

**AN INTRODUCTION TO EARTHQUAKE ENGINEERING  
BEG 454 CI**

**Year: IV**

**Semester: I**

Teaching Schedule Hours/ Week			Examination Scheme						Total Marks
			Final				Internal Assessments		
			Theory		Practical		Theory Marks	Practical Marks	
L	P	T	Duration	Marks	Duration	Marks			
2	-	2	1.5	40	-	-	10	-	50

**Course Objective:**

The student will learn the basic understanding and nature of the earthquakes, analysis of structures subjected to earthquakes and design of structures to resist strong ground motions. The student will also learn the practical approach including use of prevalent codes in analysis and design of structures for earthquake loads.

**Course Contents:**

**1.0 Introduction (2 hrs)**

- 1.1 Effects of earthquakes
- 1.2 Theories and criteria of earthquake design
- 1.3 Basic requirements for earthquake resistant structures

**2.0 Fundamental of Earthquake Engineering (6 hrs)**

- 2.1 Earthquake and Seismicity
- 2.2 Causes of earthquakes
- 2.3 Mechanism of earthquakes
- 2.4 Measure of earthquakes
- 2.5 Attenuation laws
- 2.6 Local soil conditions
- 2.7 Response spectra of earthquakes
- 2.8 Seismic risk and seismic zoning

**3.0 Basics Structural Dynamics (6 hrs)**

- 3.1 Introduction
  - 3.1.1 Dynamic problems
  - 3.1.2 Response of structures of vibration
- 3.2 Introduction to Single degree of freedom (SDOF) system
  - 3.2.1 Simple harmonic motion
  - 3.2.2 Equation of motion and natural frequency
  - 3.2.3 Free vibration response (damped and undamped) of SDOF system
- 3.3 Multi degree of freedom (MDOF) System
  - 3.3.1 Modeling of MDOF system structures
  - 3.3.2 Equation of motion in matrix form

#### **4.0 Lateral Load Resisting Systems for Buildings**

**(8 hrs)**

- 4.1 Different structural systems for lateral loads
- 4.2 Floor diaphragms
- 4.3 Lateral load distribution with rigid floor diaphragms
- 4.4 Centre of mass and centre of rigidity
- 4.5 Torsionally coupled and uncoupled system
- 4.6 Moment resisting frames
- 4.7 Shear walls

#### **5.0 Earthquake Design Buildings**

**(8 hrs)**

- 5.1 Strength, stiffness and stability requirements
- 5.2 Ductility of the system and members
- 5.3 Seismic coefficient method and code provisions
- 5.4 Response spectrum method and the code provision
- 5.5 Introduction to modal analysis
- 5.6 Code provision on ductility factors, drift limit
- 5.7 Detailing of reinforced concrete moment resisting frames for earthquakes

#### **References:**

- V.K. Manicka Selvam, Elementary Structural Dynamics, Dhanpat Rai Publication Clough
- R.W., Penzien J., Dynamics of Structures, McGraw-hill Inc.
- Chopra Anil, Dynamics of Structures, Prentice-Hall
- P. Agrawal & M. Shrikhande, Earthquake Resistance Design of Structures. Printice Hall of India, New Delhi, 2006.
- V.K. Manicka Selvam, An Introduction to Earthquake Analysis of Structures, Dhanpat Rai Publications
- I.S. 1893:2002 (Part I) Indian Standard Criteria for Earthquake Resistant Design of Structures, Bureau of Indian Standards
- I.S. 13920:1993 – Indian Standard Ductile Detailing of Reinforcement Concrete Structures, Bureau of Indian Standards