Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

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

Subject Code:3170624 Date:16-01-2023

Subject Name:Design of Prestressed Concrete structures

Time:10:30 AM TO 01:00 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)**	What are the applications of prestressed concrete?	**03**
	(b)	What is the need for the use of high strength concrete and tensile steel in prestressed concrete?	**04**
	(c)	A concrete beam having a rectangular section 100 × 300 mm is prestressed by a parabolic cable with an initial prestressing force of 260 kN. The cable has an eccentricity of 50 mm at the centre and concentric at the supports. If the span of the beam is 12 m and subjected to a live load of 5 kN/m. Calculate the short term deflection at midspan. Assume Ec = 38 kN/mm^2, creep coefficient = 2, loss of prestress = 20%. Estimate the long-term deflection.	**07**
Q.2	**(a)**	Define the losses present in post-tensioned member?	**03**
	(b)	Write about pressure line concept.	**04**
	(c)	A pretensioned beam 250 mm wide and 360 mm deep is prestressed by 10 wires of 8mm dia. Initial stress to 1000 N/mm^2. The centroid of the steel wires is located at 105mm from the soffit. Determine the max.stress in concrete immediately after transfer allowing elastic shortening of concrete only at the level of centroid of the steel. If however, the concrete is subjected to additional shortening due to the creep and shrinkage and the steel is subjected to relaxation of stress of 5% of initial stress. Find the final percentage of loss of stress in steel wires. Take Es=210 kN/mm^2, Ec=36.85 kN/mm^2, ϕ=1.60, take residual shrinkage strain = 3X10^{-4}.	**07**
		OR	
	(c)	A PSC beam of 230 mm wide and 450 mm deep is used over an span of 4m is pre stressed by a cable carrying a force of 650 kN & located at an eccentricity of 75mm. The beam supports three concentrated loads of 25 kN at each quarter span points. Determine the location of the pressure line in beam at centre, quarter & support sections. Neglect the moment due to self weight of the beam.	**07**
Q.3	**(a)**	Write advantages and disadvantages of prestressed concrete	**03**
	(b)	List the factors influencing the short term and long term deflections of prestressed concrete members.	**04**
	(c)	An unsymmetrical I section having top flange 750 x 200 mm bottom flange 450 x 250 mm thickness of web 150mm overall depth 1000mm. If permissible tensile and compressive stress at transfer and working load are not to exceed zero in tension 15 N/mm^2 in compression. Determine P and e to resist self weight and applied moment 1012 kNm and 450 kNm. Assume loss of pre stress 15%.	**07**

OR

Q.3 **(a)** Discuss IS 1343 recommendations for design of prestressed members subjected to bending and torsion. **03**

(b) Explain the different modes of flexural failure observed in prestressed concrete beams? **04**

(c) A box girder of pre-stressed concrete bridge of span 40m has overall dimensions of 1200mm by 1800mm. The uniform thickness of walls 200mm. The live load analysis indicates a maximum live load moment of 3000 kN at centre of span. The beam is pre-stressed by parabolic cables with an effective force of 8000 kN. The cables which are concentric at supports have an eccentricity of 800mm at centre of span section. Compute the resultant stresses at centre of span section using the internal resisting couple method. **07**

Q.4 **(a)** Explain drying shrinkage strain and autogenous shrinkage strain. **03**

(b) Enumerate the requirements of end blocks in post-tensioned pre-stressed concrete element. **04**

(c) A beam of symmetrical I-section spanning 8 m has flange width of 150 mm and flange thickness of 80 mm respectively. The overall depth of the beam is 450 mm. Thickness of web is 80 mm. The beam is prestressed by a parabolic cable with an eccentricity of 150 mm at the centre of the span and zero at the supports. The Live Load on the beam is 3kN/m. (1) Determine the effective force in the cable for balancing the Dead Load and Live Load on the beams (2) Calculate the shift of the pressure line from the tendon centre line. **07**

OR

Q.4 **(a)** Explain the concept of load balancing. **03**

(b) State the assumptions of Strain compatibility method. **04**

(c) A PSC beam of span 8m has the following data: Area $=32\times10^3$ mm^2, E=38 kN/m^2, width of gyration 72 mm Cable: parabolic, 6 wires of 7 mm HTS, concentric at supports and eccentric by 50mm at mid span. Fpe= 1000 N/mm^2 Determine the deflection for the following cases: i) Self weight+ Prestress
ii) Self weight + Prestress +Live load of 3 kN/m **07**

Q.5 **(a)** Enlist various loads acting on bridges. **03**

(b) Define transmission length, and what is expression of it as per IS 1343 (2012) recommendations. **04**

(c) Compute the bursting force and Design suitable anchorage zone reinforcement according IS 1343. The end block of size 200mm wide and 300mm deep is post tensioned with two Freyssinet anchorage each of 100 mm diameter with their centers located at 75 mm from the top and bottom of the beam. The force transmitted by each anchorage being 3000 kN. **07**

OR

Q.5 **(a)** Distinguish between creep and shrinkage. **03**

(b) Distinguish between web-shear, flexural and flexure shear cracks in concrete beams with sketches. **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 400 kN. The slab is required to support a uniformly distributed L.L of 26 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 0.75. **07**

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