

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. SEMESTER: VI

Civil Engineering

Subject Name: **Earthquake Engineering**
 Subject Code: **160605**

Teaching Scheme				Evaluation Scheme		
Theory	Tutorial	Practical	Total	University Exam (Theory) (E)	Mid Sem Exam (Theory) (M)	Practical (I)
4	0	2	6	70	30	50

Module I:

Sr. No	Course Content
1.	<p>Fundamentals of Earthquake Vibrations of buildings:</p> <p>Static load v/s Dynamic load (force control and displacement control), simplified single degree of freedom system, modeling of buildings, natural frequency, resonance v/s increased response, responses of buildings to different types of vibrations like free and forced, damped and undamped vibration, response of building to earthquake ground motion, introduction to multi degree of freedom systems (mode shapes).</p>

Module II:

Sr. No	Course Content
1.	<p>Earthquake Basics:</p> <p>Earth interior, plate tectonics, faults, consequences of earthquake, Earthquake parameters, magnitude & intensity, scales, Seismic zones of India, damages caused during past earthquakes (world wide).</p>
2.	<p>Earthquake resistant Masonry features :</p> <p>Un-reinforced Masonry, Basics of masonry: units of masonry, good construction practice, Earthquake resistant features: bands and vertical reinforcement (IS 4326, IS 13827, IS 13828)</p>

Module III :

Sr. No	Course Content
1.	Design Philosophy: Philosophy of earthquake resistant design, earthquake proof v/s earthquake resistant design, four virtues of earthquake resistant structures (strength, stiffness, ductility and configuration), seismic structural configuration ,Introduction to IS: 1893 (Part I), IS: 875 (Part V). Seismic load : Seismic coefficient method – base shear and lateral force distribution along height. Introduction to Response spectrum, IS code provisions. Modal analysis of building frame.

Module IV :

Sr. No	Course Content
1.	Lateral Loads on Buildings: Lateral Load Distribution: Rigid diaphragm effect, centers of mass and stiffness, torsionally coupled and uncoupled system. Lateral Load Analysis: Analysis of frames using approximate methods like portal & cantilever methods

Module V :

Sr. No	Course Content
1.	Ductile Detailing: Concepts of Detailing of various structural components as per IS: 13920 provisions.
2.	Special topics: Introduction to soil liquefaction, structural controls & Seismic strengthening.

Note:

Weightage and Teaching Hours: Module-I (40 %) and Modules II, III, IV, V (15% each)

Term Work: Term work shall consist of laboratory works and following:

1. Presentation on study of past Indian & International Earthquakes one each
OR Preparation of various models of structural systems OR seminar/project assigned by the faculty member.
2. Presentation of any one earthquake tip & every student will participate in Quiz based on Earthquake Tips.
3. At least 25 problems based on the syllabus of Earthquake Engineering which are uniformly distributed & graded from each of the topic

IS Codes:

1. Criteria for earthquake resistant design General provision & Building - IS: 1893 (Part I 2002)
2. Code of Practice for Ductile Detailing of RC Structures - IS: 13920 (1993).
3. Code of Practice for earthquake resistant design & Construction of buildings - IS 4326 (1993).
4. Improving Earthquake Resistance of Earthen Buildings - IS 13827(1993)
5. Guide lines for Improving Earthquake Resistance low strength masonry buildings - IS 13828 (1993).

Earthquake Engineering Labs

Following experiments should be carried out in laboratory.

1. Spring Mass model
2. Mode shapes
3. Shear wall and bracing system
4. Pounding effects
5. Liquefactions

Text Books:

1. Manish Shrikhande & Pankaj Agrawal; Earthquake resistant design of structures, PHI Publication, New Delhi
2. S.K.Duggal; Earthquake resistance design of structures; Oxford University Press, New Delhi.

Reference Books:

1. A.K.Chopra; Dynamics of structures , Pearson, New Delhi
2. Clough & Penzin; Dynamics of structures,
3. Park & Pauly; Behavior of RC structure
4. John M.Biggs; Introduction to Structural Dynamics
5. C V R Murthy - Earthquake Tips, Nicee.
6. IITK-GSDMA EQ26 – V -3.0 Design Example of a Six Storey Building
7. S S Rao; Mechanical Vibration; Pearson, New Delhi.