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Reg. No.
Signature

DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2019

STRUCTURAL DESIGN - I

[Time : 3 hours

(Maximum marks : 100)

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

PART — A

(Maximum marks : 10)

Marks

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

1. Define characteristic strength.
2. Differentiate between singly and doubly reinforced beams.
3. Define effective depth of a beam.
4. What is a restrained slab ?
5. What is the difference between short and long columns.

(5×2 = 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. Find the moment of resistance of a T beam having a web width of 240mm, effective depth of 400mm, flange width of 740mm and flange thickness equal to 100mm. The beam is reinforced with 5 numbers of 16mm diameter bars. Use Fe 415 steel and M20 concrete.
3. Write the code provisions for anchoring reinforcing bars in tension and compression.
4. Bring out the differences between one way and two way slabs.
5. Write the functions of distribution steel in a slab.
6. Give the code recommendations for effective span of stairs without stringer beams.
7. Identify the slenderness limits for columns.

(5×6 = 30)

50 15
2

Marks

2 PART — C

(Maximum marks : 60)

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

UNIT — I

- III (a) Determine the depth of the neutral axis of a beam $250\text{mm} \times 400\text{mm}$, reinforced with 3 bars of 20mm diameter. Also check for the type of section. Use Fe415 steel and M20 concrete. 6
- (b) Calculate the ultimate moment carrying capacity of a rectangular beam with $b = 250\text{mm}$, $d = 350\text{mm}$, $A_{st} = 1800\text{mm}^2$. Assume grade 30 concrete and Fe 250 steel. Workout the problem from fundamentals. 9

OR

- IV (a) Determine the factored moment of resistance of a beam $230\text{mm} \times 460\text{mm}$ (effective). The beam is reinforced with 2 numbers of 16mm diameter bars on compression side at a distance of 40mm diameter from top and 4 numbers of 20mm diameter bars on tension side. Use Fe415 steel and M20 concrete. 6
- (b) An R.C.C. beam is required to carry a uniformly distributed load of 25kN/m including its self weight. The effective span of beam is 8m. Design the beam for flexure only. Use Fe415 steel and M30 concrete. 9

UNIT — II

- V (a) Calculate the maximum uniformly distributed load the T beam can carry including its own weight on a simply supported span of 5m. Width of flange is 1500mm, thickness of flange is 100mm, Depth of tension steel from the top of the flange is 500mm, width of web is 250mm, effective cover is 40mm. The reinforcement consist of 4 bars of 20mm diameter. Use Fe250 steel and M15 concrete. 8
- (b) What are the advantages of T beams ? Write down the formulae for minimum and maximum tension reinforcement provided in T beams as per IS.456:2000 7

OR

- VI (a) A reinforced concrete beam 250mm wide and 430 mm overall depth is subjected to a factored shear force of 45 kN at the support. Check the section for shear and design the shear reinforcement if necessary. Use Fe415 steel and M20 concrete. The beam is provided with tensile steel reinforcement of 684mm^2 and effective cover is 50mm. 8
- (b) Write the codal recommendations regarding curtailment of reinforcement. 7

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Marks

UNIT — III

- VII Design a simply supported R.C.C. slab for a roof of a hall having inside dimensions $4\text{m} \times 10\text{m}$ with 230mm walls all around. Assume a live load of 4 kN/m^2 and finish of 1 kN/m^2 . Use Fe415 steel and M25 concrete. 15

OR

- VIII Design a reinforced concrete slab $6.3\text{m} \times 4.5\text{m}$ simply supported on all four sides. It has to carry a characteristic live load of 10 kN/m^2 in addition to its dead weight. Assume M25 concrete and Fe415 steel; also assume that the exposure conditions to environment can be classified as mild. 15

UNIT — IV

- IX (a) Design a column square in section to carry an axial load of 1200 kN. Use Fe415 steel and M20 concrete. 10

- (b) Write the functions of transverse reinforcements in a column. 5

OR

- X (a) Design dog legged stairs for an office building in a room measuring $2.8\text{m} \times 5.8\text{m}$ clear, vertical distance between the floors is 3.6m, width of flight is 1.25m, Allow a live load of 3 kN/m^2 . Use Fe415 steel and M20 concrete. Assume the stairs are supported on 230mm walls at the end of outer edges of landing slabs. 10

- (b) Explain briefly the classification of stairs based on geometric considerations. 5
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