Marwadi University

Syllabus for Master of Technology

Structural Engineering

Design of Tall Structure

01ST1209 (PEC)

Objective of the Course: Objectives of introducing this subject at first year level in Masters of civil engineering are:

- To understand the various structural systems for high rise structures.
- To evaluate the behavior of structure under dynamic loading.
- To analyse and design of advanced structures.
- To apply the advanced method of analysis of such structures and modelling these structures in various software with pros and cons.

Credit Earned: 3

Students learning outcomes:

After successful completion of the course, it is expected that student will be able to

1. Understand the behaviour of tall structures under different loading conditions
2. Use computational software for analysis and design of high-rise structures.
3. Apply code provisions for tall structures.
4. Choose & apply appropriate structural systems for different size & height of structure.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	CSE (I)	IA (M)	Viva (V)	Term Work (TW)	
03	00	00	03	50	20	30	25	25	150

Detailed Syllabus

Sr No.	Title of the unit	Number of hours
1	**Tall Buildings** **General Consideration for Design of Tall Structures** Requirements of Tall Buildings, Factors affecting Tall Structures, Structural Concept. **Design Criteria & Loadings for Tall Buildings** Design Philosophy, National & International Code Provisions for Loading, Strength & Stability, Stiffness & Drift Limitations, Effects of Creep, Shrinkage, Temperature, Fire etc., Human Comfort Criteria.	**20**

	Gravity Load, Live Load Reduction, Construction Load, Wind Load-Static & Dynamic Methods, Earthquake Load-Concept & Procedure of Equivalent Lateral Load, Response Spectrum & Modal Analysis, Load Combinations. **Structural Forms & Systems:** **Concrete Structures-** Rigid Frame, Braced Frame, Infilled Frame, Flat Plate-Slab, Shear Wall, Coupled Shear Wall, Flat Slab with Shear Wall, Shear Wall Frame Interaction, Framed Tube Structural System, Core Supported Structures, Outrigger, Belt Truss, Buttress Core System for Tall Building. Various Floor Systems. **Steel Structures-** Rigid Frame, Semi-Rigid Frame, Braced Frame, Eccentric Braced Frame System, Buckling Restrained Brace Frame, Steel Plate Shear Wall, Interacting System of Braced and Rigid Frame, Staggered Truss System, Core Outrigger & Belt Truss System, Framed Tube System, Bundled Tube. Various Floor Systems. **Composite Structure** Various Composite Members, Composite Subsystems like Ordinary & Special Moment Frames, Composite Braced Frame, Composite Eccentric Braced Frame, Composite Tube Systems, Vertically Mix Systems. Various Floor Systems.	
2	**Dynamic Response of Tall Structures Due to Wind & Earthquake** **Wind Load** - Sensitivity of structures to wind forces, Characteristics of Wind, Code Provisions, Dynamic structural response due to wind forces, along wind Response, Cross wind response, Introduction to Wind Tunnel Engineering, worked examples, **Earthquake Load** – Behaviour of Tall Buildings under Earthquakes, Design Philosophy, Structural Damping, Static & Dynamic Approach of Earthquake Analysis of Buildings, Empirical relations for fundamental natural frequency, Modal Analysis & it's Interpretation. **Comfort criteria:** Human perception of building motion, perception thresholds, Use of comfort criteria in design	**06**
3	**Modeling of Tall Structures for Analysis & Design** Different Approach of Analysis, Assumptions & Behaviour, Modelling for Approximate Analysis- Modelling of Slabs, Continuum Analysis, Modeling for Exact Analysis of Plane Frame, Plane Shear Wall, 3-D Frame & Wall Structures, P-Delta Effects, Wall Opening Effect. **Braced Frame** -Types, Behaviour, Method of Analysis & Drift Estimation. **Rigid Frame -** Behaviour, Approximate Analysis of member Forces by Gravity and Lateral Loads, Drift Estimation. Computer Analysis of Rigid Frame. **Shear Wall & Coupled Shear Wall** – Behaviors, Method of Analysis. Modelling, Analysis & Design of Tall Structures with different configuration in Commercially Available Software.	**16**

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	5%	20%	25%	25%	20%

Recommended Study Material:

Reference Book:

1. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., South Asian Publishers, New Delhi.
2. Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications. Hel wany, S. (2007).
3. Advanced Reinforced Concrete Design, Varghese P. C., Prentice Hall of India, New Delhi.
4. Advanced Design of Concrete Structures KrishanaRaju N., Tata Mc-Graw Hill, Delhi.
5. Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India
6. Tall Building Structures on Elastic Subgrade and Research of Semi-Analytical method by Gong Yaoqing. Beijing: Tsinghua University
7. Tall Chimneys, Manohar S. N., Tata McGraw Hill Publishing Company, New Delhi
8. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., South Asian Publishers, New Delhi.
9. High Rise Building Structures, Wolfgang Schueller, Wiley
10. Advanced Reinforced Concrete, Varghese A. V., Prentice Hall of India.
11. Unified Theory of Concrete Structures, Hsu T. T. C. and Mo Y. L., John Wiley & Sons, 2010.
12. IS Codes: IS:456, IS:875, IS:1893, IS:4326, IS:13920, IS: 3370, IS: 4995 (I & II), SP:16, SP:34.

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