Geotechnical Earthquake Engineering - Video course

COURSE OUTLINE

This course on Geotechnical Earthquake Engineering introduces the fundamental concepts of earthquake engineering related to geotechnical problems, principles of earthquake, wave propagation, dynamic soil properties, liquefaction and seismic design of various geotechnical structures. This course focuses on seismic hazard analysis which includes both Probabilistic Seismic Hazard Analysis (PSHA) and Deterministic Seismic Hazard Analysis (DSHA), followed by site response analysis. Also, behaviour of various geotechnical structures such as shallow and deep foundations, retaining structures, slopes, ground anchors, waterfront retaining structures, reinforced soil-wall, tailing dam due to earthquake loading are discussed with reference to codal provisions. The course material on Geotechnical Earthquake Engineering will be very useful to the post-graduate students, researchers, teachers and practitioners. A number of selected problems will be solved to illustrate the concepts clearly.

Contents: Introduction, Basic Vibration theory, Engineering Seismology, Strong Ground Motion, Wave Propagation, Dynamic Soil Properties, Seismic Hazard Analysis, Site Response Analysis, Dynamic Soil- Structure Interaction, Soil Improvement Techniques

COURSE DETAIL

Sl. No.	Module	Contents	No. of Hours
1	Introduction to Geotechnical Earthquake Engineering	Scope and objective; Nature and types of earthquake loading; Importance of Geotechnical Earthquake Engineering	01
2	Basics of Vibration theory	Concept of dynamic load, Earthquake load, Single degree of freedom system, Multiple degree of freedom system, Free and forced vibrations, Damped and undamped systems, Equation of Motion, Response spectra.	04
3	Engineering Seismology	Basic Seismology, Earthquake, List of major earthquakes, Causes of earthquakes, Sources of earthquake data, Elastic rebound Theory, Faults, Plate tectonics, Seismograph and Seismogram, Prediction of Earthquakes, Protection against earthquake damage, Origin of Universe, Layers of Earth, Theory of Continental Drift, Hazards due to Earthquakes.	03

NPTEL

http://nptel.iitm.ac.in

Civil Engineering

Pre-requisites:

- Soil Mechanics (Geotechnical Engineering I)

Additional Reading:

- Journal and Conference papers in the area of Geotechnical Earthquake Engineering.

Coordinators:

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4	Strong Ground Motion	Size of Earthquake: Magnitude and Intensity of Earthquake, Modified Mercalli Intensity Scale, Measuring of Earthquake, Earthquake Magnitude-Local (Richter) magnitude, surface wave magnitude, Moment magnitude, Seismic energy, Correlations. Spectral Parameters: Peak Acceleration, Peak Velocity, Peak Displacement, Frequency Content and duration, Spatial Variability of Ground Motion, Attenuation Relationships, Fourier Amplitude Spectra, Arias Intensity.	03
5	Wave Propagation	Elastic response of continua (one, two and three dimensional wave equations); Waves in unbound media; Waves in semi-infinite media; Waves in layered media, Mohorovicic Discontinuity and Gutenberg Discontinuity, Seismic Travel Time Curve, Three Circle Method for locating an Earthquake's Epicentre.	03
6	Dynamic Soil Properties	Stiffness, damping and plasticity parameters of soil and their determination (laboratory testing, intrusive and non intrusive in-situ testing); Correlations of different soil parameters; Liquefaction (basics, evaluation and effects), Liquefaction hazard map, Lateral Spreading.	05
7	Seismic Hazard Analysis	Magnitude Indicators, Segmentation, Deterministic Seismic Hazard Analysis (DSHA), Probabilistic Seismic Hazard Analysis (PSHA), Earthquake Source Characterization, Gutenberg-Richter recurrence law, Predictive relationships, temporal uncertainty, Probability computations, Seismic Hazard Curve, Logic tree methods.	06
8	Site Response Analysis	Ground Response Analysis, Transfer Function, Non-linear approach. Site Classification.	02
9	Seismic Analysis and Design of Various Geotechnical Structures	Pseudo-static method, Pseudo-dynamic method, other dynamic methods, Seismic analysis of retaining wall, Seismic slope stability analysis, Behaviour of reinforced soil under seismic conditions, Seismic design of retaining structures, Seismic analysis of Tailings Dam, Seismic displacement based analysis, seismic design of shallow foundations, seismic design of pile foundations, seismic uplift capacity of ground anchors, seismic design of Municipal Solid Waste (MSW) landfills. Codal provisions/guidelines for seismic	10

		design of geotechnical structures.	

References:

1. Shamsher Prakash, “Soil Dynamics”, McGraw-Hill Book Company.
2. Steven L. Kramer, “Geotechnical Earthquake Engineering”, Prentice Hall Inc.
3. Robert W. Day, “Geotechnical Earthquake Engineering Handbook”, McGraw Hill, New York.
4. Ikuo Towhata, “Geotechnical Earthquake Engineering”, Springer-Verlag Heidelberg.
5. Kenji Ishihara, “Soil Behaviour in Earthquake Geotechnics”, Oxford University Press, USA.
6. Milutin Srbulov, “Geotechnical Earthquake Engineering: Simplified Analyses with Case Studies and Examples”, Springer-Verlag.
7. D. D. Barkan, “Dynamics of Bases and Foundations”, McGraw-Hill Book Company.
8. IS 1893, Indian Standard Criteria for earthquake resistant Design of Structures.