

**Paper ID [A0615]**

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**B. Tech. (Sem. - 5<sup>th</sup>)****DESIGN OF CONCRETE STRUCTURES - I (CE - 307)****Time : 03 Hours****Maximum Marks : 60****Instruction to Candidates:**

- 1) Section - A is **Compulsory**.
- 2) Attempt any **Four** questions from Section - B.
- 3) Attempt any **Two** questions from Section - C.

**Section - A****Q1)****(10 × 2 = 20)**

- a) Distinguish between 'Factor of safety' and 'Partial Safety Factor'.
- b) Explain the necessity for specifying maximum and minimum tension steel in reinforced beams:
- c) Why do specifications state that atleast 50 percent of the shear to be carried by steel should be in the form of stirrups?
- d) Define effective length of a column.
- e) Distinguish between the failure patterns of reinforced concrete short & long columns.
- f) What is equivalent shear as applied to torsion & shear in IS 456?
- g) What is meant by 'Dog legged staircase'?
- h) What is the minimum horizontal and vertical distance between individual bars of same diameter in a beam?
- i) What is the maximum diameter and spacing of reinforcement in two-way RCC slab?
- j) If balanced moment of resistance of a beam of width 'b' and effective depth 'd' is expressed as  $Qbd^2$ , find the value of Q for M 25 and Fe 415. Also give units of Q.

## Section - B

(4 × 5 = 20)

Q2) Design a singly reinforced beam to suit the following data:

Clear Span = 3 m

Width of supports = 200 mm

Working live load = 6 kN/m

M 20 & Fe 415.

Q3) Design the interior panel of a flat slab for a ware house to suit the following data:

Size of ware house 30 m by 30 m divided into panels 6 m by 6m

Loading class 4.5 kN/m<sup>2</sup>

M 20 grade concrete and Fe 415 HYSD bars.

Q4) Design the longitudinal and lateral reinforcements in a rectangular reinforced concrete column of size 300 mm by 500 mm to support a factored axial load of 1400 kN. The column has an unsupported length of 3 m and is braced against sidesway in both the directions. Use M 20 and Fe 415 HYSD bars.

Q5) Design one of the flights of stairs of a school building spanning between landing beams. Data given is

Type of staircase : Waist slab type

Number of steps in flight 12

Tread = 300 mm, Riser 160 mm

Width of landing beams = 400 mm

Materials: M 20 concrete Fe 415 steel (HYSD).

Q6) Describe the merits of Limit State Design method over Working Stress Method. Mention the assumptions made in Design based on Limit State.

## Section - C

(2 × 10 = 20)

Q7) A rectangular R.C.C. beam is 400 × 900 mm in size. Assuming the use of M 25 and Fe 415, determine the maximum ultimate torsional moment the section can take if

(a) No torsion reinforcement is provided.

(b) Maximum torsion reinforcement is provided.

**Q8)** Explain why IS codes do not insist on the condition  $[L_d \geq M_1/V + L_o]$  for negative steel at the interior support of a continuous beam. How does one check the anchorage length of bars in the interior support?

**Q9) (a)** Indicate the three cases regarding position of neutral axis in the design of T beams.

**(b)** Determine the area of steel required in a T beam with the following dimensions for an ultimate moment of resistance of 450 kNm. Depth of slab = 120 mm, breadth of flange = 700 mm, breadth of web = 300 mm, total depth 550 mm. M 20 and HYSD Fe 415 are used.