C **Reg. No. :** | | | | | | | | | | |

Question Paper Code: 52U03

M.E. DEGREE EXAMINATION, MAY 2018

Second Semester

Structural Engineering

15PSE203– PRESTRESSED CONCRETE STRUCTURES

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 1= 5 Marks)

1. The grade of concrete for prestressed members should be in the range of CO1- R

   (a) M20 to M30 (b) M80 to M100 (c) M30 to M60 (d) M60 to M 100

2. When the principal stresses are excessive and thin webs are used there will be_____ CO2 -R

   (a) shear failure (b) web crushing failure (c) anchorage failure (d) flexural failure

3. What is the value of secondary moment in a continuous beam with concordant cable profile? CO3- R

   (a) 0.024 (b) 0 (c) 0.028 (d) 0.031

4. Prestressed concrete tanks are generally cylindrical with diameters upto CO4 -R

   (a) 200 m (b) 100 m (c) 300 m (d) 400 m

5. Composite construction using PSC and CIP concrete is adopted in CO5- R

   (a) water tanks (b) pipes (c) bridges (d) poles

PART – B (5 x 3= 15Marks)

6.	Distinguish between creep and shrinkage of concrete.	CO1-U
7.	Define degree of prestressing.	CO2-R
8.	What are cap cables and where they are used?	CO3-U
9.	What is an interaction diagram? Explain with a sketch.	CO4-U
10.	Define unpropped construction in composite PSC construction.	CO5-R

PART – C (5 x 16= 80Marks)

11.	(a)	Explain in detail about the various systems of prestressing.	CO1- U	(16)
		Or		
	(b)	A pretensioned beam 200 mm wide and 300 mm deep is prestressed by 10 wires of 7 mm diameter initially stressed to 1200 N/mm^2 with their centroids located 100 mm from the soffit. Find the maximum stress in concrete immediately after transfer allowing only for elastic shortening. If the concrete undergoes further shortening due to creep and shrinkage while there is a relaxation of 5% of steel stress, estimate the final % loss of stress in wires using the following data: E_s = 210 KN/mm^2. $E_c = 5700\sqrt{f_{ck}}$; f_{ck}= 42 N/mm^2; creep coefficient = 1.6; total residual shrinkage strain = 3×10^{-4}.	CO1- Ana	(16)
12.	(a)	The end blocks of a post-tensioned prestress concrete beam, 300mm wide and 300mm deep, is subjected to a concentric anchorage force of 832800N by a Freyssinet anchorage of area 11720m^2.Design and detail the anchorage reinforcement for end block.	CO2- App	(16)
		Or		
	(b)	The support section of a prestressed concrete beam, 100 mm wide by 250 mm deep, is required to support an ultimate shear force of 80 kN. The compressive prestress at the centroidal axis 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. If the characteristic tensile strength of the stirrups is 415 N/mm^2, design suitable shear reinforcements in the section using IS code recommendations.	CO2- App	(16)

13. (a) A continuous beam ABC (AB=BC=10m) is prestressed by a parabolic cable carrying an effective force of 200kN.The beam supports dead load and live load of 0.24kN/m and 2.36 kN/m respectively. Calculate the resultant moments developed in the beam and locate the pressure line. CO3-U (16)

Or

(b) (i) What are the various methods of achieving continuity in PSC continuous beams? Explain with neat sketches. CO3-U (8)

(ii) What is linear transformation of tendon? Explain with a sketch. CO3-U (8)

14. (a) A prestressed concrete pipe is to be designed to withstand a liquid pressure of 1.6 N/mm^2 internally. The diameter of the pipe is 1200 mm and a shell thickness of 100 mm is proposed. The maximum permissible compressive stress in concrete is 16 N/mm^2 at transfer. A residual compression of 2 N/mm^2 is expected to be maintained at service load. The possible losses in prestress can be expected to be 20%. 4 mm, 5 mm, and 7 mm high-tension wires are available. The maximum level to which they can be subjected to is 1000 N/mm^2 at the time of prestress. Permissible longitudinal tensile stress is $0.8\sqrt{f_{ci}}$. The strength of concrete at transfer is 50 N/mm^2. Check the safety of the designed pipe against longitudinal stresses as per IS 784 specifications. CO4 -App (16)

Or

(b) A cylindrical prestressed concrete water tank of internal diameter 28 m to store water to a depth of 8 m is to be designed using M-40 m Grade concrete. The thickness of tank walls is 150 mm and 5 mm diameter high-tensile wires are available for use. The permissible compressive stress in concrete at transfer is limited to 12 N/mm^2. During service, a residual compressive stress of 1 N/mm^2 is desired in the concrete. The initial stress in high-tensile wires is 1000 N/mm^2.The loss of presstress is estimated to be 20 per cent. Assuming the base slab and tank walls are monolithically cast, determine the number of turns of circumferential wire winding per metre height of the tank at base. CO4 -App (16)

15. (a) Explain, with necessary sketches, the steps in designing a partially prestressed concrete giving all the required equations and conditions. CO5-U (16)

Or

(b) A precast pretensioned beam of rectangular section has a breadth of 100 mm and a depth of 200 mm. The beam with an effective span of 5 m is prestressed by tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150 kN. The loss of prestress may be assumed to be 15%. The beam is incorporated in a composite T-beam by casting a top flange of breadth 400 mm and thickness 40 mm. If the composite beam supports a Live Load of 8 kN/m^2, calculate the resultant stresses developed in the precast and in situ cast concrete assuming the pretensioned beam as Propped during the casting of the slab. Asssume the same modulus of elasticity for concrete in precast beam and in CIP slab. CO5-App (16)