



## **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 F320  
*Course Title* : Design of Reinforced Concrete  
*Instructor-in-Charge* : Prof. Arkamitra Kar  
*Instructor* : Pujitha

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

Design Philosophies: Concepts of Working Stress in comparison with Limit State Method; Limit State Design for flexure of Singly and doubly reinforced rectangular and flanged section beams; one-way and two-way slabs; Design for Bond, anchorage and development length; Design of beams for Shear; Limit state of serviceability for beams and slabs; Limit State Design for collapse of columns subjected to axial, uni-axial and bi-axial bending; Design of simple Footings; Design of simple Stair Cases.

### **Expected Course Outcome (CO):**

After attending this course, the student will develop an ability to:

- Design and detail an RC Beam of any straight shape according to IS 456: 2000
- Design and detail an RC Slab according to IS 456: 2000
- Design and detail an RC Column and isolated RC Footing using IS 456: 2000
- Design and detail an RC staircase using IS 456: 2000

Student Learning Outcomes (SLOs) assessed in this course – (a), (b), (j), and (k).

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

J. N. Bandhopadhyay, “Design of Concrete Structures”, 2008, 1<sup>st</sup> Edition, Prentice-Hall of India, New Delhi

## Reference Books (RB)

1. IS 456:2000 “Code of practice for Plain and Reinforced concrete”, Bureau of Indian Standards, New Delhi.
2. Special Publication (SP)-16, Design aids for reinforced concrete to IS 456:1978, Bureau of Indian Standards, New Delhi.
3. P. C. Verghese, “Limit State Design of Concrete”, 2nd edition, PHI Pvt. Ltd., New Delhi, 2011.
4. S.U.Pillai and Devdas Menon, “Reinforced Concrete Design”, 3rd Edition, TMH, New Delhi, 2009.
5. Jain, A.K., Reinforced Concrete: Limit State Design”, 6th Edition, Nemchand & Bros, Roorkee, 2002.

## Course Plan

CO	Lecture No.	Learning Objective	Topics Covered	Chapter in the Text Book
1	1-2	Objectives & Methods of Analysis & Design	Introduction, objectives, Methods of Design, Loads & Forces acting on structures	Ch 1
	3-4	Properties of Concrete	Stress-strain curve for concrete, Size effect, behavior of concrete in tension, Durability of concrete, properties of Steel, Stress-strain curve for steel	Ch 2
	5-6	Philosophies of Limit State Method	A review on various design Philosophies, Types of Limit States, partial safety factors for materials and loads	Ch 3
	7-11	Limit State of Collapse-Flexure and singly reinforced rectangular beam	Assumptions in Limit State Design, Analysis of singly reinforced rectangular, Design of Singly Reinforced Concrete Beam, Analysis of singly reinforced rectangular beams using SP-16 tables and Charts.	Ch 4
	12 - 14	Analysis & Design of Doubly Reinforced	Assumptions and basic principles, analysis and design of doubly reinforced concrete beams with rectangular section	Ch 5

		rectangular section Beams		
	15 - 16	Analysis & Design of Simply supported Flanged Sections	Effective Width, Analysis of Flanged sections for various cases, Design of simply supported Flanged beam Sections, Design of continuous beam Flanged sections	Ch 6
	17 - 18	Design for Bond, anchorage and development length	Design bond strength, development length, check for development length in tension, anchoring of reinforcing bars, bearing stress at bonds, reinforcement splicing, Design for bond, Development length, Curtailment of reinforcement, Lap splice	Ch 8
1	19 - 22	Design of Beams for Shear	Modes of failure due to shear, shear strength of concrete, critical section for shear, enhanced shear strength near support, minimum shear reinforcement, Design of shear strength, check for shear at point of tension reinforcement curtailment	Ch 7
	23 - 26	Limit state of serviceability	short term deflection calculation for beams, deflection due to shrinkage and creep, combined bending, shear, and torsion	Ch 8, 9
2	27 - 34	Design of one way and two-way Slabs	Design shear strength of concrete in slabs, design consideration for slabs, design and reinforcement detailing of one way simply supported and continuous slabs, design and reinforcement detailing of two-way slabs	Ch 10
3	35 - 39	Design of Compression Members and isolated footing	Classification of columns, Design of rectangular and circular columns subjected to Axial load, (Axial load + uni-axial bending) and (Axial load + Bi-axial bending); Design of isolated RC footings	Ch 12
4	40 - 42	Design of Stair Cases	Types of stair cases, components of staircase, structural system of stair cases, effective span, Design of stair cases spanning transversely and longitudinally	Ch 11

### Evaluation Scheme

Ec. No.	Evaluation component	Duration	Weightage	Date, time	Nature of component
1.	Midsem	90 mins.	35%	01/11 1.30 - 3.00PM	CB
2.	Class Tests	15 mins.	25%	TBA in class, 5×5%	OB
3.	Compre. Exam	180 mins.	40%	21/12 FN	CB

**Chamber Consultation Hour:** F 4-5 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:** Makeup will be given only to the genuine cases with prior permission.

**Evaluation:** Curved gradation policy will be adopted; however, the student is expected to score at least 30% of the total marks to achieve a completed grade, as this is a fully OB course.

**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.

*Arkamitra Kar (sd.)*  
**Instructor-in-charge, CE F320**