Name: Enrolment No:	UPES UNIVERSITY OF TOMORROW

UPES, Dehradun

End Semester Examination, December 2023

Programme Name: B Tech Civil Engineering
Semester : VII
Course Name : Prestressed Concrete **Time : 3 hrs**
Course Code : CIVL 3014 **Max. Marks: 100**
Nos. of page(s) : 2

Instructions: 1. Any missing data may be suitable assumed.
2. Use of the code IS 1343:2012 is permitted in the classroom.

SECTION A

S. No.		Marks	CO
Q 1	What is circular prestressing? Explain with sketches the different shapes of prestressed concrete water tanks mentioning their advantages.	1+3	CO1
Q 2	Explain with sketches the load-moment interaction diagram in column.	4	CO3
Q 3	What is a composite section in the context of prestressed concrete? Write the advantages of the composite sections.	2+2	CO4
Q 4	Outline the procedure for the design of a prestressed concrete section of a beam for flexure	4	CO4
Q 5	List various losses in pre-tensioned and post-tensioned concrete.	4	CO1

SECTION B

Q 6	A prestressed concrete beam of 500 mm wide and 750 mm deep is simply supported over a span of 7.3 meter and is prestressed with a parabolic cable having zero eccentricity at the support and 145 mm at the centre span. The live load on the beam is 45 kN/m. If the prestressing force at service is 1620 kN, find the bottom and top fibre stress (in N/mm^2) at the centre of the span.	10	CO2
Q 7	A pretensioned, T-section has a flange which is 400 mm wide and 250 mm thick. The rib is 150 mm wide by 400 mm deep. The effective depth of the cross-section is 600 mm. Given area of pre-stressing steel is 250 mm^2, grade of concrete is M50 and f_{pu} = 1600 N/mm^2, estimate the ultimate flexural capacity of the T-section.	10	CO4

Q 8	A post-tensioned prestressed beam of rectangular section 300 mm wide is to be designed for an imposed load of 15 kN/m, uniformly distributed on a span of 15 m. The stress in the concrete must not exceed 17 N/mm^2 in compression or 1.4 N/mm^2 in tension at any time and the loss of prestress may be assumed to be 10 per cent. Calculate (a) the minimum possible depth of the beam (b) for the section provided, the minimum prestressing force and the corresponding eccentricity.	**10**	**CO3**
Q 9	A prestressed girder of rectangular section 200 mm wide and 400 mm deep, is to be designed to support an ultimate shear force of 180 kN. The uniform prestress across the section is 5 N/mm^2. Given the characteristic cube strength of concrete as 50 N/mm^2 and Fe-415 HYSD bars of 8 mm diameter, design suitable spacing for the stirrups. Assume cover to the reinforcement as 40 mm. OR A concrete beam of span 15 m, 150 mm wide and 350 mm deep is prestressed with a parabolic cable having an eccentricity of 50 mm at supports and 70 mm eccentricity at the mid-span. If the cable is tensioned from one end only, calculate the percentage loss of stress in the cable due to friction. Co-efficient of friction for the cable is 0.35 and co-efficient of wave effect is 0.0015 per meter.	**10**	**CO4**
	SECTION-C		
Q 10	A precast pretensioned beam of rectangular section has a breadth of 150 mm and a depth of 300 mm. The beam with an effective span of 6 m, is prestressed by tendons whose eccentricity is such that the top fibre stress due to prestress is zero. The initial force in the tendons is 180 kN. The loss of prestress may be assumed to be 20 per cent. The beam is incorporated in a composite T-beam by casting a top flange of breadth 450 mm and thickness 50 mm. If the composite beam supports a live load of 10 kN/m^2, calculate the resultant stresses developed in the precast and in situ cast concrete assuming the pretensioned beam as (a) unpropped and (b) propped during the casting of the slab. Assume the same modulus of elasticity for concrete in precast beam and in situ cast slab. OR A post-tensioned concrete beam 100 mm x 300 mm spanning over 10 m is stressed by successive tensioning and anchoring of three cables 1, 2 and 3 respectively. The cross-sectional area of each cable is 200 mm^2 and the initial stress in the cable is 1200 N/mm^2. The first cable is parabolic with an eccentricity of 50 mm below the centroidal axis at the centre span and 50 mm above the centroidal axis at the support sections. The second cable is parabolic with zero eccentricity at the supports and an eccentricity of 50 mm at the centre span. The third cable is straight with a uniform eccentricity of 50 mm below the centroidal axis. Estimate the percentage loss of stress in each of the	**20**	**CO2**

	cables, if they are successively tensioned and anchored. Assume modular ratio to be 6.		
Q 11	A concrete beam of rectangular section 200 mm wide and 350 mm deep, is prestressed by 7 wires of 7 mm diameter located at an eccentricity of 60 mm, the initial stress in the wires being 1250 N/mm^2. Calculate the loss of stress in steel due to creep and shrinkage after 180 days. E_s = 210 kN/mm^2, Grade of concrete is M45 and Relative Humidity (RH) is 80%.	**20**	**CO1**