

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER – 2022**

**STRUCTURAL DESIGN – I**

(Note:- Use of IS 456-2000 and SP-16 are permitted)

[Maximum Marks: 100]

[Time: 3 Hours]

**PART-A**

[Maximum Marks: 10]

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

1. Define workability of concrete.
2. What is meant by effective flange width?
3. What is a restrained slab?
4. Distinguish between *long column* and short *column*.
5. Define the term nosing

(5 x 2 = 10)

**PART-B**

[Maximum Marks: 30]

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

1. List the assumptions in limit state of collapse in flexure.
2. A doubly reinforced beam section is 250mm wide and 450mm deep to the centre of the tensile reinforcement. It is reinforced with 2 bars of 16mm dia bars as compression reinforcement at an effective cover of 50mm and 4 bars of 25mm dia as tensile steel. Using M20 concrete and Fe250 steel, calculate the ultimate moment of resistance of the beam.
3. What do you understand by the term development length?
4. What are the advantages of T beam?
5. Write the design procedure for *design* of one way slab.
6. A reinforced concrete short column 400mmx400mm has to carry an axial load of 1200kN. Find the area of steel required.
7. Give the code recommendation for effective span of stairs without stringer beam.

(5 x 6 = 30)

**PART-C**

[Maximum Marks: 60]

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

**UNIT – I**

- III. (a) Find the depth of neutral axis of a singly reinforced beam 200x400mm effective depth reinforced with 4nos of 16mm dia of Fe 415 steel and M20 concrete. Also check the type of section. (7)
- (b) Find the limiting moment of resistance of a singly reinforced section 200x450 mm with effective cover 40 mm. Also determine the limiting percentage of steel. Use M20 concrete and Fe415 steel. (8)

**OR**

- IV. (a) Under which situations doubly reinforced sections are preferred. (7)
- (b) A beam of rectangular section is 200mm wide and 300mm deep to the centre of the tensile reinforcement. It has to carry a dead load of 8.5kN/m and a live load of 7.5kN/m. Find the steel reinforcement required for the mid span section. The beam has a span of 5m. Use M20 concrete and Fe250 steel. Effective cover to compression steel is 40mm. (8)

**UNIT – II**

- V. (a) A T beam of flange width 850 mm flange thickness 100mm rib width 275mm has an effective depth of 475mm. The beam is reinforced with 4 bars of 20mm dia. Find the ultimate moment of resistance. Use M20 concrete and Fe415 steel. (7)
- (b) Write short notes on (a) bond (b) types of shear reinforcement. (8)

**OR**

- VI. (a) A simply supported reinforced concrete beam is 250mm wide and 500mm effective depth and is reinforced with 4 bars of 22mm dia as tensile steel. If the beam is subjected to a factored shear of 65kN at the support find the nominal shear stress at the support and design shear reinforcement. Use M20 and Fe250 steel. (8)
- (b) Write the codal recommendations regarding curtailment of reinforcement. (7)

### UNIT- III

- VII. Design a slab over a room 4mx6m as per I.S code. The edges of the slab are simply supported and corners are not held down. The live load on the slab is 3000N/m<sup>2</sup>. The slab has a bearing of 150mm on the supporting walls. Use M20 concrete and Fe 415 steel. (15)

**OR**

- VIII. (a) What are the difference between one way and two way slab. (5)
- (b) Design a simply supported slab having a clear dimension of 4mx10m with 230mm walls all around an office building. Use M20 concrete and Fe415 steel.  
LL=4kN/m<sup>2</sup> and FF=0.6kN/m<sup>2</sup>. (10)

### UNIT - IV

- IX. Design a square footing for a short axially loaded column of size 300x300 mm carrying 600kN load. Use M20 concrete and Fe415 steel. Safe bearing capacity of soil is 180kN/m<sup>2</sup>. (15)

**OR**

- X. (a) A short R.C.C. column 400mmx400mm is provided with 8 bars of 16mm dia. If the effective length of column is 2.25m, find the ultimate load for the column.  
Use M20 concrete and Fe415 steel. (8)
- (b) State the functions of longitudinal and transverse reinforcement in a column. (7)

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