Reg. No.					

## MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL (A constituent unit of MAHE, Manipal)

### VII SEMESTER B. TECH (CIVIL) END SEMESTER EXAMINATIONS DECEMBER 2023

### SUBJECT: PRE-STRESSED CONCRETE DESIGN [CIE 4066]

Date of Exam:02 /12/2023

Time: 2.30 PM-5.30 PM

Max. Marks: 50

#### Instructions to Candidates:

Answer ALL the questions & missing data may be suitably assumed.
 Use of IS 1343 – 2012 is allowed.

Q. NO	QUESTION	Μ	СО	BL
1A.	Prestressed concrete members will have relatively higher stiffness than corresponding RCC members. Substantiate with reasons.	03	1	2
1B.	<ul> <li>A PSC post-tensioned beam spanning 10m is pre-stressed with wires of a total area of 350 mm<sup>2</sup>. All wires have a parabolic profile with zero eccentricity at the ends and an eccentricity of 50mm at mid-span. Each cable carries an initial pre-stress of 1000N/mm<sup>2</sup>, and all wires are tensioned simultaneously from one end.</li> <li>(a) Compute the total percentage of loss of pre-stress with the following data: Es=200kN/mm<sup>2</sup>, M50 concrete; Shrinkage Strain=3X10<sup>-4</sup>; creep coefficient =1.6; Relaxation of Steel=6%; Stress in concrete at the level of cable= 6N/mm<sup>2</sup>; slip=1mm, k=0.0015/m, μ=0.35.</li> <li>(b) Compute the jacking force required to compensate for Loss due to length and curvature effect and slip of anchorage if stress of 1000 N/mm<sup>2</sup> is required after anchoring.</li> </ul>	07	2	3
2A.	A simply supported beam of span 12m carries two concentrated loads of 80kN each at one-third span points. The beam is rectangular in the section of 360mm (width) $\times$ 720mm(depth). Assume the prestressing force in the cable to be 1000kN, and sketch suitable cable profiles of two cables to balance self-weight and external loads.	04	1	3
2B.	A symmetrical 'I' section of the Post-tensioned PSC beam was designed for a single- span bridge girder spanning 20m. The cross-section details: the flange width = 500mm, overall depth = 800mm, and thickness of the flange and web =120mm. M40 grade of concrete is used, and the beam is fully prestressed. The cable is parabolic with zero eccentricity at supports and 300mm eccentricity at midspan with the prestressing force 800kN. The beam carries a UDL of 16kN/m throughout the span, and the loss of prestress	06	3	3

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	is 16%. Draw the stress distribution diagram at midspan for the transfer and working			
	stage and check for permissible limits as per the code.			
3A.	Simply supported bonded post-tensioned beam of span 13.5m loaded with a working load of 17kN/m. The beam is pre-stressed by 25 indented wires of 6mm diameter whose characteristic strength is 1800N/mm <sup>2</sup> . The effective cover to the centroid of pre-stressing steel is 275mm from base, and the M40 grade of concrete is used. The section details are as follows: Top flange - 475mm × 100mm, Web 125mm × 775mm, Bottom flange -150mm × 150mm, $y_t = 425.33$ mm, $I = 1.82 \times 10^{10}$ mm <sup>4</sup> . Check for the limit state of collapse	06	4	3
3B.	A simply supported pre-tensioned beam of span 13m loaded with a working load of 17kN/m. The beam is pre-stressed by 15 indented wires of 5 mm diameter with a characteristic strength of 1800N/mm <sup>2</sup> . The grade of concrete is M40, and the section has an overall depth of 1025mm. The effective pre-stress is $0.6f_p$ and Initial prestress = 1500N/mm <sup>2</sup> . Design end zone reinforcement as per the IS 1343-2012.	04	5	4
4A.	<ul> <li>A simply supported PSC beam with a span 8m and has a rectangular cross-section of breadth of 400mm and depth of 600mm. It is pre-stressed with an initial pre-stressing force of 500KN. The cable has zero eccentricity at the support section and linearly increases to 100mm at the midsection. Grade concrete M-35. The beam is loaded with a point load 500kN at mid-span. Take creep coefficient = 1.5 and assume the loss of pre-stress is 20%.</li> <li>i) Check for serviceability limits according to I.S.1343 specifications.</li> <li>ii) Evaluate the safe service load (point load)on the beam.</li> </ul>	06	4	4
4B.	A PSC beam of width 250mm and depth 500mm is pre-stressed using a parabolic cable, which has zero eccentricity at supports and 150mm below cgc at mid-span. The beam is simply supported over a span of 8m and carries a superimposed load of 10 kN/m over the whole span. M40 grade concrete is used for the beam and is prestressed with an effective prestress of 750 kN. Check whether the beam is safe in the limit state of collapse in shear according to IS1343-2012 and design the shear reinforcement if required. Assume the beam to be uncracked in flexure.	04	4	4
5A.	$\begin{array}{ c c c c c c c c c c c c c c c c c c c$		3	4
5B	State the assumptions made in the design of prestressed concrete flexure members.	03	3	2