

Devi Ahilya Vishwavidhyalaya, Indore, India Institute of Engineering & Technology				II Year B.Tech. (Civil Engineering)		
Course Code & Name	Instructions Hours per Semester and Credits					
<b>4RVPC4</b>  <b>Design of RCC Structures – I</b>	<b>Classroom Instruction (CI)</b>		<b>Lab Instruction (LI)</b>	<b>Term Work (TW) and Self Learning (SL)</b>	<b>Total no. of Hours Per semester</b>	<b>Total Credits (Total Hours/30)</b>
	<b>L</b>	<b>T</b>	<b>P</b>	<b>TW+SL</b>	<b>120</b>	<b>4</b>
	<b>20</b>	<b>10</b>	<b>20</b>	<b>70</b>		

**Course Learning Objectives:**

1. To understand design philosophies.
  2. To understand the design concepts of various structural elements using Limit state method and detailing of reinforcement
  3. To understand the design of beam and slab using limit state method.
  4. To learn about the design and analysis of column in different loading cases.
- To learn and understand different types of staircases.

**Prerequisites:** Engineering Mechanics, Structural Mechanics

### COURSE CONTENTS

**UNIT-I**

**Basic Principles of Structural Design:** Basic concepts of Reinforced concrete, Various properties of concrete and reinforcing steel, Introduction to working stress method and limit state methods of design, partial safety factor for load and material. Calculation of various loads for structural design, Partial load factors. Neutral Axis Depth, limiting values of neutral axis for different grades of steel, Balanced, Under Reinforced and Over Reinforced Sections, Limit state of collapse in flexure, assumptions, stress strain curves for concrete and steel, Stress block, Moment of Resistance of beam Sections.

**UNIT -II**

**Design of Beams by L.S.M:** Limit state of collapse in shear, design shear strength of concrete, design strengths of vertical / inclined stirrups and bent up bars in, Design of beam for flexure, shear and bond. Design of singly reinforced rectangular beams, Doubly reinforced rectangular & Flanged Beams, Lintel, Cantilever, simply supported and continuous beams, Beams with compression reinforcement, Redistribution of moments in continuous beams.

**UNIT-III**

**Design of slabs by L.S.M :** Classification of slabs , Effective spans ,Imposed loads on slabs (IS: 875), strength and stiffness requirements, minimum and maximum permitted size, spacing and area of main and secondary reinforcement as per IS 456 -2000, Design of one way cantilever, simply supported, slabs and sunshades, Design of continuous slabs using B.M coefficients,

check for stiffness, curtailment of tension reinforcement, Tension and torsion reinforcement requirement., Design of two way slab

#### **UNIT-IV**

**Design of columns by L.S.M:** Classification of Columns, Limit state of collapse in compression, assumptions, limiting strength of short, axially loaded compression members, effective length of compression members, slenderness limits for columns, minimum eccentricity for column loads, longitudinal and transverse reinforcement as per I S 456-2000, Design of axially loaded short columns with lateral ties / helical reinforcement,

**Design of column footing** Types of footings, Footings with uniform thickness and sloped footings, minimum thickness, critical sections, minimum reinforcement, distribution of reinforcement, development length, anchorage, cover, minimum edge thickness requirements as per IS 456-2000 – Design of isolated footing (square and rectangular) and combined footings by limit state,

#### **UNIT-V**

**Design of Staircases by L.S.M:** Types of stairs according to geometry and structural behavior planning a staircase, effective span of stairs, effective breadth of flight slab, distribution of loads on flights Staircases with waist slab having equal and unequal flights with different support conditions with different support conditions, Slab less tread-riser staircase.

**NOTE:** - All the designs for strength and serviceability should strictly be as per the latest version of IS:456. Use of SP-16 (Design aids)

#### **Course Outcomes:**

CO. No.	CO	PO
CO1	Apply the fundamental concepts of limit state method to solve problems related to structures	PO-1, PO-2, PO-3
CO2	Practice IS code provisions for the design of concrete elements	PO-1, PO-2, PO-3
CO3	Design the structural behaviour of reinforced concrete elements in bending, shear, compression and torsion.	PO-1, PO-2, PO-3
CO4	Design beams, slabs, stairs, and columns and draw the details of reinforcement.	PO-1, PO-2, PO-3
CO5	Analyze and design for deflection and crack control of reinforced concrete elements.	PO-1, PO-2, PO-3, PO-5

#### **BOOKS RECOMMENDED:**

1. Plain & Reinforced Concrete Vol. I & II – O.P. Jain & Jay Krishna
2. Limit State Design by P.C.Varghese ; Prentice Hall of India, New Delhi
3. Design of Reinforced Concrete Elements by Purushothman; Tata McGraw Hill, New Delhi
4. Reinforced Cement Concrete by Gupta & Mallick, Oxford and IBH
5. Reinforced Cement Concrete by P. Dayaratnam, Oxford and IBH

6. Plain & reinforced concrete - Rammutham
7. Plain & reinforced concrete – B.C. Punnia
8. Structural Design & Drawing by N.K.Raju.

### CO-PO-PSO Relationship

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PSO 1	PSO 2	PSO 3
4RVPC4.CO1	3	3	3									3	2	3
4RVPC4.CO2	3	3	3		1							3	2	3
4RVPC4.CO3	3	3	3		1							3	2	3
4RVPC4.CO4	3	3	3		1							3	2	3
4RVPC4.CO5	3	3	3									3	2	2

### List of Practical Assignment:

1. **Study of Stress-Strain Curves:** Plotting stress-strain curves for concrete and steel; identification of yield point, ultimate strength, and modulus of elasticity.
2. **Moment of Resistance Calculation:** Determination of neutral axis depth and moment of resistance for balanced, under-reinforced, and over-reinforced beam sections.
3. **Design of Singly Reinforced Rectangular Beam:** Flexural design using IS 456-2000 provisions.
4. **Design of Doubly Reinforced Beam:** Calculation of additional reinforcement for compression zone.
5. **Design of Flanged Beam (T-beam/L-beam):** Flexural design considering flange contribution.
6. **Shear Design of Beam:** Calculation of shear strength of concrete and design of stirrups (vertical/inclined).
7. **Design of One-Way Slab:** Cantilever and simply supported slab design with reinforcement detailing.
8. **Design of Two-Way Slab:** Using IS coefficients, reinforcement layout, and torsion reinforcement requirements.
9. **Design of Short Axially Loaded Column:** With lateral ties and helical reinforcement, considering slenderness limits.
10. **Design of Isolated Footing:** Square/rectangular footing design with reinforcement detailing, checking for shear and bending.
11. **Design of Waist Slab Staircase (Equal Flights):** Effective span, load distribution, reinforcement detailing.
12. **Design of Cantilever Staircase (Slabless tread-riser type):** Calculation of effective breadth, reinforcement layout, and checks for stiffness.