

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — APRIL, 2019**

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 water cement ratio.
2. What is a T-beam ?
3. What is a one way slab ?
4. Define effective length of column.
5. Define the term nosing.

(5×2 = 10)

PART — B

(Maximum marks : 30)

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

1. What is limit state ? What are the various limit states for section is designed ?
2. Differentiate between singly and doubly reinforced beams.
3. What do you understand by the term development length ?
4. Determine the ultimate moment of resistance of a 150mm thick slab reinforced with 10mm bars at 200mm c/c. The effective cover is 25mm. Use M20 concrete and Fe 415 steel.
5. What are the points to be considered in designing one way cantilever slab ?
6. Find the ultimate load carrying capacity and allowable load for a short column of size 500mm × 500 mm. The column is reinforced with 4 - 25 mm diameter bars. Use M20 concrete and HYSD grade Fe 415 steel. Assume $e_{min} < 0.05D$.
7. Distinguish between short and long column.

(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) Give steps for determining moment of resistance of a singly reinforced beam. 6
- (b) Design a doubly reinforced beam of rectangular section using the following data :
Effective span = 5m, Section = 250 mm × 500mm (overall), Total load = 40kN/m,
Effective cover = 50mm.
Use M20 and Fe 415. 9

OR

- IV (a) What is a doubly reinforced beam ? What are the conditions in which we design a doubly reinforced beam ? 7
- (b) Determine the moment of resistance of a beam of dimension 250mm × 350mm. The area of steel consists of 3 bars of 12mm diameter placed at a distance of 40mm from bottom of beam. Use M20 and Fe 415 steel. 8

UNIT — II

- V (a) Find the moment of resistance of a T-beam having a web width of 240mm, effective depth of 400mm flange width of 740mm and flange thickness equal to 100mm. The beam is reinforced with 5 -16mm², Fe 415 bars. Use M20 concrete. 8
- (b) A reinforced beam of span 5m is 250mm wide and 500mm deep (effective). It has 4 bars of 22mm as tensile reinforcement. The beam carries a load of 30kN/m inclusive of self weight. Design the beam for shear. Use M20 and Fe 415 steel. 7

OR

- VI (a) Write notes on :
(i) Bond (ii) Types of shear reinforcement (iii) Curtailment of bars. 6
- (b) Determine the limiting moment of resistance and limiting area of steel for a reinforced concrete T-beam having flange width of 1600 mm, effective depth of 350mm and thickness of flange is 100mm. The width of web is 250mm. Use M20 grade of concrete and Fe 500 steel. 9

UNIT — III

- VII (a) What is the function of providing distribution steel in a slab ? 6
- (b) Design a reinforced concrete simply supported slab with corners free to lift for a room measuring 4m × 5m from inside. The slab carries a live load of 3kN/m² inclusive of floor finishes etc. Use M20 concrete and Fe 415 steel. 9

OR

- | | | Marks |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| VIII | (a) What are the difference between one way and two way slab ? | 6 |
| | (b) Design a simply supported roof slab for a room $7.5\text{m} \times 3.5\text{m}$ clear in size. The Slab is carrying an imposed load of 5kN/m^2 . Use M20 mix and Fe 415 steel. | 9 |

UNIT — IV

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| IX | (a) What is a column ? Give the classification of column. | 6 |
| | (b) Design a column of size $450\text{mm} \times 600\text{mm}$ and having 3m unsupported length. The column is subjected to a load of 2000kN and is effectively held in position but not restrained against rotation. Use M20 concrete and Fe 415 steel. | 9 |

OR

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|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|
| X | (a) What are footing ? How are they classified ? | 6 |
| | (b) Design a square footing of uniform thickness for an axially loaded column of $450\text{mm} \times 450\text{mm}$ size. The safe bearing capacity of soil is 190kN/m^2 . Load on column is 850kN. Use M20 concrete and Fe 415 steel. | 9 |
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