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

Autonomous Institute Affiliated to VTU

January / February 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, may be suitably assumed.
3. Use of IS 1343-2012 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.

			CO	PO	Marks
		UNIT – I			
1	a)	List the advantages of prestressed concrete.	CO 1	PO1	**4**
	b)	Explain pressure line with a neat sketch.	CO 1	PO1	**4**
	c)	A rectangular concrete beam of c/s 30cm deep and 20cm wide is prestressed by means of 15 wires of 5mm dia located 6.5cm from the bottom of the beam, and 3 wires of diameter 5mm located 2.5cm from the top. Assuming the prestress in the steel as 840 N/mm^2. Calculate the stress at extreme fibers of the midspan section when the beam is supporting its own weight over a span of 6m if an udl of 6kN/m is imposed. Evaluate the maximum working stress in concrete take $D_c = 24kN/m^3$	CO 2	PO2	**12**
		OR			
2	a)	Explain why high tensile steel is needed for prestressed concrete construction?	CO 1	PO1	**4**
	b)	Explain briefly the concept of load balancing in PSC structure.	CO 1	PO1	**4**
	c)	An unsymmetrical I section beam is used to support a imposed load of 2kN/m over a span of 8m. The sectional details are top flange 100mm wide and 60mm thick. Thickness of the web is 80mm. Overall depth of the beam is 400mm. at the center of the span, the effective prestressing force of 100kN is located at 50mm from the soffit of the beam . Estimate the stress at the mid span section of the beam for the following load condition i) prestress+self weight ii) prestress + self weight +Live load.	CO 1	PO1	**12**
		UNIT – II			
3	a)	List the various losses of pre-stress in post tensioned members.	CO 1	PO1	**4**
	b)	A pre-tensioned concrete beam 100mm wide and 300mm deep is prestressed by straight wires carrying an initial force of 150kN at an eccentricity of 50mm. The modulus of elasticity of steel and concrete are 210 and 35 kN/mm^2. Estimate the percentage loss of stress in steel due to elastic deformation of concrete. If the area of steel wires is $188mm^2$.	CO 1	PO1	**12**
	c)	List the factors influencing deflections in PSC members.	CO 2	PO2	**4**

			OR			
	4	a)	Explain how Loss of prestress due to anchorage slip and loss due to friction is accounted in post tensioned beams.	***CO*** 1	***PO1***	**06**
		b)	A pre stressed concrete simply supported beam of rectangular section 250mm x 500mm has an effective span of 8 m and carries a udl of 3 kN/m. It is pre stressed with a straight cable carrying an effective force of 250 KN at an eccentricity of 80 mm. Find the short term deflection and long term deflection at mid span. Assume live loads and dead loads are applied simultaneously after release of pre stress. Take E_c for Concrete as 40 KN/mm^2, loss of pre stress as 20% and Creep Coefficient as 2.0.	***CO*** 2	***PO2***	**14**
			UNIT - III			
	5	a)	Mention the advantages of partial prestressing.	***CO*** 1	***PO1***	**5**
		b)	Explain types of flexural failure and transmission length	***CO*** 1	***PO1***	**5**
		c)	A pre-tensioned prestressed concrete beam having a rectangular section 150mm wide and 350 mm deep has an effective cover of 50mm. if f_{ck}= 40 N/mm^2, f_p= 1600 N/mm^2 and area of prestressing steel= 461 mm^2. Calculate the ultimate flexural strength of the section using IS 1343 codal provisions.	***CO*** 2	***PO1***	**10**
			OR			
	6	a)	A post tensioned concrete girder of box section 1000 mm x 1000 mm overall dimensions has a uniform wall thickness of 200 mm. The girder is post tensioned by high tensile wires of area 2250 mm^2 located at an effective depth of 900 mm. If f_{ck}= 40 N/mm^2 and f_p = 1600 N/mm^2, calculate the ultimate flexural strength of the box girder section as per IS code.	***CO*** 2	***PO1***	**08**
		b)	A prestressed concrete beam, having an unsymmetrical I-section, has a fibre stress distribution of 13 N/mm^2 (compression) at the top edge linearly reducing to zero at the bottom. The top flange width and thickness are 2400 mm and 400 mm respectively, the bottom flange width and thickness 1200 mm and 900 mm respectively, and the depth and thickness of web are 1000 mm and 600 mm respectively. The total vertical service load shear in the concrete at the section is 2350 kN. Compute and compare the principal tensile stress at the centroidal axis and at the junction of the web with the lower flange.	***CO*** 2	***PO1***	**12**
			UNIT – IV			
	7		Design a symmetrical I Section for a pretentioned beam of span 12 m carrying a super imposed load of 30 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	***CO*** 2	***PO3***	**20**
			OR			

	8	a)	A post tensioned prestressed beam of rectangular section 250mm wide is to be designed for an imposed load of 12kN/m on a span of 12m. The stress in the concrete must not exceed 12N/mm^2 in compression or 1.4 N/mm^2 in tension at any time and the loss of prestress may be assumed to be 15%. Calculate i) the minimum possible depth, ii) for the section, the minimum pre-stressing force and the corresponding eccentricity.	*CO* 2	*PO3*	**20**
			UNIT – V			
	9	a)	Draw the sketch showing the stress distribution in end block by double anchor plate.	*CO* 1	*PO1*	**5**
		b)	Sketch the forces acting on the end block	*CO* 1	*PO1*	**5**
		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	*CO* 2	*PO2*	**10**
			OR			
	10	a)	Explain with neat sketches i) Transmission length and factors affecting it ii) Anchorage zone reinforcement	*CO* 1	*PO1*	**8**
		b)	The end block of post tensioned prestressed member is 550 mm wide and 550 mm deep. 4 cables each made of 7 wires of 12 mm diameter strands and carrying a force of 1000 kN are anchored by plate anchorages 150 x 150 mm located with their centers @ 125 mm edges of end block. The cable duct is 50 mm diameter. The 28 days cube strength of concrete is 45 N/mm^2. The cube strength of concrete at transfer is 25 N/mm^2, permissible bearing stresses behind anchorages should confirm to IS 1343. The characteristic yield strength of mild steel reinforcement is 260 N/mm2. Design suitable anchorages for end blocks.	*CO* 2	*PO2*	**12**

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