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**FIRST SEMESTER 2023-2024**

Course Handout Part II

Date: 11-08-2023

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” 2nd 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**

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| **Lecture No.** | **Learning Objective** | **Topics to be covered** | **Chapter in TB/RB book** |
| 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-ϕ soils, Analysis of Retaining and Reinforced earth wall in seismic region. | IS-1893 Part-3 |

**Evaluation Scheme**

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| **Ec. No.** | **Evaluation component** | **Duration** | **Weightage** | **Date, time** | **Nature of component** |
| 1. | Midsem | 90 min. | 35% | 09/10 - 11.30 - 1.00PM | CB |
| 2. | Assignments (3 No.) | 10 days each | 15% | Continuous | OB |
| 3. | Project (1 No.) | 2 months | 10% | Nov 2023 | OB |
| 4. | Comprehensive Exam | 180 min. | 40% | 06/12 AN | 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  
CE F428**