B.E. / Civil / Sem - VII / 'C' Scheme / Subj - DLOC - III - PSC / Date :- 18/11/25 Q3

S.H. 2025

Time: 3hour Max. Marks: 80

Q8. Code :- 10095156

NOTE: IS:1343-2012 is allowed in the examination.

Q1. All the Questions are compulsory and carry equal marks.

A Why there is a need of high strength steel and concrete in prestressed concrete structures?

B Explain the concept of load balancing with neat sketches.

C Differentiate the losses between pre-tensioning and post-tensioning.

D Explain the pressure line or thrust line.

E Determine the principle tensile stress, modulus of rupture, and short term & long term modulus of elasticity of concrete, if the characteristic strength of concrete is 50 N/mm^2 and creep coefficient is 1.6.

Q2. 10 marks each

A A 5 m long simply supported beam 200 mm x 450 mm is prestressed by a parabolic cable carrying an effective force of 200 kN. Cable is located at 150 mm below centroid at mid span and 100 mm above centroid at supports. The beam supports a uniformly distributed factored load of 90 kN/m (inclusive of self weight). Calculate the principal tensile stresses at a fiber 100 mm above centroidal axis at support section.

B Define kern points and derive equation for upper and bottom kern points.
Find the efficiency of a T-section: flange 500 mm × 200 mm, web 750 mm × 100 mm

Q3. 10 marks each

A A post tensioned beam of rectangular section 200 mm x 450 mm is prestressed by a cable made up of 12 – 8 mm wires. Cable is located at 100 mm from soffit of the beam at mid span and it is concentric at supports. The wires are initially stressed to 1100 MPa. Calculate loss of stress and loss of strain in steel. Jacking force is applied from one end only. Take $\mu = 0.15$, K= 0.0066 / m, anchorage slip = 2 mm, span = 6 m simply supported, $E_s = 210$ kN/mm^2, $E_c = 35$ kN/mm^2, Shrinkage strain in concrete $(\varepsilon_{ca} + \varepsilon_{cd}) = 300 \times 10^{-6}$. Creep coefficient 1.6, $f_p = 1500$ MPa, consider normal relaxation of steel.

B A simply supported prestressed concrete beam 150 mm wide and 400 mm deep of span 10 m is subjected to a live load of 5 kN/m. A prestressing force of 200 kN is applied at an eccentricity of 50 mm. Design shear reinforcement. Take $\gamma_c = 24$ kN/m^3, $\eta = 0.85$ and M40 concrete.

Q4. 10 marks each

A A post tensioned beam of rectangular section having a span of 10 m is subjected to a uniformly distributed load of 15 kN/m. The width of the section being 250 mm, loss ratio may be assumed as 0.85. If the section needs to be design considering as zone – 1 element & stresses in concrete should not exceed 15 N/mm^2 in compression in any case determine;
(i) Depth of the beam such that section is safe in limit state of serviceability cracking and maximum compression in flexure,
(ii) Prestressing force

B A beam of rectangular section, 400 mm wide and 1200 mm deep is pretention by a tendon consists of 3300 mm^2 of strands of characteristic strength of 1700 N/mm^2. The strands are located at 870 mm from the top face of the beam. If f_{cu}=60 N/mm^2, estimate the flexural strength of the section as per IS1343 provisions.

Q5. **10 marks each**

A A post-tensioned unsymmetrical I-section having the following properties is used for a 30 m long bridge girder.
Overall depth 1000 mm, position of the centroid from top edge 440 mm, area 345000 mm^2, $Z_t = 95 \times 10^6$ mm^3, $Z_b = 75 \times 10^6$ mm^3
Consider type-1 element and M55 concrete with f_{ci} = 38.5 MPa, imposed uniformly distributed load 3 kN/m.
Determine optimum prestressing force and corresponding eccentricity. Also locate safe cable zone. Take $\eta = 0.85$, $\gamma_c = 25$ kN/m^3

B A concrete beam with a single overhang is simply supported at A & B over a span of 8 m and the overhang BC is 2 m. The 300 mm wide & 900 mm deep beam supports a uniformly distributed live load 33.52 kN/m over the entire span in addition to its self-weight. Suggest suitable cable profile which can balance the dead and live load. Determine the eccentricity of the prestressing cable at different prominent sections if effective force in it is 750 kN. Take $\gamma_c = 24$ kN/m^3

Q6. **10 marks each**

A A 6 m long simply supported beam has rectangular C/s 200 mm x 450 mm. It is prestressed by a cable consisting of 20 H T wires of 4 mm ϕ each, having $f_y = 1600$ MPa and $f_i = 1100$ MPa. Beam carries 8 kN/m impose load. Consider 20 percent loss in prestress at service. Determine stresses at mid span, quarter span and support section at service stage, if cable is linear having 50 mm eccentricity towards soffit of the beam at supports and maximum 125 mm towards soffit of the beam at mid span.

B An 8 m long simply supported concrete beam having $E_c = 35 \times 10^3$ N/mm^2, is 200 mm x 500 mm deep. It is prestressed by two cables as under;

Cable	Profile	Eccentricity from neutral axis at		Effective Prestressing Force
		Supports	Mid span	
Cable 1	Parabolic	50 mm above	100 mm below	280 kN
Cable 2	Straight	100 mm below	100 mm below	180 kN

Determine safe uniformly distributed imposed load on the beam such that deflection is within safe permissible limit.

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