[Time : 3 hours]

N.B.:

MARKS: 80

1. **Q.1** is **compulsory**
2. Attempt any **three** question out of remaining **five**
3. Assume **suitable** data if **required**

Q.1 Write short notes on **20**

(A) Derive the expression for development length and explain anchorage bond

(B) Explain under reinforced, balanced and over reinforced rectangular section also draw strain and stress diagram for singly reinforced rectangular section.

(C) Draw stress-strain curve diagram for concrete and steel

(D) differentiate between pre-tensioning and post-tensioning

Q.2 (a) Find the moment of resistance of the R. C. C. beam of size 450 mm x 750 mm over all depth is reinforced with 8 bars of 20 mm diameter on tension side at effective cover of 35 mm. Use concrete grade as M25 and steel as Fe415. Also write what are the major defects of the Modular ratio method. **10**

(b) Determine the moment of resistance of the beam whose section is 300 x 600 mm and reinforced with 2 bars of 17 mm diameter tor steel at top and 6 bars of 20 mm dia. mild steel bars at bottom. Take effective cover as 50 mm for tension and compression steels. Use M15 grade of concrete. What superimposed load this beam can carry if its effective span is 8 m and is simply supported at its end. **10**

Q.3 (a) Determine the moment of resistance of the T-beam use following data: $b_f = 1050$ mm, $D_f = 120$ mm, $b_w = 300$ mm, cover = 50 mm, d = 450mm and $A_{st} = 1900$ mm^2 Use M 20 and Fe 415. **12**

(b) Design the shear reinforcement in a cantilever beam 250mm wide, 450mm effective depth carrying a u.d.l of 30 KN/m. The span of beam is 3.5m. The beam has main tension steel of 8 nos. Bar 12 mm dia Use M 20 /Fe 415. Value of permissible shear stress are given in table below. **08**

$100A_s/bd$	≤ 0.15	0.25	0.5	0.75	1.00	1.25	1.5	1.75
τ_{bd}	0.18	0.22	0.3	0.35	0.39	0.42	0.45	0.47

Q.4 (a) Design a one way cantilever slab having width of 230mm over a length of 3m, to support a live load of 3kN/m^2. Adopt M20 concrete and Fe 415 steel. **10**

(b) A short column ofsquare section is to be designed to carry an axial load of 1025KN design the column, permissible stresses in concrete and steel are 5MPa and 130MPa respectively. **10**

Q.5 Design a rectangular isolated sloped footing for a column of size 300 x 750 mm carrying an axial load of 1750 kN. The safe bearing capacity of the soil at the site is 200 kN/m2. The materials used are M15 and Fe415. **10**

(b)A rectangular concrete beam of c/s 250mm×350mm is prestressed by means of 15 wires of 6mm diameter located 60mm from the bottom of the beam and 5 wires of dia. 8mm 50mm top. Assuming prestress in steel as 1000N/mm^2. Calculate the stresses at the extreme fibres of the mid span section, when the beam is supporting its own weight over a span of 5m and a u.d.l of 5KN/m is imposed. **10**

Q.6 (a) A prestressed concrete beam of size 300mm * 500mm isprestressed with wires (area 320mm^2) located at a constant eccentricity of 50mm and carrying an initial stress of 1100N/mm^2, the span of beam is 9m. Calculate the percentage loss of stress in wires if (i) the beam is pretensioned (ii) the beam is post tensioned. Use the following data: Es = 210 KN/mm^2 and Ec= 35 KN/mm^2, relaxation of steel stress = 5% of initial stress, shrinkage of concrete = $300*10^{-6}$ for pretensioning and $200*10^{-6}$ for post-tensioning, Creep coefficient = 1.6, slip at anchorage= 1mm
frictional co-efficient for wave effect = 0.0015/m **15**

(b)Explain in detail pressure line theory in prestressed concrete **5**

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