

COURSECONTENT

EARTH QUAKE RESISTANT DESIGN OF STRUCTURES								
III Semester-SE								
Course Code	Category	Hours/ Week			Credits	Maximum Marks		
		L	T	P		C	CIA	SEE
2532053	Core	3	0	0	3	40	60	100
Contact Classes:48	Tutorial Classes :Nil	PracticalClasses:Nil			TotalClasses:48			
Prerequisites:NIL.								

Course Overview:

This course covers the fundamentals of engineering seismology, including earthquake causes, seismic waves, and measurement techniques, along with seismic zoning in India. It emphasizes seismic design principles such as load paths, structural configuration, and ductility. The course includes analysis methods like static and dynamic approaches, and IS code-based design of RC buildings. It also addresses shear wall design, irregularities, and non-structural elements. Finally, it focuses on ductile detailing, capacity-based design, and structural behavior during earthquakes through practical case studies.

Course Objectives:

1. To understand the fundamentals of engineering seismology, earthquake phenomena, seismic waves, seismic zones, and basic seismic design requirements.
2. To learn conceptual seismic design principles including load-resisting systems, ductility, materials behavior, and seismic analysis methods (static and dynamic).
3. To apply IS code-based earthquake-resistant design for RC buildings, including analysis of irregularities, structural walls, masonry behavior, and non-structural elements.
4. To design shear walls effectively, understanding their behavior, load actions, moment resistance, and performance of coupled shear walls.
5. To develop skills in ductile detailing and capacity-based design for RC buildings to ensure safer performance during earthquakes.

Course Outcomes:

After completion of the course, students will be able to:

1. Outline earthquake phenomena, seismic waves, measuring instruments, and seismic design requirements.
2. Summarize conceptual design of lateral load resisting systems, material ductility, and seismic analysis methods.
3. Examine RC buildings for earthquake resistance, considering irregularities, structural walls, and non-structural elements.
4. Calculate rectangular and flanged shear walls for earthquake-resistant structures.
5. Demonstrate ductility considerations and capacity-based design principles for RC buildings under seismic loads.



SYLLABUS:

UNIT-I

Engineering Seismology: Earthquake phenomenon cause of Earthquakes- Faults- Plate tectonics- Seismic waves- Terms associated with Earthquakes- Magnitude/Intensity of an earthquake- scales- Energy Released- Earthquake measuring instruments- Seismoscope, Seismograph, accelerograph- Characteristics of strong ground motions- Seismic zones of India.

Introduction- Functional Planning- Continuous Load Path- Overall form- simplicity and symmetry- elongated shapes- stiffness and strength - Seismic design requirements- regular and irregular configurations- basic assumptions.

UNIT-II

Conceptual Design- Horizontal and Vertical Load Resisting Systems- System and Members for Lateral Loads and High Rise / Tall Structures. Twisting of Buildings – Flexible Building and Rigid Building Systems. Strength and Stiffness – Ductility – Definition – Ductility Relationships – Choice of construction Materials Unconfined Concrete & Confined Concrete- Design Earthquake Loads – Basic Load Combinations Permissible Stresses.

Seismic Methods of Analysis – Static Method – Equivalent Lateral Force Method. Dynamic Analysis – Response Spectrum Method.

UNIT-III

Introduction to Earthquake Resistant Design – Seismic Design Requirements and Methods.

RC Buildings – IS Code based Method.- Vertical Irregularities – Mass Irregularity Torsional Irregularity - Plan Configuration Problem - Design Lateral Force, Base Shear Evaluation – Lateral Distribution of Base Shear – Structural Walls Strategies and the Location of Structural Walls – Sectional Shapes – Behaviour of Unreinforced and Reinforced Masonry Walls – Behaviour of Walls Box Action and Bands, Behaviour of infill Walls- Non-Structural Elements – Failure Mechanism of Nonstructural Elements, Effects of Nonstructural Elements on Structural System – Analysis – Prevention of Damage to Nonstructural Elements – Isolation of Non-Structures.

UNIT-IV

Design of Shear walls: Classification according to Behavior, Loads in Shear walls, Design of Rectangular and Flanged Shear walls, Derivation of Formula for Moment of Resistance of Rectangular Shear walls – Behaviour of Coupled Shear Walls.

UNIT-V

Ductility Considerations in Earthquake Resistant Design of RC Buildings: Introduction- Impact of Ductility- Requirements for Ductility- Assessment of Ductility- Factors affecting Ductility- Ductile detailing considerations as per IS 13920. Behavior of beams, columns and joints in RC buildings during Earthquakes- Vulnerability of open ground storey and short columns during earthquake. Capacity Based Design: Introduction to Capacity Design, Capacity Design for Beams and Columns- Case studies.



REFERENCES:

1. Earthquake Resistant Design of structures–S.K.Duggal,OxfordUniversityPress
2. Earthquake Resistant Design of structures–PankajAgarwaland Manish Shrikhande,Prentice Hall of India Pvt. Ltd.
3. Seismic Design of Reinforced Concrete andMasonry Building –T. Paulay and M.J.N. Priestly, John Wiley & Sons
4. Masory and Timber structures including earthquake Resistant Design –AnandS.Arya, Nemchand& Bros
5. Earthquake –Resistant Design of Masonry Building –MihaTomazevic, Imperial college Press.
6. DesignofReinforcedConcreteStructuresbyN.Subramanian,OxfordUniversityPress.
7. EarthquakeTips–LearningEarthquakeDesignandConstructionC.V.R.Murty

REFERENCE CODES:

1. IS:1893(Part-1)-2016.“Criteria for Earth quake Resistant–Design of structures.” B.I.S., New Delhi.
2. IS:4326-1993,“EarthquakeResistantDesignandConstructionofBuilding”,Codeof Practice B.I.S., New Delhi.
3. IS:13920-2016,“Ductiledetailingofconcretestructuresubjectedtoseismicforce”—— Guidelines, B.I.S., New Delhi.

ELECTRONICRESOURCES:

<https://nptel.ac.in/courses/105107204>

<https://nptel.ac.in/courses/105104200>

<https://nptel.ac.in/courses/105101004>

MATERIALSONLINE:

1. Course template
2. Tutorial question bank
3. Definitions and terminology
4. Assignments
5. Model question paper – I
6. Model question paper – II
7. Lecture notes
8. E-Learning Readiness Videos (ELRV)