EARTHQUAKE RESISTANT DESIGN OF STRUCTURES

Lectures / Tutorials : 4 Periods/Week — Sessional marks : 40
Semester End Exam. : 3 Hours — Semester End Exam. Marks : 60
Credits : 4

Course objectives:

- To teach the basic concepts of vibration of single degree of freedom systems
- To explain the elements of earthquake ground motion characteristics
- To calculate the lateral forces on a building using equivalent static method
- To analyse and design single storey, single bay RC framed building subjected to an earthquake
- To introduce architectural features of buildings to resist earthquakes
- To introduce Geo-technical earthquake engineering

Course outcomes :

- Learn the fundamentals vibration of single degree freedom systems
- Learn the earthquake ground motion characteristics
- Able to calculate the lateral forces on a building using equivalent static method
- Can analyse and design a single storey and single bay RC framed building
- Know the architectural features of buildings to resist earthquakes
- Understand the behavior of soil beneath a foundation during an earthquake

UNIT-I

Elements of structural dynamics

Sources of vibrations; Types of vibrations; Degrees of freedom; Spring action and damping; Free vibration of undamped system having single degree of freedom; Free vibration of viscous damped system having single degree of freedom; Forced vibration of a viscous damped single degree freedom system subjected to harmonic excitation; Earthquake excitation (Base excitation) of a single degree freedom system.

UNIT-II

Elements of Earthquake Ground motion

Earthquake size – Intensity and magnitude; Seismic Zoning-Introduction; Strong Motion Earthquakes - Introduction; Response spectrum (elastic); Local site effect (Effect of type of soil).

Seismo-resistant building architecture

Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity/redundancy, non-structural elements, foundation soil/ liquefaction. Foundations; Quality of construction and materials – quality of concrete, construction joints, general detailing requirements

UNIT III

Analysis of single storey and single bay RCC Plane Frame (Columns vertical) :

(As per IS:1893(part-I)-2002)

Calculation of lateral force due to earthquake using equivalent static method ; Analysis for different load combinations; Design forces and moments in beam and columns.

UNIT-IV

Design of single storey and single bay RCC plane frames (Columns vertical)

(As per IS:456-2000 and IS13920-1993)

Design of column; Design of beam; Design of footing ; Detailing of entire frame

Elements of Geotechnical Earthquake Engineering

Liquefaction – Definition and types, Effect of liquefaction on built environment, Evaluation of liquefaction susceptibility, Liquefaction hazard mitigation ; Seismic slope stability – Introduction, Pseudo-static analysis, Sliding block methods

NOTE

Two questions of 12 marks each will be given from each unit out of which one is to be answered. Twelve questions of one mark each will be given from entire syllabus which is a compulsory question.

TEXT BOOKS

1. Earthquake Resistant Design of Structures by Pankaj Agarwal, and Manish Shrikhande , PHI Learning, 2006 .

2. Geotechnical Engineering by S.K.Gulhati & Manoj Datta, Tata McGraw-Hill,2010

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REFERENCE BOOKS

1.Elements of Earthquake Engineering by Jai Krishna, A.R.Chandrasekaran and Brijesh Chandra, Second Edition, South Asian Publishers, 1994.

2. Dynamics of Structures by A.K.Chopra, 3rd Edition, Person Education, 2007.