MANIPAL INSTITUTE OF TECHNOLOGY

M. TECH (STRUCTURAL ENGINEERING)

END SEMESTER EXAMINATION (MAKEUP), JUNE 2024

DESIGN OF PRESTRESSED CONCRETE STRUCTURES (CIE 5217)

(13 – 06 - 2024)

TIME: 3HRS. **MAX. MARKS: 50**

Note: 1. Answer all questions.
2. IS:1343-2012 is permitted.

Q. NO	QUESTION	MARK	CO	BL
1A	Design a Type 1 rectangular post tensioned prestressed beam of size 320 × 640 mm cross section and span 14m. M45 grade concrete is used, and the tendons are initially prestressed to 76% of its characteristic strength (f_{pk} =1780 MPa). A live load of 16 kN/m acts throughout the span of the beam and loss of prestress is 15%.	**7**	**1**	**5**
1B	A pretensioned one way simply supported slab of span 4.0m has a thickness of 130 mm and is prestressed with 6 no. of 7 mm diameter wires with initial prestress of 300 kN for every 1m length having 15 % loss of prestress at service. A total load (inclusive of self-weight) of 5.6 kN/m^2 acts on the slab. If f_{pk} = 1620 MPa and initial prestress is $0.75f_{pk}$ and M40 grade of concrete is used, compute the shear capacity of the section and check whether shear reinforcement is required.	**3**	**4**	**4**
2	A simply supported post tensioned flanged beam of span 7m having top flange 420 × 130 mm and web of 130 × 700 mm is subjected to a live load of 10 kN/m acting throughout the span. Steel tendon having zero eccentricity at support and 230 mm eccentricity at midspan is made of 9 no. of 7mm diameter wires having parabolic profile with characteristic strength 1720 MPa and effective prestress of 1045 MPa. Evaluate the ultimate flexural strength (M_{UR}) of the beam and check for serviceability limits at working and long term according to IS:1343-2012 specifications. Take Φ = 1.5, M45 grade of concrete and loss of prestress as 20%.	**10**	**2**	**5**
3	A two span post-tensioned Type1 PSC continuous beam ABC, with span AB = 12 m and BC = 10 m has symmetrical section with flange 420 × 120 mm and web 160 × 560 mm, having I = 14.115×10^9 mm^4. M45 grade of concrete is used along with a concordant cable profile carrying an effective prestressing force of 800kN. Evaluate the critical stresses at service for a case of live load	**10**	**3**	**5**

	10 kN/m acting throughout the span, taking 20% loss of prestress, and check whether they are within the permissible limits prescribed by IS:1343-2012.			
4	Design a simply supported post tensioned one-way slab of 4.5 m span carrying a live load of 2.2 kN/m^2 and finish load of 1.2 kN/$m^{2.}$ Take M40 grade of concrete, 7 mm wires having characteristic strength of tendon 1650 MPa, initial prestress of 1200 MPa, 15% loss of prestress and (span/d) ratio of 45. Provide the transverse reinforcement details.	**10**	**4**	**5**
5	A composite T beam is made up of a pre-tensioned rib 180 mm thick and 360 mm deep, a cast-in-situ slab of 140 mm thickness and flange width for composite action can be taken as 700 mm. The beam is simply supported over a of span 6 m supporting a live load of 14 kN/m. Assume M40 grade of concrete in precast web and slab, high strength wires with initial prestress as $0.76f_{pk}$ (characteristic strength f_{pk} = 1720 MPa) and long term loss as 15%. Design the composite section and compute the stresses in the critical section at various stages. The precast member is unpropped during the casting of the CIP portion.	**10**	**5**	**5**