

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/  
COMMERCIAL PRACTICE - NOVEMBER-2021**

**STRUCTURAL DESIGN - I**

[Maximum marks: 75]

(Time: 2.15 Hours)

**PART – A**

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

Marks

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

1. Which are the different grades of high strength concrete?
2. Define limiting depth of N.A of a R.C Section?
3. Write the code provision for development length of a tension member?
4. Define Slenderness ratio of a column?
5. Distinguish between dog-legged stair and open well stairs. (3 x 2 = 6)

**PART – B**

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

1. Compare working stress and limit state method of design?
2. Explain partial safety factor for materials and loads in limit state design?
3. Write the procedure for checking the deflection of a doubly reinforced beam?
4. (i) Identify the situations under which minimum shear reinforcement needed in a beam?  
(ii) A simply supported beam having 500 mm wide and 400 mm effective depth is provided with 2-legged 8mm diameter of Fe 250 grade vertical stirrups. Determine the spacing of the stirrups at the mid span of the beam.
5. With the help of a sketch specify the different end conditions of restrained slab.
6. Sketch the reinforcement details in a flight of a stair spanning along the direction of flight?
7. With the help of a sketch explain (i) Isolated footing (ii) Combined footing. (4 x 6= 24)

**PART – C**

Answer *any of the three units* from the following. Each full question carries 15 marks

**UNIT –I**

- III. (a) Differentiate between under reinforced section and over reinforced section. (6)

- (b) Determine the ultimate moment of resistance of a singly reinforced simply supported beam having 250 mm wide and 400 mm effective depth reinforced with 3 numbers of 20 mm diameter bars. Grade of concrete and steel is M20 and Fe 415 respectively. (9)

**OR**

IV. (a) Define:

(i) Depth of Neutral Axis

(ii) Lever arm

(iii) Moment of resistance of a R.C section. (6)

- (b) A doubly reinforced beam having 5 m span, 200 mm wide and 400 mm effective depth carrying a udl of 40 kN/m including self weight in its entire span. Calculate the area of tension and compression reinforcement required for the beam. Grade of concrete and steel is M20 and Fe 415 respectively. Effective cover for compression reinforcement is 40mm. (9)

### UNIT-II

- V. (a) A simply supported T-beam having 6 m span, flange width 1200 mm, effective depth 400 mm and rib width 300 mm is provided with tension reinforcement of 1440 mm<sup>2</sup>. Check the safety of the beam against deflection. Grade of steel is Fe 415. (6)

- (b) An RCC beam 250 mm wide and 360 mm effective depth is subjected to a factored shear force of 40 kN at the support. Check the section for shear and design the shear reinforcement if necessary. Use M20 grade concrete and Fe 415 grade steel. The beam is provided with tensile reinforcement of 700 mm<sup>2</sup>. (9)

**OR**

- VI. (a) Explain: (i) Bond strength (ii) Curtailment of bars. (6)

- (b) Determine the moment of resistance of a T-beam having 4 m effective span, width of web 260 mm, effective depth 450 mm and flange thickness 120 mm. The centre to centre spacing of beams are 3m. The beam is reinforced with 6 number of 16mm diameter bars. The grade of concrete is M20 and grade of steel is Fe 415. (9)

### UNIT-III

- VII. (a) State the purpose of providing distribution steel in one way slab. Write the code provision for distribution steel. (5)

- (b) Design a simply supported one way slab for a room having effective span 3 m carrying an imposed load of 3 kN/m<sup>2</sup> and floor finish 1.5 kN/m<sup>2</sup>. Use M20 grade concrete and Fe 415 grade steel. (10)

**OR**

- VIII. (a) Write the function of tension steel in slab. (3)

- (b) Design a slab over a room 4 x 5 m. The edges of the slab are simply supported and

the corners are held down. The live load on the slab is  $3 \text{ kN/m}^2$  and a floor finish of  $1 \text{ kN/m}^2$ . Use M20 grade concrete and Fe 415 steel. (12)

**UNIT-IV**

- IX. (a) What are the various end conditions for finding the effective length of a column? (6)
- (b) Design a short R.C.C square column to carry an axial load of 800 kN. Use M25 grade concrete and Fe 415 grade steel. (9)

**OR**

- X. (a) Sketch the critical section for one way and two way shear for a square isolated column footing. (6)
- (b) Design an intermediate flight for a dog legged stair having effective span 4m. Provide a rise of 160 mm and tread 270 mm. Live load on the stair is  $5 \text{ kN/m}^2$ . Use M20 concrete and Fe 415 Steel. (9)

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