**SECOND SEMESTER 2018-2019**

**Course Handout Part-II**

**Date: 07-01-2019**

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. Kalyana Rama J S**

**1. Scope and 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.

**2. Text Book:**

T1. Duggal, S K (2007) “Earthquake Resistant Design of Structures” Oxford University Press.

T2. Agarwal, P. and Shrikhande, M. (2006), “Earthquake Resistant Design of Structures” Prentice-Hall of India.

**3. Reference Books:**

R1. IS: 1893(All parts), 4326, 13827, 13828, 13920, 13938 and other relevant BIS codes

R2. Villaverde R. (2009)” Fundamental Concepts of Earthquake Engineering” CPC press.

R3. Kramer S.L., (1996) “Geotechnical Earthquake Engineering” Pearson Education.

R4. Krishna, J., Chandrasekaran, A.R. and Chandra, B. (1994) “Elements of Earthquake Engineering.” South Asian Publisher.

R5. Saran, S. (2006), “Soil Dynamics and Machine foundation” 2nd edition, Galgotia Publisher.

**5. Course Plan**

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| **Lecture No.** | **Course Outecomes** | **Topics to be covered** | **Chapter in Textbook/Reference 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 | | 6,7,10,11  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 | | Lecture Notes |
| 17-20 | 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- 2002 (Part-1) for multistoried buildings, torsion response of buildings | | IS:1893-Part1  5, T1 |
| 21-24 | Calculate EQ forces on a structure using various methods | Equivalent frame analysis, Response Spectrum method, Time history method of analysis. | | 18, T2  IS:1893-Part1 |
| 25-30 | 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 |
| 31-32 | Detail steel connections and bracing members for earthquake resistant design | Causes of failure of steel structures, case studies, detailing of steel connections, bracing members. | | 9,T1, IS800-2008 |
| 33-35 | Analyze stack-like structures for seismic loads | Seismic analysis of chimneys, cooling towers, etc. as per Indian Standards | | IS1893- Part-4 |
| 36-38 | Analyze water tanks for seismic loads | Seismic analysis of water tanks as per Indian Standards | | IS1893- Part-2 |
| 39-40 | Apply suitable retrofit and strengthening techniques for various seismic zones | Seismic retrofit of existing buildings. seismic strengthening of damaged buildings. | | IS:13935 |

**6. Evaluation Scheme**

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| Component | Duration | Weightage | Date & Time | Remarks |
| Mid Semester Exam | 1.5 Hour | 25% | 16/3  11.00 -12.30 PM | Closed Book |
| Take home Assignments | - | 10% | Continuous | Open book |
| Seminars | - | 5% |  | Open book |
| Project | - | 20% |  | Open Book |
| Comprehensive Examination | 3 Hours | 40 % | 13/05 AN | Closed Book |

**7. Chamber Consultation Hour:** To be announced in the class

**8. Notice:** Notices will be displayed on Department of Civil Engineering Notice Board and CMS.

**9. 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**