



SECOND SEMESTER 2015-2016

Course Handout Part-II

Date: 13-01-2016

In addition to part -I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No. : CE G615
Course Title : Earthquake Engineering
Instructor-in-charge : RAVI KANT MITTAL
Instructor : Dipendu Bhunia

1. Scope and Objective of the Course:

Earthquakes create destructive forces that nature unleashes on earth. Since earthquakes are so far unpreventable and unpredictable, the only course open to us is to design and construct the structure in such a manner that the loss of property and life is minimized. The course deals with various aspects of seismic design and construction of buildings, bridge, tanks, chimneys, retaining structures, embankments and dams. EQ codes and their provisions are to be studied in-depth. Aim of the course is to know the various aspects in the analysis, design and construction in order to produce safe and economical EQ resistant structures.

2. Text Book:

T1. Agarwal, P. and Shrikhande, M. (2006), "Earthquake Resistant Design of Structures" Prentice-Hall of India.

T2. Duggal, S K (2013) "Earthquake Resistant Design of Structures" Oxford University Press.

3. Reference Books:

R1. Saran, S. (2012), "Analysis and design of foundations and retaining structures subjected to seismic loads" I K Lee Publishers.

R2. Kramer S.L.,(1996) "Geotechnical Earthquake Engineering" Pearson Education.

R3. Subramanian N (2011) "Steel Structures (Design and Practices)" Oxford Univ. Press.

R4. IS: 1893(All parts), 4326, 13827, 13828, 13920, 13938 and other relevant BIS and International, codes

R5. Bandhopadhyay J. N. (2008), "Design of Concrete Structures", PHI Pvt. Ltd. New Delhi.

R6. Varghese P. C. (2011) "Limit State Design of Reinforced Concrete", 2nd Edition, PHI Pvt. Ltd., New Delhi.

4. Course Plan

Learning Objective	Topics to be covered	No of Lec.	Ref. to Ch.
Introduction to EQ Engineering	Importance and scope of the course, seismic hazard mitigation.	1	1T1
Engineering seismology, size and strength of EQ	Causes of earthquake, seismic waves, magnitude and intensity, Seismic hazard in India and development of seismic zoning map.	1	1,2,T1
Determining site characteristics and seismic Hazard.	EQ ground motion parameters, dynamic soil properties and local site effects.	2	3,4,5,T1, 2R1
Concept and principle of EQ resistant design. Code of practice.	EQ resistant design philosophy, basic principles of EQ resistant design, load combination, regular and irregular	4	IS:1893-Part1 12, 14,15, T1; 5, T2





BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
Instruction Division

	buildings, reasons of failure during earthquake, Codal provisions of IS: 1893- 2002 (Part-1) for multi-storeyed buildings.		
EQ analysis of buildings using equivalent lateral load analysis	EQ analysis of buildings using equivalent lateral load analysis based on approximate fundamental natural period of buildings. Response spectra of IS1893-part1.	1	
Determination of EQ forces using dynamic analysis	Mode Superposition method, Modal combination rules using absolute sum, SRSS and CQC method. Time history method of analysis for EQ analysis of multistory buildings.	3	16,18 T1 IS:1893-Part1
Seismic Soil-Structure Interaction Analysis	Soil-Structure Interaction effects and dynamic analysis including SSI, International code of practice.	2	11,T1
Evaluation of liquefaction and Remedial measure	Phenomena of liquefaction and Factors Affecting Liquefaction, Various methods of evaluation of liquefaction. Anti-liquefaction measure. Code of practice.	3	2,R1, 9,12, R2, Notes
Seismic design consideration for shallow foundation	Dynamic bearing capacity and Seismic design of shallow foundation, Codal provisions.	2	4R1, Lec. Notes
Seismic design consideration for deep foundation	Seismic design of deep foundations. Pseudo static approaches. Plies in liquefiable soil. Codal provisions.	2	5R1, Lec. Notes
EQ resistant design of retaining structures	Seismic earth pressure, $c-\phi$ soils, Displacement based seismic design consideration for retaining structures.	2	IS-1893 Part-3 3,7,8,9,10R1, 11,R2.
Torsion response of buildings	Design eccentricity, moment and shear forces due to torsion.	2	5,T2
Earthquake resistant design of non-engineered construction	EQ resistant guidelines and provisions for non engineered earthen, stone masonry, and brick masonry.	3	6, T2 IS:4326, IS:13827,IS:13828
EQ resistant design of bridges	Principles of seismic design of bridges, hydrodynamic pressure, seismic design of bearing and stoppers, piers and ductile detailing, seismic isolation for bridges.	3	IS-1893 Part-3
EQ resistant design of tanks	Seismic analysis and design of water/ liquid storage tanks	3	IS1893- Part2
EQ resistant design of	Seismic analysis and design of industrial	3	IS1893- Part4





industrial structure and stack like structures	structure and stack like structures such as chimneys etc. including SSI effects.		
Earthquake resistant design and detailing of R.C.C. structures	Causes of failure of RCC structures, case studies. Concept of ductility, design and detailing of Beams, columns, joints as per 13920, strong columns and weak beams concept.	3	20,T1; 8,T2, IS:13920, R3, R5, R6
Earthquake resistant design of steel buildings	Causes of failure of steel structures, case studies, design and detailing of steel connections, bracing members.	2	9,T2, IS800-2008
Response control	Seismic base isolation, energy dissipating devices. Case histories.	2	5.18,T2

5. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Remarks
MID SEM. TEST	90 min	25%	17/3 11:00 - 12:30 PM	CB
Literature review, seminar and project		20%	Continuous	OB
Term paper		10%	Continuous	OB
Assignment		10%	Continuous	OB
Comprehensive Examination	3 hrs	35%	10/5 AN	CB

6. Chamber Consultation Hour: To be announced in the class

7. Reading assignments will be given as and when necessary.

8. Notice: Notices will be displayed on Civil Engg., Department Notice Board only.

Instructor-in-charge

