Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

II SEMESTER M.TECH (STRUCTURAL ENGINEERING)
END SEMESTER EXAMINATIONS, JUNE 2017

SUBJECT: ADVANCED PRESTRESSED CONCRETE [CIE 5252]
REVISED CREDIT SYSTEM

Time: 3 Hours   MAX. MARKS: 50

Instructions to Candidates:

- ❖ *Answer all questions*
- ❖ *Use of IS:1343-2012, IS:784-2001, Authorized Design Aid are permitted*
- ❖ *Any Missing data may suitably assumed*

1.A	A post-tensioned beam of span 11 m has symmetrical I- section with top & bottom flange 450 mm wide x 100 mm deep, web: 100 mm wide x 750 mm deep. The beam is pre-stressed by a parabolic tendon concentric at the supports and with an eccentricity 300 mm at the centre of span. The cross-sectional area of pre-stressing strands provided, A_p = 960 mm^2 and f_{pk} = 1470 MPa, and stress in pre-stressing steel at service, f_{pe} = 860 MPa. Longitudinal reinforcements of 12 mm diameter are provided to hold the stirrups. Grade of concrete is M35. Design the stirrups at section 2.5 m from the left support if the beam carries uniformly distributed load including self-weight of 28 kN/m at working.	**10**
2.	Design a Post-tensioned Type-I PSC continuous rectangular beam of two equal span, AB = 13 m and BC = 13 m to carry a live load of 18 kN/m. Use M-45 grade concrete and tendon of ultimate strength 1860 N/mm^2. Assume 15% loss at service. Sketch the maximum and minimum eccentricities of the prestressing force at different locations along the beam and the column. Check the critical section at mid-support for permissible stresses.	**10**
3.	A composite tee beam is made up of a pre-tensioned rib 350 mm wide and 900 mm deep and a cast-in-situ slab of 150 mm thickness and 1500 mm width. The beam is simply supported over a of span 13 m to support an imposed load of 12 kN/m. Assume grade 40 concrete in precast web and slab and high strength wire of f_{pk} = 1470 MPa. Assume time dependent loss in cable as 15%. Design the composite section and shear connections. Compute stresses in the section at various stages. The	**10**

	precast member is propped during the casting of the CIP portion.	
4.	Design a PSC Portal Frame ABCD, of size column AB = DC = 5 m and beam BC = 10 m. The ends of the columns are fixed at A and D. The beam carries super imposed load of 23 kN/m. Assume cross section of beam as 300 mm X 750 mm and that of Columns 300 mm X 750 mm. Take material properties as f_{ck} = 35 N/mm^2, f_{pk} = 1720 N/mm^2. The pre-stressing is f_{pe} = 1035 N/mm^2 including 16% long term losses. Sketch the maximum and minimum eccentricities of the pre-stressing force at different locations along the beam and the column. Compute the stresses at section mid-span of BC at transfer and at service.	**10**
5.	A non-cylindrical pre-stressed concrete pipe of internal diameter 1000 mm and length 5 m, is required to with stand a working pressure of 1.4 N/mm^2. Design pipe thickness, and longitudinal and circumferential pre-stressing forces, spacing of wires. Assume circumferential winding by the process of die. Use high tensile wire of 5 mm diameter ultimate strength 1570 N/mm^2 and M-40 grade concrete. Assume minimum compressive stress under working load to be 1.0 N/mm^2. Take coat thickness as 22 mm, height of fill 2.0 m, density of fill material 16 kN/m^3, coefficient Ct = 0.9. Analyse the stresses for circumferential pre-stressing requirement at site test condition.	**10**