Shri Vaishnav Vidyapeeth Vishwavidyalaya

Master of Technology (Structural Engineering)

SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 1201	**DCS**	**THEORY AND DESIGN OF METAL STRUCTURES**	2	1	2	4	60	20	20	30	20

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; Un-stiffened 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; 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.

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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 un-braced gable frames with gantry rigid industrial frames and fire resisting design.

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 un-stiffened elements; Axially loaded compression members.

Text Books:

1. Duggal S.K., Limit state design of steel structure, TMH publication,2014
2. Punmia BC, Design of Steel structure, Laxmi Publication, 2011

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,2011

List of Practical's:

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

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 1202	DCS	THEORY OF PLATES AND SHELL	2	1	0	3	60	20	20	0	0

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, parabolic, elliptic and cylindrical shells.

Course Outcomes:

1. Analyse and design thin shell structures including domes, hyperbolic, parabolic, 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 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; cylindrical shells; Hyperbolic-parabolic shells; Funicular shells

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Text Book:

1. S Timoshenko, S Woinowasky K, Theory of Plates and Shells,McGraw Hill Co. Ltd.
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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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 1203	DCS	FINITE ELEMENT METHOD	2	1	0	3	60	20	20	0	0

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:

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 of different methods

UNIT II

Solution of Finite Element Method: Solution of Equilibrium Problems; Eigen value problems; Propagation problems; Computer implementation of Gaussian Eliminations; Choleski's 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's interpolation functions; Isoparametric Elements; Numerical Integration

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UNIT V

Static Analysis: Formulation of equilibrium equation; Analysis of truss and frames; Plane Stress and Plane Strain Problems.

Text Book:

1. Weaver, Johnson, Finite element for structural analysis, Prentice-Hall International
2. HC Martin, Matrix structural analysis, McGraw-Hill Inc.
3. CF Abel, CS Desai, Finite element methods, Prentice Hall India Learning Private Limited, 2008

References Books:

1. Schaum's Outline of Finite Element Analysis (Schaum's Outlines), McGraw-Hill Education,1995
2. C. S. Krishnamoorthy, Finite Element Analysis Theory and Programming, Tata McGraw-Hill,2000

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 1204	**DCS**	**DESIGN OF EARTH QUAKE RESISTANT STRUCTURES**	2	1	0	3	60	20	20	0	0

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 and 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 of ductile detailing of RCC structures.

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UNIT IV

Seismic Design of Special Structures: Elevated liquid storage tanks; Hydrodynamic pressure in tanks; Stack like structures; IS-1893 code provisions for bridges; Superstructures and substructures; Submersible bridges; Hydrodynamic effect due to reservoir; Concrete gravity dams.

UNIT V

Engineering Seismology: Basic terms related to engineering seismology; 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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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 1205(1)	DCS	STRUCTURAL DESIGN OF FOUNDATION AND RETAINING STRUCTURES	2	1	0	3	60	20	20	0	0

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 impart knowledge on geotechnical and structural design of different types of foundation and retaining structures appropriate to the type of soil for different structures.

Course Outcomes:
At the completion of this course, the student shall acquire knowledge and ability,

1. To select and design appropriate foundations based on various criteria,
2. To check the stability of various components of different types of foundations
3. To understand various recommendations regarding earthquake design of foundations
4. To select and design different types of retaining wall based on various criteria.

Syllabus:

UNIT I
Foundation Structures- Rigid and Flexible Foundations; Loads and their effects; Design requirements; Geotechnical design; Empirical and exact methods of analysis of foundations; Design loads for foundations; Recommended approach to structural design of foundations; Introduction to combined piled raft foundation (CPRF)

UNIT II
IS 456 Provisions for Design of Footings and Pedestals: Design Loads for foundation design,; Basis of structural design of R.C. footings; Soil pressure on foundations; Conventional analysis of footings subjected to vertical load and moments; General planning and design of independent footings, minimum depth and detailing of steel requirements, checking for development lengths of main bars in footings.

UNIT III
Design of Raft Foundations: Common types of rafts; Plain slab rafts for lightly loaded buildings, flat slab rafts for framed buildings; Mat foundation, beam and slab rafts, cellular rafts, piled rafts, annular rafts, grid foundation; Deflection requirements of beams and slabs in rafts; General considerations in design of rigid rafts; Types of loadings and choice of rafts

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UNIT IV

Effect of Earthquakes on Foundation Structures: IS 1893 (2016) recommendations regarding layout of foundations; Classification of foundation strata, types of foundations allowed in sandy soils; Methods to prevent liquefaction and settlement.

UNIT V

Design of Cantilever and Basement Retaining Walls: Introduction, earth pressure on rigid walls; Calculation of earth pressure on retaining walls; Design of ordinary R.C. cantilever walls; Design of basement walls

Text Book:

1. P.C. Varghese, Design of Reinforced Concrete Foundations, Prentice Hall India Learning Private Limited (2009)
2. Swami Saran, Analysis and Design of Sub structures, Oxford and IBH Publishing Co. PVT. Ltd, New Delhi
3. Unnikrishnana Pillai and Devadas Menon, Reinforces Concrete Design, McGraw Hill Publishing Pvt. Ltd.

References Books:

1. Tomlinson, Foundation Design and Construction, Prentice Hall Publication
2. Relevant IS Codes.

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COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 1205(2)	DCS	INSTRUMENTATION AND EXPERIMENTAL TECHNIQUES	2	1	0	3	60	20	20	0	0

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; Iso-chromatics; 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 mode; Law of structural similitude and non-dimensional analysis; Buckingham Pi theorem; Prediction for Prototype; Size effect; applications.

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Text Book:

1. Transducer & Instrumentation by Murty, D.V.S, Prentice Hall India Learning Private Limited; 2 edition (2008)
2. Instrumentation and Technique by S. Sheel, Narosa Publishing House (2013)

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SEMESTER II

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY			PRACTICAL	
							END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*
MTCE 1205(3)	DCS	DESIGN OF TALL STRUCTURES	2	1	0	3	60	20	20	0	0

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

Course Outcomes:

1. Achieve Knowledge of design and development of problem solving skills.
2. Understand the principles of strength and stability
3. Design and develop analytical skills.
4. Summarize the behavior of various structural systems.
5. Understand the concepts of P-Delta analysis

Syllabus:

UNIT I

Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads

UNIT II

Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.

UNIT III

Behaviour of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores

UNIT IV

Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist,

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UNIT V

Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis,

Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire.

Text Book:

1. Tall Building Structures: Analysis and Design, Bryan Stafford Smith, Wiley,
2. Structural Analysis and Design of Tall Buildings: Steel and Composite Construction, Bungale S. Taranath, CRC Press, 2011.
3. Lynn S.Beedle, "Advances in Tall Buildings"- CBS Publishers and Distributors.

References Books:

1. Designing Tall Buildings: Structure, Mark Sarkisian, Routledge; 1 edition, 2011.
2. Dr. Y.P. Gupta – Editor, "Proceedings National Seminar on High Rise Structures-Design and Construction practices for middle level cities"- New Age International Limited

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