Code No: R193201A **R19** **SET - 1**

III B. Tech II Semester Regular Examinations, June-2022

PRE-STRESSED CONCRETE

(Civil Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**
All Questions Carry Equal Marks

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UNIT-I

1. Explain the systems and methods of prestressing with neat sketches. [15M]

(OR)

2. a) Why is high tensile steel needed for prestressed concrete construction? [7M]
   b) Explain Magnel system. [8M]

UNIT-II

3. A rectangular concrete beam 360 mm deep and 200 mm wide is prestressed by means of fifteen 5 mm diameter wires located 65 mm from the bottom of the beam and three 5 mm wires, located 25 mm from the top of the beam. If the wires are initially tensioned to a stress of 840 N/mm^2, calculate the percentage loss of stress due to elastic deformation of concrete only. E_S = 210 kN/mm^2 and E_C = 31.5 kN/mm^2. [15M]

(OR)

4. a) List the loss of prestress. [6M]
   b) A concrete beam of 10 m span, 100 mm wide and 300 mm deep is prestressed by 3 cables. The area of each cable is 200 mm^2 and the initial stress in the cable is 1200 N/mm^2. Cable 1 is parabolic with an eccentricity of 50 mm above the centroid at the supports and 50 mm below at the centre of span. Cable 2 is also parabolic with zero eccentricity at supports and 50 mm below the centroid at the centre of span. Cable 3 is straight with uniform eccentricity of 50 mm below the centroid. If the cables are tensioned from one end only. Estimate the percentage loss of stress in each cable due to friction. Assume μ = 0.35 and k = 0.0015 per m. [9M]

UNIT-III

5. A post tensioned bridge of girder of 24 m length with unbonded tendons is of box section of overall dimensions 1200 mm wide by 1800 mm deep, with wall thickness of 150 mm. The high tensile steel has an area of 4000 mm^2 and is located at an effective depth of 1600 mm. The effective prestress in steel after all losses is 1000 N/mm^2. Estimate the ultimate flexural strength of the section. Take f_{ck} = 40 N/mm^2, f_p = 1600 N/mm^2. [15M]

(OR)

6. A pretensioned T section has a flange width of 1200 mm and 150 mm thick. The width and depth of the rib are 300 mm and 1500 mm respectively. The high tension steel has an area of 4700 mm^2 and is located at an effective depth of 1600 mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40 and 1600 Mpa respectively, calculate the flexural strength of the section. [15M]

UNIT-IV

7. A concrete beam of rectangular section 150 mm wide and 300 mm deep is prestressed by a parabolic cable having an eccentricity of 75 mm at center of span below centroidal axis and zero eccentricity at support sections. The effective force in the cable is 350 kN. The beam supports a concentrated load of 20 kN at the center of span in addition to self-weight. The span of a simply supported beam is 8 m and the modulus of elasticity of concrete is 38 kN/mm^2. Calculate short term and long term deflections. Assume loss ratio as 0.8 and creep coefficient as 1.6. [15M]

(OR)

8. A composite beam is made by casting 300 × 900 mm precast prestressed with cast in situ slab of 1500 × 150 mm. the effective prestress of 12 Mpa at the soffit and zero at the top. Calculate the uniformly distributed for the composite action on a simply supported span of 16 m. The weight of concrete is 25 kN/m^3. [15M]

UNIT-V

9. a) Write the steps involved in the design of beams for shear. [6M]
   b) Determine the ultimate strength of the flanged beam for the following data: top & bottom flanges = 500 × 100 mm, web thickness=125 mm, area of prestressing steel=1900 mm^2, distance between bottom of top flange to the center of prestressing steel = 425 mm. [9M]

(OR)

10. The support section of prestressed concrete beam, 200 mm wide and 250 mm deep, is required to support an ultimate shear force of 80 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 the 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 the IS: 1343 recommendations. [15M]

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UNIT-I

1. a) What are the various methods of prestressing and Explain? [9M]
   b) What are the classifications of prestressed concrete structures? List out the advantages of prestressed concrete. [6M]

(OR)

2. a) Discuss the relative advantages and disadvantages of prestressed concrete over reinforced concrete. [8M]
   b) Compare the load carrying mechanism of a prestressed concrete beam with that of a reinforced concrete beam. [7M]

UNIT-II

3. A pretensioned beam 250 mm wide and 300 mm deep is prestressed by 12 wires of 7 mm diameter initially stressed to 1200 MPa with their centroid located at 100 mm from the soffit. Estimate the percentage loss of prestress due to elastic shortening, creep, shrinkage and relaxation using the following data: [15M]
   Relaxation of steel stress = 90 MPa
   Creep Coefficient = 1.6
   Residual shrinkage strain = 3×10^{-6}
   E_s=210 kN/mm^2 and E_c = 35 kN/mm^2

(OR)

4. A post-tensioned cable of a beam 10 m long is initially tensioned to a stress of 1000 N/mm^2 at one end. If the tendons are curved so that the slopes are 1 in 20 at each end with an area of 600 mm^2, Calculate the loss of pressure due to friction, given the following. Coefficient of friction between duct and cable = 0.5 friction. Coefficient for wave effect = 0.0015/m. During anchoring, if there is a slip of 3mm at the jacking end; Calculate the final in the cable and the percentage loss of prestress due to friction and slip. [15M]

UNIT-III

5. A PSC beam of effective span 16m is of rectangular section 400 mm wide and 1200 mm deep. A tendon consists of 3300 mm^2 of strands of characteristic strength 1700 N/mm^2 with an effective prestress of 910 N/mm^2. The strands are located 870 mm from the top face of the beam. If f_{cu} =60N/mm^2, estimate the flexural strength of the section as per IS 1343 provisions for the following cases: (i) Bonded tendons (ii) Unbonded tendons. [15M]

(OR)

6. A prestressed beam has symmetrical I-section in which the depth of each flange is one-fifth of the overall depth and the web is thin enough to be neglected in bending calculations. At the point of maximum bending moment ,the prestressing force is located at the center of the bottom flange and the total loss of prestress is 20%.If there is to be no tensile stress in the concrete at any time, show that the dead load must be at least one-seventh of the live load. [15M]

UNIT-IV

7. a) Discuss about prediction of long term deflections. [7M]
   b) Explain the effect of straight and trapezoidal tendon profiles on deflections of prestressed concrete members with neat sketches. [8M]

(OR)

8. A composite beam of rectangular section is made up of a pretensioned inverted T-beam having a slab thickness and width of 150 mm and 1000 mm respectively. The rib size is 150 mm × 850 mm. The cast in situ concrete has a thickness and width of 1000 mm with a modulus of elasticity of 30 kN/mm^2. If the differential shrinkage is 100 × 10^{-6}units, evaluate the shrinkage stresses developed in the precast and cast in situ units. [15M]

UNIT-V

9. Explain in detail by neat sketches about the shear strength of beams with and without shear reinforcement using IS: 1343. [15M]

(OR)

10. A prestressed concrete beam of rectangular section 150 mm wide and 300 mm depth is to be designed to support an ultimate shear force of 130 kN at support. The uniform Prestress across the section is 5N/mm^2. Using IS 1343 codal provisions design suitable shear reinforcement. Characteristic strength of concrete is 40N/mm^2 and effective cover is 50 mm. Use Fe415 Steel for shear reinforcement. [15M]

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UNIT-I

1. a) Explain with sketches the freyssinet system of prestressing. [8M]
   b) Explain with sketches Gifford-Udall System of prestressing. [7M]

(OR)

2. a) Distinguish between concentric and eccentric tendons, indicating their practical applications. [8M]
   b) Explain the Lee-McCall system with a neat sketch. [7M]

UNIT-II

3. a) State different types of losses encountered in pretensioned systems. [6M]
   b) A rectangular concrete beam 100 × 300 mm is prestressed by means of eight 5 mm wires located 65 mm from the bottom and two 5 mm wires located 35mm from the top of the beam. If the wires are tensioned to strength of 900 N/mm^2, calculate the percentage loss of stress in steel immediately after transfer allowing for the loss of stress due to elastic deformation of concrete only. Given E_s = 210kN/mm^2 and E_c = 31.5kN/mm^2. [9M]

(OR)

4. A prestressed concrete pile, 250 mm wide and 250 mm deep contains 60 pretensioned wires each of 3 mm diameter initially stressed to 700 N/mm^2 with their centroids located 250 mm from the soffit. Estimate the finial percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using IS 1343 code and the following data: relaxation of steel 5% of initial stress modulus of elasticity of steel and concrete as 210 kN/mm^2 and 35 kN/mm^2; creep coefficient = 1.6; residual shrinkage strain = 3×10^{-6}. [15M]

UNIT-III

5. a) A prestressed concrete T section has 1800 mm × 200 mm flange, 450 mm × 1500mm rib and 100 numbers of 8 mm high tensile wires are located at 1600mm from the top of flange. Calculate the flexural strength of the beam using M40 and Fe1600. [8M]
   b) Explain the various methods of flexural failure encountered in PSC members. [7M]

(OR)

6. Calculate the depth of a post-tensioned PSC beam 300 mm wide designed to carry a live load of 9 kN/m over a span of 10 m. The stress in concrete must not exceed 17 N/mm^2 in compression or 1.04 N/mm^2 in tension at any time. Assuming loss of prestress as 15%, calculate the minimum prestressing force and its eccentricity. [15M]

UNIT-IV

7. A concrete beam with a cross sectional area of 32000 mm^2 and radius of gyration of 72 mm is prestressed by a parabolic cable carrying an effective prestress of 1100 MPa. The span of the beam is 10 m. The cable, composed of 6 wires of 7 mm diameter, has an eccentricity of 50 mm at the center and zero at the supports. Neglecting all losses, determine the central deflection of the beam for (a) prestress + self-weight (b) prestress + self-weight + live load 3 kN/m. [15M]

(OR)

8. A composite beam consists of a precast rib of breadth 120 mm and depth 240 mm and a cast-in-situ flange of width 480 mm and thickness 50 mm. The rib is a post tensioned unit which is subjected to an initial prestressing force of 230 kN. The loss of Prestress is 15%. The tendons are provided such that their center of gravity is 80 mm above the soffit. The composite beam has to support a live load of 4kN/m. Determine at mid span location the resultant stresses in the rib and flange if the beam is unpropped. The span of a simply supported composite beam is 6 m. Assume the same modulus of elasticity for concrete in rib and flange. [15M]

UNIT-V

9. Outline the factors influencing the ultimate shear resistance of PSC sections with flexure shear cracks. [15M]

(OR)

10. A PSC beam of rectangular section 250 mm wide by 600 mm deep is prestressed by two post tensioned cables, of area 600 mm^2 each, initially stressed to 1600 mm^2. The cable is located at constant eccentricity of 1100 mm. The span of the beam is 10 m. If f_{ck} = 40 N/mm^2. Estimate the ultimate shear resistance of the support section un-cracked in flexure. [15M]

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UNIT-I

1.	a)	Explain about pre-tensioning and post-tensioning systems with figures.	[8M]
	b)	Mention advantages and limitations of prestressed concrete?	[7M]
		(OR)	
2.	a)	Explain thermo-electric prestressing with a neat sketch.	[8M]
	b)	What is the need for high strength steel and concrete in prestressed concrete?	[7M]

UNIT-II

3.	A rectangular beam 200 mm wide and 300 mm deep is prestressed by 12 wires each of 7 mm diameter initially stressed to 1500 N/mm^2 with their centroids located 100 mm from the soffit. Estimate the final percentage loss of stress in wires, if the beam is pre-tensioned using IS 1343 and the following data: relaxation of steel 5% of initial stress, modulus of elasticity of steel and concrete as 210 kN/mm^2 and 35 kN/mm^2 respectively; creep coefficient=1.6; residual shrinkage strain = 3×10^{-6}.	[15M]
	(OR)	
4.	Explain in detail about all types of losses in both pre-tensioned and post-tensioned members with clear procedure.	[15M]

UNIT-III

5.	A post-tensioned prestressed concrete Tee beam having a flange width of 1200 mm and flange thickness of 200 mm, thickness of web being 300 mm is prestressed by 2000 mm^2 of high-tensile steel located at an effective depth of 1600 mm. If f_{ck}= 40 N/mm^2 and f_p = 1600 N/mm^2, estimate the ultimate flexural strength of the unbounded tee section, assuming span/depth ratio as 20 and f_{pe} = 1000 N/mm^2.	[15M]
	(OR)	
6.	A pretensioned Tee section has a flange width of 300 mm and thickness of flange is 200 mm. The rib is 150 mm wide by 350 mm deep. The effective depth at which high tensile steel of area 200 mm^2 provided is 500 mm. Given f_{ck} = 50 N/mm^2 and f_p=1600 N/mm^2 estimate the flexural strength of the tee section.	[15M]

UNIT-IV

7. A PSC beam has a rectangular section 100 mm wide and 200 mm deep span over 2.76 m. The beam is prestressed by a straight cable containing 5 wires of 5 mm diameter stressed to 1200N/mm^2 at an eccentricity of 37 mm. Assume the modular ratio as 6.2. The E_c=34 kN/mm^2 and modulus of rupture is 4 N/mm^2. Calculate the maximum deflection of beam at the following stages: [15M]
   (i) Prestress + Self weight of beam
   (ii) Prestress + Self weight of beam + Imposed Load of 8.4 kN/m

(OR)

8. a) What are the advantages of composite construction of prestressed concrete members? [8M]
   b) Explain in detail the general design considerations and the design procedure for the design of composite sections. [7M]

UNIT-V

9. The support section of a prestressed concrete beam 100 × 250 mm is required to support an ultimate shear force of 60 kN. The compressive prestress at the centroidal axis is 5N/mm^2. The characteristic strength of concrete is 40N/mm^2. The cover to the tension reinforcement is 50 mm. if the characteristic tensile strength of steel in stirrup is 250 N/mm^2, design suitable shear reinforcement. [15M]

(OR)

10. Explain in detail by neat sketches about the shear strength of beams with and without shear reinforcement using IS: 1343. [15M]

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