1822

April 2025

Time – Three hours
(Maximum Marks: 100)

[***N.B.*** 1. Answer all questions under Part-A. Each question carries 3 marks.
2. Answer all the questions either (a) or (b) in Part-B. Each question carries 14 marks.
3. Use of IS 456, IS 800, Structural Engineering Handbook and Steel Tables approved by the board are permitted.
4. Assume suitable data, if necessary.]

PART – A

1. Write any three assumptions of working stress method.
2. What are the advantages of limit state method?
3. Write the formula for finding the flange width of T-beam.
4. Find out the design shear strength of concrete for M25 grade concrete if the percentage of steel is 1% and cross sectional area is 65000 mm^2.
5. Why torsion reinforcement is provided in slab?
6. Classify the stairs based on their structural behaviour and geometry.
7. Mention the assumptions in limit state of collapse in compression.
8. When combined footing is provided?
9. Write about block shear failure in tension member.
10. What is meant by imperfection factor?

[Turn over.....

PART – B

11. (a) Find the moment of resistance of a beam 250mm wide and 500mm deep overall, when reinforced with 2 Nos. of 16mm diameter bars in compression zone and 4 Nos. of 20mm diameter bars in tension zone with an effective cover of 40 mm. Use M20 grade of concrete and Fe 415 steel. Use limit state method.

(Or)

(b) M20 grade concrete and Fe415 grade steel are used in doubly reinforced beam with 400mm wide, 550mm effective depth and the effective cover to both tension and compression reinforcement from the outer surface is 50mm. The tension and compression reinforcement consists of 4 bars of 20mm diameter and 4 bars of 16mm diameter respectively. Locate the neutral axis and determine the moment of resistance of the beam.

12. (a) A 'T' beam section has a flange of 1280 mm x 100 mm, effective depth of 700 mm and breadth of web of 280 mm. It is reinforced with 5 nos. of 25 mm diameter Fe415 grade steel bars in the tension zone. M20 grade concrete is used. Determine the moment of resistance of the section at the limit state of collapse.

(Or)

(b) A simply supported rectangular beam has an effective depth of 600mm and breadth of 300mm. The beam is reinforced with 3 bars of 20mm as tension reinforcement at the support. The beam is subjected to a factored shear force of 180kN at the support. Check the shear stress and design shear reinforcement. Grade M20 and Fe 250 steel are used. Use 8mm diameter and 2 legged stirrups.

13. (a) Design the interior panel of a continuous two-way slab of effective spans 5.5m x 4.5m to carry an imposed load of $4kN/m^2$ by limit state method. The floor finish will be $1kN/m^2$. Use M20 grade concrete and Fe 415 steel.

(Or)

(b) A waist slab is supported by a landing beam at its ends. Horizontal distance between beams is 3.0m and vertical distance between is 1.5m. The tread is 260mm and rise 150mm. The live load is $3kN/m^2$ and floor finish is $0.8kN/m^2$. Design the waist slab using M20 grade concrete and Fe 415 steel.

14. (a) Design a short circular column with circular rings using concrete grade M20 and steel grade Fe 415 to carry an axial load of 700kN. The effective length of the column is 3.5m. Mild steel bars may be used for transverse reinforcement. Ignore minimum eccentricity.

(Or)

(b) A RC Column, 300mm square in size carries an axial load of 1000kN including its self weight. SBC of soil is 90kN/m^2. M20 grade concrete and Fe250 grade mild steel reinforcement are to be used. Determine (i) the size and thickness required for the square base (with uniform depth) for the limit state of collapse in flexure (ii) the area of tension steel required at the critical section (the effect of shear need not to be considered).

15. (a) A column 2.8m long has to support a factored load of 800kN. The column is effectively held at both ends and restrained in direction at one of the end. Design the column using suitable sections. Take f_y = 250N/mm^2.

(Or)

(b) Design a simple steel beam to resist a bending moment of 120kNm. The yield stress of the section is 250 MPa and f_u=410N/mm^2. Select a suitable section.
