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

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

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

CIVIL ENGINEERING

CE7006 DESIGN OF PRESTRESSED CONCRETE STRUCTURES

(Regulation 2015)

Time: 3hrs **Max.Marks: 100**

(IS 1343 : 2012, IS 456 : 2000, IS 3370 : 2021 are permitted)

PART- A (10x2 = 20 Marks)

(Answer all Questions)

Q.No	Questions	Marks
1	Distinguish between bonded and un-bonded post-tensioned members.	2
2	What is creep? How does it affect prestressed members?	2
3	What are the ways of improving shear resistance of structural concrete members by prestressing techniques?	2
4	Give the assumptions made for estimating the flexural stresses of a prestressed beam.	2
5	How are the end anchorage stresses determined using Magnel method?	2
6	Discuss the factors influencing the transmission of prestressing force from steel to concrete.	2
7	Why is it advantageous to use precast prestressed units in association with in- situ cast concrete?	2
8	What is linear transformation of cable profile?	2
9	List any two types of prestressed sleepers adopted by the railways.	2
10	Differentiate between cylinder and non-cylinder pipes.	2

PART- B (5x 13 = 65 Marks)

Q.No	Questions	Marks
11 (a)	Describe in detail the pre-tensioning system and post-tensioning system. Also discuss their applications.	13
	(OR)	
11 (b)	A rectangular concrete beam 100 mm wide by 250 mm deep spanning over 8 m is prestressed by a straight cable carrying an effective prestressing force of 250 kN located at an eccentricity of 40 mm. The beam supports a live load of 1.2 kN/m. Calculate the resultant stress distribution for the centre-of-span cross-section of the beam assuming the density of concrete as 24 kN/m^3.	13
12 (a)	A pretensioned beam of rectangular section 400 mm wide by 1000 mm overall depth is prestressed by 800 mm^2 of high tensile steel wires at an eccentricity of 300 mm. If characteristic cube strength of concrete 'f_{ck}' is 40 N/mm^2 and characteristic tensile strength of prestressing steel 'f_p' = 1600 N/mm^2, calculate the ultimate flexural strength of the section using Indian Codal provisions.	13
	(OR)	
12 (b)	A prestressed beam of rectangular section 90 mm wide and 180 mm deep, is to be designed to support two imposed loads of 3.5 kN each located at one-third points over a span of 3m. If there is to be no tensile stress in the concrete at transfer and service loads, calculate the minimum prestresing force and the corresponding eccentricity. Assume a loss ratio of 0.8.	13

13 (a)	A rectangular concrete beam of cross-section 150 mm wide and 300 mm deep, is simply supported over a span of 8 m and is prestressed by means of a symmetric parabolic cable, at a distance of 75 mm from the bottom of the beam at mid span and 125 mm from the top of the beam at support sections. If the force in the cable is 350 kN and the modulus of elasticity of concrete is 38 kN/mm^2, calculate the deflection at mid-span when the beam is supporting its own weight.	13
	(OR)	
13 (b)	Design the bearing plate and the end zone reinforcement for the end block of bonded post-tensioned beam of dimension 350 mm × 500 mm according to the Indian Standard Code IS: 1343 provisions. The effective prestressing force is 900 kN and tendon is centrally placed at the ends. The strength of M50 grade concrete at transfer is 40 N/mm^2.	13
14 (a)	A precast post-tensioned beam of rectangular section 300 mm wide, 1200 mm deep and span 20 m is prestressed using parabolic cable having eccentricity of 200 mm from the soffit at the mid-span. The area of prestressing steel is 1400 mm^2 and the initial prestress is 1500 N/mm^2. The grade of concrete for the precast beam is M60. After the precast beam is erected in place, a top slab of width 1200 mm and thickness 180 mm is cast over it. The resulting composite beam carries live load of intensity 6 kN/m respectively. If unpropped composite construction is used, determine the stresses in concrete at the mid-span at service. The compressive strength of concrete in slab is 40 N/mm^2. Assume the same modulus of elasticity for concrete in precast beam and in-situ cast slab.	13
	(OR)	
14 (b)	What are the advantages and disadvantages of statically indeterminate prestressed concrete structures?	13
15 (a)	List the various merits and demerits of partial prestressing over full prestressing? Also give the applications for partially prestressing.	13
	(OR)	
15 (b)(i) (ii)	Discuss the design considerations for prestressed concrete poles. What are the typical cross sections of prestressed concrete poles adopted in various countries?	9 4

PART- C (1x 15 = 15 Marks)

(Q.No. 16 is Compulsory)

Q.No	Questions	Marks
16	A concrete beam is prestressed by a cable with an initial stress of 1000 N/mm^2 in the wires. The grade of concrete in the beam is M-50. The beam is located in an area having a relative humidity of 50 per cent. The beam is exposed to the environment on three sides having a depth of 400 mm and a width of 300 mm. The beam was cured for seven days before it was prestressed. Using the Indian Standard Code method, estimate the loss of stress in steel due to shrinkage of concrete at the age of 28 days. Assume modulus of elasticity of steel as 210 kN/mm^2	15