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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

September / October 2023 Supplementary Examinations

Programme: B.E. **Semester: VII**
Branch: CIVIL ENGINEERING **Duration: 3 hrs.**
Course Code: 16CV7DCPSC **Max Marks: 100**
Course: Analysis and Design of Pre-Stressed Concrete Members **Date: 13.09.2023**

Instructions:
1. Unit 1 and 5 have internal choice. Units 2, 3 and 4 are compulsory.
2. Use of IS 1343-2012 is permitted.
3. Assume missing data if any suitably and state the same clearly.

UNIT - I

1	a	Explain Freyssinet method of prestressing with a neat sketch	**08**
	b	Describe briefly thermoelectric pre stressing	**06**
	c	State the factors influencing the deflections	**06**

OR

2	a	Describe Hoyer's long line method of pre stressing with a neat sketch	**08**
	b	A pre stressed concrete 'I' section is used as a post tensioned beam of span 18 meters. It is having Prestress cables of area 200 mm^2 at a depth of 25 mm from the top of the section and an area of 800 mm^2 at a depth of 40 mm from the bottom of the section which has a total depth of 970 mm. The initial pre stress in the cables is 1500 N/mm^2 with a loss of 250 N/mm^2. The permissible stresses in concrete under working condition are 17 N/mm^2 (Compression) at the top of the section and 1.7 N/mm^2 (Tension) at the bottom. Calculate the total allowable load on the beam given that, I_{xx}=15x109 mm^4 , area of cross section =12x104 mm^2 .The neutral axis of the cables is at a depth of 546 mm from the bottom of the section.	**12**

UNIT - II

3	a	Describe the importance of principal stresses and how shear force is nullified to some extent in pre stressed concrete	**06**
	b	A rectangular beam of cross section 250mm width and 600 mm depth is simply supported over a span of 12 meters. It is pre stressed by means of symmetric parabolic cable at a distance of 200 mm from bottom fibers at support section and at a distance of 80 mm from the bottom fibers at mid span section. Initial pre stress in the cable is 500 kN. Determine: (i) Maximum deflection of beam at transfer (ii) Central concentrated force to be applied to nullify the above deflection. Assume unit weight of concrete = 25 kN/m^3, Ec=35x10^3 N/mm2	**14**

UNIT - III

4 a A pre stressed concrete beam 250 mm x 800 mm is subjected to a shear force of 1000 kN. The fiber stresses under working load = 4 N/mm^2 . If the effective pre-stress is 1000 N/mm^2 and the area of cable is 800 mm^2, design the shear reinforcement. The cables are inclined at an angle of $\sin^{-1}$ (1/6). Assume an effective cover of 100 mm to prestressing steel. **10**

b A post tensioned bridge girder is of box section with over all dimensions 1200 mm wide by 1800 mm deep with a wall thickness of 150 mm. The high tensile steel has an area of 2000 mm^2 and is located at an effective depth of 1600 mm. The effective pre stress in steel after all losses is 1200 N/mm2 and effective span of the girder is 20 meters. If f_{ck}= 40 N/mm^2 and f_p=1600 N/mm^2, evaluate the flexural strength of the section **10**

UNIT – IV

5 a A post tensioned pre-stressed concrete beam of span 12 meters has a rectangular section of 300 mm wide and 750mm depth. The beam is prestressed with a parabolic cable concentric at supports and with an eccentricity of 200 mm at the center of span. The cross sectional area of high tensile wires in the cable is 500 mm^2. The wires are stressed using a jack at the left end so that the initial force in the cable at right end is 250 kN. **14**

Using the following data evaluate,

(i) The jacking force required at the left end

(ii) The total loss of stress in the wires for the following data

a) Co –efficient of friction for curvature effect = 0.55
b) Friction co-efficient for wave effect = 0.003/m
c) Relaxation of steel stress = 4%
d) Total shrinkage strain of concrete = 0.0002
e) Creep coefficient = 2.2
f) Modulus of elasticity of steel = 210 kN/m^2
g) Modulus of elasticity of concrete = 35 kN/m^2

b Describe the loss induced due to successive pre stressing of cables in a PSC member **06**

UNIT – V

6 a Describe briefly the state of stress in the anchorage zone of the end block of a PSC beam with a neat sketch **05**

b An unsymmetrical “I” section having the following section properties is used for a bridge girder. The thicknesses of top and bottom flanges are 200 mm and 250 mm respectively. The widths of top and bottom flanges are 750 mm and 450 mm respectively. The thickness of web = 150 mm, overall depth is 1000 mm. The area of section = 34.5 x 104 mm^2 , Z_t = 95 x 10^6 mm^3 , Zb = 75x10^6 mm^3 and the position of the centroid of section is 440 mm from the top. If the permissible tensile and compressive stresses at transfer and working loads are not to exceed zero in tension and 15 N/mm^2 in compression, determine the pre stressing force required and the corresponding eccentricity to resist the self-weight moment and applied moment of 1000 kN-m and 450 kN-m respectively. The loss ratio = 0.85 **15**

OR

7	a	Explain transmission length and the factors effecting it	**05**
	b	Design a pretensioned PSC beam having effective span of 12 m to carry applied load of 6 kN/m. Take the cube strength of concrete fck = 50 MPa, cube strength at transfer fci = 35 MPa, tensile strength of concrete = 1.7 MPa, modulus of elasticity of concrete Ec = 34000 MPa, Load factors for dead load and live load 1.4 and 1.6 respectively, loss ratio is 0.8. Permissible stresses at transfer 15 MPa (f_{ct}) and 1.0 MPa (f_{tt}) in compression and tension respectively, at working loads the compressive and tensile stresses are 17 MPa (f_{cw}) and 0.0 MPa (f_{tw}) respectively. Use 7 mm high tensile steel wires having an ultimate tensile strength f_{pu} 1600 MPa	**15**

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