

(ELECTIVE – B/I)

4/4 B.Tech. SEVENTH SEMESTER
EARTHQUAKE RESISTANT DESIGN

CE7T4B

Credits:3

Lecture: 3 periods/week

Internal assessment: 30 marks

Tutorial: 1 period /week

Semester end examination: 70 marks

Pre-requisites: Engineering Geology, Design of concrete structures

Learning objectives:

- To estimate the lateral loads and to design the structures for lateral and gravity load combinations.
- To learn earthquake engineering concepts and design philosophies.

Course outcomes:

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

1. Understand knowledge of structural dynamics for single degree and multi degree of freedom systems.
2. Understand the earthquake engineering terminology and aseismic planning.
3. Apply the IS codal design and construction provisions in earthquake resistant structures
4. Apply proper detailing practices as per IS codal provisions and design shear walls as per building requirements.
5. Apply knowledge of Structural dynamics in view of earthquake problem and understand significance of base isolation.

UNIT – I

INTRODUCTION TO STRUCTURAL DYNAMICS

Theory of vibrations – Lumped mass and continuous mass systems – Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion – Undamped and damped free vibration – Damping – Response to harmonic excitation – Concept of response spectrum.

MULTI-DEGREE OF FREEDOM (MDOF) SYSTEMS

Formulation of equations of motion – Free vibration – Determination of natural frequencies of vibration and mode shapes – Orthogonal properties of normal modes – Mode superposition method of obtaining response.

UNIT – II

EARTHQUAKE ENGINEERING

Engineering Seismology – Earthquake phenomenon – Causes and effects of earthquakes – Faults – Structure of earth – Plate Tectonics – Elastic Rebound Theory – Earthquake Terminology – Source, Focus, Epicenter etc - Earthquake size – Magnitude and intensity of earthquakes – Classification of earthquakes – Seismic waves – Seismic zones – Seismic Zoning Map of India – Seismograms and Accelegrams.

ASEISMIC PLANNING

Plan Configurations – Torsion Irregularities – Re-entrant corners – Non-parallel systems – Diaphragm Discontinuity – Vertical Discontinuities in load path – Irregularity in strength and stiffness – Mass Irregularities – Vertical Geometric Irregularity – Proximity of Adjacent Buildings.

UNIT – III

CODAL DESIGN PROVISIONS

Review of the latest Indian seismic code IS:1893 – 2002 (Part-I) provisions for buildings – Earthquake design philosophy – Assumptions – Design by seismic coefficient and response spectrum methods – Displacements and drift requirements – Provisions for torsion.

CODAL CONSTRUCTION PROVISIONS

Review of the latest Indian seismic code IS: 4326 provisions for buildings – General principles – Special Construction Features – Types of construction – Categories – Masonry Construction.

UNIT – IV

CODAL DETAILING PROVISIONS

Review of the latest Indian Seismic codes IS: 13920 provisions for ductile detailing of R.C buildings – Beam, column and joints

SHEAR WALLS

Types – Design of Shear walls as per IS: 13920 – Detailing of reinforcements.

UNIT – V

EARTHQUAKE RESPONSE OF BUILDINGS

Introduction – Rigid base excitation – Formulation of equations of motion for SDOF and MDOF Systems – Earthquake response analysis of single and multi-storyed buildings – Use of response spectra.

BASE ISOLATION

Classification of Isolation systems – Effectiveness and Applications of Base Isolation.

Learning resources:

Text books:

1. Dynamics of Structures, (2nd edition) by Clough and Penzien, McGrawHill, 1993.
2. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India, New Delhi, 2008.

Reference books:

1. Dynamics of Structures, (2nd edition) by Chopra, A.K., Pearson Education, Indian Branch, Delhi , 2001.
2. Structural Dynamics, (2nd edition) by Mario Paaz. 2004.
3. Basics of Structural Dynamics and Aseismic Design by S.R. Damodarasamy & S. Kavitha, PHI Learning PVT. Ltd., Delhi, 2013.

e-learning resources:

www.nicee.org

IS CODES: IS: 1893, IS: 4326 and IS: 13920