Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

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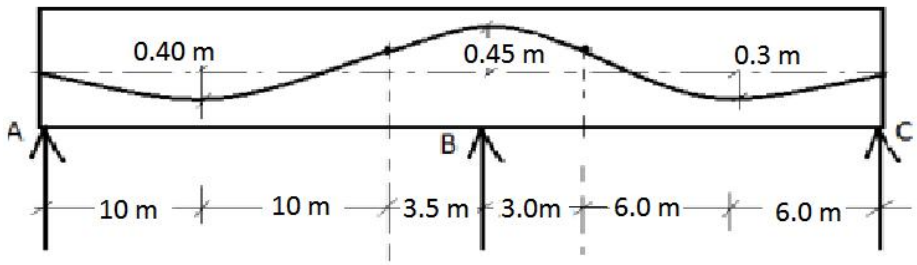
II SEMESTER M.TECH. STRUCTURAL ENGINEERING
END SEMESTER EXAMINATIONS, MAY 2023
SUBJECT: Design of Pre-stressed Concrete Structures (CIE 5271)

Time: **Date: 22 /05/2023** MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions. **Missing data may be suitable assumed.**
- *Use of IS:1343-2012, IS:784-2001*

Q	Description	M	CO	BT L
1	Design a post-tensioned rectangular Type-2 PSC simply supported beam of span 25 m to carry total service load of 20 kN/m excluding self weight. Assume M-50 grade concrete. Take allowable tensile strength of concrete as 2 N/mm^2. Take fpk = 1700 MPa. The strength of concrete at transfer can be taken as 0.7f_{ck}. Long term loss of pre-stress is 15%. Sketch the suitable parabolic cable profile. Check the critical sections for permissible stresses and ultimate moment.	10	CO1	4
2a	A two span continuous beam, ABC of cross-section 400 mm wide x 1100 mm deep, is prestressed with cable profile as shown in figure. If a prestressing force of 3000 kN is applied at one end C, Determine the force in the cable over the support B. C00000000000000alculate increase in the length of the cable considering the length from support C to support B only. Assume μ = 0.3 and wobble effect = 0.005/meter length, Ap = 2800 mm^2, Ep = 200GPa. 	05	CO1	5
2b	Design the bearing plate and the end zone reinforcement for the following bonded post tensioned beam. The beam is having rectangular cross-section 300 mm wide and 500 mm deep. A prestressing force of 1000 kN is applied by a single tendon. The eccentricity of the tendon, at the ends of the beam is 50 mm below the CGC. Take M 45 grade concrete.	5	CO1	4
3	Figure shows composite T- beam made up of a post-tensioned rib 300 mm thick and 700 mm deep and a cast-in-situ slab of 160 mm thick and 1400 mm width. The beam is simply supported over a effective span of 10 m. The composite beams are spaced at 2.0 m c/c. Live load on the slab is 5.0 kN/m^2 and finish load 3 kN/m^2. Moment of Inertia of the composite section about the centroidal axis (shown in the figure) is 29.1 x 10^9 mm^4. Grade of concrete is M40 in precast web and slab. The precast web is post tensioned using high strength wire fpk = 1500 MPa. The long term loss in prestress is 15%. The precast web is unpropped when slab is cast. (a) Design post tensioned precast web (b) Check for the compressive stresses in the precast web and cast-in-place slab.	10	CO3	5

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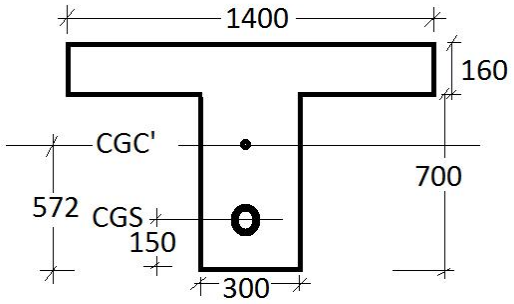
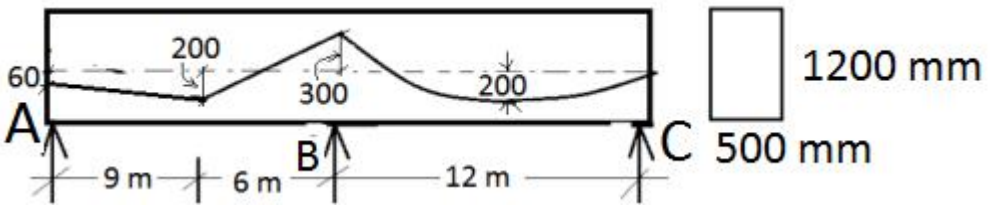
				
4	A continuous pre-stressed concrete rectangular beam with section 500 mm x 1200 mm is prestressed with bonded tendon profile as shown in the figure (eccentricity of the cable is in mm). Take Pe = 2000 kN. a) Draw thrust line due to prestress only b) Evaluate the stresses in concrete at section mid of span BC, if the beam is loaded with live load of 20 kN/m over left span AB and no live load on the right span BC. 	**10**	**CO4**	**5**
5a	A non-cylindrical pre-stressed concrete pipe of internal diameter 400 mm and length 5 m, is required to with stand a working pressure of 1.5 N/mm^2. With following data: i) circumferential winding by the process of counter weight/break, ii) high tensile wire of 4 mm diameter with ultimate strength 1570 N/mm^2, iii) M-40 grade concrete, iv) minimum compressive stress under working load to be 1.5 N/mm^2, v) coat thickness as 25 mm,vi) strength of concrete at winding 30 MPa and at detensioning longitudinal 20 MPa, vii) bedding angle = 120^0 & θ = 180^0. a) Design pipe thickness, longitudinal and circumferential pre-stressing forces and spacing of wires. b) Evaluate stress induced in the core at factory test due to internal pressure. c) Evaluate compressive stress induced in the core due to circumferential winding at factory test.	**5**	**CO5**	**4**
5b	Evaluate the number of prestressing wires required for the precast plank of (type-1) composite slab for flexural with the following data. Width of the slab = 0.40 m, effective span 3.5 m, thickness of the precast plank = 60 mm, thickness of the cast-in-situ topping slab = 60 mm, grade of concrete in precast plank = M60, grade of concrete in topping = M20. Assume pre-tensioned 7 mm wire, fpk = 1500 MPa, are located at mid-depth of the precast plank. During casting of the topping, planks are not propped. Live load on slab = 3 kN/m^2, and finish load = 2 kN/m^2. Assume long term loss as 20%. Take Moment of Inertia of composite section about its centroidal axis as 43x10^6 mm^4. Centroid of the composite section is located at 52 mm from the bottom surface of the plank. Evaluate the compressive stress in the plank for permissible stresses at service only.	**5**	**CO3**	**4**