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A24 - 6205

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/ COMMERCIAL PRACTICE, APRIL - 2024

STRUCTURAL DESIGN - I

[Maximum marks: 100] [Time: 3 Hours]

[Use of I S 456-2000 and S P 16 are permitted.
Essential data may be suitably assumed.]

PART – A
Maximum marks: 10

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

1. How water-cement ratio affect the strength and workability of concrete?
2. Specify characteristic load and characteristic strength.
3. What are the types of reinforcements used to resist the shear force in a beam?
4. What are the conditions to select the length and spacing of torsion reinforcements in a slab?
5. What is meant by punching shear in a column footing? (5 x 2 = 10)

PART – B
Maximum marks: 30

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

1. What is lever arm of a beam? Derive the expression for lever arm for a singly reinforced beam.
2. Differentiate between Doubly reinforced beam and T-beam. What are the conditions to satisfy such beams?
3. Briefly describe the procedure to determine the diameter and number of longitudinal bars for a short column.
4. Describe how the effective span of a stair is determined as per different supporting conditions.
5. What are the types of slabs according to the dimensions and supporting conditions?
6. What is the necessity of curtailment of reinforcement? What are the criteria to determine the amount of curtailment?
7. Calculate the bending moment of a continuous slab at various sections as per the following data. Centre to centre distance of supports = 3.3m, Number of supports = 5, Dead load = 5kN/m^2, Live load = 2kN/m^2.

(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) Describe the stress-strain relationship of concrete and steel in limit state method. (6)

(b) Determine the dimensions and longitudinal reinforcement for singly reinforced beam to resist an applied BM 50kNm. Use M20, Fe415 steel and b=250mm. (9)

OR

IV. (a) Derive the expression for Neutral axis for a singly reinforced rectangular beam. (6)

(b) Determine the maximum u. d. load that can carry by a beam for the following data. Eff. span=5m, b=300mm, d=550mm, Ast=2500mm^2, Asc=982mm^2, fy=415MPa, fck = 20MPa, dc = 50mm. (9)

UNIT - II

V. (a) Design the shear reinforcement for a beam 250mmx330mm effective size to carry a U.D. load 25kN/m including self weight at 4m effective span. It is provided 16mm dia bars 4nos. on tension side, at support. Take M20 concrete and Fe415 steel. (6)

(b) A T-beam has bf = 740mm, bw = 240mm, d = 350mm, Df = 85mm. Find the longitudinal reinforcement for an applied BM = 80kNm. Use M20 concrete and Fe415 steel. (9)

OR

VI. (a) Describe the conditions to provide different types of shear reinforcements in a beam. (6)

(b) Find the effective depth and area of steel required for a T-beam for the following data. Bf = 800mm, bw = 250mm, Df = 100mm, applied load including self wt. = 25kN/m, eff. span = 8m (simply supported). Use M20 concrete and Fe415 steel. (9)

UNIT - III

VII. (a) Describe conditions for the design of simply supported slabs as per IS 456:2000. (6)

(b) Calculate the reinforcement required for a slab for a room 3.5mx10m, simply supported on 200mm thick walls on four sides, using following data. Total u.d.load=10kN/m^2. Use M20 concrete and Fe415 steel. (9)

OR

VIII. (a) Determine the reinforcements required for a cantilever slab of uniform depth = 125mm, unsupported length = 2m, imposed load = 3kN/m^2. (6)

(b) Design the middle strip reinforcements for a room slab 4mx5m simply supported on 200mm thick walls. The corners are held down. All loads including self weight = 7.5kN/m^2. (9)

UNIT – IV

IX. (a) What are the different types of stairs as per the shape and support conditions? (6)

(b) Design a square short column to carry an axial load of 1200kN. Use M20 concrete and Fe415 steel. (9)

OR

X. (a) Draw the longitudinal section of a dog legged stair and show the following details. Width of support on both ends = 250mm, width of landing = 1.0m, thickness of slab = 150mm, Tread = 300mm, Rise = 150mm, vertical distance b/w landing = 1.80m, horizontal distance b/w landing = 3.3m, main reinforcements = 10mm dia bars @ 100mm c/c, distributors = 10mm dia @ 250mm c/c. (6)

(b) Design an isolated footing of uniform thickness for a column 400x400mm to carry an axial load of 600kN including wt. of footing. Take SBC = 180kN/m^2, Use M25 concrete and Fe415 steel. (9)
