

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(MID SEMESTER EXAMINATION MO/2023)

CLASS: BTECH
BRANCH: CIVIL

SEMESTER : VII
SESSION : MO/2023

SUBJECT: CE414 - PRE-STRESSED CONCRETE

TIME: 02 Hours

FULL MARKS: 25

INSTRUCTIONS:

1. The question paper contains 5 questions each of 5 marks and total 25 marks.
 2. Attempt all questions.
 3. The missing data, if any, may be assumed suitably.
 4. IS 1343 is allowed in the examination hall.
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		CO	BL
Q.1(a)	Write the advantages of post-tensioning system.	[2] 1	K1
Q.1(b)	Mention the various stages of post-tensioning and show the stages in schematic diagram.	[3] 1	K2
Q.2(a)	A prestressed concrete beam, 200 mm wide and 300 mm deep, is used over an effective span of 6 m to support an imposed load of 4 kN/m. The density of concrete is 24 kN/m ³ . Find the magnitude of the concentric prestressing force necessary for zero fibre stress at the soffit at the quarter span section of the beam when the beam is fully loaded.	[2] 3	K2
Q.2(b)	A prestressed concrete beam, 120 mm wide and 300 mm deep, is prestressed by a cable which has an eccentricity 100 mm at the central one-third of span sections and zero at the ends varying linearly. The span of the beam is 6 m. If the beam supports two concentrated loads of 10 kN each at one-third span points, determine the magnitude of the prestressing force in the cable for load balancing.	[3] 3	K3
Q.3(a)	A concrete beam of unsymmetrical I-section spanning 18 m has top flange width and thickness of 500 mm and 200 mm respectively and bottom flange width and thickness of 250 mm and 200 mm respectively. The overall depth of the beam is 1000 mm. The thickness of the web is 150 mm. The beam is prestressed by a parabolic cable located 150 mm from the soffit of the beam at the centre and concentric at the supports with an effective force of 1600 kN. The dead load moment is 233 kN-m at mid-span. Evaluate the kern levels.	[2] 2	K4
Q.3(b)	Determine the cracking moment and location of pressure line at mid-span at transfer for the beam mentioned in Q.3(a). Grade of concrete is M30.	[3] 2	K4
Q.4(a)	A pretensioned beam 250 mm wide and 300 mm deep is prestressed by 12 wires each 7 mm diameter initially stressed to 1200 N/mm ² with their centroids located 100 mm from the soffit. Estimate the percentage loss of stress due to elastic deformation. Assume $E_s = 210 \text{ kN/mm}^2$ and $E_c = 35 \text{ kN/mm}^2$.	[2] 3	K3
Q.4(b)	A prestressed concrete girder AB is post-tensioned using a cable concentric at supports and having an eccentricity of 400 mm at the centre of span. The effective span of the girder is 25 m. The initial force in the cable is 400 kN at the jacking end A. Determine the loss of force in the cable due to friction and wave effect and the effective force in the cable at the farther end B. Assume coefficient of friction $\mu = 0.3$ and coefficient of wave effect $K = 0.0043/\text{m}$.	[3] 3	K3
Q.5(a)	Calculate the percentage loss of prestress due to anchorage slip of 3 mm in a concrete beam of length of 30 m which is post-tensioned by a tendon subjected to an initial stress of 1200 N/mm ² and modulus of elasticity of $2.1 \times 10^5 \text{ N/mm}^2$.	[2] 3	K2
Q.5(b)	For a pre-tensioned beam, Young's modulus of steel and concrete are $2.1 \times 10^5 \text{ N/mm}^2$ and $3.5 \times 10^4 \text{ N/mm}^2$ respectively. The ultimate shrinkage strain is 0.0002 and creep coefficient is 1.6. What is the sustained stress in concrete at the level of steel if the loss due to creep is three times the loss due to shrinkage?	[3] 3	K3