PART – C (1×15=15 Marks)

16. a) A rectangular concrete beam of cross section 150 mm wide by 300 mm deep is simply supported over a span of 8 m. The beam is pre-stressed by a parabolic cable having an eccentricity of 25 mm towards the top at supports and 754 mm towards the soffit at mid span. If the force in the cable is 350 kN and the modulus of elasticity of concrete is 38000 N/mm² estimate

a) The deflection at mid span when the beam is supporting its own self weight. (8)

b) The concentrated load which must be applied at mid span to restore it to the level of supports. (7)

(OR)

b) A pre-stressed concrete tank wall is subjected to a hoop tension of 1 kN/mm due to water pressure. The maximum and minimum permissible compressive stress in concrete under working pressure is 13 N/mm² and 1 N/mm² respectively. The loss of pre-stress due to various causes may be taken as 25 percent. High tensile wires of 5 mm diameter with an initial stress of 1000 N/mm² are available for circumferential wire winding. Design suitable thickness for the tank walls and the spacing of circumferential wire winding. Assume the diameter of the tank as 30 m and height of water in tank as 7.5 m.

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b) A pre-tensioned beam 250 mm wide and 300 mm deep is pre-stressed by 12 wires each 7 mm diameter initially stressed to 1200 $N/mm^2$ with their centroids located 100 mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep shrinkage and relaxation using Is 1343-80 code with the following data :

Relaxation of steel stress = 90 $N/mm^2$

$E_S$ = 210 $kN/mm^2$

$E_C$ = 35 $kN/mm^2$

Creep co-efficient ($\varphi$) = 1.6

Residual shrinkage strain = $3 \times 10^{-4}$.

12. a) A double Tee-section having a flange 1200 mm wide and 150 mm thick is prestressed by 4700 $mm^2$ of high tensile steel located at an effective depth of 1600 mm. The ribs have a thickness of 150 mm each. If the cube strength of concrete is 40 $N/mm^2$ and tensile strength of steel is 1600 $N/mm^2$ determine the flexural strength of the double tee-girder using IS : 1343 code provisions.

(OR)

b) A concrete beam of rectangular section, 300 mm wide and 800 mm deep is subjected to a twisting moment of 30 kN.m and a pre-stressing force of 150 kN acting at an eccentricity of 220 mm. Calculate the maximum principal tensile stress. If the beam is subjected to a bending moment of 100 kN.m in addition to the twisting moment, calculate the maximum principal tensile stress.

13. a) A two-span continuous prestressed concrete beam ABC (AB = BC = 15 m ) has a uniform cross-section with a width of 250 mm and a depth of 600 mm. The cable carrying an effective prestressing force of 500 kN is parallel to the axis of the beam and located at an eccentricity of 200 mm.

a) Determine the secondary and resultant moment developed at mid support section B. (7)

b) If the beam supports an imposed load of 2.4 kN/m, calculate the resultant stresses developed at the top and bottom of the beam at B. Also calculate the resultant line of thrust through the beam AB. (6)

(OR)

b) A continuous beam ABC (AB = BC = 20 m) has a rectangular section 400 mm wide and 600 mm deep throughout the two spans and is prestressed by a concordant cable having a cross-sectional area of 1700 $mm^2$ located 60 mm from the soffit of the beam at mid span points and 60 mm from the top of the beam at B. If the beam supports uniformly distributed superimposed service load of 4.24 kN/m throughout the spans, estimate the load factor against failure assuming,

a) Elastic distribution of moments. (6)

b) Complete redistribution of moments.

Adopt $f_{pu}$ = 1600 $N/mm^2$ and $f_{cu}$ = 40 $N/mm^2$, $D_c$ = 24 $kN/m^3$. (7)