31261- STRUCTURAL DESIGN

UNIT I

PART – A: REINFORCED CONCRETE STRUCTURES

1.1 GENERAL

Reinforced Cement Concrete – Concept of Composite material – Purpose of providing reinforcement – materials used in R.C.C and their requirements – different grades of cement and steel – Characteristic strength and grades of concrete – types of loads on structures as per (IS: 875)

1.2 INTRODUCTION TO LIMIT STATE METHOD

Concept – different limit states- Characteristic strength and design strength of materials – Characteristic loads and design loads - partial safety factors for loads and material strength - Limit state of collapse in flexure – assumptions – stress strain curves for concrete and steel – Stress block – limiting values of neutral axis for different grades of steel (Proof not necessary) – Moment of resistance of singly/ doubly reinforced rectangular sections – Problems.

1.3 DESIGN OF BEAMS FOR FLEXURE BY L.S.M

Effective span of cantilever, simply supported and continuous beams – breadth and depth requirements for beams – control of deflection – minimum depth requirement for stiffness –minimum concrete cover for durability and fire resistance – minimum and maximum reinforcement, spacing for main reinforcement and side face reinforcement as per IS 456- 2000-design bending moments – Design of singly and doubly reinforced rectangular beams –cantilever, simply supported beams.

UNIT II

2.1 DESIGN OF ONE WAY SLABS BY L.S.M

Classification of slabs – Effective spans - Imposed loads on slabs (IS: 875) – strength and stiffness requirements –minimum and maximum permitted Curriculum Development Centre, DOTE. Page 142 size, spacing and area of main and secondary reinforcement as per IS 456-2000. Design of cantilever, simply supported slabs and sun shades by limit state method.

2.2 DESIGN OF TWO WAY SLABS BY L.S.M

Introduction –Effective span –thickness of slab for strength and stiffness requirements - Middle and edge strips – B.M coefficients – design of B.M. – simply supported and restrained slabs – tension and torsion reinforcement requirement– Design of two way slabs using B.M. coefficients. Simplysupported two way slabs only (Corners not held down only) – curtailment of reinforcement – check for stiffness**.**

UNIT III

3.1 DESIGN OF BEAMS FOR SHEAR 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 shear –.principle of shear design – critical sections for shear – nominal shear stress – design of vertical stirrups and bent up bars for rectangular beams using limit state method –simple problems.

3.2 DESIGN OF STAIRCASES

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 – Design of doglegged staircase only.

UNIT IV

R.C.C STRUCTURES

4.1 DESIGN OF COLUMNS BY L.S.M

Limit state of collapse in compression – assumptions - limiting strength of short axially loaded compression members - effective length of compression members – slenderness limits for columns – classification of column - minimum eccentricity for column loads – longitudinal and transverse reinforcement as per I S 456-2000-Design of axially loaded short columns with lateral ties – square , Rectangular & circular columns. (With circular ties only)

4.2 DESIGN OF COLUMN FOOTINGS

Types of Footings – Footings with uniform thickness and sloped footings – minimum thickness – critical sections – minimum reinforcement – development length, anchorage value, cover, minimum edge thickness requirements as per IS 456-2000 – Design of isolated footing (Square and Rectangular only) with uniform thickness by Limit State method – For Examination ,

(i) Problems on Design of size of footing and area of steel only.

(ii)For given sizes and other required details of the footing, check for punching shear and transverse shear only. (Any one problem**)**

UNIT V

STEEL STRUCTURES

5.1 DESIGN OF SIMPLE BEAMS BY LSM

Classification of beams – lateral buckling of beams – assumptions – minimum thickness of elements – limiting deflection of beams – Design of laterally supported beams using single rolled steel sections (Built up sections not included).

5.2 DESIGN OF TENSION MEMBERS BY LSM

General – Effective sectional area of Angles /T-sections connected by one leg / flange (welded connections only) – Design of ties using single angle

5.3 DESIGN OF COMPRESSION MEMBERS BY LSM

Effective length of compression members – slenderness ratio – minimum thickness of elements – effective sectional area – Design of steel columns using single rolled steel sections without cover plates. (Lacing and battens, Built up sections not included)

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REFERENCES

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7. Explanatory hand book SP24, Design Aid SP 16, Detailing of Reinforcement SP 34
8. Dr. Ram Chandra, ”Design of Steel Structures, Vol-I ”, Standard Book House, New Delhi, Tenth Edition, 1999.
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