Model Question Paper-1/2 with effect from 2021-22 (CBCS Scheme)

USN

Sixth Semester B.E. Degree Examination
Design of Prestressed Concrete Structures

TIME: 03 Hours **Max. Marks: 100**

Note:
01. Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.
02. IS 1343 may be permitted
03. Any missing data may be assumed suitably

		Module -1	***Bloom's Taxonomy Level**	**Marks**
Q.01	a	Explain the need for high strength concrete & steel in PSC members.	L2	8
	b	A concrete beam of symmetrical I section of span 10 m has flange width of 200 mm, flange thickness 70 mm, overall depth 500 mm, web thickness 100 mm. The beam is prestressed by a parabolic cable with eccentricity 150 mm at midspan & concentric at supports. The initial & final prestressing forces in the cable are 250 kN & 175 kN respectively. The beam supports a live load of 3 kN/m. Calculate the fibre stresses in concrete at midspan at transfer & working load. Sketch the stress distributions.	L4	12
		OR		
Q.02	a	Explain Freyssinet & Magnel Blaton systems with neat sketches.	L2	8
	b	A concrete beam of symmetrical I section of span 8 m has flange width of 250 mm, flange thickness 80 mm, overall depth 450 mm, web thickness 80 mm. The beam is prestressed by a parabolic cable carrying a force of 120 kN at eccentricity of 150 mm at midspan. The beam supports a superimposed load of 3 kN/m. Calculate the resultant stresses at midspan for the following cases of loading: i) prestress + self-weight, ii) prestress+ self-weight + live load.	L4	12
		Module-2		
Q. 03	a	A pretensioned beam 200 mm x 300 mm is prestressed by 10 wires of 7 mm dia initially stressed to 1200 N/mm^2 with their centroids located at 100 mm from soffit. Find the maximum stress in concrete immediately after transfer, allowing only for elastic shortening of concrete. If the concrete undergoes a further shortening due to creep & shrinkage while there is a relaxation of 5% of steel stress, estimate final percentage loss of stress in wires with the following data: E_s = 210 kN/mm^2, $E_c = 5700\sqrt{f_{cu}}$, f_{cu} = 42 N/mm^2, creep coefficient = 1.6, total residual shrinkage strain = 300 x 10^{-6}.	L4	20
		OR		
Q.04	a	List the factors affecting deflection in PSC members.	L1	8
	b	A beam of span 6 m has uniform section 120 x 300 mm & is prestressed by a triangular cable with eccentricity 100 mm at midspan below the centroid & 40 mm at supports above the centroid. Initial prestress is 300 kN. Taking loss ratio as 80%, determine i) maximum deflection at transfer of prestress & ii) maximum deflection at working load of 8 kN/m. Assume M40 concrete.	L4	12
		Module-3		
Q. 05	a	A pre-tensioned, 'T' section has a flange which is 300 mm wide, 200 mm thick, the rib is 150 mm wide and 350 mm deep. The effective depth of beam	L4	10

		is 500 mm, given area of tendons is 200 mm^2, f_{ck} = 50 N/mm^2 and f_p = 1600 N/mm^2. Estimate the ultimate moment capacity of 'T' section using IS code 1343 recommendations.		
	b	A prestressed girder has to be designed to cover a span of 12 m, to support a udll of 15 kN/m. M45 grade concrete is used. The permissible stress in compression may be assumed as 14 N/mm^2 & 1.4 N/mm^2 in tension. Assume 15% losses in prestress during service load conditions. The preliminary section proposed for the girder has a symmetric I section with flanges 300 mm wide & 150 mm thick; web is 120 mm wide & 450 mm deep. Check the adequacy of the section provided & design minimum prestressing force & corresponding eccentricity for the section.	L4	10
		OR		
Q. 06	a	An unsymmetrical I section having the following section properties is used for a bridge girder: Thickness of top & bottom flanges = 200 mm & 250 mm respectively, width of top & bottom flanges = 750 mm & 450 mm respectively, web thickness =150 mm, overall depth = 1000 mm, area of section = 345000 mm^2, Z_t = 95 x 10^6 mm^3, Z_b = 75 x 10^6 mm^3, y_t = 440 mm. If the permissible tensile & compressive stresses at transfer & working loads are not to exceed 0 in tension & 15 N/mm^2 in compression, determine the prestressing force required & the corresponding eccentricity to resist self-weight & applied moments of 1012 & 450 kNm respectively. Loss ratio = 0.85	L4	20
		Module-4		
Q. 07	a	A concrete beam having rectangular cross section 200 mm by 400 mm is prestressed by a parabolic cable having e = 120 mm at the centre of span reducing to zero at supports. Span of the beam is 10 m & live load is 2.5 kN/m. Determine the effective force in the cable to balance dead & live loads on the beam. Estimate the principal stresses at the support section & take D_c = 24 kN/m^3.	L4	10
	b	The cross-section of a PSC beam is a T section with the following details: Overall depth = 1300 mm, Web thickness = 150 mm, Distances of top & bottom fibres from the centroid are 545 mm & 755 mm respectively. At a particular section the beam is subjected to an ultimate moment M = 2130 kNm & a shear force V = 237 kN, effective depth d = 1100 mm, cube strength of concrete = 45 N/mm^2, effective prestress at the extreme tensile face of the beam f_{cp} = 19.3 N/mm^2, I = 665 x 10^8 mm^4. Area of steel tendons 2310 mm^2. Tensile strength of tendons = 1500 N/mm^2. The effective prestress in the tendons is 890 N/mm^2 after all losses. Estimate the ultimate shear resistance of the section using Indian code regulations.	L4	10
		OR		
Q. 08	a	A simply supported beam of section 120 mm by 300 mm having span 7 m is prestressed by a parabolic cable having maximum eccentricity of 100 mm at the midspan & minimum eccentricity of 20 mm at support, both below CGC of concrete. Effective prestress in the cable is 300 kN. The beam carries a udl 30 kN/m exclusive of self-weight. Determine the principal tension at 0.6 m from the left support & 20 mm above the centroidal axis. Take D_c = 25 kN/m^3.	L4	10
	b	The support section of a PSC beam, 100 mm wide & 250 mm deep, is required to support an ultimate shear force of 60 kN. The compressive prestress at the centroidal axis is 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to tension reinforcement is 50 mm. If the characteristic tensile strength of steel in stirrups is 250 N/mm^2, design suitable reinforcements at the section using IS 1343 recommendations.	L4	10
		Module-5		
Q. 09	a	Explain the Zielinski & Rowe method of computing bursting tension in end block with suitable sketches.	L2	10
	b	Calculate the transmission length at the end of a pre-tensioned beam as per Hoyer's method & Krishna Murthy's empirical relation using the following data: Span of beam = 50 m, Diameter of wires used = 7 mm, Coefficient of	L4	10

		friction between steel & concrete = 0.1, Poisson's ratio for steel & concrete are 0.3 & 0.15 respectively, E_s = 210 kN/mm^2, E_c = 30 kN/mm^2, f_{pu} = 1500 N/mm^2, f_{pi} = 1050 N/mm^2, f_{pe} = 900 N/mm^2, f_{cu} = 42 N/mm^2.		
OR				
Q. 10	a	Explain anchorage zone stresses with suitable sketches.	L2	10
	b	The end block of a post-tensioned PSC member is 550 mm wide & 550 mm deep. 4 cables each made up of 7 wires of 12 mm diameter strands & carrying a force of 1000 kN are anchored by plate anchorages, 150 mm by 150 mm, located with their centers at 125 mm from the edges of the end block. The cable duct is of 50 mm diameter, 28-day cube strength of concrete is 45 N/mm^2, cube strength at transfer is 25 N/mm^2, permissible bearing stresses behind anchorages should conform with IS 1343. Characteristic yield stress in mild steel reinforcement is 260 N/mm^2. Design suitable anchorages for the end block.	L4	10