Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – SUMMER 2025

Subject Code:3170624 Date:08-05-2025

Subject Name:Design of Prestressed Concrete structures

Time:02:30 PM TO 05:00 PM Total Marks:70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**
5. **IS Code- 1343 (2012) and IS: 456 (2000) is permitted.**

			Marks
Q.1	**(a)**	Differentiate between prestressed concrete and reinforced concrete.	**03**
	(b)	Explain the basic concept of Prestressed Concrete.	**04**
	(c)	Explain various types of losses that occur in prestress concrete.	**07**
Q.2	**(a)**	Explain the Post-tensioned method of prestressing concrete.	**03**
	(b)	Distinguish between creep and shrinkage losses of prestressed concrete.	**04**
	(c)	A pre-tensioned concrete beam, 100 mm wide and 300 mm deep, is prestressed by straight wires carrying an initial force of 150 kN at an eccentricity of 50 mm the Modulus of Elasticity of steel and concrete are 210 and 35 kN/m^2 respectively. Estimate the percentage loss of stress in steel due to elastic deformation of concrete if the area of steel wires is 188 mm^2.	**07**
		OR	
	(c)	A prestressed concrete beam 100 mm x 300 mm is post tensioned by parabolic the cable with an eccentricity of 50 mm at the center and concentric at the supports, prestressing force being 240 kN. Estimate the loss of prestress in cable due to the creep of concrete. Take the modular ratio as 6 and the creep coefficient as 3.	**07**
Q.3	**(a)**	Enlist the assumptions of the Strain compatibility method for prestressed concrete.	**03**
	(b)	Define the following terms: Post-Tensioning, Tendon, Anchorage, Bonded Prestressed Concrete, Partial Prestressing, Eccentric Prestressing, Circular Prestressing.	**04**
	(c)	A pre-tensioned concrete beam having a rectangular section, 150 mm wide and 350 mm deep has an effective cover of 50 mm. If, f_{ck} = 40 N/mm^2, f_p = 1600 N/mm^2, the area of prestressing steel A_p = 461 mm^2, calculate the ultimate flexural strength of the section using IS: 1343- 2012.	**07**
		OR	
Q.3	**(a)**	Discuss the effect of tendon profile on the deflection of the prestressed concrete beam.	**03**
	(b)	Explain the provisions for bursting tensile force and bearing stress for prestressed concrete sections as per the IS: 1343: 2012.	**04**

	(c)	A pre-tensioned T-section has a flange with dimensions of 300 mm in width and 200 mm in thickness. The rib is 150 mm wide by 350 mm deep. The effective depth of the cross section is 500 mm. If, f_{ck} = 50 N/mm^2, f_p = 1600 N/mm^2, the area of prestressing steel A_p = 200 mm^2, estimate the ultimate moment capacity of T-section using the IS: 1343-2012.	**07**
Q.4	**(a)**	Explain flexural, flexural-shear, and web shear cracks in the concrete beam with the sketches.	**03**
	(b)	A prestressed concrete beam spans 10 m of rectangular section 120 mm wide and 300 mm deep and is axially prestressed by a cable carrying an effective force of 180 kN. The beam supports a total udl of 5 kN/m including self-weight. Compare the magnitude of the principal tensile stress in the beam with and without axial prestress.	**04**
	(c)	Explain the provision of the design of shear reinforcement as per the IS:1343- 2012.	**07**
		OR	
Q.4	**(a)**	Explain the various modes of failure that are encountered in prestressed concrete beams subjected to bending moment, shear force, and torsion simultaneously.	**03**
	(b)	Write a note on the computation of the ultimate shear resistance of the prestressed concrete section when the section is cracked, and uncracked in flexure.	**04**
	(c)	Explain the reinforcement provisions for resisting combined shear, torsion, and bending stresses in prestressed concrete according to IS:1343-2012.	**07**
Q.5	**(a)**	Enlist various tension members of prestressed concrete and explain the elastic design of prestressed tension member.	**03**
	(b)	Discuss the maximum allowable compressive stress limits in flexure due to prestressing at both the service stage and transfer stage for post-tensioned and pre-tensioned members, as per IS:1343-2012.	**04**
	(c)	Describe composite prestressed construction and its advantages. Additionally, provide a detailed sketch of composite bridge decks incorporating precast prestressed elements.	**07**
		OR	
Q.5	**(a)**	Justify the statement that the use of high-strength concrete and high-tensile steel is essential in prestressed concrete.	**03**
	(b)	Describe the stresses that occur in a short prestressed concrete column during the transfer stage and under service conditions.	**04**
	(c)	A simply supported prestressed concrete beam with 10 m span and a rectangular section of 600 x 900 mm is subjected to prestressing force of 5600 kN applied at an eccentricity of 200 mm below the centroid of the section. Find top and bottom fibre stresses at transfer and after application of live load 80 kN/m. Consider losses 15%. Draw stress distribution diagram at mid span for stresses at transfer stage and at the service stage.	**07**

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