



Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)



II SEMESTER M.TECH (STRUCTURAL ENGINEERING) END SEMESTER EXAMINATIONS, MAY 2016

SUBJECT: ADVANCED PRESTRESSED CONCRETE [CIE 544]

REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- ★ Answer any **FOUR** FULL questions
- Use of IS:1343-2012, IS:784-2001,IS:784-1985 and Authorized Design Aid are permitted
- ✤ Any Missing data may suitably assumed

1.	A section of post-tensioned (bonded) pre-stressed concrete rectangular beam, 350 mm x 1000 mm deep is pre-stressed by an effective force of 1500 kN acting at an effective depth of 800 mm. At service load conditions, the section is subjected to a bending moment of 800 kN-m and a transverse shear force of 700 kN. If $f_{ck} = 40$ N/mm ² , fy = 415 N/mm ² , fpk = 1600 N/mm ² , i) find the factor of safety against limit state of collapse in flexure ii) design suitable transverse reinforcements, iii) design minimum longitudinal reinforcement.	12.5
2.	Design a Post-tensioned Type1 PSC continuous rectangular beam of two equal span, $AB = 6$ m and $BC = 6$ m to carry a live load of 15 kN/m. The beam has to be casted using M-45 grade concrete and has to be pre-stressed using high tensile steel wires having characteristic strength of 1570 N/mm ² . The strength of concrete at transfer can be taken as $0.7f_{ck}$. Loss of pre-stress is 20%. Sketch the maximum and minimum eccentricities of the prestressing force at different locations along the beam and the column. Check the critical sections for permissible stresses.	12.5
3.	A composite tee beam is made up of a pre-tensioned rib 300 mm thick and 900 mm deep and a cast-in-situ slab of 200 mm thickness and 1200 mm width. The beam is simply supported over a of span 15 m to support an imposed load of 18 kN/m. Assume grade 40 concrete in precast web and slab and high strength wire of $f_{pk} =$ 1470 MPa. Assume loss in cable as 20%. Design the composite section and shear connections. Compute stresses in the section at various stages. The precast member is unpropped during the casting of the CIP portion.	12.5
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4.	A PSC Portal Frame ABCD has column $AB = DC = 4$ m and beam $BC = 12$ m. The ends of the columns are fixed at A and D. The beam carries super imposed load of 20 kN/m. Cross section of beam is 300 mm X 700 mm and that of Columns is 300 mm X 650 mm. Design the frame using M-45 grade concrete. Sketch the maximum and minimum eccentricities of the prestressing force at different locations along the beam and the column. Compute stresses in the critical section at various stages.	12.5
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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 1.2 N/mm ² . Design pipe thickness, and longitudinal and circumferential pre-stressing forces, spacing of wires. Assume circumferential winding by the process of counter weight/break. Use high tensile wire of 4 mm diameter ultimate strength 1715 N/mm ² and M-40 grade concrete. Assume minimum compressive stress under working load to be 1.0 N/mm ² . Assume coat thickness as 25 mm. Calculate the circumferential stresses due to : a) weight of earth fill, b) live load, c) internal pressure (@site test pressure) d) circumferential prestressing (@ site test) Take i) height of earth fill = 1.5 m loose granular material, ii) Live load = Class AA (IRC), iii) bedding angle = 60 degree.	12.5
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