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Question Paper Code : 41157

M.E./M.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

First Semester

Structural Engineering

ST 5101 — ADVANCED CONCRETE STRUCTURES

(Regulations 2017)

Time : Three hours Maximum : 100 marks

Use of IS 456 and SP 16 is permitted.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write an expression for short term deflection of beams due to applied loads.

2. Write a note on factors affecting crack width in beams.

3. How do you determine the design bending moment in deep beams?

4. What is a corbel? Write the Mode of failures of a corbel.

5. List out the assumptions of the yield line analysis of reinforced concrete slabs.

6. Enumerate the components of flat slab construction.

7. Give the assumptions made in Baker's method.

8. List out the factors that increase ductility of a member.

9. Draw the stress- strain relationship for unconfined concrete.

10. Write the general considerations of ductile detailing of reinforced concrete column members with axial load and moment.

PART B — (5 × 13 = 65 marks)

11. (a) Design a short spiral column subjected to P_u = 2100 kN and M_u = 187.5 kNm using M 25 grade of concrete and Fe 415 of steel. The preliminary diameter of the column may be taken as 500 mm.

Or

(b) A reinforced concrete wall is 100 mm thick. Determine the critical ratio of horizontal steel required to control shrinkage cracks with M 25 grade of concrete and grade of Fe 415 steel. If 10 mm grade Fe 415 steel at 300 mm spacing is provided on both faces of the wall estimate the spacing of the cracks and its width due to a drop in temperature of 20°C.

12. (a) A reinforced concrete deep beam girder is continuous over a span of 9 m apart, from center to centre. It is 4.5 m deep, 300 mm thick, and the supports are columns of 900 mm in width. If the girder supports a uniformly distributed load of 200 kN/m including its own weight, design the beam for necessary steel. Assume M 20 concrete and Fe 415 steel.

Or

(b) A Concrete column of 400 mm diameter, reinforced with 8 bars of 20 mm diameter, is braced and hinged at both ends, 8 m apart. Check the safety of the column if it carries a factored axial load of 1100 kN. Take concrete of M 20 grade and steel of 415 grade. The reinforcement has an effective cover of 60 mm.

13. (a) A flat plate with 7.5 m × 6 m panels on 500 × 500 mm columns has a slab thickness of 185 mm, designed for a total characteristic load of 9.3 kN/ m. Check the safety of the slab if M 25 grade of concrete and Fe 415 steel are used for its construction. How do you increase the shear capacity of the slab?

Or

(b) The peripheral spandrel beam of a flat slab is 250 mm × 475 mm in size, and the depth of the main slab is 175 mm. The transverse distribution of moments at the end–span results in a negative moment of 5.8 kNm for the half column strip, and 1.6 kNm for the half middle strip, the total negative moment being 7.4 kNm on each side of the column. Determine torsional moment for which the spandrel beam should be designed. Assume fck = 20 N/mm².

14. (a) A four span continuous T beam ABCDE of 4 m in each span is subjected to a characteristic load of 40 kN/m including its weight. Design the beam so that it fails by plastic failure at the supports at an ultimate load, with a load factor 1 .5.

Or

(b) A Reinforced concrete section is 200 mm × 550 mm depth. If the applied moment is 140 kNm determine the instantaneous curvature assuming a tensile stress in concrete at level of steel of 1 N/mm². Assume Ec = 28,000 N/mm² and Es = 2,00,000 N/mm², (m = Es/Ec = 7.14); fck = 20 Refer-(Fig. 14(b)).

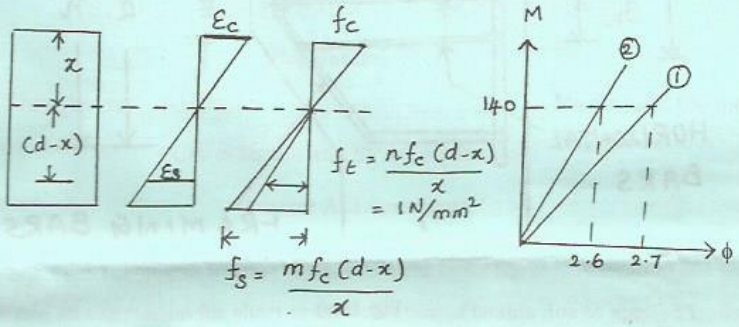

Fig. 14(b)

15. (a) Beam AB is to be designed for moments M_A = –69 kNm and +23 kNm, M_B = –88 kNm and +3 kNm. The characteristic dead and live loads are 10 and 5 kN/m respectively. The span is 6 m and, beams are 300 × 500 mm with 150 mm slab. Assume f_{ck} = 20 N/mm² and fy = 415 N/mm². The structure is situated in seismic zone IV. Design should be made according to the provisions of IS 13920(1993).

Or

(b) A block of ten storied flats in Chennai has its lowermost columns 500 × 700 mm in size. In order to use the ground floor for car parking, the lower columns are made free standing. Comment on the considerations to be given for detailing of these freestanding columns. Assume f_{ck} = 20 N/mm² and fy = 415 N/mm² and the height of free bay is 4 metres.

PART C — (1 × 15 = 15 marks)

16. (a) Design the corbel given below.

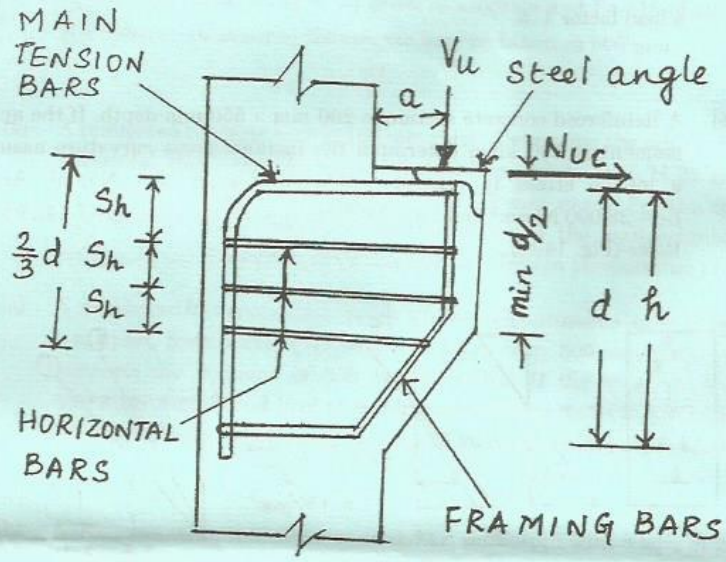

Fig. 16(a)

Or

(b) (i) Explain the various methods of determining the ultimate load carrying capacity of reinforced concrete slabs.

(ii) A Reinforced concrete slab 5 m × 5 m is simply supported along the four edges and is reinforced with 10 mm dia. Fe 415 steel bars at 150 mm c/c both ways. The average effective depth of the slab is 100 mm and the overall depth of the slab is 130 mm. The slab carries a flooring of 50 mm thick having unit weight of 2.2 kN/m². Determine the maximum permissible service load, if M 20 concrete is used.

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