CIVIL

TE Sem VI CBGS

Theory of Reinforced and Prestressed Con.

40 + 26

9.6.15

76

QP Code: **4985**

(3 Hours) [Total Marks: 80]

Instructions: 1. Question No. 1 is **COMPULSORY.** 2. Answer any **THREE** from the remaining.
3. Each full question carries **EQUAL** marks. 4. **ASSUME** any suitable data, if needed.

1. a) Write a brief note on the Equivalent Concrete Area of a Reinforced Concrete member. **(04 M)**

b) Write down the formula for modular ratio proposed in IS 456:2000. What is the advantage of using IS value as different from a constant value m = 15 as is used in some other codes? **(04 M)**

c) Distinguish between one-way slab & two-way slab. **(04 M)**

d) What are the assumptions made in the design of Prestressed Concrete members? **(04 M)**

e) A Singly Reinforced concrete beam 250 mm wide & 400 mm deep to the centre of the tensile reinforcement has a span of 5 metres & carries a total UDL of 9000 N/m, inclusive of the self weight. Concrete is M20 & steel is Fe415. State whether the beam section is balanced, under-reinforced or over-reinforced. **(04 M)**

2. a) It is proposed to modify a singly reinforced balanced section so as to reduce its moment of resistance by reducing the area of steel by 50%. Find the ratio of the reduced moment of resistance to that of the balanced section. Use M20 concrete & Fe415 steel. **(08 M)**

b) A rectangular beam reinforced on both sides is 300 mm wide & 550 mm deep. The centres of the compression & tension steel are 50 mm from the respective edges. If the limiting stresses in concrete & steel are 7 MPa & 230 MPa respectively, determine the steel areas for a bending moment of 90 kNm. Take m = 13.33. **(08 M)**

c) Write a brief note on the loss of prestress in a Pre-Tensioned member due to elastic shortening of concrete. **(04 M)**

3. a) An R. C. beam of span 5 m is 250 mm wide & 500 mm deep to the centre of tensile steel, consisting of 4 bars of 22 mm diameter. The beam carries a load of 30 kN/m inclusive of self weight. Design the shear reinforcement (stirrups). Use M20 concrete & Fe415 steel. Max. nominal shear τ_{cmax} = 1.8 MPa. Refer Table 1. **(08 M)**

Table 1: Permissible Nominal Shear Stresses in Concrete Beams, τ_c (IS 456: 2000)

100 A_{st}/bd	τ_c (MPa) for M20 concrete
1.00	0.39
1.25	0.42

b) Write a brief note on the IS Recommendations for Development Length. **(04 M)**

c) An isolated T-Beam of span 5 m has a 800 mm wide & 180 mm thick flange. The overall depth is 500 mm & the width of rib (web) is 275 mm. The tensile steel consists of 4 bars of 25 mm diameter. Effective cover to the steel is 40 mm. If the permissible stresses in concrete & steel are 7 MPa & 230 MPa respectively, find the Moment of Resistance of the beam. Take m = 13.33. **(08 M)**

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4. a) A rectangular RCC column section 700 mm deep & 450 mm wide is reinforced with 7 bars of 28 mm diameter, placed at an effective cover of 50 mm on both the sides, along the 450 mm side (i.e. along the width). Determine the maximum thrust on the section, which can be applied at a distance of 100 mm from the centre line (i.e. line bisecting the 700 mm side), if the compressive stress in concrete is not to exceed 7 MPa. Take m =13.33. **(08 M)**

b) A column 400 mm X 400 mm X 6 metres long has to support an axial load of 875 kN. Find the necessary reinforcement for the column. Use 16 mm diameter bars & 5 mm diameter ties. Use M20 concrete. Take safe stresses for concrete & steel as 5 MPa & 130 MPa respectively. **(08 M)**

c) Write a brief note on the externally & internally prestressed members. **(04 M)**

5. a) In a prestressed concrete beam 200 mm wide & 300 mm deep with 6 m. span, an initial prestressing force of 400 kN is applied at an eccentricity of 70 mm, by tendons of area 400 mm^2. Assuming $E_s = 2 \times 10^5$ MPa & $E_c = 0.333 \times 10^5$ MPa, anchor slip = 1.5 mm, creep coefficient in concrete $\Phi = 1$, concrete shrinkage = 0.0002 & creep loss in steel = 3%, find: i) loss of stress due to elastic shortening of concrete. ii) loss of stress due to anchorage slip. iii) loss of stress due to creep of concrete. iv) loss of stress due to concrete shrinkage. v) loss of stress due to creep in steel. vi) total percentage loss of stress in the tendons. **(06M)**

b) Design a slab over a room 5 m X 7 m as per IS code guidelines. The edges of the slab are simply supported & the corners are not held down. The Live Load on the slab is 3000 N/m^2. The slab has a bearing of 150 mm on the supporting walls. Use M20 concrete & Fe415 steel. Refer Table 2. **(07M)**

Table 2: BM coefficients for slabs spanning in 2 directions at right angles- S/S on 4 sides.

$l_y/l_x = r$	α_x	α_y	$l_y/l_x = r$	α_x	α_y
1.0	0.062	0.062	1.3	0.093	0.055
1.1	0.074	0.061	1.4	0.099	0.051
1.2	0.084	0.059	1.5	0.104	0.046

c) A square column 500 mm X 500 mm carries an axial load of 1500 kN. Design a square footing for the column. The safe bearing capacity of soil is 225 kN/m^2. Use M20 concrete & Fe415 steel. Checks for one way shear & two way shear are not required. **(07 M)**

6. a) A beam of symmetrical I-section spanning 8 m has flange width of 200 mm & flange thickness of 60 mm. The overall beam depth is 400 mm. Web thickness is 80 mm. The beam is prestressed by a parabolic cable with an eccentricity of 150 mm at the centre & zero at the supports with an effective force of 100 kN. The live load on the beam is 2000 N/m. Draw the stress distribution diagram at the mid span section for: i) prestress + self weight ii) prestress + self weight + live load. Take the concrete weight as 25000 N/m^3. **(07 M)**

b) Write a note on the pressure line concept as applied to the prestressed concrete. **(04 M)**

c) What are the major defects of the Modular Ratio Method? **(03 M)**

d) Design a one-way simply supported slab supported on masonry walls. Clear span is 3 m, live load is 2500 N/m^2. Use M20 concrete & Fe415 steel. Provide a wall bearing of 120 mm at each end. Draw the reinforcement details. **(06 M)**
