Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV/DEC 2024

CIVIL ENGINEERING

CE 7006 – DESIGN OF PRESTRESSED CONCRETE

(Regulation 2015)
(IS 1343 is permitted to use)

Time: 3hrs

Max.Marks: 100

PART- A (10 x 2 = 20 Marks)
(Answer all Questions)

Q. No	Questions	Marks
1	List different post tensioning systems that is generally used.	2
2	Why is high-tensile strength steel is needed for prestressed concrete construction?	2
3	Differentiate bonded and unbonded prestressing.	2
4	Mention the conventional failure of an over reinforced prestressed concrete beam.	2
5	Sketch the typical tensile stress distribution in an end block of a post-tensioned beam with a single anchorage.	2
6	What are the factors that influences the deflection of PSC members?	2
7	Define a concordant cable in the context of prestressed concrete design.	2
8	What are the advantages of using composite construction with in situ concrete in structural members?	2
9	What are the primary considerations in the design of a water tank?	2
10	Specify the functions of a sleeper in a railway track.	2

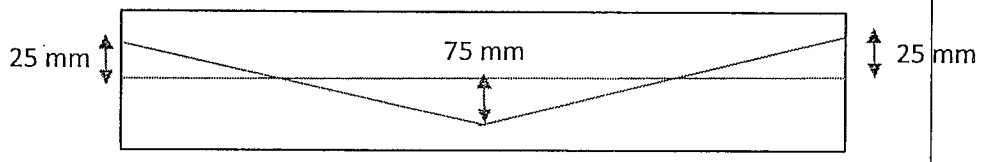
PART- B (5 x 13 = 65 Marks)
(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks
11 (a) (i)	A post tensioned prestressed concrete beam is designed to support uniformly distributed dead load and live loads of 6 kN/m and 9 kN/m respectively. The beam is simply supported over a span of 12 m. The beam is prestressed by 48 wires of 5 mm diameter at an average eccentricity 250 mm, The cross-section of the beam is a symmetrical I section 300 mm by 750 mm overall with flange and web thickness of 120 mm and 100 mm respectively. Determine the maximum stresses developed at various stages of loading if the beam is prestressed by steel stressed to initial stress of 1100 N/mm^2. Loss factor = 0.85.	13
	(OR)	
11 (b) (i)	A pretensioned beam of section 230 mm wide and 300 mm deep is prestressed by 10 wires each of 7 mm diameter initially stressed to 1100 N/mm^2 with their centroids located at 75 mm from the soffit. Estimate the loss of prestress using IS 1343. Given the following data: Relaxation of steel stress = 85 N/mm^2 Es = 210 kN/mm^2; Ec= 38 kN/mm^2 Creep co-efficient = 1.6 Residual shrinkage strain = $3x10^{-4}$	13

12 (a) (i)	A post-tensioned unbounded prestressed beam of T-section with flange width of 1100 mm and 120 mm thick, thickness of web being 250 mm is prestressed with high strength steel wires of area 4250 mm^2 located at an effective depth of 1500 mm. If the compressive strength of concrete is 40N/mm^2 and the ultimate tensile strength of wire is 1700N/mm^2, span to effective depth ratio is 20, effective prestress is 1000 N/mm^2, estimate the ultimate flexural strength of section as per IS1343 recommendations.	13
	(OR)	
12 (b) (i)	A prestressed beam of rectangular section 150 mm wide and 300 mm deep is to be designed to support an ultimate shear force of 130 kN. The uniform prestress across the section is 5 MPa. Given the characteristic cube strength of the concrete as 30 MPa, grade of steel as Fe 415, and effective cover to the reinforcement as 50 mm. Design suitable shear reinforcements according to IS 1343 recommendations.	13
13 (a) (i)	The end block of a post-tensioned prestressed member is 550 mm wide by 550mm deep. Four cables, each made up of 7 wires of 12 mm diameter strands, each carrying a force of 1000 kN are anchored 150 by 150 mm plate anchorages, located with their centres at 125 mm from the edges of the end block. The cable duct is of 50 mm diameter. The characteristic compressive strength of concrete is 45 N/mm^2. The cube strength of concrete at transfer is 25 N/mm^2. Permissible bearing stresses behind anchorages should conform to IS: 1343 code specifications. The characteristic tensile strength of steel reinforcement is 260 N/mm^2. Design suitable anchorage reinforcements for the end block and check for bearing stresses.	13
	(OR)	
13 (b) (i)	A concrete beam of T section spanning 6 m has flange width and thickness of 300 mm and 75 mm respectively. The overall depth of the beam is 600 mm. The thickness of the web is 50 mm. The beam is prestressed by a parabolic cable with an eccentricity of 125 mm at the centre below the centroid and zero at the supports with an effective force of 175 kN. Effectiveness factor is 0.75. Live load on the beam is 2.0 kN/m. Determine the short term and long-term deflections. Given the density of PSC as 25 kN/m^3 , age at transfer as 28 days and modulus of elasticity of concrete as Ec=38 kN/mm^2	13
14 (a) (i)	The mid span section of a composite T beam comprises a pretensioned beam, 250 mm wide and 800 mm deep and an in situ cast slab 900 mm wide and 150mm deep. The effective prestressing force located 200 mm from the soffit of the beam is 1800 kN. The moment due to the weight of the precast section is 300 kN.m at mid span. After this is erected in place, the top slab is cast producing a moment of 135 kN.m at mid span. After the slab concrete is hardened, the composite section is to carry a maximum live load moment of 700 kN.m. Compute the resultant final stresses at a. the top of slab, and b. the top and bottom of the precast section.	13
	(OR)	
14 (b) (i)	Estimate the ultimate moment capacity of the composite cross section shown in Q.No.14(a) using the Indian standard code provisions: Given the following data; Area of steel = 2000 mm^2 Cube strength of slab concrete =35 N/mm^2 Tensile strength of steel = 1680 N/mm^2	13
15 (a) (i)	A non-cylindrical pre-stressed concrete pipe of 1.2 m diameter and thickness of the concrete shell is 75mm is required to convey water at a working pressure of 1.5 N/mm^2. The length of the pipe is 6m. The loss ratio is 0.8. Determine the circumferential wire winding using 5mm diameter wires stretched to1200 N/mm^2. The maximum permissible tensile stress is 11.2 N/mm^2.	13
	(OR)	

15 (b) (i)	A pre-tensioned prestressed concrete pole of rectangular section 150 mm wide by 400 mm deep at the base is proposed for a pole of height 10 m. The analysis of wind loads on pile face and wires, indicate a maximum design moment of 25 kNm at the base section. The permissible compressive stress in concrete is 14 N/mm² and no tension is permitted under working loads. The loss of prestress may be taken as 30 percent. 5 mm high tensile wires initially stressed to 1500 N/mm² are available for use. Check the adequacy of the section and determine the number of wires required in the section.	**13**

PART- C (1 x 15 = 15 Marks)
(Q.No. 16 is Compulsory)

Q. No	Questions	Marks
16 (i)	A concrete beam of 10 m span is prestressed by a linearly varying cable having eccentricities as shown in Fig.Q.No.16. The force in the cable is 180 kN. The beam supports a concentrated load of 25 kN at the centre of the span. If E = 38 kN/mm². Loss ratio =0.8 and creep coefficient =1.6. Compute the short-term and long-term deflections. The cross-section of the beam is 150 mm x 300 mm.  Fig.Q.No.16	**15**