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15CV51

Fifth Semester B.E. Degree Examination, July/August 2021
Design of RC Structural Elements

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer any FIVE full questions.
2. Use of IS456-2000 and SP(16) are permitted.

1 a. Write the difference between working stress method and limit state method. **(06 Marks)**
   b. Derive an expression for area of stress block – $0.36f_{CK}X_u$ and depth of centre of compressive force from the extreme fibre in compression $0.42\ x_u$. **(10 Marks)**

2 a. What are the factors influences short term and long term deflection? **(06 Marks)**
   b. Derive an expression of resistance of moment for a balanced section in terms of F_y and p. **(10 Marks)**

3 a. What are the differences between singly reinforced and doubly reinforced beam. **(06 Marks)**
   b. Determine the moment of resistance (flexural). For the rectangular beam of size 250×450 mm consist of 4 bars of 18 mmϕ in tension zone. The beam is simply supported over a span of 5 m. Also determine the uniformly distributed load (UDL) which the beam can carry. Use M-20 concrete and Fe-415 steel. Assume clear cover is 40 mm. **(10 Marks)**

4 a. Determine moment of resistance for a cantilever beam 300×400 mm consist of 2 bars of 18mmϕ in bottom and 4 bars of 18 mmϕ in top. Use M20 concrete and Fe415 steel. **(06 Marks)**
   b. Determine the moment of resistance of a T beam. The effective width of the flange is 2500 mm, depth of flange (D_F) 150 mm, width of the rib (B_W) is 300 mm and effective depth (d_f) is 800 mm. F_{CK} is 20 N/mm^2, $F_y = 415$ N/mm^2. Take area of steel is 6000 mm^2. **(10 Marks)**

5 Design a simply supported rectangular beam of clear span 5 m, supported on 230 mm thick wall. It is also subjected to an uniformly distributed load (UDL) 25 kN/m along with 10 kN point load at midspan. Use M20 concrete and Fe-415 steel. Design the beam for flexural and shear and also sketch the reinforcement details. **(16 Marks)**

6 A T-beam slab floor of an office comprises a slab of 150 mm thick spanning between ribs or webs of 250 mm wide spread at 3.2 m centre to centre. Clear span of beam is 7.7 m. The beam is 600 mm deep including slab and simply supported over a walls of 300 mm wide. Live load on floors 4 kN/m^2, floor and ceiling finishing is 0.75 kN/m^2. The beam also supports a partition wall which transmit a load of 12 kN/m. Design one of the intermediate beam for flexure and shear. Two main bars are to be bent near the support. Assume effective cover is 50 mm. **(16 Marks)**

7 Design a rectangular slab 4m × 6m continuous over two adjacent edges to support a live load of 3 kN/m^2. Characteristic strength of concrete and steel is 20 and 415 N/mm^2. Use limit state method of design and sketch the reinforcement details. **(16 Marks)**

8   Design a open wall staircase for an residential building of a room size $4m \times 5.5m$. Take riser height 150 mm, thread 250 mm, floor to floor height is 3.6 m width of the stair is 1.5 m. Use M25 concrete and Fe500 steel. Also sketch the reinforcement details.   **(16 Marks)**

9   Design a rectangular column 3.5 m long restrained in position and direction at both the ends to carry an axial load of 2000 kN. Use M25 concrete and Fe415 steel. Also draw the reinforcement pattern.   **(16 Marks)**

10   Design a square footing for a square column of size $450 \times 450mm$ carrying a service load of 2000 kN. Take Safe Bearing Capacity of soil (SBC) is 300 kN/m^2 at a depth 1.5 m below ground level. Adopt M20 concrete and Fe415 steel.   **(16 Marks)**

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