In addition to Part-I (General Handout for all course appended to the Time Table) this portion gives further specific details regarding the course.

Course No.   **:** CE F428
Course Name   **:** Earthquake Resistant Design and Construction
Instructor-in-Charge : Dr. Shivang Shekhar (shivangshekhar@hyderabad.bits-pilani.ac.in)

1. Course Description

Earthquake resistant design philosophy. Ground motion characterization, response spectra and design spectra. Free and forced vibration analysis of single and multiple degree of freedom system. Seismic analysis and design of buildings and other structures as per relevant codes. Seismic design of foundations and liquefaction of soil, Earthquake resistant construction and detailing for masonry & concrete structure as per relevant codes.

2. Scope and Objective

Earthquakes are one of the most destructive forces that nature unleashes on earth. Since earthquakes are so far unpreventable and unpredictable, the only option 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 civil engineering structures such as buildings and bridges. Now provisions of BIS codes on Earthquake Engineering are mandatory for any new construction after June 30, 2007. Earthquake 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 earthquake resistant structures.

3. Text Books

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.

4. Reference Books

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

R2. Paulay, T. and Priestley, M.J.N "Seismic Design of Reinforced Concrete and Masonry Buildings",

John-Wiley & Sons, Inc.

R3. Krishna, J., Chandrasekaran, A.R. and Chandra, B. (1994) "Elements of Earthquake Engineering." South Asian Publisher.

R4. Priestley, M. N., Seible, F., & Calvi, G. M. (1996). Seismic design and retrofit of bridges. John Wiley & Sons.

R5. Kramer S.L., (1996) "Geotechnical Earthquake Engineering" Pearson Education.

R6. Saran, S. (2006), "Soil Dynamics and Machine foundation" 2nd edition, Galgotia Publisher.

R7. Chopra, A.K. (2007) "Dynamics of Structures: Theory and Application to earthquake Engineering" Pearson Education.

5. Course Plan

Lecture No.	Learning Objective/Modules	Topics to be Covered	Chapter in the Text Book
1-2	Introduction to Earthquake Engineering	Importance and scope of the course, failure of structures in past major earthquakes	T1, T2, R2, R2
3-6	Engineering Seismology	Causes of earthquake, seismic waves, magnitude and intensity, seismic hazard in India, strong ground motion characteristics and related terminology, strong ground motion database, local site effects.	T1, T2, R5
7-11	Basics of Structural Dynamics	Dynamics of Single Degree of Freedom Systems, Numerical Evaluation of Dynamic Response, Response Spectra, Dynamics of Multi-Degree of Freedom Systems	T1, T2, R7
12-16	Earthquake Resistant Design	EQ resistant design philosophy, load combination, regular and irregular buildings, codal provisions of IS: 1893- 2016 (Part-1) for buildings	T1, T2, R1
17-23	Analysis of Structures for Earthquake Loads	EQ analysis of buildings using equivalent lateral load analysis based on approximate fundamental natural period of buildings, design response spectra of IS1893-part1, mode superposition method, modal combination rules using absolute sum, SRSS and CQC method, time history method of analysis for	T1, T2, R1, R2

		EQ analysis of multistory buildings, analysis of RC framed buildings with unreinforced masonry walls, special considerations for Unreinforced masonry walls in case of Stiffness irregularity, strength discontinuity etc., torsional response of buildings, soil-structure interaction	
24-27	Ductile Detailing of Reinforced Concrete Structures	Concept of ductility and capacity based design, detailing of beams, columns, joints as per 13920, strong columns and weak beams concept.	T1, T2, R1
28-32	Introduction to Seismic Design of Bridges, and other Structures	Principles of seismic design of bridges, codal provisions, Introduction to seismic design of steel and masonry buildings	R1, R3, R4
33-34	Geotechnical Aspects of Earthquake Engineering	Dynamic bearing capacity and seismic design of shallow foundations, codal provisions, phenomena of liquefaction and factors affecting liquefaction, various methods of evaluation of liquefaction and settlement, measure to control liquefaction, code of practice.	T1, T2, R1, R5, R6
35-38	Seismic Retrofit and Isolation	Introduction to seismic retrofitting of super-structural and sub-structural elements, base isolation, energy dissipation devices.	T2, R2, R4
39-42	Seismic Vulnerability Assessment of Civil Engineering Structures	Introduction to seismic vulnerability assessment methods and tools, Performance based seismic design philosophy	R1, Research Papers, and International Codes

6. Evaluation Scheme

SNo.	Evaluation Component	Duration (Minutes)	Weightage (%)	Date & Time	Remarks
1	Midsemester Exam	90	30	05/03 1.30 - 3.00PM	OB

2	Quiz	20	5	To be announced later in the class	OB
3	Assignments (Nos. 3 to 5)	-	10	Continuous evaluation	OB
4	Project and Seminar	-	20	Continuous evaluation	OB
5	Comprehensive Exam	120	35	15/05 FN	OB

7. Chamber Consultation Hour

Doubt/clarifications should be raised using BITS official email ID. Specific time for online consultation will be announced in the first class of the semester.

8. Notices

Notices concerning this course will be displayed on Google Classroom [Class code - 7fqinn6].

9. Reading assignments

The reading assignments will be given as and when necessary [Students are expected to learn any one standard commercial finite element software in order to carry out assigned project]

10. Make up policies

Make-up would be granted only for genuine cases with **prior permission**.

11. 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.

(SHIVANG SHEKHAR)
Instructor-in-charge
CE F428