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15CV51

Fifth Semester B.E. Degree Examination, July/August 2022

Design of RC Structural Elements

Time: 3 hrs.

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS 456-2000 and SP-16 is permitted.
3. Assume any missing data suitably.

Module-1

- 1 a. Differentiate between working stress method and limit state method of RCC design. (06 Marks)
- b. What is stress block? Derive from the fundamentals the expressions for the area of stress block $0.36 f_{ck} b x_u$ and depth of centre of compressive force from the extreme fibre in compression $0.4 x_u$. (10 Marks)

OR

- 2 a. Briefly explain under reinforced, over reinforced and balanced sections with sketch. (06 Marks)
- b. A T-beam section has a the following data:
(i) Effective width of flange = 1600 mm
(ii) Thickness of flange = 120 mm
(iii) Width of rib = 300 mm
(iv) Effective depth = 600 mm
Main reinforcement consist of 8 bars of 20 mm dia. The grade of concrete and steel used are M_{20} and Fe415 respectively. Determine the short term maximum deflection if it is subjected to a total service load of 40 kN/m, when used as a simply supported beam of span 6m. (10 Marks)

Module-2

- 3 a. A RCC beam of section 300 mm \times 500 mm is reinforced with 4 bars of 16 mm diameter with an effective cover of 50 mm. The beam is simply supported over a span of 5m. Find the maximum permissible udl on the beam. Use M_{20} grade concrete and Fe 500 steel. (07 Marks)
- b. Calculate the moment of resistance of a R.C. beam of rectangular section 250 mm wide and 500 mm deep, if it is reinforced with 6 number of 20 mm bars on tension side and 2 number of 20 mm bars on compression side. Assume steel of grade Fe 250 and concrete of grade M_{20} . Effective cover on both sides is 40 mm. (09 Marks)

OR

- 4 a. Define singly and doubly reinforced beams. List the situations when they are adopted. (04 Marks)
- b. An isolated T beam has flange of 2400 mm wide and 120 mm deep. The effective width and depth of web are 300 mm and 580 mm respectively. The tension reinforcement consists of 8 bars of 22 mm diameter. The effective span of simply supported T-beam is 3.6 m. Determine the moment of resistance of the beam. Use M_{20} grade concrete and Fe 415 steel. (12 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-3

- 5 Design a rectangular beam of section 230 mm × 500 mm of effective span 6m. Effective cover for reinforcement should be kept as 50 mm. Imposed load on the beam is 40 kN/m. Use M₂₀ concrete and Fe 415 steel. (16 Marks)

OR

- 6 A rectangular beam is to be simply supported on supports of 230 mm width. The clear span of the beam is 6m. The beam is to have width of 300 mm. The characteristic superimposed load is 12 kN/m. Using M₂₀ concrete and Fe 415 steel design the beam. (16 Marks)

Module-4

- 7 a. Distinguish between one way slab and two way slab. (04 Marks)
b. Design a continuous RC slab for a class room 7m wide and 14 m long. The roof is to be supported on R.C.C. beams spaced at 3.5 m intervals. The width of beam should be kept 230 mm. The superimposed load is 3 kN/m² and finished load expected to 1 kN/m². Use M₂₀ concrete and Fe 415 steel. (12 Marks)

OR

- 8 Design a dog legged stairs for an office building in a room measuring 2.8 m × 5.8 m clear. Vertical distance between the floors is 3.6 m. Width of the flight is to be 1.25 m. Allow a live load of 3 kN/m². Sketch the details of the reinforcements. Use M₂₀ concrete and Fe 415 steel. Assume the stairs are supported on 230 mm walls at the end of outer edges of landing slabs. (16 Marks)

Module-5

- 9 a. Differentiate between short columns and long columns. (04 Marks)
b. A corner column 400 × 400 mm, is subjected to a factored loads P_u = 1300 kN, M_{ux} = 190 kN-m and M_{uy} = 110 kN-m. Design the reinforcement in the column, assuming M₂₅ concrete and Fe 415 steel and effective cover of 60 mm. Assume it as short column. (12 Marks)

OR

- 10 Design a square footing for a short axially loaded column of size 400 mm × 400 mm carrying 1100 kN load. Use M₁₅ concrete and Fe 415 steel. SBC of soil is 150 kN/m². Sketch the details of reinforcement. (16 Marks)
