2021 SCHEME

Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN | | | | | | | | | | |

Course Code | 2 | 1 | C | V | 8 | 1 |

Eighth Semester B.E. Degree Examinations, April/May 2025

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

Duration: 3 hrs **Max. Marks: 100**

Note: *1. Answer any* **FIVE** *full questions, choosing* **ONE** *full question from each module.*
2. Use of IS 1343-2012 code book is permitted
3. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO: PI)*
		Module-1		
1.	**a.**	List the advantages and disadvantages PSC over RCC.	**10**	**(1 :1: 1.2.1)**
	b.	Explain HOYER'S long line pre-tensioning system.	**10**	**(1 :1: 1.2.1)**
		(OR)		
2.	**a.**	Explain load balancing concept in pre-stressed concrete members.	**06**	**(1 :1: 1.2.1)**
	b.	A rectangular beam 100 mm wide and 250 mm deep support over a span of 8 m is pre-stressed by a straight cable carrying a prestressing force of 250 kN. Located at an eccentricity of 40 mm from the centroidal axis of beam. The beam supports a live load of 2 kN/m. Calculate the resultant stress at the center of beam. Take density of concrete 24 kN/m^3.	**14**	**(3 :1: 1.2.1)**
		Module-2		
3.	**a.**	Define loss of pre-stress. Briefly explain the different losses with formula.	**06**	**(1 :2: 1.2.1)**
	b.	A PSC beam 200 mm wide and 300 mm deep has a span of 6 m is initially pre-stressed by a force of 400 kN applied at a constant eccentricity of 70 mm. The tendons have an area of 400 mm^2. If $E_S = 2\times10^5$ N/mm^2, $E_C = 0.333\times10^5$ N/mm^2, Co efficient of creep $\phi=2$, shrinkage strain 0.0002, Relaxation of stress in steel=3 %. Determine the % loss of pre-stress in tendon.	**14**	**(3 :2: 2.1.3)**
		(OR)		
4.	**a.**	Explain the effect of tendon profile on deflection.	**06**	**(1 :2: 1.2.1)**
	b.	A rectangular concrete beam of cross-section 150 mm wide and 300 mm deep is simply supported over a span of 8 m and is pre-stressed by means of a symmetric parabolic cable, at a distance of 75 mm from the bottom of the beam at mid-span and 125 mm from the top of the beam at support sections. If the force in the cable is 350 kN and the modulus of elasticity of concrete is 38 kN/mm^2. Calculate (i) The deflection at mid-span when the beam is supported its own weight (ii) The concentrated load which must be applied at mid-span supporting its own weight to restore it to the level of support.	**14**	**(3 :2: 2.1.3)**

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)

Module-3

5.	**a.**	Explain the various types of flexural failures with neat sketch.	**06**	**(1 :3: 1.2.1)**
	b.	A pre tensioned beam of T-section with 1250 mm × 120 mm flange. The thickness of web is 180 mm and overall depth is 1600 mm. The beam is pre-stressed with high tensile wires of area 4700 mm^2 are located at an effective depth of 1500 mm. M-40 grade concrete is used and fp= 1600 N/mm^2. Calculate ultimate flexural strength of T-Beam.	**14**	**(3 :3: 2.1.3)**

(OR)

6.	**a.**	A post-tensioned bridge girder with unbounded tendons is a box section of overall dimension (1200 mm × 1800 mm) with a flange thickness of 150 mm. The high tensile Steel has an area of 4000 mm^2 and located at an effective depth of 1600 mm. The effective stress in the steel after all the losses is 1000 N/mm^2 and effective Span of girder is 24m. If f_{ck}=40 N/mm^2 f_p= 1600 N/mm^2, calculate ultimate flexural strength of the section web thickness is 300 mm.	**20**	**(3 :3: 2.1.3)**

Module-4

7.	**a.**	Explain the types of shear cracks with neat sketches.	**06**	**(1 :4: 1.2.1)**
	b.	A pre-stressed I-section has the following properties: Area = 55 × 10^3 mm^2, Second moment area = 189 × 10^7 mm^4. Statical moment about the centroid = 468 × 10^4 mm^3. Thickness of web = 50 mm. It is pre-stressed horizontally by 24 wires of 5 mm diameter and vertically by similar wires at 150 mm centres. All the wires carry a tensile stress of 900 N/mm^2. Calculate the principal stresses at the centroid when a shear force of 80 kN (unfactored) acts upon this section.	**14**	**(3 :4: 2.1.3)**

(OR)

8.	**a.**	The support section of a PSC beam 120 mm ×300 mm is required to carry an ultimate shear force of 120 kN. The compressive prestress at the centroid of cross section is 5 N/mm^2. The concrete used M40. Cover to tension reinforcement is 50 mm. The characteristic strength of steel used for stirrups is 415 N/mm^2. Design Suitable shear reinforcement and sketch details.	**20**	**(3 :4: 3.1.4)**

Module-5

9.	**a.**	Explain the stress distribution in end block of a post tensioned and pre-stressed concrete member with neat sketch.	**08**	**(1 :5: 1.2.1)**
	b.	A post tensioned beam with c/s (500 mm × 500 mm) mm is pre-stressed with an effective prestressing force of 700 kN using anchor plate of dimension (200 mm × 200 mm) placed concentrically. A cube strength of concrete at transfer stage is 30 N/mm^2. Check for the safety of beam against bearing failure.	**12**	**(3 :5: 2.1.3)**

(OR)

10.	**a.**	The end block of a pre-stressed concrete girder is 200 mm wide by 300 mm deep. The beam is post tensioned by two Freyssient a charges each of 100 mm diameter with their centres located at 75 mm from the top and bottom of beam. The force transmitted by each anchorage being 2000 kN. Determine the bursting force and design suitable reinforcements according to Indian standard IS1343-2012 code provisions. Sketch the arrangement of anchorage zone reinforcement.	**20**	**(3 :5: 2.1.3)**

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