GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL (STRUCTURAL ENGINEERING) (20)

ADVANCED SEISMIC DESIGN OF STRUCTURES

SUBJECT CODE: 2742003

M.E. 4th SEMESTER

Type of course: Elective

Prerequisite: Earthquake Engineering and Structural Dynamics

Rationale: It is well understood that most of the structures are expected to deform beyond elastic limit when subject to strong ground shaking; for the seismic analysis of over ground and underground structures, consideration of the soil–structure interaction becomes extremely important when the soil or the foundation medium is not very firm and; seismic inputs are essential for deterministic analysis and random vibration analysis of structures. Thus, the study of performance based design, earthquake inputs, elastic and inelastic response analysis and seismic soil-structure interaction have become important for the earthquake resistant design of structure.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks		Practical Marks				
L	T	P	C	ESE (E)	PA (M)	ESE (V)		PA (I)		
						ESE	OEP	PA	RP	
3	0	2#	4	70	30	20	10	10	10	150

Content:

Sr. No.	Course Content	Total Hrs	% Weightage
1	**Earthquake Inputs:** Time History Records and Frequency Contents of Ground Motion; Power Spectral Density Function of Ground Motion; Construction of Design Spectrum; Site Specific, Probabilistic and Uniform Hazard Spectrums; Predictive Relationships for earthquake parameters	**9**	20
2	**Response analysis for specific ground motion:** Time and frequency domain analyses of single and multi point excitations.	**8**	20
3	**Inelastic response of analysis -** Incremental analysis for SDOF and MDOF systems, push over analysis.	**9**	20
4	**Performance based seismic design:** Overview of the principles of performance-based seismic design, failure mode control and capacity design	**8**	20
5	**Seismic soil structure interaction –** Direct, sub-structure method and equivalent spring-dashpot analysis for soil-structure interaction problems.	**8**	20

Reference Books:

1. Seismic Analysis of Structures by T. K. Datta, Wiley International.
2. Dynamics of Structures - Application to Earthquake Engineering by A. K. Chopra.
3. Dynamics of Structures by R.W. Clough and J. Penzien.

4. Geotechnical Earthquake Engineering by C.L. Kramer.
5. Earthquake Engineering by Bruce A. Bolt.
6. Earthquake Resistant Design of Structures by Pankaj Agarwal and Manish Shrikhande, PHI, 2008
7. Advances in Performance-Based Earthquake Engineering, Fardis (editor), Springer, 2010.

Course Outcome:

After learning the course the students should be able to:

1. Construct Design Spectrum; Site Specific, Probabilistic and Uniform Hazard Spectrums,
2. Carry out time and frequency domain analyses of single and multi point excitations,
3. To perform inelastic analysis of SDOF and MDOF systems,
4. Understand the principles of performance-based seismic design, failure mode control and capacity design.
5. To understand Seismic soil structure interaction problems.

List of Experiments/Tutorials:

1. Minimum 15 problems from above topics along with cross checking using any open-source / professional software wherever applicable.
2. Experimental study of behaviour of structure in linear and nonlinear range using shake table testing.
3. Experimental study of behaviour of structure using structural controls.

Design based Problems (DP)/Open Ended Problem:

1. Study of real life building for conventional design and performance based design including cost aspects.
2. Performing seismic hazard analysis for a specific site.
3. Construction of response spectrum.
4. Developing computer program for dynamic analysis of structure.

List of Open Source Software/learning website:

http://nptel.ac.in/
www.nicee.org
http://www.earthquakeinfo.org/
opensees.berkeley.edu/
http://ocw.mit.edu/courses/civil-and-environmental-engineering/
www.eeri.org/
www.earthquakeengineering.com/
www.curee.org

Review Presentation (RP): The concerned faculty member shall provide the list of peer reviewed Journals and Tier-I and Tier-II Conferences relating to the subject (or relating to the area of thesis for seminar) to the students in the beginning of the semester. The same list will be uploaded on GTU website during the first two weeks of the start of the semester. Every student or a group of students shall critically study 2 papers, integrate the details and make presentation in the last two weeks of the semester. The GTU marks entry portal will allow entry of marks only after uploading of the best 3 presentations. A unique id number will be generated only after uploading the presentations. Thereafter the entry of marks will be allowed. The best 3 presentations of each college will be uploaded on GTU website.