Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U1104

B.E. / B.Tech DEGREE EXAMINATION, APRIL 2024

Professional Elective

Civil Engineering

21CEV104- PRESTRESSED CONCRETE STRUCTURES

(Regulations 2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	A prestressed concrete rectangular beam of size 300mm X 900 mm is prestressed with an initial prestressing force of 700kN at an eccentricity of 350 mm at mid span, determine the stress at the top fiber at mid span due to prestress alone ?	CO1-App
2.	Distinguish between pretensioned and post tensioned members?	CO1-U
3.	What are the assumptions made in strain compatibility method?	CO1-U
4.	What is effective reinforcement ratio?	CO1-U
5.	What are the factors affecting deflection?	CO1-U
6.	Define anchorage zone.	CO1-U
7.	Compare propped and unpropped construction methods.	CO1-U
8.	Sketch some typical cross section of composite bridge deck with precast prestressed elements.	CO1-U
9.	What are the forces considered in the calcluation of defletcion of prestressed concrete beams ?	CO1-U
10.	Compare Prestressed cylinder and non-Cylinder Pipe.	CO1-U

PART – B (5 x 16= 80 Marks)

11.	(a)	A Post tensioned beam 250mm wide and 350mm deep is prestressed by 10wires of 8mm diameter initially stressed to 1100N/mm^2 with their centroids located 100mm from the sofit. Determine the maximum stress in concrete immediately after transfer allowing only for elastic shortening of concrete. If the concrete undergoes a further shortening due to creep and	CO2 App	(16)

shrinkage while there is a relaxation of 6% of steel wires, estimate the final percentage loss of stress in the wire using IS code regulation and the following data.
E_s= 210KN/mm^2, E_C= 36.94 KN/mm^2, creep coefficient =1.6 total residual shrinkage strain =3 X10^{-4}.

Or

(b) A prestressed concrete beam of rectangular section 150mm wide by 350 mm deep is used over an effective span of 6 m to support a uniformly distributed load of 5 KN/m, which includes the self - weight of the beam. The beam is prestressed by a straight cable carrying a force of 200kN and located at an eccentricity of 50mm. Determine the location of the thrust-line in the beam and plot its position at quarter and central span sections. CO2 App (16)

12. (a) A pretension prestressed concrete beam having a rectangular section 120 mm wide and 320 mm deep has an effective cover of 40 mm. If f_{ck} = 40 N/mm^2, f_p= 1200 N/mm^2 and the area of prestressed steel A_p = 460 mm^2, Calculate the ultimate flexural strength of section using IS 1343 provisions. CO3 App (16)

Or

(b) A Pre tensioned T-section has a flange 180mm wide and 130mm thick. The width and depth of the rib are 280mm and 1480mm respectively. The high tensile steel has an area of 4650mm2 and is located at an effective depth of 1580mm.If the characteristics cube strength of concrete and tensile strength of steel are 40 and 1550N/mm2 respectively. Calculate the flexural strength of the T-Section. CO3 App (16)

13. (a) A concrete beam with a cross sectional area of 32 X 10^3 mm^2 and radius of gyration of 72 mm is prestressed by a parabolic cable carrying an effective stress of 1000 N/mm^2.The span of beam is 8m.The cable composed of 6wires of 7mm diameter has an eccentricity of 50mm at the center and zero at the supports. Neglecting all losses, find the central deflection of the beam as follows:
a) self-weight + Prestress.
b) self-weight + Prestress + Live load of 2KN/m.
Assume E = 38KN/mm^2 , D_c = 24KN/m^3. CO2 App (16)

Or

(b) The end block of Post tensioned PSC beam 300mm wide and 300mm deep is subjected to a concentric anchorage force of 800KN by a freyssinet anchorage system of area 11000mm^2.Design and detail the average reinforcement for the end block. CO2 App (16)

14. (a) A precast pre – tensioned beam of rectangular section has a breadth of 100mm and depth of 200mm. The beam with an effective span of 5m is prestressed by the tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150kN. The loss of prestress is 15%. The top flange width is 400mm with the thickness of 40mm.If the composite beam supports a live load of 8kN/m^2. Calculate the resultant stresses developed if the section is propped and unpropped. Assume same modulus of elasticity in precast beam and in situ slab. CO4 Ana (16)

Or

(b) A composite T beam is made up of pre – tensioned rib of 100mm wide and 200mm deep and a cast in situ slab of 400mm wide and 40mm thick. Having the modulus of elasticity as 28 kN/mm^2 , if the differential shrinkage is 100 x 10^{-6} determine the shrinkage stresses developed in precast and cast in situ units. CO4 Ana (16)

15. (a) A prestressed concrete pipes is to be designed to withstand a fluid pressure of 1.7 N/mm^2.The diameter of the pipe is 1300mm and shell thickness is 100mm.The max compressive stress in concrete at transfer is 16N/mm^2.A residual compression of 1N/mm^2 is expected to be maintained at service loads. Loss ratio is 0.8 high tensile wires of 5mm diameter. Analyse the spacing of wire winding for various initial stress i)The number of turns of wires per meter length.
ii)The pitch of wire winding for initially stressed to 1kN/mm^2& 5 KN/mm^2. CO5 Ana (16)

Or

(b) To store water below 7.5 meters, a cylindrical PSC water tank with an internal diameter of 35 meters is needed. With an initial tension of 1000 N/mm^2, 5 mm diameter wires are used in the circumferential winding. Freyssinet cable, consisting of twelve 8 mm diameter wires stretched to 1200 N/mm^2, is used to create vertical prestressing.With fmin = 1 N/mm^2, fct = 13 N/mm^2, and fc = 40 N/mm^2, the loss ratio is 0.75.examining the stresses present in PSC tanks and, assuming a fixed base, estimating the wire spacing in the water tank. CO5 Ana (16)