

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE, NOVEMBER – 2024**

STRUCTURAL DESIGN I

[Maximum Marks : 100]

[Time : 3 hours]

[Note:- Assume missing data for design
Detailing is essential for design
Use of IS 456-2000 and SP 16 are permitted]

PART – A

(Maximum Marks : 10)

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

1. Define water cement ratio. What is its relation with strength?
2. What is development length?
3. Define distribution reinforcement in slabs.
4. What is the Min & Max percentage of steel in Column as per code?
5. Write the Min clear cover needed for slab, beam, column, footing. (5x2=10)

PART – B

(Maximum Marks : 30)

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

1. Explain the assumptions for flexural design.
2. Write the design steps for shear design.
3. Compare One way slab and Two way slab.
4. What are the types of stairs? Explain.
5. Define doubly reinforced beam. What are the advantages of a doubly reinforced beam?
6. Write a brief note about the effective width of flange in flanged section as per Code.
7. Differentiate long column and short column.

(5x6=30)

PART – C

(Maximum Marks : 60)

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

UNIT – I

- III.** (a) A rectangular concrete beam, located inside a building in a coastal area, is simply supported on two 230mm thick walls and 6m apart masonry wall (centre to centre). The beam has to carry, in addition to its own weight, a distributed live load of 10kN/m and a dead load of 5kN/m. Design the beam section for maximum moment at midspan. M25 & Fe 415 Steel. (9)
- (b) An RC beam section has overall dimensions of 240 x 600 mm and clear cover of 25mm. Find its moment of resistance if it is reinforced with 3 No of 25 mm bars. M25 and Fe415 steel. (6)

OR

- IV.** (a) A rectangular RC section has an overall dimension of 300 x 600mm. It is subjected to an external Working moment of 325kNm. If the concrete grade is M30 and steel Fe 500, Design the section. (9)
- (b) Explain (i) Limit state of collapse (ii) Limit state of serviceability (6)

UNIT – II

- V.** (a) A T beam section has the following dimensions $b_f = 800\text{mm}$, $D_f = 125\text{mm}$, $D = 600\text{mm}$, $b_w = 300\text{mm}$. It is reinforced on tension side with 6 No of 25mm bars. Concrete and steel of Grade M25 and Fe 415. Find the Moment of resistance of section. (8)
- (b) An RC beam having dimension 300 x 700mm is subjected to a SF of 100kN, a BM of 30kNm and a twisting moment of 45kNm. Find the equivalent Shear force and BM for the design. Concrete and steel of Grade M30 & Fe 415. Clear cover 30mm. (7)

OR

- VI.** (a) Design the shear reinforcement for rectangular beam section of overall dimension 300 x 600 mm if the shear force at the section is (i) 100kN (ii) 200kN. The beam is reinforced on tension side with 5 No of 25mm bars. Clear cover 30mm Grade M25 & Fe 415. (9)
- (b) Calculate development length in terms of diameter for plain bars of grade Fe 250 & Fe 415 if the grade of concrete is M20. Also calculate the development length for deformed bars. (6)

UNIT –III

- VII.** A hall is having clear dimension 8m x 14.5m. The 4 sides of hall are masonry wall of width 230mm. The slab is supported by 3 intermediate beams having width 300mm along the 8m direction. The specified floor load consists of a LL of 4kN/m^2 & a DL of (floor finish, partitions, etc) 1.5kN/m^2 additional to self weight. Design the slab system M20 & Fe 415. Beam subjected to moderate exposure condition. (15)

OR

- VIII.** Design a slab having clear dimensions 4.0m x 5.0m. 4 sides are supported by masonry walls having thickness 230mm. Assuming a floor finish of 1kN/m^2 and a LL of 4kN/m^2 . Design and detail the slab if its one short edge discontinuous. M20 & Fe 415. (15)

UNIT – IV

- IX.** Design a waist dog legged slab type stair case for an office building, given the following data. height between floor 3.2m, width of flight 1.25m, LL = 5kN/m^2 Finish load = 0.6kN/m^2 . Assume the stairs to be supported on 230mm thick masonry wall. Assume mild exposure conditions. M20 Concrete & Fe415 Steel. (15)

OR

- X.** (a) Design the reinforcement in a spiral column of 400mm diameter subjected to a factored load of 1500kN. The column has an unsupported length of 3.4m and is braced against sideway. Use M25 concrete and Fe415 steel. (9)
- (b) Define Footing. What are the types of Footing? Explain. (6)
