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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER - 2025

STRUCTURAL DESIGN I

[Note: *1. Assume missing data for design.*
2. Detailing is essential for design.
3. 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 characteristic strength.
2. Define bond.
3. Define one way slab.
4. Describe effective length of column.
5. Define combined footing. (5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

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

1. State the assumptions of limit state method of design in flexure.
2. Mention the situations where doubly reinforced beams are needed.
3. Explain the types of shear reinforcement.
4. A simply supported beam of span 5m carries a uniformly distributed load of 28 kN/m and is reinforced with 4 bars of 20 mm diameter. If 2 bars are cranked up near the support, check the development length at the support. Concrete is of M20 grade and steel is of Fe 415. Breadth of beam is 250 mm and effective depth is 480 mm and width of support is 600 mm.
5. Distinguish between one way slab and two way slab.
6. Explain the design procedure for torsion reinforcement in two way restrained slabs.
7. Differentiate between short and long column. (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. A reinforced concrete beam 200 mm x 400 mm effective depth is reinforced with 3 bars of 16 mm diameter. The grade of concrete is M20 and f_y = 415N/mm^2. Check whether the beam is under reinforced or over reinforced. Find the ultimate moment of resistance. (7)

b. A reinforced concrete section is 300 mm x 510 mm. It is subjected to a factored moment of 110 kNm. Using concrete of M20 grade and Fe 415 steel, design the reinforcement. Use effective cover as 40 mm. (8)

OR

IV. a. Find the ultimate moment of resistance of a singly reinforced rectangular beam section 200 mm x 410 mm effective depth reinforced with 4 bars of 16 mm diameter steel. Concrete is of M20 grade and f_y = 415 N/mm^2. (7)

b. An RCC beam of size 250 mm x 450 mm overall depth carries a udl of 20kN/m in addition to its self weight. The effective span of the beam is 5.5 m. Concrete is of M 15 grade and Fe 250 steel. Design the reinforcement for the beam. Assume effective cover to reinforcement as 40 mm. (8)

UNIT – II

V. a. Explain development length of reinforcement. (6)

b. An RCC singly reinforced simply supported T beam has a flange of 850 mm width and 130 mm thickness and is having area of steel 3600 mm^2 provided at an effective depth of 460 mm and width of web is 260 mm. Calculate moment of resistance of the section using M20 concrete and Fe 415 steel. (9)

OR

VI. a. Sketch a T beam and explain the dimensions. (6)

b. A reinforced concrete beam 260 mm x 420 mm overall depth is subjected to a factored shear force of 50 kN at the support. Check the section for shear and design the shear reinforcement if necessary. The beam is provided with tensile steel reinforcement of 694 mm^2 at an effective cover of 50 mm. Use M20 concrete and Fe 415 steel. (9)

UNIT- III

VII. a. List the different edge conditions of a two way restrained slab. Draw a line sketch showing slabs with different edge conditions. (6)

b. Design a one way slab with a clear span of 3.5 m simply supported on 230 mm thick masonry wall and subjected to live load of 4 kN/m^2 and a surface finish of 1 kN/m^2. Assume Fe 415 steel, M20 concrete and slab is subjected to moderate exposure conditions. (9)

OR

VIII. a. Explain the procedure for the design of one way slab. (6)

b. Design a simply supported slab to cover a room with internal dimensions 4 m x 5 m and 230 mm thick brick walls all round. Assume a live load of 3 kN/m^2 and a finish load of 1 kN/m^2. Use M 20 concrete and Fe 415 steel. Assume that slab corners are free to lift up. Assume mild exposure conditions. (9)

UNIT - IV

IX. a. A rectangular column 400 mm x 500 mm is reinforced with 0.8% reinforcement based on gross area. Fe 415 steel and M 30 concrete is used. Find the ultimate load carrying capacity of column. (6)

b. Design a square footing of uniform thickness for an axially loaded column of 400 mm x 400 mm size. The safe bearing capacity of soil is 190 kN/m^2. Load on column is 850 kN. Use M20 concrete and Fe 415 steel. (9)

OR

X. a. Explain the IS Code requirements of tensile reinforcement for the design of footings. (6)

b. Design a short RC square column to carry an axial load of 900 kN. Use concrete of M 25 and Fe 415 grade steel. (9)

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