BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI: PILANI CAMPUS
INSTRUCTION DIVISION
FIRST SEMESTER 2016-2017
Course Handout Part II

Date: 02- 08-2016

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 F311**
Course Title **: DESIGN OF CONCRETE STRUCTURES**
Instructor-in-Charge **: Shamsher Bahadur Singh**

1. Scope and Objective of the Course:

This course deals with analysis and design of Reinforced Concrete (RC) Structures using the Limit State design methods (Limit State of Strengths and Serviceability). Introduction to various design philosophies used in practice for design of RC structures will be provided and discussed. Specific structures to be discussed and designed are beams, slabs, columns, and staircases. In addition, basis for design of isolated footings will be discussed with example. Students will be given group projects to be executed over the whole semester so that they can have an opportunity to apply the basic design concepts they have learnt in the course to enhance their reinforced concrete structural design. At the end of this course, the students will be able to design the standard practical reinforced concrete structural elements used in the buildings and bridges.

2. Text Book (TB):

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

3. Reference Book (RB):

- S U Pillai & Devdas Menon, "Reinforced Concrete Design", 3rd Edition, Tata McGraw Hill, New Delhi
- Jain, A.K., "Reinforced Concrete : Limit State Design", Nem Chand & Bros., Roorkee, 6th ed., 2002
- Subramanian, N., "Design of Reinforced Concrete Structures," Oxford University Press, New Delhi,2013.
- P. C. Varghese, "Limit State Design of Reinforced Concrete", 2nd Edition, PHI Pvt. Ltd., New Delhi, 2011
- Krishna Raju, N., Pranesh, R. N., "Reinforced Concrete Design," New Age International Pubs., New Delhi, 2012.
- IS 456:2000 "Code of practice for Plain and Reinforced concrete", Bureau of Indian Standards, New Delhi
- Special Publication (SP)-16, Design aids for reinforced concrete to IS 456:1978, Bureau of Indian Standards, New Delhi.

4. Course Plan:

S. No.	Topic	Learning Objective	Lec. No.	Ref. to TB
1.	Methods of Design of Concrete Structures	Introduction, Load factor Method, Limit State Method, Working Stress Method, Introduction to IS 456-2000 and SP-16, IS 10262.	02	Ch. 1
2.	Partial Safety Factors in Limit State Design	Principles of Limit State Design, Characteristic strengths and Load, Partial safety factors for loads, and material strengths, stress-strain characteristics of steel and concrete	02	Chs. 2-3
3.	Theory of Singly Reinforced Members in Bending and Design Examples	Cover to Reinforcements, Ultimate strengths of RC Beams, Balanced, Under-Reinforced, and Over-reinforced sections, Nominal Moment Capacity of section, Analysis and Design Examples.	04	Ch.4
4.	Analysis & Design of Doubly Reinforced Rectangular Beams: Rectangular Sections	Assumptions and basic principles, analysis and design of doubly reinforced concrete beams of rectangular sections, Strain Compatibility Method, Use of Formulae Steel Beam Theory, Use of Design Aids SP 16, Specifications	03	Ch.5

		Regarding Spacing of Stirrups in Doubly Reinforced Beam		
5.	Design for Shear, Limit State of Collapse in Shear	Type of Shear failures, Design Shear Strength in Concrete Beams, Design of Stirrups, Rules for Minimum Shear Reinforcement, Shear in Members subjected to Compression and Bending.	04	Ch. 7
6.	Design of Flanged Beams	Basis of Design and Analysis of Flanged Beams, T-beam formulae for Analysis and Design, Limiting Capacity of T-beams by Use of Design Aids, Tables in SP-24 for Design of Tea-Beams, Design of Flanged Beams in Shear, Detailing of Reinforcements	03	Ch. 6
7.	Design of Bending Members for Limit State of Serviceability	Design for Limit State of Deflection, Empirical Method for Deflection Control in Beams, Empirical Method of Control of Cracking in Beams, Bar Spacing Rules for Beams and Slabs, Minimum Percentage of Steel in Beams and Slabs	03	Ch. 9
8.	Bond, Anchorage, Development Lengths and splicing	Development Lengths of Tension and Compression Bars, Equivalent Development Length of Hooks and Bends, splicing of Bars and Curtailment of Bars and their anchorage	02	Ch. 8
9.	Design of Slabs	Considerations for Design of Slabs, Design for Shear in one-way slab, Use of Design Aids SP16, Design of Two-way simply supported slabs, Reinforcement details	04	Ch. 10
10.	Design of Compression Members	Classification of columns based on slenderness ratio, reinforcement & loading, Design of rectangular and circular columns subjected to Axial load, (Axial load + uni-axial bending) and (Axial load + Bi-axial bending)	08	Ch. 12
11.	Design for Torsion	Principles of Design for Combined Bending, Shear, and Torsion by IS 456, Detailing of Torsion Steel in flanged beams.	02	Ch. 8
12.	Design of Staircases	Principles of Design, Design of Staircases spanning transversely and longitudinally.	03	Ch. 11
13.	Design of Footings	Design loads for foundation design, Basis of Design of Footings, Design of Independent Footing.	03	Ch. 13

5. **Evaluation Scheme:**

Component	Duration	Weightage	Date & Time	Venue	Remarks
Midterm Examination	1.5 Hrs	20	5/10 2:00 - 3:30 PM	—	Close Book
Tutorial Tests	-	10		—	Open Book
Lab Record	—	5		—	-
Quizz test	1 Hr.	10			Close Book
Design Project* followed by Viva-Voce examination	Over the whole semester	10 (Reports)+10 (Viva-Voce)		-	Open Book
Compre. Examination	3 Hrs	35	7/12 FN	—	Open Book

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

7. Notice: Notice if any concerning this course will be displayed on the Notice Board of Civil Engineering Deptt.

*Design project will be announced in the class in the second week of semester. There will be two evaluations in the whole semester (1) Midterm Design report (5% weightage) (2) Final design report (5% weightage) followed by Viva-Voce examination (10% weightage). There will be 10 groups each having one project. Everybody in a group will get the same marks for report, however, viva-voce examination marks will be strictly based on performance of individual student of a particular group.

Instructor-in-Charge (CE F311)