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Fifth Semester B.E. Degree Examination, Feb./Mar. 2022
Design of RC Structural Elements

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of Code IS456:2000 and SP16 is permitted.

Module-1

1 a. What are the different loads to be considered in the design of a reinforced concrete element? **(08 Marks)**

b. What is stress block? Derive from the fundamentals the expression for the area of stress block $0.36f_{ck}x_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42x_u$. **(12 Marks)**

OR

2 a. Explain (i) Short term deflection (ii) Long term deflection (iii) Side face reinforcement. **(08 Marks)**

b. A rectangular simply supported beam of span 5m is 300×650mm in cross section and is reinforced with 3 bars of 20mm on tension side at an effective cover of 50mm determine the short deflection due to an imposed working load of 20 kN/m excluding self weight. Assume grade of concrete M_{20} and steel as Fe 415. **(12 Marks)**

Module-2

3 a. Differentiate between under reinforced, over reinforced and balanced section. **(08 Marks)**

b. A single reinforced concrete beam 250×450mm deep upto the centre of reinforcement is reinforced with 3-16mm diameter at an effective cover 50mm, effective span 6m. M_{20} concrete and Fe415 steel. Determine the central point load that can be supported in addition to the self weight. **(12 Marks)**

OR

4 a. A reinforced concrete beam has a support section with a width of 250mm and effective depth of 500mm. The support section is reinforced with 3 bars of 20mm diameter on the tension side. 2 legged 8mm diameter strings are provided at a spacing of 200mm centre to centre. Calculate the shear strength of the support section for M20 grade concrete and Fe415 steel. **(10 Marks)**

b. A Tee beam has the following data:
(i) C/C spacing of beams = 3.20m
(ii) Simply supported effective span of beam = 8m.
(iii) Depth of slab = 150mm,
(iv) Size of web of beam = 250×500mm
Calculate the moment of Resistance for balanced section **(10 Marks)**

Module-3

5 A Tee beam slab floor of an office comprises a slab 150mm thick spanning between ribs of 250mm wide spaced at 3.2m centre to centre. Clear span of beam = 7.70m. The beam is 600mm deep including slab and simply supported over walls of 300mm wide. Live load on floor = 4 kN/m^2. Floor and ceiling finish = 0.75 kN/m^2. The beam also support a portion wall transmits a load of 12 kN/m. Design one of the intermediate beam for flexure and shear. Also check for beam for deflection control. Assume effective cover = 50mm M_{20} grade concrete and Fe 415 steel. **(20 Marks)**

OR

6 a. Distinguish between L beam and T beam. **(06 Marks)**

b. A rectangular beam 230mm × 550mm deep is subjected to a sagging bending moment of 40 kNm, shear force of 30 kN and twisting moment of 11.5 kNm at a given section at service state. Design the reinforcement if M_{20} grade concrete and Fe415 steel are used. Sketch the details. **(14 Marks)**

Module-4

7 Design a RCC slab for an office floor 3.5×5.5m all four edges discontinuous and corners held down. The live load is 3 kN/m^2. Assume floor finish and ceiling finish as 1 kN/m^2. Use M_{20} grade concrete and Fe415 steel. Sketch the reinforcement details. **(20 Marks)**

OR

8 a. Distinguish between one-way and two-way slab. **(06 Marks)**

b. Design the middle flight of a open well type stair case to be provided for a stair case to be provided for a stair hall of size 3.25×3.25m. Size of open well = 1.25m × 1.25m. Floor to floor height = 3.6m. Size of landing at each corner = 1m × 1m. Thickness of stair hall wall is 230mm. The stair slab is embedded into the wall by 200mm. The live load on stair = 3 kN/m^2. Calculate the area of steel required at midspan of flight. **(14 Marks)**

Module-5

9 a. Design a column 4m long restrained in position and direction at both ends to carry an axial load of 1600 kN. Use M-20 grade concrete and Fe-415 grade steel. Sketch the reinforcement details. **(10 Marks)**

b. Design a R.C. column, 400mm square to carry an ultimate load of 1000 kN and ultimate moment of 160 kNm. Use M_{20} concrete and Fe415 steel. Provide a cover of 40mm. **(10 Marks)**

OR

10 Design an isolated footing of uniform thickness for an RC square column of size 500mm × 500mm bearing a vertical load of 600 kN. The safe bearing capacity of the soil may be taken as 120 kN/m^2. Use M_{20} grade concrete and Fe-415 grade steel. Sketch the reinforcement details. **(20 Marks)**

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