MANIPAL INSTITUTE OF TECHNOLOGY

M. TECH (STRUCTURAL ENGINEERING)

END SEMESTER EXAMINATION, APRIL -MAY 2024

DESIGN OF PRESTRESSED CONCRETE STRUCTURES (CIE 5217)

(30 – 04 - 2024)

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

Note: 1. Answer all questions.
2. IS:1343-2012 and IS:784-2001 are permitted.

Q. NO	QUESTION	MARK	CO	BL
1A	Design a Type 1 rectangular post tensioned prestressed beam of span 16m to carry a live load of 18kN/m throughout the span. Assume size of the beam 350 × 700 mm and M40 grade concrete. The tendons are initially prestressed to 0.76 f_{pk} (characteristic strength, f_{pk} =1840 MPa), and assume long term loss of prestress as 20%.	**7**	**1**	**5**
1B	A pretensioned one way simply supported slab of span 4.5 m has a thickness of 130 mm and is prestressed with 6 no. of 7 mm diameter wires with initial prestress of 260 kN for every 1m width having 15 % loss of prestress at service. A total load (inclusive of self-weight) of 6 kN/m^2 acts on the slab. If f_{pk} = 1600 MPa and initial prestress is 0.7f_{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 T-beam of span 6m having top flange 400 × 120 mm and web of 120 × 680 mm is subjected to a live load of 9.26 kN/m acting throughout the span. Steel tendon having zero eccentricity at support and 237 mm eccentricity at midspan is made of 8 no. of 7mm diameter wires having parabolic profile with characteristic strength 1630 MPa and effective prestress of 980 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, M50 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 = 9 m and BC = 12 m has symmetrical I-section with flanges 400 × 100 mm and web 150 × 500 mm, having I = 8.83×10^9 mm^4. A concordant cable profile carrying an effective prestressing force of 750kN. If M45 grade of concrete is used, evaluate the critical stresses at service for a case of live	**10**	**3**	**5**

	load 9 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 4.2 m span carrying a live load of 2 kN/m^2 and finish load of 1 kN/m^2. Take M40 grade of concrete, 7 mm wires having characteristic strength of tendon 1620 MPa, initial prestress of 1134 MPa, 15% loss of prestress. Assume Span/d ratio of 42. Provide the transverse reinforcement details.	**10**	**4**	**5**
5	A composite T beam is made up of a pre-tensioned rib 200 mm thick and 400 mm deep, a cast-in-situ slab of 150 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 12 kN/m. Assume M45 grade of concrete in precast web and slab, high strength wires with initial prestress as $0.76f_{pk}$ (characteristic strength f_{pk} = 1670 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 cast-in-situ slab (CIP) portion.	**10**	**5**	**5**