

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

STRUCTURAL DESIGN - I

[Time : 3 hours

(Maximum marks : 100)

(Note :— Use of IS 456 - 2000, 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 workability of concrete.
2. Define the term Bond in concrete.
3. What are unrestrained slabs ?
4. What is slenderness ratio ?
5. What is an isolated footing ?

(5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. Explain the different types of section based on the relation between x_u and $x_{u\max}$.
2. State the assumptions of limit state of collapse.
3. What are the various forms of shear reinforcement ?
4. Explain the difference between one way and two way slab.
5. What are the steps for design of shear reinforcement ?
6. Design a circular column to carry axial load of 1500kN.
Take M25 grade concrete and Fe 415 steel.
7. List the various types of foundations.

(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) Determine the depth of neutral axis of a beam $250\text{mm} \times 400\text{mm}$, reinforced with 3 bars of 20mm diameter. Also check for the type of section. Use M20 concrete and Fe 415 steel. 6
- (b) A Doubly reinforced beam $230\text{mm} \times 500\text{mm}$ effective is subjected to a factored moment of 200kNm. Find the reinforcement required. Use M20 concrete and Fe 415 steel. 9

OR

- IV (a) A rectangular R C C beam is 200mm wide and 500mm deep. It is reinforced with 4 bars of 25mm in compression. Find out the area of tensile reinforcement required. Also find out the moment of resistance of this section. Use M20 concrete and Fe 250 steel. Assume cover for tension reinforcement = 50mm. 7
- (b) An R.C.C. beam, $200\text{mm} \times 400\text{mm}$ (effective), is reinforced with 3-16 mm ϕ bars of Fe 415 steel. Find the ultimate uniformly distributed load which the beam can carry safely over a span of 5m. Take M20 concrete. 8

UNIT — II

- V (a) Sketch a T-beam and mark all the parts and dimensional notations. 6
- (b) A simply supported RCC beam 250mm wide and 450mm deep (effective) is reinforced with a 4 - 18mm ϕ bars. Design the shear reinforcement, if M20 grade of concrete and Fe 415 steel is used and beam is subjected to a shear force of 150kN at service state. 9

OR

- VI (a) An RCC beam $250\text{mm} \times 500\text{mm}$ has a clear span of 5.5m. The beam has 2-20mm diameter bar going into the support. Factored shear force is 140kN. Check for development length, if Fe 415 and M20 grade of concrete is used. 8
- (b) A T-beam floor system has 120mm thick slab supported on beams. The width of beam is 300mm and effective depth is 580mm. The beam is reinforced with 8 bars of 20mm ϕ . Use M20 grade of concrete and Fe 415 steel. The beam are spaced 3m centre to centre. The effective span of beam is 3.6m. Find the moment of resistance of the section. 7

UNIT — III

- VII (a) Explain briefly the IS code method of design of restrained two way slab. 6
- (b) A simply supported slab of a building has a clear span 2.5m and is supported on beams 230mm width. Design the slab, if the beam is carrying a live load of 5kN/m^2 . Use M20 concrete and Fe 415 bars. 9

OR

- VIII (a) What is a two way slab ? What are the types of two way slab ? 6
- (b) Design a cantilever slab for an overhanging of 1.25m. The imposed load on slab consists of 1kN/m^2 of live load and weight of finishing is 800N/m^2 . Use M20 concrete and Fe 415 steel. 9

UNIT — IV

- IX (a) What are the functions of transverse reinforcement in column ? 6
- (b) Design a circular column of diameter 400mm subjected to a load of 1200kN. The column is having spiral ties. The column is 3m long and is effectively held in position at both ends but not restrained against rotation. Use M25 concrete and Fe 415 steel. 9

OR

- X (a) Describe various components of the staircase with a neat sketch. 6
- (b) Design a dog legged staircase for an office building in a room measuring $3\text{m} \times 6\text{m}$ (clear dimensions). Floor to floor height is 3.5m. The building is a public building liable to overcrowding. Stairs are supported on brick walls 230mm thick at the end of landings. Use M20 Concrete and Fe 415 steel. 9