



# **Birla Institute of Technology & Science, Pilani**

Hyderabad Campus

## **FIRST SEMESTER 2022-2023**

### Course Handout Part II

Date: 29-08-2022

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 F428  
*Course Title* : Earthquake Resistant Design and Construction  
*Instructor-in-Charge* : Dr. Mohan S C

### **Scope & Objective of the Course**

Earthquakes are one of the most 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. Now provisions of BIS codes on earthquake engineering are mandatory for any new construction after June 30, 2007. 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.

### **Text Book (TB)**

- T1. Duggal, S K (2007) "Earthquake Resistant Design of Structures" Oxford University Press.
- T2. Chopra, Anil K. "Dynamics of Structures: Theory and applications to earthquake engineering", Pearson Edu., 5th edition, 2017.

### **Reference Books (RB)**

- R1. IS: 1893(All parts), 13920, 4326, 13827, 13828, 13938 and other relevant BIS codes
- R2. Agarwal, P. and Shrikhande, M. (2006), "Earthquake Resistant Design of Structures" Prentice-Hall of India.
- R3. Villaverde R. (2009) "Fundamental Concepts of Earthquake Engineering" CPC press.
- R4. Kramer S.L., (1996) "Geotechnical Earthquake Engineering" Pearson Education.
- R5. Saran, S. (2006), "Soil Dynamics and Machine foundation" 2<sup>nd</sup> edition, Galgotia Publisher.
- R6. Web-Resources: <https://www.eeri.org/>, [www.nicee.org/](http://www.nicee.org/), <http://nees.org/>, <https://www.usgs.gov/>, <http://www.asc-india.org/>, <http://www.sciencecourseware.org/eec/Earthquake/>

### **Course Plan**

<b>Lecture No.</b>	<b>Learning Objective</b>	<b>Topics to be covered</b>	<b>Chapter in TB/RB book</b>
1-8	Formulate an equation of motion and evaluate displacement, velocity and acceleration response of SDOF and MDOF system	Free and forced vibrations-Undamped and damped, Response of SDOF and MDOF structures, natural frequencies and mode shapes	1,2,3,4,9,12 T2
9-11	Study the basic causes of EQ and Evaluate the size and strength of EQ	Causes of earthquake, seismic waves, magnitude and intensity, Seismic Risk, Seismic hazard in India and development of seismic zoning map.	1,T1
12-13	Determine site characteristics	Characterization of EQ ground motion parameters	3,T1
14-16	Evaluate liquefaction potential and apply suitable remedial measure	Phenomena of liquefaction and Factors Affecting Liquefaction, Various methods of evaluation of liquefaction. Anti-liquefaction measure. Code of practice	IS:1893-Part1, Lecture Notes
17-24	Understand the concept and principle of EQ resistant design using Indian Code of practice.	EQ resistant design philosophy, basic principles of EQ resistant design, regular and irregular buildings, reasons of failure during earthquake, Codal provisions of IS: 1893- 2016 (Part-1) for multistoried buildings, torsion response of buildings	IS:1893-Part1 5, T1
25-28	Calculate EQ forces on a structure using various methods	Equivalent Static method, Response Spectrum method, Time history method of analysis.	18, R2 IS:1893-Part1
29-38	Design and detail of RCC structures as per standard guidelines to satisfy ductility criteria	Causes of failure of RCC structures, case studies. Concept of ductility, Ductile design, Beams, columns, joints, strong columns and weak beams concept. Design and detailing of beam column joint, Design and detailing of RC shear wall.	8, T1, IS:13920
39-40	Analyze retaining structures for seismic loads	Seismic earth pressure for $c-\phi$ soils, Analysis of Retaining and Reinforced earth wall in seismic region.	IS-1893 Part-3

### Evaluation Scheme

Ec. No.	Evaluation component	Duration	Weightage	Date, time	Nature of component
1.	Midsem	90 mins.	35%	02/11 9.00 - 10.30AM	CB
2.	Assignments (3 No.)	10 days each	15%	Continuous	OB
3.	Project (1 No.)	2 months	10%	Nov 2022	OB
4.	Compre. Exam	180 mins.	40%	22/12 FN	CB

**Chamber Consultation Hour:** Th 3-4 PM, or by prior appointment based on urgency through BITS email only (WhatsApp or any other social media texts shall not be considered).

**Notices:** All notices concerning the course will be conveyed through Google Classroom. CB components allow the students to use any and all relevant IS Codes.

**Make up policy:** Make-up will be granted only to genuine cases with prior permission from the IC. Make ups will not be given to students who contact the IC after the evaluation component.

**Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**