) efficiently & economically (D) with safety provisions

Course Outcomes:

1. Design bolted and welded connections in different steel structures.
2. Design various storage structures like bunker, silo and tanks.
3. Design light gauge steel sections.
4. Understand and analyze the behavior of space structures.
5. Design various types of steel bridges.

Syllabus:

UNIT I
Design of Connections- Types of connections – Welded and Bolted – Throat and Root Stresses in Fillet Welds – Seated Connections – Unstiffened and Stiffened seated Connections – Moment Resistant Connections – Clip angle Connections – Split beam Connections – Framed Connections HSFG bolted connections.

UNIT II
Design of Storage Structures -Introduction to Storage Structures and classifications, Design of Bunkers, Design of Silos, and Design of Pressed steel water tank.

UNIT III
Design of Bridges- Study and interpretation of loading standards for bridges, Codal provision for bridge structure, Classification for bridge structure, Design of truss bridges, plate girder bridge as per IS codes Specification.

UNIT IV
Analysis And Design of Industrial Buildings Analysis and design of different types of trusses, Introduction to space structures and Double layer grids, Analysis and design of industrial buildings, Braced and unbraced- gable frames with gantry rigid industrial frames and fire resisting design.

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UNIT V

Design of Light Gauge Steel Sections Forms of light gauge sections, shapes of decks and panels, local buckling of thin element, Multiple stiffened compression element, compression on unstiffened elements, Axially loaded compression members.

Text Books:

1. Duggal S.K., Limit state design of steel structure, TMH publication.
2. Punmia BC, Design of Steel structure, Laxmi Publication

Reference Books:

1. Subramanian.N, Design of Steel Structures, Oxford University Press, 2014.
2. Dayaratnam P. Design of Steel structure, S. Chand ltd. New Delhi 2008.
3. Ramchandra Design of Steel structure, Scientific Publishers.
4. Wie Wen Yu, Design of Cold Formed Steel Structures, McGraw Hill Book Company, 1996

List of Practical's:

1. Detailed drawing of various structural systems as per the syllabus.

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 1202	DCS	INSTRUMENTATION & EXPERIMENTAL TECHNIQUES	60	20	20	30	20	3	1	2	5

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1. To learn about the calibration and sensitivity
2. To know in detail about Sensors
3. To know transducers and photo elasticity.
4. To understand the model analysis.

Course Outcomes:

5. To develop the knowledge about used instruments in civil engineering
6. To have the knowledge about Moiré phenomenon.
7. To have the idea about the model analysis.

Syllabus:

UNIT I

Generalized measurement systems, calibration and sensitivity. Standards of measurements of various quantities.
Detectors: Sensor system elements, transducer and devices, Different type of sensors, Modifying and transmitting method.

UNIT II

Construction details of: Temperature transducers, vibration and shock measurement, Force and Load transducers, Velocity transducers, Torque transducers, pressure measurements and pressure transducers.

UNIT III

Photo elasticity: Basic optics and polariscope, Photo elastic effect: Stress-optic relations, Isoclinic, Isochromatics, Calibration of model, Separation techniques, Fractional Fringe order determination, Stress freezing techniques.

UNIT IV

Moiré phenomenon, analysis of moiré fringes, measurement of strain, displacement, rotation and slope for in plane and out of plane problems.

UNIT V

Model Analysis: Different types of model, Law of structural similitude and non-dimensional

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analysis, Buckingham Pi theorem, Prediction for Prototype, Size effect, applications.

Text Book:

1. Transducer & Instrumentation by Murty, D.V.S
2. Instrumentation and Technique by S. Sheel

References Books:

3. Instrumentation and Technique V.S. Edelman

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 1203	DCS	FINITE ELEMENT METHOD	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives: To provide the fundamental concepts of the theory of the finite element method

Course Outcomes:

To provide the fundamental concepts of the theory of the finite element method: Outcomes:

1) To obtain an understanding of the fundamental theory of the FEA method
2) To develop the ability to generate the governing FE equations for systems governed by partial differential equations
3) To understand the use of the basic finite elements for structural applications using truss, beam, frame, and plane elements
4) To understand the application and use of the FE method for heat transfer problems.

Syllabus:

UNIT I

Introduction to Finite Element Method: General Applicability and Description of Finite Element Method Comparison with other methods.

UNIT II

Solution of Finite Element Method: Solution of Equilibrium Problems, Eigen value problems, propagation problems, computer implementation of Gaussian eliminations, Choleskis decomposition, Jacobi's and Ranga Kutta Method.

UNIT III

General Procedure of Finite Element Method: Descretization of the domain, Selection of Shapes, Types and Number of elements, node numbering technique, Interpolation Polynomials, their selection and derivation in terms of global and local coordinates, Convergence requirements. Formulation of Element Characteristic matrices and vectors, Variational approach. Assembly of Element matrices and Vectors and Derivation system equations, computation of element resultants.

UNIT IV

Iso-parametric Formulation: Lagrange and Hermite interpolation functions, Isoparametric Elements, Numerical Integration.

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UNIT V

Static Analysis: Formulation of equilibrium equation, Analysis of truss, Frames, Plane Stress and Plane Strain Problems Plates and Shells.

Text Book:

1. Weaver, Johnson, Finite element and structural analysis
2. HC Martin, Matrix structural analysis
3. CF Abel, CS Desai, Finite element methods

References Books:

1. Buchanan, Finite element Analysis (schaum Outline S), TMH
2. Krishnamurthy, Finite element analysis, TMH)

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 1204	DCS	DESIGN OF EARTH QUAKE RESISTANT STRUCTURES	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

This course integrates information from various engineering and scientific disciplines in order to provide a rational basis for the design of earthquake-resistant structures.

Course Outcomes:

1 Understanding of basic principles and importance of structural dynamics and earthquake effects on structures.
2 Learning the importance of structural dynamics and earthquake exactions in civil engineering in practice.
3 Learning and apply basic methods employed for analysis of civil engineering problems involving dynamics and earthquake.

Syllabus:

UNIT I

Seismic Strengthening of Existing Buildings: Cases histories-Learning from earthquakes, seismic strengthening procedures.

UNIT II

Torsion & Rigidity: Rigid Diaphragms, Torsional moment, Center of mass and center of rigidity torsion effects. Lateral Analysis of Building Systems: Lateral load distribution with rigid floor diaphragms, moment resisting frames, shear walls, lateral stiffness of shear walls, shear wall-frame combination, examples.

UNIT III

Concept of Earthquake Resistant Design: Objectives of seismic design , Ductility, Hysteric response & energy dissipation, response modifications factor, design spectrum, capacity design, classification of structural system, IS code provisions for seismic design of structures, multi-storied buildings, design criteria, P-A effects, storey drift, design examples ductile detailing of RCC structures.

UNIT IV

Seismic Design of Special Structures: Elevated liquid storage tanks, Hydrodynamic pressure in

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tanks, stack like structures, IS-1893 code provisions for bridges; Superstructures, substructures, submersible bridges, dams; Hydrodynamic effect due to reservoir, concrete gravity dams.

UNIT V

Engineering Seismology: Basic terms, seismic waves, earthquake magnitude and intensity, ground motion, dynamic response of structures, normalized response spectra, seismic coefficients and seismic zone coefficients.

Text Book:

1. Chopra A.K., Dynamics of Structures', Theory & Applications to Earthquake Engineering, Prentice Hall India, New Delhi-1995
2. Clough & Penzien, Dynamics of Structures , McGraw Hill Book CO. Inc.
3. Paz M, Structural Dynamics, , Van Nostrand Reinhold, New York
4. Paz, M, International Handbook of Earthquake Engineering, Chapman & Hall, New York.

References Books:

1. IS-1893-1984, Indian Standard Criteria for Earthquake Resistant Design of Structures, B.I.S., New Delhi.
2. IS-4326-1993, Indian Standard Code of Practice for Earthquake Resistant Design and Construction of Buildings, B.I.S., New Delhi.

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 1205	DCS	DESIGN OF TALL STRUCTURES	60	20	20	0	0	3	1	0	4

Legends: L - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

1 To know the Behavior of tall structures
2 To understand Characteristics of Wind and Earthquake Forces
3 To understand the shear walls and frame structure

Course Outcomes:

1. To have knowledge about tall buildings
2. To have the understanding about the shear walls and their behaviors.

Syllabus:

UNIT I
Behavior of tall structures under static and dynamic loads, model analysis.

UNIT II
Characteristics of Wind and Earthquake Forces, Gust Factor and Karman Vortices, Approximate and Regorlons Methods of analysis for wind and Earthquake Forces.

UNIT III
Shear walls, Frame Structures, Coupled shear walls, Tabular Structures, Ductility and reinforcement details at joint.

UNIT IV
Criteria for design of Chimneys, T.V. Towers and other Tall Structure.

UNIT V
Modeling of tall structures, case studies.

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Text Book:

1. Analysis of shear wall buildings by Kajmi

References Books:

1 Coull, Smith, Design of tall buildings

2 Taranath, Design of tall buildings

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 1206	DCS	THEORY OF PLATES AND SHELL	60	20	20	0	0	3	1	0	4

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit; ***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:

To enable the student analyze and design thin shell structures including domes, hyperbolic, paraboloid, elliptic and cylindrical shells.

Course Outcomes:

1 Analyse and design thin shell structures including domes, hyperbolic, paraboloid, elliptic and cylindrical shells
2 Formulate Finite Element Equations for solution of the structural response of plate bending problems and obtain solutions to shell structures

Syllabus:

UNIT I

Theory of Plates: Bearing of long rectangular plates to the cylindrical surface with different edge conditions. Pure bending of plates-Differential equations of equilibrium. Theory of small deflections of laterally loads plates. Boundary conditions, moment curvature relationship.

UNIT II

Analysis of rectangular plates, Navier's and levy solutions, exact theory of plates, symmetrical bending of circular plates, continuous rectangular plates

UNIT III

Special and approximate methods of theory of plates, singularities, use of influence surfaces, use of infinite integrals and transforms, strain energy methods, experimental methods.

UNIT IV

Theory of Shells: Classification of shells, Gaussian curvature, General theory of cylindrical shells, membrane theory and bending theory for cylindrical shells, long and short shells, shells, shells with and without edge beams, Fourier loading.

UNIT V

Equation of equilibrium for shells of surface of revolution, Reduction to two differential equations of second order. Spherical shells, membrane theory for shells of double curvature-syn-elastic and anti-elastic. Cylindrical shells, Hyperbolic-parabolic shells, funicular shells.

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Text Book:

1. S Timoshenko, S Woinowasky K, Theory of Plates and Shells
2. Theory of Plates and Shells by bhavikatti New age publication Delhi

Reference Books-

1. Analysis of plates by T.K.Varadan and K.Bhaskar , Narosa Publishing House, 1999.
2. Stresses in Shells by Flugge. Blaisdell Publishing Co, 1966
3. Design and construction of concrete shell roofs by G.S.Ramaswamy, CBS Publishers& Distributors,1986.

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			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	Th	T	P	CREDITS
MTCE 1207	DCS	ADVANCED FOUNDATION ENGINEERING	60	20	20	0	0	3	1	0	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:
The primary objective of this course is to equip the student with the knowledge of how to explore the soil, design the foundations for different conditions and check the stability of structures

Course Outcomes:

1. Identify a suitable foundation system for a structure.
2. Analyse and design shallow foundations.
3. Analyse and design pile foundations.
4. Examine and discuss various machine foundations.
5. Analyse and design Sheet piles and cofferdams.

Syllabus:

UNIT I

Deep Open Cuts: Introduction, Types of Coffer Dams, Design data for cellular cofferdam, Stability analysis of cofferdam, interlock stresses. Soil Exploration: Introduction, Methods of exploration, Direct Methods and techniques of exploration, Methods of boring types of samples, Disturbance of soil sample, Soil samples and sampling techniques, Ground water observations, Boring records, Spacing and depth of bore holes, Indirect methods of soil exploration, Penetration tests, Geophysical methods, Dynamics methods, Sequence of exploration programs

UNIT II

Shallow Foundations: Introduction, General Requirements, Depth of foundation, Bearing capacity, Eccentric Inclined loads, Bearing capacity of stratified soils, Settlement of footings, Settlement of footings from constitutive laws, Settlement and tilt of eccentrically loaded footings, Allowable settlement, Plate bearing test, Standard penetration test Effect of water table, shallow foundation classification, Modulus of sub-grade reaction, Beams on elastic foundation, Raft foundation.

UNIT III

Pile Foundation: Introduction, Uses of piles, Types of piles, pile drivers, Bearing capacity of piles, Static analysis, Pile load test, Dynamic methods, other methods, Negative skin friction, Pile group, Ultimate bearing capacity of pile groups, Settlement of pile group, Influence of pile

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cap. Laterally loaded piles, Ultimate resistance, Elastic methods, Pile groups under lateral load, batter pile under lateral load, Batter pile groups under inclined loads, pile under dynamic loads.

UNIT IV

Coffer Dams: Introduction, types of Coffer Dams, Design data for cellular cofferdam, Stability analysis of cofferdam, Interlock stresses.

UNIT V

Machine Foundations : Introduction, Criteria for satisfactory action of a machine foundation, Definitions, Degrees of freedom of a block foundation, Analysis of block foundation, Theory of linear weightless spring, Equivalent soil springs, Vertical vibration, Rocking vibration, Vibration in shear, Simultaneous rocking sliding and vertical vibrations for a foundation, Indian standard on design and construction of foundations for reciprocating machines,
Foundations for impact type machines, Indian Standard on design and construction of foundations for impact type machines, Analysis of block foundation based on elastic half space theory.

Text Book:

1 Bowles, Foundation: Analysis and Design, McGraw Hill Book CO. Inc.

References Books:

1 B. J. Kasmalkar; "Foundation Engineering", 6th ed., Pune Vidyarthi Griha Prakashan, Pune, 1989. 2..
2 P.PurushotthamaRaj , "A Text book of Soil Mechanics