

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2018**

**STRUCTURAL DESIGN - I**

[Time : 3 hours

(Maximum marks : 100)

[Note :— Use of IS 456-2000 and SP-16 are permitted.]

**PART — A**

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. Define partial safety factors used in limit state design.
2. State the advantage of T-beams compared to rectangular beams.
3. Specify the locations where the torsion reinforcements are to be provided in a two way slab.
4. Identify slender column.
5. Compare the strength of short column using lateral ties and using helical reinforcement.

(5×2 = 10)

**PART — B**

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Explain the limit state method of design.
2. Write down the circumstances under which doubly reinforced beams are needed.
3. A simply supported T - beam having 5 m span, flange width 1000 mm, depth of beam 400 mm, width of rib 250 mm are provided with tension reinforcement of 1200 mm<sup>2</sup>. Check the beam for stiffness. Grade of steel is Fe415.
4. List the steps involved in the design of vertical stirrups when bent-up bars are provided.
5. Specify the requirements of reinforcements in one way slab and two way slab.
6. List the different edge conditions of a two way restrained slab. Draw a line sketch showing slabs with different edge conditions.
7. Explain with neat sketch the distribution of loading on stairs with open well.

(5×6 = 30)

## PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

## UNIT — I

- III (a) A cantilever beam having 200mm wide is subjected to a factored moment of 20kNm. Design the beam for flexure. Adopt M20 concrete and Fe415 steel is used. 6
- (b) Determine the ultimate moment of resistance of a singly reinforced simply supported beam having size  $200 \times 400$ mm (effective), reinforced with 3 numbers of 16mm diameter bars. Concrete is M20 grade and steel Fe415 grade. 9

OR

- IV (a) Explain : 6
- (i) Limit state of collapse (ii) Limit state of serviceability.
- (b) A doubly reinforced beam having 230mm wide and 360mm effective depth is subjected to a factored moment of 135kNm. Determine the area of tension and compression reinforcement for the beam. Concrete used is M20 grade and steel Fe415 grade. Effective cover for compression reinforcement is 40mm. 9

## UNIT — II

- V (a) Explain : 6
- (i) Development length of reinforcement.
- (ii) Anchoring of reinforcement bars.
- (b) A series of beams are placed at 3m c/c having effective span of 5m. The thickness of slab is 100mm. The width of rib is 230mm and effective depth of 400mm. The beams are supported on masonry walls. The beam is subjected to a factored moment of 200 kNm. Design the T-beam for flexure using M20 grade concrete and Fe 415 grade steel. 9

OR

- VI (a) A singly reinforced simply supported beam having span 4m, 300mm wide and 500mm effective depth is reinforced with 5 numbers of 20mm diameter bars of Fe415 grade. Check the beam for deflection. 6
- (b) A simply supported beam having size  $300 \times 400$ mm(effective) and 6m span, subjected to a load of 40 kN/m including self weight. The tensile reinforcement consists of 5 numbers of 20mm diameter bars. Concrete is M20 grade and steel Fe250. Design the shear reinforcement for the beam. 9

## UNIT — III

- VII (a) Explain the design procedure for torsion reinforcement in two way restrained slabs. 6
- (b) Design a R C C one way slab to carry a super imposed load of  $2\text{kN/m}^2$  over an effective span of 4m, simply supported on masonry walls 300mm thick at the ends. Use M20 concrete and Fe415 grade steel. 9

OR

- VIII A slab is simply supported over a room of  $4 \times 5$  m and rests on 200mm thick walls at its ends. The live load on the slab is  $1.5 \text{ kN/m}^2$  and floor finish of  $1 \text{ kN/m}^2$ . Design the roof slab, if the corners of the slab are held down. Use M20 grade concrete and Fe415 grade steel. 15

## UNIT — IV

- IX Design a flight of a dog logged stair case having an effective span of 4.3m. Provide a rise of 150mm and tread 250mm. The live load on stair is  $3 \text{ kN/m}^2$ . Use M20 Concrete and Fe415 steel. Apply the checks. 15

OR

- X (a) Find the effective depth from bending consideration for a square isolated footing of uniform thickness for a column having size  $300 \times 300$  mm carrying a load of 2000kN. The bearing capacity of soil is  $180 \text{ kN/m}^2$ . Use M25 concrete and Fe-415 grade steel. 8
- (b) A short square column 300mm side is reinforced with 4 bars of 20mm diameter longitudinal reinforcement and lateral ties. Using partial safety factors of 1.5, find the safe load that column can carry. Adopt M20 concrete and Fe500 grade steel. 7
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