COURSE TITLE   :   STRUCTURAL DESIGN - I
COURSE CODE   : 5015
COURSE CATEGORY : A
PERIODS/WEEK   : 5
PERIODS/SEMESTER: 65
CREDITS   : 5

TIME SCHEDULE

Module	Topics	Period
1	Introduction to materials Concept of RCC design-different methods Concept of limit state design Flexural design of singly reinforced beams, lintels, doubly reinforced beams & flanged beams	20
2	Design of flanged beams Apply check for shear, stiffness, Torsion, & bond	13
3	Design of one way slab & two way slab	16
4	Design of staircase, columns and footings	16
	TOTAL	**65**

COURSE OUTCOME

Sl.	Sub	Student will be able to
1	1	Understand the concept of Limit State Design
	2	Design R C C structural elements as per I S 456- 2000, IS 875 & SP 16

SPECIFIC OUTCOME

Upon completion of the course the student should be able to:

MODULE - I

1. 1.0   Know the properties of ingredients of concrete
   1.1.1 List the ingredients of concrete
   1.1.2 Identify the grades of cement
   1.1.3 Identify the grading of fine and coarse aggregate
   1.1.4 Mention the quality of water as per the BIS
   1.1.5 Identify the admixtures used in concrete

1.2.0 Understand the properties of concrete
1.2.1 List grading of concrete
1.2.2 Define water cement ratio and workability
1.2.3 State the relationship between water cement ratio and strength
1.2.4 Draw the stress-strain curve of Concrete

1.3.0 Know the properties of steel
1.3.1 List the different grades of steel
1.3.2 Sketch the stress – strain curve for Mild steel and HYSD bars

1.4.0 Understand the placing and compaction of concrete
1.4.1 Explain the different methods of proportioning of concrete
1.4.2 Explain mixing, placing, compaction and curing of concrete

1.5.0 Understand the concept of Limit State Design
1.5.1 Compare the different methods of design
1.5.2 Define characteristic load and characteristic strength
1.5.3 Identify the partial safety factors for materials and loads
1.5.4 Draw the Idealized stress-strain curve
1.5.5 Explain the Limit State of Collapse and Serviceability

1.6.0 Apply Limit State Design for Beams
1.6.1 Sate the assumptions
1.6.2 Draw the stress block parameters
1.6.3 Define depth of Neutral axis, Lever arm, Moment of Resistance
1.6.4 Explain the different types of sections
1.6.5 Calculate depth of Neutral axis, Limiting depth of NA, Lever arm, Moment of Resistance, Limiting Moment of resistance
1.6.6 Design singly reinforced rectangular sections for different loading condition(simply Supported and cantilever beams)
1.6.7 Differentiate between singly and doubly reinforced beams
1.6.8 State the circumstances with which the doubly reinforced sections are Recommended
1.6.9 Calculate Moment of Resistance of Doubly reinforced sections
1.6.10 Design Doubly reinforced sections

1.7.0 Analyse the different loading condition of Lintels
1.7.1 Design a lintel with different loading condition

MODULE- II

2.1.0 Analyse flanged beams
2.1.1 Design of flanged beams under different loading conditions

2.2.0 Apply the check for shear, stiffness as per BIS
2.2.1 Identify the shear and torsional behavior in RCC members.
2.2.2 Design of beams under different loading conditions for shear

2.2.3 Identify Basic l/d ratio, Modification factor for Tension and compression reinforcement, deduction factor for flanged beams

2.2.4 Check the deflection of singly reinforced, doubly reinforced and flanged beams

2.2.5 Identify bond and anchorage

2.2.6 Calculate development length

2.2.7 Check for curtailment of bars in beams

2.2.8 Identify Code provisions for lap length

MODULE - III

3.1.0 Analyse the behavior of slabs

3.1.1 Design of one way slabs- simply supported, Continuous, cantilever and sunshade

3.1.2 Design of Two way slab- simply supported and restrained, for different end conditions

MODULE - IV

4.1.0 Analyse the behavior of staircase, columns & footings

4.1.1 Design of staircases under different loading and end conditions.(Dog legged & open well)

4.1.2 State the behavior of short and long columns

4.1.3 Identify Slenderness limit for columns as per BIS

4.1.4 Design the short column for direct load

4.1.5 Design the column for uni-axial bending using SP16

4.1.6 Identify slender column

4.1.7 Identify Column footings- isolated & combined

4.1.8 Design of isolated column footing- square & rectangular

CONTENT DETAILS

The subject of RCC is to be taught in SI Units and according to the latest IS Codes (IS 456 :2000,IS 875 and SP 16)

MODULE- I

Properties of ingredients of concrete – Cement-sand-fine and coarse aggregate- Grading of aggregate-water - quality of water –admixtures- materials for concrete –water cement ratio-workability- stress strain curve of concrete- different grades of steel-stress- strain curve of steel-proportioning, mixing of concrete, placing, Compaction of concrete and curing of concrete-different grades of concrete and their strength- Permissible stresses in concrete and steel.

The concept of Limit State Design, Partial Safety factors in Limit State method of Design, values of Partial safety factors as per BIS, Principles of Limit State Design, Characteristic load & characteristic strength, stress -strain curve of Concrete and steel, assumptions made in the Limit State method of Design, Depth of neutral axis , Lever arm-Moment of resistance. Type of sections - Limiting value of NA and Limiting moment of resistance. Design a singly reinforced rectangular simply supported beam and Cantilever

beams for different loading conditions for flexure, (also using SP 16). Design doubly Reinforced Rectangular beams under different loading conditions. Design of lintels under different loading conditions.

MODULE- II

Design of flanged beams under different loading conditions, Check for stiffness as per IS code, Basic l/d ratio, Modification factor, reduction factor for flanged beams, Check the deflection of singly reinforced, doubly reinforced and flanged beams, the shear and torsion behavior in RCC members, Nominal shear stress, maximum shear stress in concrete, permissible shear stress in concrete. Design beams under different loading Conditions for shear, bond and anchorage, calculation of development length, Check for curtailment of bars in beams, Code provisions for lap length

MODULE – III

Study the behavior of slabs, Design of one way slabs - simply supported – Continuous – cantilever. Design of sunshade. Design of Two way slab - simply supported - restrained and different end condition

MODULE – IV

Design of staircases under different loading and end conditions - dog legged and open well. Theory on design of columns - behavior of short and long columns - Slenderness limit for columns as per IS code. Design the short column for direct load - Design the column for uniaxial bending using SP16, Study of slender columns. Theory of Column footing - isolated and combined. Design of isolated column footing - square and rectangular

REFERENCES

1. P C Varghese   : Limit State Design of RCC   ; Prentice Hall of India Ltd.
2. H J Sha   : Design of RCC Structures   ; Charotar Publishers
3. Ashok K Jain   : Limit State Design of R CC structures   ; Jain book agency
4. Ramamrutham   : Design of RCC Structures   ; Dhanpat Rai & Sons
5. B C Punmia   : Design of RCC Structures   ; Standard Publishers
6. A.K.Goel & IC Syal   : Design of RCC structures   ; S.Chand & Co.
7. S Unnikrishna pillai and Devadas menon: Limit State Design of RC structures   ; Tata Mc Graw Hill
8. S.S. Bhavakkatti   : Design of RCC structural elements(vol-I);New age International