Course Code	Course Title	L	T	P	C
17CE004	EARTHQUAKE RESISTANT DESIGN OF STRUCTURES	3	1	2	5

Course Objective:

1. Deals with calculation of earthquake forces by different methods
2. This course integrates information from various engineering and scientific disciplines in order to provide a rational basis for the design of earthquake-resistant structures.
3. The course deals with special provisions and requirements of structures for their safety against earthquake forces.

Course Outcomes:

The students will be able to:

1. Gain knowledge about principles of earthquake engineering and design procedures
2. Analyze the structures for lateral forces like wind and earthquake using different dynamic approaches
3. Understand the working principle of different response control systems like base isolation and dampers
4. Understand the importance of ductility of building in Earthquake resistance design

Skills:

1. Calculation of Earthquake forces on structures
2. Determination of total base shear by using Static and Dynamic approaches
3. Ductile detailing of structures
4. Design of base isolation systems
5. Design and analysis of steel structures for lateral forces

Activities:

1. Take plan of a 6 storied residential building and calculate base shear using Static equivalent method
2. Using mode superposition technique find out total base shear for a residential building in your zone
3. Conduct dynamic analysis on a 4 storied residential building using STAAD Pro
4. Take any ongoing construction project and do ductile detailing by using IS 13920
5. Make a working model of a building to demonstrate base isolation.

UNIT-I: Design forces for buildings:

Introduction; Equivalent static method; Mode superposition technique; Dynamic inelastic-time history analysis; Advantages and disadvantages of these methods; Determination of lateral forces as per IS1893 (Part 1) – Equivalent static method, Model analysis using response spectrum.

UNIT-II: Earthquake resistant design of a long two-storey, two-bay RCC building:

Determination of lateral forces on an intermediate plane frame using Equivalent static methods and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893(Part 1); Identification of design forces and moments in the members.

UNIT-III: Steel Buildings:

Behavior of steel; Materials and workmanship; Steel frames – unbraced, braced; Ductile design of frame members; Flexural members; Frame members subjected to axial compression and bending; Connection design and joint behavior ; Steel Panel zones; Bracing members

UNIT-IV: Seismic protection of structures:

Introduction; Considerations for seismic isolation; Basic elements of seismic isolation; seismic- isolation design principle, Implementation of energy dissipation devices; Metallic yield dampers, friction dampers, viscoelastic dampers, tuned mass dampers, tuned liquid dampers; Shape memory alloy dampers; Modelling, linear and nonlinear procedures; Detailed system requirements; Application to multi-storey buildings; Testing of energy dissipation devices.

UNIT-V: Ductility considerations in earthquake resistant design of RCC buildings:

Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility– Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920.

TEXT BOOKS :

1. Pankaj Agarwal and Manish Shrikhande, "Earthquake resistant design of structures" ,Prentice- Hall of India, 2006.
2. T.Paulay and M.J.N.Priestley, "Seismic design of reinforced concrete and masonry buildings", John Wiley & Sons, 1991.

REFERENCE BOOKS:

1. SK Duggal , "Earthquake resistant design of structures", Oxford University Press. 2007
2. F.Naeim, Kluwer "The seismic design handbook", Academic publishers, 2001

LABORATORY EXPERIMENTS

List of experiments

1. Perform Equivalent Static analysis on G+6 building using SAP2000
2. Perfom Linear dynamic analysis using SAP2000
3. Perform Non Linear Pushover Analysis on Bay frame of high rise building using SAP2000
4. Perform Non Linear Pushover Analysis with infill wall Bay frame of high rise building using SAP2000
5. Perform Non Linear time history Analysis considering different response spectrums of El centro, Kobe earthquakes etc using SAP2000.