Reg. No.

IANIPAL INSTITUTE OF TECHNOLOGY

ANIPAL A constituent unit of MAHE, Manipal)

VII SEMESTER B. TECH (CIVIL) END SEMESTER EXAMINATIONS **DECEMBER 2022** SUBJECT: PRE-STRESSED CONCRETE DESIGN [CIE 4066]

Date of Exam: 28 /11/2022

Time of Exam 9.00am to 12.00pm

Max. Marks: 50

Instructions to Candidates:

- Answer ALL the questions & missing data may be suitably assumed
 Use of IS 1343 2012 is allowed

Q.NO.	QUESTION		CO	
1A.	A simply supported PSC beam of span 12m is pre-stressed with a parabolic cable having zero eccentricity at supports and eccentricity of 360 mm below center of gravity of concrete (c.g.c.) at mid span. The c/s area of prestressing steel 500 mm ² is tensioned from left end with an initial prestress of 700MPa. Use the following details:			
	$E_c=35~kN/mm^2,~Es=200~kN/mm^2$, Relaxation of steel = 4% of initial stress, shrinkage strain = $2x10^{-4}$, creep coefficient 1.6, anchorage slip = 2 mm, use uncoated stress relieved strand and duct is made of coated with lead, stress in concrete at level of steel = $5N/mm^2$.			
	 i) Determine the losses to be considered for the design of a post tensioned beam. ii) Compute the jacking force required in the cable if the stress required after anchoring is 700MPa. 			
1B.	 A rectangular PSC beam of cross section 350mm wide and 700mm deep has a span of 12m. It is pre-stressed with an initial pre-stressing force of 700kN. The loss of prestress is 20% of initial prestress. The beam carries working load of 8kN/m throughout the span. Take creep coefficient =1.5 and M40 grade of concrete. i) Suggest a suitable eccentricity to limit the deflection under transfer stage as per codal provisions. ii) What is the magnitude of uniformly distributed load that can be applied within the serviceability criteria if an eccentricity of 300mm is provided? 	05	CO4	
2A.	Define the following: a) Thermo electric prestressing b) Chemical prestressing	02	CO1	
2B.	A simply supported PSC beam of span 15m is pre-stressed with a parabolic cable having zero eccentricity at supports and eccentricity of 100mm below center of gravity of concrete (c.g.c.) at mid span. The initial pre-stressing force induced is 500 kN. The cross section of beam is an unsymmetrical I-section with top flange 450mm X 100 mm, web 100mm X 600mm and bottom flange 350mm X 200mm. I = 1.79×10^{10} mm ⁴ , Yt = 470mm. The beam is subjected to working load of 10 kN/m throughout the span. Loss of prestress is 20%. Beam is fully pre-stressed pre-tensioned member. Draw the stress distribution	04	CO3	

	diagram across the depth at mid span for transfer and working stage.				
2C.	A pre tensioned beam of span 12m with an Unsymmetrical I section having overall depth of 950mm and c/s area $1.32 \times 10^5 \text{ mm}^2$, Yt = 312.73mm and I= 7.79 x 10^9 mm^4 . It is subjected to a live load of 10kN/m throughout its span. M40 grade of concrete is used and the beam is designed as type 2 member, consider loss 20%. Limiting the stresses as per IS 1343 provisions, determine a suitable prestressing force and eccentricity that is required.	04	CO3		
3A.	A prestressing force 400KN is transmitted through a Fressynet anchor of diameter 135mm which is located at center of the end block of section 200mm X 350mm. Design the end block with Fe-415 steel. Grade of concrete is M-35				
3B.	A simply supported bonded pre-tensioned beam of span 13m loaded with a working load of 17kN/m. Beam is prestressed with 15 number of indented wires 5 mm diameter with an initial prestress of 1200 N/ mm² and an effective prestress of 1000 N/mm². The stress in the wires at critical section is 1200 N/mm². The effective cover to the centroid of pre-stressing steel is 275mm. The grade of concrete is M40 and bond strength 1.9MPa. Check for the development length and design the end zone reinforcement using 6mm diameter 2-legged stirrups of HYSD steel. Section Properties are as follows:Top flange400mm × 250mm Bottom flangeWeb150mm × 600mm 200mm × 250mm				
4 A .	A PSC beam designed to carry a live load of 15 kN/m over a span of 12 m. Grade of Concrete: M-35; Characteristic Strength of Steel: 1700 N/mm²; Area of steel: 500mm²; Effective pre-stressing force: 650kN; Cable profile: Parabolic which is concentric at supports and having an eccentricity of 250mm at mid span. Effective cover to longitudinal reinforcement: 100mm. Analyse the post tensioned beam for limit state of collapse in flexure. Beam Cross section details shown below.Top flange450mm × 150mm 800mm 450mm × 630mm Bottom flangeyt472.09mm 472.09mm				
4B .	A PSC beam designed to carry a live load of 15 kN/m over a span of 12 m. Grade of Concrete: M-35; Characteristic Strength of Steel: 1700 N/mm²; Area of steel: 500mm²; Effective pre-stressing force: 650kN; Cable profile: Parabolic which is concentric at supports and having an eccentricity of 250mm at mid span. Effective cover to longitudinal reinforcement: 100mm. Design the Shear reinforcement at support. Use 8mm diameter HYSD bars. Take Ultimate shear resistance of section cracked in flexture 100kN. Beam Cross section details shown below.Top flange450mm × 150mm U00kN. Beam U00kN. Beam U00kN. Beam U00kN. Beam U150mm × 630mm U1				
4C.	Define transmission zone and explain its significance in pretensioned prestressed members.				

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5A	The prete Consider character pre-stress full prest						
	section given below.						
		Top flange	$410 \text{mm} \times 140 \text{mm}$				
		Web	140 mm \times 620 mm				
		Bottom flange	$200 \text{mm} \times 200 \text{mm}$				
		Ι	$1.79 \text{ x } 10^{10} \text{ mm}^4$				
		y _t	420.62mm				
	The pretensioned beam of span 10m loaded with a working load of 15kN/m.						
	Consider prestressing force as 1000kN and M40 grade concrete. The						
	characteristic strength of HTS wires used for tendon is 1600 N/mm ² , Loss of						
	pre-stress is 20%. Determine the limiting zone of eccentricity for the fully						
	prestress	restressed beam. The trial section given below.					
5B		Top flange	410 mm \times 140 mm		05	CO3	
30		Web	140 mm \times 620 mm				
		Bottom flange	$200 \text{mm} \times 200 \text{mm}$				
		Ι	$1.79 \text{ x } 10^{10} \text{ mm}^4$				
		y _t	420.62mm				