Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- VII EXAMINATION-SUMMER 2023

Subject Code: 3170624 Date: 21/06/2023

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 is basic principle of prestressed concrete	**03**
	(b)	Explain the various losses of prestress in post-tensioned members.	**04**
	(c)	A post-tensioned concrete beam of rectangular section, 100 mm wide and 300 mm deep, is stressed by a parabolic cable with zero eccentricity at the supports and an eccentricity of 50 mm at the centre of span. The area of the cable is 200 mm^2 and initial stress in the cable is 1200 N/mm^2. If the ultimate creep strain is 30 x 10^{-6} mm/mm per N/mm^2 of stress and modulus of elasticity of steel is 210 mm^2, compute the loss of stress in steel only due to creep of concrete. A =3x10^2 mm^2 P = (200 x 1200) = 240,000 N I=225 X 10^6 mm^4 e=50 mm	**07**
Q.2	**(a)**	Distinguish between creep and shrinkage.	**03**
	(b)	What are the advantages and disadvantages 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/mm^2 respectively. Estimate the percentage loss of stress in steel due to elastic deformation of concrete if the area of steel wires is 188 $mm^{2.}$ Modular ratio: 6	**07**
		OR	
	(c)	A concrete beam is prestressed by a cable carrying an initial prestressing force of 300 kN. The cross-sectional area of the wires in the cable is 300 mm^2. Calculate the percentage loss of stress in the cable only due to shrinkage of concrete using IS: 1343 recommendations assuming the beam to be, (a) pre-tensioned and (b) post-tensioned. Assume E_s = 210 kN/mm^2 and age of concrete at transfer = 8 days.	**07**
Q.3	**(a)**	What are the different types of flexural failure modes observed in prestressed concrete beam?	**03**
	(b)	What is anchorage slip? How do you compute the loss of stress due to anchorage slip?	**04**
	(c)	The cross-section of a symmetrical I-section prestressed beam is 300 mm by 700 mm (overall), with flange and web 100 mm thick. The beam is posttensioned by cables containing 40 wires of 5 mm diameter high-tensile steel wires at an eccentricity of 200mm. The 28- days strength of concrete incompression is 40N/mm^2. Assuming that the grouting of the tendons is 100 percent effective, determine the ultimate moment of resistance of the section using IS 1343 (2012) recommendations.	**07**

OR

Q.3 **(a)** Under what situations and type of structures would you recommend the use of unbonded tendons? **03**

(b) Distinguish between Pre-tensioned and Post-tensioned 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/mm2 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**

Q.4 **(a)** What is creep in prestressed concrete? What are the factors that affect creep of concrete? **03**

(b) Distinguish between web shear, flexural and flexure-shear cracks in concrete beam with sketches. **04**

(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 75 mm. 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**

OR

Q.4 **(a)** Enlist the assumptions of Strain compatibility method **03**

(b) What is creep in prestressed concrete? What are the factors that affect creep of concrete? **04**

(c) A bonded prestressed concrete beam is of rectangular section of width 400 mm and overall depth 1200 mm. The tendons consisting of 3300 mm^2 of standard strands with characteristic strength of 1700 N/mm2. The strands are located at 870 mm from the top face of the beam. The characteristic cube strength of concrete is 60 N/mm^2. Estimate the ultimate moment capacity of section using IS 1343 (2012) recommendations. **07**

Q.5 **(a)** Define the terms: (1) Pretensioning (2) Tendon (3) Anchorage **03**

(b) Explain transmission length in pre-tensioned members. **04**

(c) A pretensioned T section has a flange 1200mm wide and 150mm thick. The width and depth of the rib are 300mm and 1500mm respectively. The high tensile steel has an area of 4700mm^2 and is located at an effective depth of 1600mm.calculate the flexural strength of T section. **07**
(Assume f_{ck} = 40N/mm^2, f_p = 1600N/mm^2 and use IS Code method)

OR

Q.5 **(a)** Define (1) Post-tensioning (2) Bonded Prestressed Concrete (3) Degree of Prestressing. **03**

(b) State the assumptions made in the design of prestressed concrete members for the limit state of collapse in flexure. **04**

(c) A PSC beam of span 8m has the following data: Area =32×10^3 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. **07**
Fpe= 1000 N/mm^2
Determine the deflection for the following cases:
i) Self weight+ Prestress
ii) ii) Self weight + Prestress +Live load of 3 kN/m

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