T.E Civil VI CBSGS

TRPC

27.12.16

QP Code : 577804

(3 Hours) **[Total Marks : 80**

N.B. : (1) Question no. **1** is **compulsory**
(2) Attempt any **three** from the remaining.
(3) Each full question carries **equal** marks.
(4) **Assume** any suitable data, if needed.

1. (a) Why is the Over-Reinforced Design not practiced? **2**
(b) In Working Stress Method of RCC Design, for concrete in compression due to bending, a Factor of Safety of____ is approximately considered on characteristic strength of concrete & a Factor of safety of___ is approximately considered on yield strength of steel in tension due to bending. **2**
(c) With a neat sketch, explain the Post-Tensioning of a member. **4**
(d) Calculate Modular Ratio, Neutral Axis Constant, Lever Arm Constant & Moment of Resistance Constant for a balanced design of singly reinforced beam. Use M30 concrete & Fe415 steel. **4**
(e) Distinguish between the one-way slab & two-way slab. **4**
(f) Critically compare Reinforced Concrete Beam & Prestressed Concrete Beam. **4**

2. (a) A S/S beam of width 240 mm & overall depth 600 mm is reinforced with 4 bars of 12 mm diameter on tension side. Clear cover to steel = 25 mm. Find the safe Uniformly Distributed Load on the beam, in addition to its self weight on a span of 4 m. Use M20 concrete & Fe415 steel. **8**

(b) A simply supported beam 260 mm wide & 490 mm deep to the centre of tensile reinforcement is provided with 6 bars of 22 mm diameter. The maximum Shear Force for the beam is 140 kN. One main bar is bent up to resist part of the shear. Design the shear reinforcement. Use M20 concrete & Fe415 steel. Refer table 1 below. **8**

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

$100 A_{st}/bd$	τ_c (MPa) for M20 concrete
1.25	0.42
1.50	0.45
1.75	0.47
2.00	0.49

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(c) Why high strength steel & high strength concrete are used in Prestressed Concrete? 4

3. (a) Find the Moment of Resistance of a singly reinforced beam of width = 240 mm; effective depth = 570 mm. It is reinforced with 3 bars of 20 mm. diameter on tension side. Also state whether the beam is under-reinforced, balanced or over-reinforced. Use M20 concrete & Fe415 steel. 8

(b) A short column of square section is to be designed to carry an axial load of 1200 kN. Carry out the design for column. Permissible stresses in concrete & steel are 5 MPa & 130 MPa resp. 8

(c) Explain loss of Prestress in a Pre-Tensioned member due to elastic shortening of concrete. 4

4. (a) A pre-tensioned concrete beam 250 mm wide & 360 mm deep has a span of 12 m. The beam is prestressed by steel wires of area 350 mm^2 provided at a uniform eccentricity of 60 mm with an initial prestress of 1255MPa. Determine the percentage loss of stress in the wires. Es = 210 kN/mm^2, Ec = 36 kN/m^2, ultimate creep strain = 45 X 10^{-6} mm/mm per MPa, shrinkage of concrete = 300 X 10^{-6}, Relaxation of steel stress= 5% of initial stress. 8

(b) An isolated Tee-Beam of flange width 2000 mm & rib width of 250 mm is loaded with 22 kN/m load inclusive of self weight. The span of the beam is 8 m & it is simply supported. Slab thickness is 100 mm. Design the beam for flexure. Use M20 concrete & Fe415 steel. 8

(c) A prestressed concrete beam 300 mm wide & 600 mm deep is prestressed using 5 high tension bars of 12 mm diameter at 220 mm from the soffit of the beam. The effective stress in the steel is 810 MPa. Find the bending moment that must be applied to the section to just avoid tension at soffit of the beam. 4

5. (a) A square column 490 mm X 490 mm carries an axial load of 1625 kN. Design a square footing for the column. The safe bearing capacity of soil is 238 kN/m^2 . Use M25 concrete & Fe415 steel. Checks for one way shear & two way shear are not needed. 8

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(b) A beam of reinforced concrete is 250 mm wide & 400 mm deep to the centre of tensile steel. It is reinforced with 4 bars of 16 mm diameter as compressive steel at an effective cover of 50 mm & with 4 bars of 20 mm diameter as tensile steel. If the stresses in concrete & steel are not to exceed 7 MPa & 230 MPa respectively, find the Moment of resistance of the beam. Take m = 13.33. 8

(c) Determine the parabolic profile (dip of cable) of a load balancing cable for a beam of span 6 m carrying an all inclusive load of 42 kN/m. The prestressing force in the tendon is 1200 kN. The beam section is 400 mm X 600 mm. 4

6. (a) Design a one-way simply supported slab supported on masonry walls. Clear span is 3m, live load is 4010 N/m^2. Use M20 concrete & Fe415 steel. Provide a wall bearing of 120 mm at the each end. 8

(b) Design a slab over a room 4 m X 6 m. 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. 8

Table 2: BM coefficients for slabs spanning in 2 directions at right

l_y/l_x = r	α_x	α_y	l_y/l_x = r	α_x	α_y
1.2	0.084	0.059	1.5	0.104	0.046
1.3	0.093	0.055	1.75	0.113	0.037
1.4	0.099	0.051	2.0	0.118	0.029

(c) What are the assumptions made in designing prestressed concrete elements? 4
