Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII (NEW) EXAMINATION – SUMMER 2022

Subject Code:3170624 Date:14/06/2022

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. **Use of IS: 1343 (2012) is permitted.**

			MARKS
Q.1	**(a)**	Explain the basic concept of Prestressed Concrete.	**03**
	(b)	State the advantages and disadvantages of Prestressed concrete.	**04**
	(c)	A rectangular concrete beam, 300mm deep and 200mm wide, is prestressed by means of 15 wires of 5mm diameter located 65mm from the bottom of the beam and 3 wires of 5mm diameter, 25mm from the top. Assuming the initial prestress in the steel as 850 N/mm^2, calculate the percentage loss of stress immediately after transfer, allowing for the loss of stress due to elastic deformation of concrete only. Take E_s = 210 kN/m^2 and E_c = 31.5 kN/m^2.	**07**
Q.2	**(a)**	List the various types of loss of prestress in pre-tensioned and post-tensioned members.	**03**
	(b)	Distinguish between Pre-tensioned and Post-tensioned Concrete members.	**04**
	(c)	A post-tensioned prestressed beam of rectangular section 250mm wide is to be designed for an imposed load of 12 kN/m, uniformly distributed on a simply supported span of 12m. The stress in the concrete must not exceed 17 N/mm^2 in compression or 1.4 N/mm^2 in tension at any stage and the loss of prestress may be assumed to be 15%. Calculate (a) the minimum possible depth of the beam; (b) for the section provided, the minimum prestressing force and the corresponding eccentricity.	**07**
		OR	
	(c)	A simply supported prestressed concrete beam with a rectangular section150mm wide, 300mm deep supports a uniformlydistributed load of 4 kN/m, which includes the self-weight of the beam. Theeffective span of the beam is 5 m. The beam is concentrically prestressedby cable carrying a force of 180 kN. Locate the position of the pressure linein the beam.	**07**
Q.3	**(a)**	List the various types of tensioning devices used in prestressed concrete.	**03**
	(b)	State the assumptions made in the design of prestressed concrete members for the limit state of collapse in flexure.	**04**
	(c)	An unsymmetrical I-section beam is used to support a LL of 3 kN/m over a simply supported span of 10m. The sectional details are: Top flange 300mm wide and 60mm thick; bottom flange 150mm wide and 60mm thick; web thickness 80mm; overall depth of beam 500mm. At the center of the span, the effective prestressing force of 150 kN is	**07**

located at 50mm from the soffit of the beam. Estimate the stresses at the mid-span of the beam for the following combinations: (a) Prestress + self-weight; (b) Prestress + self-weight + LL.

OR

Q.3	**(a)**	Explain the difference between Immediate and Time-dependent losses inPrestressed concrete sections.	**03**
	(b)	State the maximum permissible compressive stress in flexure at the transfer stage and service stage.	**04**
	(c)	A 6m long simply supported rectangular beam of cross-section 300mm deep and 200mm wide is prestressed by means of 15 wires of 5mm diameter located 65mm from the bottom of the beam and 3 wires of 5mm diameter, 25mm from the top. Assuming the prestress in the steel as 900 N/mm^2, calculate the stresses at the extreme fibres of the mid-span section when the beam is subjected to uniformly distributed LL of 5 kN/m in addition to its own self-weight. Take density of concrete as 24 kN/m^3.	**07**
Q.4	**(a)**	Explain the concept of load balancing.	**03**
	(b)	Explain the different modes of flexural failure observed in prestressed concrete beams?	**04**
	(c)	A bonded prestressed concrete beam is of rectangular section of width400mm and overall depth 1200mm. The tendons consisting of 3300 $mm^2$of standard strands with characteristic strength of 1700 N/mm2. The strandsare located at 870 mm from the top face of the beam. The characteristiccube strength of concrete is 60 N/mm^2. Estimate the ultimate moment capacity of section using IS 1343 (2012) recommendations.	**07**

OR

Q.4	**(a)**	Explain drying shrinkage strain and autogenous shrinkage strain.	**03**
	(b)	State the assumptions of Strain compatibility method.	**04**
	(c)	The floor slab for an auditorium of span 10m is to be designed as a one-way prestressed concrete slab with parallel post-tensioned cables in each of which the force at transfer is 500 kN. The slab is required to support a uniformly distributed LL of 25 kN/m^2 with compressive and tensile stress in concrete at any stage not exceeding 15 N/mm^2 and zero respectively. Design the suitable thickness for the slab and estimate the maximum horizontal spacing of the cables and their position at the mid-span section. Assume the prestress loss ratio as 0.80.	**07**
Q.5	**(a)**	Explain transmission length in pre-tensioned members.	**03**
	(b)	State the four fundamental conditions for stresses at transfer and service stage.	**04**
	(c)	Explain stress distribution in the end block in the prestressed concrete beam.	**07**

OR

Q.5	**(a)**	What is creep in prestressed concrete? What are the factors that affect creep of concrete?	**03**
	(b)	Discuss IS 1343 recommendations for design of prestressed memberssubjected to shear.	**04**
	(c)	Compute the bursting force and Design suitable anchorage zone reinforcementaccording IS 1343. The end block of size 200mm wide and 300mm deep ispost tensioned with two Freyssinet anchorage each of 100 mm diameter withtheir centers located at 75 mm from the top and bottom of the beam. The forcetransmitted by each anchorage being 2000 kN.	**07**

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