EARTHQUAKE TECHNOLOGY

Paper Code: ETCE-413	**L**	**T/P**	**C**
Paper: Earthquake Technology	**3**	**1**	**4**

INSTRUCTIONS TO PAPER SETTERS: **MAXIMUM MARKS: 75**

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 25 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be of 12.5 marks

***Objective**: To introduce the basic concepts in dynamic as well as probabilistic modeling of earthquake loading and dynamic analyses/simulation with uncertainty in earthquake engineering and to introduce the basics of structural dynamic analyses with emphasis on earthquake engineering applications.*

UNIT I

Introduction, Causes and Classification of Earthquakes, Surface Wave Magnitude, Body Wave Magnitude, Moment Magnitude, Modified Mercalli Intensity Scale, Comprehensive Intensity Scale [MSKG 64] as per IS: 1893 Part-I, Characteristics of ground motion, local site effects, Impact of earthquake on buildings and infrastructure, Iso-seismal map, Development of seismic zoning map of India, Types of Ground failures due to earthquake.

D' Alembert's principle, Equation of motion, Degrees of freedom, Damping, Free and Forced Vibrations of an un-damped and damped single degree freedom system and its equivalence.

[T1][No. of Hours: 11]

UNIT II

Free vibrations of an Un-damped two degree freedom system, Determination of frequencies and mode shape and concept of vibration absorber, Equation of Motion for multi-degree freedom system using D' Alembert's principle, Stiffness Coefficient and Flexibility coefficient, Determination of Frequencies and Mode Shapes for Three storey building idealize as lumped mass cantilever model with one degree of freedom at each mass, using matrix iteration technique, Holzers' Method and Stodolas' Method.

[T2][No. of Hours: 11]

UNIT III

Orthogonality Property of Normal Modes, Modal Analysis, Modal Super position Methods, Fourier Spectra, Response Spectra, Dynamic Analysis by Response Spectrum Method as per IS 1893, Effect of form and irregularities in building as per IS 1893 on its seismic performance, Short column Effect.

Comparative Merits of Stiff and Flexible construction, Failure Modes, Whipping Effect, General Principles and Philosophy of Earthquake Resistant Design, Concept of Capacity Based Design and Performance Based Design.

Torsion in buildings during earthquakes, Determination of Torsional shares in columns of a framed building. Different type of lateral load resistance systems, Pounding of buildings and Required seismic separation between two adjacent buildings storey, Drift limitations for Buildings as per IS Code, Introduction of P- Δ Effect,

[T1,T2][No. of Hours: 11]

UNIT IV

Earthquake resistance requirements for horizontal and vertical projections of the building, Special considerations for non-structural components attached to the building.

Importance of shear wall buildings in earthquake resistance and Design of Reinforced Concrete Shear Walls as per IS 13920, Concept of Vibration Isolation of Buildings, Control devices like active control, passive control, hybrid control, semi-active control, isolation devices, energy dissipation devices, Need for Seismic Evaluation of Buildings and their Retrofitting, Condition Assessment of existing Buildings, GSDMA Guidelines on Seismic Evaluation and strengthening of Buildings.

[T1,T2][No. of Hours: 11]

Text Books:

[T1] Steven and Kramer.-Geotechnical Earthquake Engineering, Pearson Education.
[T2] Anil K. Chopra -Dynamics of Structures" [Third Edition], Published by Pearson Education

References Books:

[R1] IS 1893 [Part-I]- 2002 : "Criteria for Earthquake Resistance Design of Structure".
[R2] IS 4326: 1993 – "Earthquake Resistant Design and Construction of Building – Code of Practice.

[R3] IS 13920: 1993 – Ductile Detailing of Reinforced Concrete Structures Subjected to Seismic Force – Code of Practice.
[R4] IS 13935: 1995 “Repair and Seismic Strengthening of Buildings – Guidelines “.
[R5] GSDMA-IITK “Guidelines for Seismic Strengthening of Buildings.