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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: CIVIL ENGINEERING **Duration: 3 hrs.**

Course Code: 22CV6PCPSC **Max Marks: 100**

Course: Design of Pre-stressed Concrete Structures

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, to be suitably assumed and clearly stated.
3. Use of IS 1343-2012 is permitted.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			UNIT - I	*CO*	*PO*	Marks
1	a)		Explain the advantages and disadvantages of Pre stressed concrete	*CO1*	*PO 1*	**06**
	b)		A pre stressed concrete 'I' section is used as a post tensioned beam of span 20 meters. It is having prestress cables of area 200mm^2 at a depth of 25 mm from the top of the section and an area of 800mm^2 at a depth of 40mm from the bottom of the section which has a total depth of 970 mm. The initial prestress in the cables is 1500 N/mm^2 with a loss of 250 N/mm^2. The permissible stress in concrete under working conditions are 17N/mm^2 (Compression) at the top of the section and 1.7 N/mm^2 (Tension) at the bottom. Calculate the total allowable load on the beam given that, Ixx=15x10^9 mm^4, area of cross section =12x10^4 mm^2 .The neutral axis of the cables is at a depth of 546 mm from the bottom of the section	*CO1*	*PO3*	**14**
			OR			
2	a)		Explain Freyssinet method of prestressing with a neat sketch	*CO1*	*PO1*	**08**
	b)		Describe Hoyer's long line method of pre stressing with a neat sketch	*CO1*	*PO1*	**06**
	c)		Describe load balancing technique with a suitable example	*CO1*	*PO1*	**06**
			UNIT - II			
3	a)		Explain the losses in prestress due to length and curvature effect, elastic shortening and slip in anchorage.	*CO1*	*PO1*	**06**
	b)		A post tensioned concrete beam of 'T' section having flange width of 600 mm and depth of 150 mm and with a web of width 150 mm and depth 600 mm is pre stressed successively by three cables 1, 2, and 3.The cross sectional area of each cable is 440 mm^2 with an	*CO1*	*PO3*	**14**

			initial prestress in the cable = 1300 N/mm^2 .The span of the beam is 16 meters. Modular ratio = 6. The first cable is parabolic with an eccentricity of 100 mm below the centroidal axis at center and 50 mm above the centroidal axis at support sections. The second cable is also parabolic with zero eccentricity at supports and with an eccentricity of 175 mm at center of span. The third cable is straight with a constant eccentricity of 175 mm throughout the span below centroid of beam. Estimate the loss in each cable when they are successively tensioned and anchored.			
			OR			
	4	a)	A prestressed concrete beam with a symmetrical 'I' section has a flange width and depth of 200 mm x 60 mm. The thickness of the web is 80 mm and the overall depth of the beam is 400 mm. The beam is pre stressed by a cable carrying a force of 1000 kN. The span of the beam is 8 meters. The center line of the cable is 150 mm from the soffit of the beam at center of span linearly varying to 250 mm from soffit of the supports. Compute the initial deflection at midspan due to prestress and the self-weight of the beam assuming E_c = 38 x10^3 N/mm^2 . Compare the deflection with the limiting deflection permitted as per IS 1343-2012. Take unit weight of concrete =24 kN/m^3	*CO1*	*PO3*	**15**
		b)	State the factors influencing the deflections.	*CO1*	*PO1*	**05**
			UNIT - III			
	5	a)	A pre tensioned PSC 'T'-Beam is having 1000mm wide and 140mm flange depth. The rib is 250mm wide and 1450 mm deep. It is pre-stressed by high tensile steel wires of 4500mm^2 area located at an effective depth of 1400mm.The characteristic compressive strength of concrete is 45 N/mm^2, tensile strength of steel is 1500 N/mm^2.Estimate the flexural strength of the 'T' section.	*CO1*	*PO2*	**14**
		b)	Describe the IS code method of design of shear of PSC member.	*CO1*	*PO2*	**06**
			OR			
	6	a)	A PSC beam of 'I' Section with flanges 500 mm wide and 200 mm deep with a web thickness 150 mm with an overall depth of 1200 mm has a span of 20 meters. The cable is parabolic with zero eccentricity at supports and maximum eccentricity of 400 mm at mid span and effective prestress of 1250 kN. Live load =20 kN/m. Determine the principal tension at support section and at the junction of web and flange.	*CO1*	*PO3*	**14**
		b)	Explain the different types of flexural failure.	*CO1*	*PO1*	**06**
			UNIT - IV			
	7	a)	A prestressed girder has to be designed to cover a span of 12m, to support an uniformly distributed live load of 15kN/m.M45 Grade	*CO2*	*PO3*	**10**

			concrete is used for casting the girder. The permissible stress in compression may be assumed as 14N/mm^2 and 1.4 N/mm^2 in tension. Assume 15% losses in prestress during service load conditions. The preliminary section proposed for the girder consists of a symmetrical I-section with flange 300mm wide and 150mm thick. The web is 120mm wide by 450mm deep. i)Check the adequacy of the section provided to resist the service loads. ii)Design the minimum prestressing force and the corresponding eccentricity for the section.			
		b)	A pretensioned beam 80mm wide and 120mm deep, simply supported over a span of 3m is to be designed to support working loads of 4kN each acting at one third span points. If the permissible stresses in tension are zero at transfer and 1.4 N/mm^2 under working loads. Design the number of 3mm wires and the corresponding eccentricity required at the mid span section. Permissible tensile stress in wires is 1400N/mm^2. The loss of the prestress is 20% and the density of the concrete is 24kN/m^3.	*CO2*	*PO3*	**10**
			OR			
	8		Design a rectangular pre tensioned beam of span 12 m carrying a super imposed load of 15 KN/m. Assume compressive stress of concrete as 15 MPa at transfer and 12 MPa at working load. No tensile stress is allowed in the concrete The initial stress in steel is not to exceed 1000 MPa Assume the loss of pre stress as 15%. Assume f_{ck}=50 MPa, f_p= 1600 N/mm^2.	*CO2*	*PO3*	**20**
			UNIT - V			
	9	a)	The end block of a post tensioned PSC beam is 250 mm wide by 480 mm deep. The beam is tensioned by two Freyssinet anchorages, each of 120 mm diameter with their centers located at 120 mm from the top and bottom of the beam. The force transmitted by each anchorage being 2150 kN. Calculate the bursting force and design suitable reinforcements according to IS 1343-2012 code provisions. Take Fe415 grade steel and 8 mm diameter bars	*CO2*	*PO3*	**14**
		b)	Explain the terms i) End block ii) Bursting tension with reference to post-tensioned prestressed members.	*CO2*	*PO1*	**06**
			OR			
	10	a)	Describe briefly the state of stress distribution in anchorage zone	*CO2*	*PO1*	**04**
		b)	Explain transmission length and the factors effecting it	*CO2*	*PO1*	**06**
		c)	A pre tensioned beam is prestressed using 5mm dia wires with an initial stress of 80% of the ultimate tensile strength of steel = 1600N/mm^2 . The cube strength of concrete at transfer is 30N/mm^2 . Calculate: i) Transmission length; ii) Bond stress at ½ of Lt distance from the end and iii) Overall average bond stress	*CO2*	*PO2*	**10**

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