Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 29-05-2025 **Time:** 09:30 am – 12:30 pm

School: SOE	**Program:** Civil Engineering	
Course Code: CIV3047	**Course Name:** Fundamentals of PreStressed Concrete Design	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3
Marks	28	48	24

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Define the following terms (i) Partial prestressing (ii) Full prestressing.	**2 Marks**	**L1**	**CO1**
2.	List the benefits of pre stressed concrete structures.	**2 Marks**	**L1**	**CO1**
3.	Outline the differences between RCC and PSC structures.	**2 Marks**	**L1**	**CO1**
4.	Explain hydrogen embrittlement in steel.	**2 Marks**	**L2**	**CO1**
5.	List the various types of loss of pre stress in pre tensioned concrete.	**2 Marks**	**L1**	**CO2**
6.	With usual notations, write the expression used to calculate loss of pre stress due to elastic deformation of concrete.	**2 Marks**	**L1**	**CO2**
7.	What are anchorage slip and friction losses in PSC members?	**2 Marks**	**L1**	**CO2**
8.	Outline the factors influencing deflections in PSC sections.	**2 Marks**	**L1**	**CO2**
9.	List the assumptions made in strain compatibility method of analysis of beams.	**2 Marks**	**L1**	**CO3**
10.	Describe briefly the flexural failure of over reinforced sections.	**2 Marks**	**L2**	**CO3**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	A rectangular concrete beam 300 mm wide and 800 mm deep supports two concentrated loads of 20 kN each at the third point of a span of 9m: a) Suggest a suitable cable profile. If the eccentricity of the cable profile is 100 mm for the middle third portion of the beam, calculate the prestressing force required to balance the bending effect of the concentrated loads (neglect self-weight of beam) b) For the same cable profile, find the effective force in the cable if the resultant stress due to all the loads is zero at the bottom fibre of the mid-span section.	**10 Marks**	**L3**	**CO1**
	b.	The cross-section of a prestressed concrete beam used over a span of 6m is 100 mm wide and 300 mm deep. The initial stress in the tendons located at a constant eccentricity of 50 mm is 1000 N/mm^2. The sectional area of the tendons is 100 mm^2. Determine the percentage increase in stress in the wires when the beam supports a live load of 4 kN/m. Density of concrete is 24 kN/m^3. Modulus of elasticity of concrete is 36 kN/mm^2 and steel is 210 kN/mm^2 respectively.	**10 Marks**	**L3**	**CO1**
		Or			
12.	**a.**	A rectangular prestressed beam 150 mm wide and 300 mm deep is used over an effective span of 10m. The cable with zero eccentricity at the supports and linearly varying to 50 mm at the centre, carries an effective prestressing force of 500 kN. Find the magnitude of the concentrated load Q located at the centre of the span for the following conditions: • If the load counteracts the bending effect of the prestressing force (neglect self-weight of beam) • If the pressure line passes through the upper kern of the section under the action of external load, self-weight, and prestress.	**10 Marks**	**L3**	**CO1**
	b.	A rectangular concrete beam of cross section 120 mm wide and 300 mm deep is prestressed by a straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. The beam supports an imposed load of 3.14 kN/m over a span of 6m. If the modulus of rupture of concrete is 5 N/mm^2, calculate the load factor against cracking assuming the density of concrete as 24 kN/m^3.	**10 Marks**	**L3**	**CO1**

13.	**a.**	A pre-tensioned beam having 200mm width and 300 mm depth is prestressed by 10 wires of 7mm diameter initially stressed to 1200N/mm^2, with their centroids located 100mm from the	**20 Marks**	**L3**	**CO2**

		soffit. Calculate the maximum stress in concrete immediately after transfer, allowing only for elastic shortening of concrete. If the concrete further undergoes shortening due to creep and shrinkage while there is relaxation of 5% of steel stress, calculate the final percentage loss of stress. Take E_s = 210kN/mm^2, f_{ck} = 42N/mm^2, Creep Coefficient, Φ = 1.6, Total residual shrinkage strain = 3x10^{-4}.			
		Or			
14.	**a.**	A prestressed concrete pile, 250x250 mm, contains 60 pre-tensioned wires, each of 2mm diameter, uniformly distributed over the section. The wires are initially tensioned on the prestressing bed with a total force of 300 kN. Calculate the final stress in concrete and the percentage loss of stress in steel after all losses. Assume E_s = 210 kN/mm^2 and E_c = 32 kN/mm^2, Creep coefficient = 1.5, Shrinkage strain = 200x10^{-6}, Relaxation of steel stress = 5% of initial stress.	**20 Marks**	**L3**	**CO2**

15.	**a.**	A prestressed concrete beam of rectangular section 120mm wide x 300mm deep, spans over 6m. The beam is prestressed by a straight cable carrying effective force of 200kN at an eccentricity of 50mm. Take Ec as 38kN/mm^2 and ρ_c= 24 kN/m^3. Determine the deflection at center of span under prestress and self-weight. Also calculate the magnitude of the uniformly distributed live load which will nullify the deflection due to prestress and self-weight.	**10 Marks**	**L3**	**CO2**
	b.	A prestressed concrete slab bridge deck designed for IRC loads has the following parameters. Estimate the long-term deflection of the slab using the if the effective span of the slab is 10.4m. Take the total dead load as 14 kN/m, live load at center of span as 93.2 kN, and effective prestressing force after losses is 1350 kN/mm width of slab. Assume E_c = 33 kN/mm^2, I = 10.4x10^9 mm^4, Eccentricity of parabolic cable at center of span is 195 mm and creep coefficient as 2.5.	**10 Marks**	**L3**	**CO2**
		Or			
16.	**a.**	The deck of prestressed concrete culvert is made up of a slab of 500 mm thick. The slab is spanning over 10.4 m and supports a total UDL of 33.5 kN/m, including DL and LL. The modulus of elasticity of concrete is 38 kN/mm^2. The concrete slab is prestressed by a straight cable each containing 12 high tensile wires of 7mm diameter stressed to 1200 N/mm^2 at a constant eccentricity of 195 mm. The cables are spaced at 328 mm intervals in the transverse direction. Estimate the instantaneous deflection of the slab at center of span under prestress and the imposed loads.	**10 Marks**	**L3**	**CO2**
	b.	A post-tensioned roof girder spanning over 30m has an unsymmetrical I section with second moment of area of section	**10 Marks**	**L3**	**CO2**

		as 72490 x 10^6 mm^4 and an overall depth of 1300 mm. The effective eccentricity of the group of cables is 580 mm at the centre of span and 170 mm at the supports. The cables carry an initial prestressing force of 3200 kN. The self-weight of the girder is 10.8 kN/m and the live load on the girder is 9 kN/m. The modulus of elasticity of concrete is 34 kN/mm^2. If the creep coefficient is 1.6, and the total loss of prestress is 15%, calculate the deflections at the following stages and compare them with the permissible values according to the Indian Standard Code (IS:1343) limits: (i) Instantaneous deflection due to prestress and self-weight (ii) Resultant maximum long-term deflection allowing for loss of prestress and creep of concrete.			

17.	**a.**	A pretensioned prestressed concrete beam having a rectangular section with a width of 150 mm and overall depth of 350 mm is prestressed by tendons of effective area 461 mm^2 at an effective depth of 300 mm. Assuming a characteristic strength of concrete and steel as 40 and 1600 N/mm^2, estimate the ultimate flexural strength of the section using the provisions of IS 1343 code.	**15 Marks**	**L3**	**CO3**
	b.	Describe the assumptions made in strain compatibility method of flexural analysis of PSC members.	**5 Marks**	**L2**	**CO3**
		Or			
18.	**a.**	A pretensioned prestressed concrete beam having a rectangular section with a width of 200 mm and overall depth of 400 mm is prestressed by tendons of effective area 450 mm^2 at an effective depth of 350 mm. Assuming a characteristic strength of concrete and steel as 40 and 1500 N/mm^2, estimate the ultimate flexural strength of the section using the provisions of IS 1343 code.	**15 Marks**	**L3**	**CO3**
	b.	Explain the various types of flexural failure of PSC beams.	**5 Marks**	**L2**	**CO3**