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Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VII SEMESTER B.TECH (CIVIL ENGINEERING)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: STRUCTURAL DESIGN IV [CIE 409]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.
- Use of **IS: 1343-1980** is permitted
- Assume density of concrete as **25kN/m^3**

1A.	Define: (i) Partial and Moderate Prestressing (ii) Electrothermal Prestressing	**04**
1B.	A post-tensioned beam of span 10m is provided with a parabolic cable having area of 380mm^2 and stressed to 1270N/mm^2. The cable is parabolic having zero eccentricity at supports and 240mm eccentricity below the centroid at midspan. It is tensioned from one end only and except for loss due to friction and loss due to anchorage slip, all the other losses are allowed in the design. HTS bars having characteristic strength 1650MPa and M45 grade concrete is used. If the member is loaded at 28 days, compute the jacking force required and total percentage of subsequent loss of stress given the following details: anchorage slip = 2 mm, coefficient of wave effect k = 0.0015/m, coefficient of friction μ = 0.55, stress in concrete at the level of steel = 3N/mm^2.	**06**
2A.	A simply supported beam AB of span 9m carries two concentrated loads of 40kN each at one third span points. The beam is rectangular in section with a width 300mm and depth of 600mm. Assume the prestressing force in the cable to be 900kN, sketch suitable cable profile (single cable) to balance self weight and external loads.	**03**
2B.	An unsymmetrical 'I' section of post tensioned PSC beam of span 14m carries an UDL of 16kN/m throughout the span, having overall depth of 1000mm and cross sectional area 172 × 10^3 mm^2. The cable is parabolic with zero eccentricity at supports, and 320mm eccentricity at midspan. The Initial prestressing force in tendons is 1000kN and loss of prestress is 18% Given: I = 1.871 × 10^{10} mm^4, Y_b = 524.419mm, M40 grade of concrete and type 1 beam. Draw the stress distribution at transfer and working stage, and check for permissible limits as per the code.	**07**
3A.	Precisely explain how failure due to Bonding is controlled in Pretensioned members.	**04**
3B.	A simply supported unbonded post tensioned PSC beam of span 18m carries a live load of 10kN/m throughout the span. The beam is prestressed with parabolic cable having zero eccentricity at supports and an eccentricity of 150mm below c.g.c. at mid span, with initial prestress of 800kN. The cross section of beam is an unsymmetrical I section having top flange 450mm × 120mm, bottom flange 250mm × 170mm and web 120mm × 400mm. Given: I = 7.88 × 109 mm4, yb = 383.84mm, loss of prestress is 20% and M40 grade of concrete is used. If the age of loading is $60 days, check	**06**

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	for limit state of serviceability in deflection as per the code and compute the limits of eccentricity which keeps the central deflection within serviceability limits.	
4A.	Check for the limit state of collapse for simply supported bonded post-tensioned beam of span 12m loaded with a working load of 18kN/m. The beam is pre-stressed by 25 indented wires of 7mm diameter whose characteristic strength is 1890N/mm^2. The effective cover to the centroid of pre-stressing steel is 275mm. The grade of concrete is M40. The section is as given in table 1.	**06**
4B.	If the beam given in **Q. No. 4A** is pre-tensioned, check for the development length and design the end zone reinforcement, if effective pre-stress is 0.7f_p and f_{pu} = 1605N/mm^2.	**04**
5A.	Design the shear reinforcement for a simply supported PSC beam of span 7.75m loaded with 15kN/m which is pre-stressed with an effective pre-stressing force of 450 kN with a parabolic cable having maximum eccentricity of 250mm. The shear resistance at a section which is cracked in flexure is 75kN. The grade of concrete is M40 and the section is as in table 1.	**06**
5B.	The end block of a post-tensioned beam is having a rectangular section of 400mm × 980mm. It is pre-stressed using two anchor plates of size 300mm × 245 mm. c.g.c of which are placed symmetrically 245mm from the top and the bottom edges respectively. Effective pre-stressing force imparted to each plate is 900kN. Grade of concrete is M40. Compute Bursting Tension and design the end block reinforcement using 8mm diameter HYSD steel.	**04**
6	Design a simply supported type-1 pre-tensioned PSC beam of span 11.5m loaded with a working load of 16.5 kN/m. Take M40 grade concrete and trial cross-section as in table 1. Loss of pre-stress is 19%.	**10**

TABLE: 1

Top flange	410mm × 140mm
Web	140mm × 620mm
Bottom flange	200mm × 200mm
y_t	420.62mm
I	1.79×10^{10} mm^4