SHIV NADAR UNIVERSITY

GRADUATE COURSE DESCRIPTION

I. COURSE TITLE: EARTHQUAKE ENGINEERING

II. COURSE CODE : CED647

III. COURSE CREDITS (L:T:P): (3:0:0)

IV. TOTAL CONTACT HOURS/ BATCH/WEEK (L:T:P): (3:0:0)

V. COURSE TYPE (Core/Elective): ELECTIVE

VI. PREREQUISITE/S (IF ANY): MECHANICS OF SOLIDS

VII. SCHOOL/ DEPARTMENT: CIVIL ENGINEERING

VIII. COURSE CONTENT & SYLLABUS:

The course on Earthquake Engineering provides the fundamental concepts, principles and application of earthquake engineering in seismic analysis and design of natural structures (natural as well as manmade). The course consists of Seismology, which explains the causes of occurrence of earthquake and its characterization, seismic analysis of the structures under earthquake excitation, and concept of response spectrum to determine structure response and design earthquake forces. Finally, the soil structure interaction and inelastic response spectra is also covered in this course.

Unit I

Seismology:

- Earth's Interior and Plate Tectonics;
- Causes of Earthquakes and Seismic Waves;
- Measurement of Earthquakes and Measurement parameters;
- Modification of Earthquake due to the Nature of Soil;
- Seismic Hazard Analysis

Unit II

Earthquake Inputs:

- Time History Records and Frequency Contents of Ground Motion;
- Power Spectral Density Function of Ground Motion;
- Concept of Response Spectrums of Earthquake;
- Combined D-V-A Spectrum and Construction of Design Spectrum;
- Site Specific, Probabilistic and Uniform Hazard Spectrums;

Unit III

Dynamics for Earthquake Analysis:

- Equations of Motion for SDOF and MDOF Systems;
- Undamped Free Vibration of SDOF and MDOF Systems;
- Mode Shapes and Frequencies of MDOF System;
- Rayleigh Damping Matrix;
- Direct Time Domain Analysis of MDOF System;
- Direct Frequency Domain Analysis of MDOF System;
- Modal Analysis in Time and Frequency Domain;

Unit IV

Response Analysis for Specific Ground Motion:

- Equations of Motion for Single and Multi-Support Excitations and Solutions;
- Equations of Motion in State Space and Solutions;

Unit V

Response Spectrum Method of Analysis:

- Concept of Equivalent Lateral Force for Earthquake;
- Modal Combination Rules;
- Response Spectrum Method of Analysis of Structures and Codal Provisions;
- Response Spectrum Method of Analysis for Torsionally Coupled Systems;

Unit VI

Seismic Soil - Structure Interaction:

- Fundamentals of Seismic Soil-Structure Interaction;

IX. EVALUATION SCHEME:

- **Mid Semester Exam: 25 %**
- **End Semester Exam: 35%**
- **Assignment: 20%**
- **Project: 20%**

X. RECOMMENDED READING(S):

1. Clough R.W. and Penzien J., 'Dynamics of Structures', McGraw-Hill, 2nd edition, 1992.
2. Newmark N.M. and Rosenblueth E., 'Fundamentals of Earthquake Engg.,' Prentice Hall, 1971.
3. David Key, 'Earthquake Design Practice for Buildings', Thomas Telford, London, 1988.
4. Ellis L. Krinitzsky, J.M. Gould and Peter H. Edinger, 'Fundamentals of Earthquake Resistant Construction', John Wiley, 1993.
5. Pankaj Agarwal and Manish Shrikhande, 'Earthquake Resistant Design of Structures', PHI, 2008.
6. I.S. Codes No. 1893, 4326, 13920 etc.