CBCS SCHEME

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17CV82

Eighth Semester B.E. Degree Examination, June/July 2023
Design of Prestressed Concrete Elements

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Use of IS : 1343 – 1980 is permitted.*

Module-1

1 a. Explain the need of high strength concrete and high strength steel for PSC members. **(10 Marks)**

b. A prestressed concrete beam of 400×600 mm deep is provided with a tendon having parabolic cable profile with zero eccentricity at supports and 100 mm at mid span of 6 m span. If the total load including self weight is of 35 kN/m on the span. Compute the extreme stresses at mid span section. The tendons carry a prestressing force of 1000 kN. **(10 Marks)**

OR

2 a. Explain Hoyer's long line method of pretensioned concrete with a neat sketch. **(10 Marks)**

b. A simply supported T beam having cross section of flange width 1200 mm and 200 mm thick, rib is 240 mm wide and 1000 mm deep. The beam carries a load of 12 kN/m over a span of 16 m. Determine the prestressing force and its eccentricity to produce net stress equal to zero and 12 MPa at top and bottom respectively. **(10 Marks)**

Module-2

3 a. Explain the different types of losses in PSC members with relevant formulae. **(10 Marks)**

b. A post tensioned concrete beam simply supported over a span of 12 m is of cross section $230\text{mm} \times 750\text{mm}$ and is prestressing with 10 numbers of # 7 mm diameter bars with zero eccentricity at support and 200 mm of midspan. Calculate the loss due to different causes for the following data:

$f_{cK} = 40$ N/mm^2 ;	Initial prestress $(P_0) = 1000$ N/mm^2 ;
$\mu = 0.50$;	$K = 0.003$/m ;
Anchorage slip = 5 mm of Jacking end ;	$\phi = 1.6$;
Shrinkage strain = 0.0002 ;	Relaxation of steel stress = 3% ;
$E_{steel} = 210$ MPa ;	$E_{concrete} = 37.5$ MPa

Compute the total percentage loss and Jacking force required.
Assume : Jacking is done at one end only. **(10 Marks)**

OR

4 a. List the various factors affecting the deflection of PSC beams. **(10 Marks)**

b. Estimate the short term and long term deflection for a PSC beam of 200×400 mm. The span of beam is 10 m. It is prestressed by parabolic cable with an eccentricity of 75 mm at mid span and zero at support. The initial prestressing force is 600 KN and there is 20% loss. The live load is 3 KN/m. $E_C = 35$ N/mm^2, $\phi = 2.0$ and $\gamma_{concrete} = 25$ KN/m^3. **(10 Marks)**

Module-3

5 a. List and explain the types of flexural failure of PSC beam. **(10 Marks)**

b. A pretensioned T-section has a flange width of 1500 mm and thickness of flange 200 mm, width of rib is 300 mm and depth of rib is 1800 mm respectively. The area of H.T steel is 5000 mm^2 at an effective depth of 1800 mm. If $f_{CK} = 40$ N/mm^2 and $f_P = 1600$ N/mm^2. Calculate the flexural strength of section as per IS : 1343 provisions. **(10 Marks)**

OR

6 a. A pretensioned hollow box section with 600 mm width and 400 mm in depth and the thickness of wall is 100 mm, has 40 numbers of #5 mm diameter of H.T.Wires at the bottom flange. The beam is pretensioned with the centroid of the wires at a distance of 50 mm from the soffit of the beam. Determine the ultimate moment carrying capacity of members. Take f_{cK} = 60 MPa, f_P = 1700 MPa. **(10 Marks)**

b. A PSC beam of effective span 16 m is of rectangular section 400 mm wide and 1200 mm deep. A tendon consisting 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_{CK} = 60 MPa, estimate the flexural strength of the bonded tendons as per IS : 1343 provisions. **(10 Marks)**

Module-4

7 a. Enumerate the different ways of improving the shear of PSC beams. **(10 Marks)**

b. A concrete beam of rectangular section has a width of 120 mm and 300 mm deep has a span of 10 m is prestressed with parabolic cable which has maximum eccentricity of 100 mm below CGC at mid span and minimum eccentricity of 20 mm below CGC at support. Effective prestressing force in the cable is 300 KN. The beam carries all inclusive live load of 30 KN/m. Compute the principal tension at 0.6 m from the left support and 20 mm above the centroidal axis. **(10 Marks)**

OR

8 a. List and explain the different types of shear cracks in PSC beams. **(10 Marks)**

b. A PSC beam 250 mm wide and 1500 mm deep is subjected to a shearing force of 900 KN. The fiber stress under working loads is 4 N/mm^2. If the beam is having a prestressing area 1500 mm^2 and the effective prestress is 1000 N/mm^2. Design the shear reinforcement. The cable are inclined at an angle of $\sin\theta = \frac{1}{6}$. Take f_{CK} = 40 MPa. **(10 Marks)**

Module-5

9 a. What is meant by composite construction in PSC? **(10 Marks)**

b. A composite beam is made up of a precast rib of size (120 mm × 200mm) and a cast-in-situ slab of size (400 mm × 40 mm). It was prestressed with a force of 250 KN with straight cables at an eccentricity of 35 mm. Determine the deflection of the beam, if it is unsupported at the time of casting slab. Assume 15% loss.
Given : Span = 6 m, Live load = 4 kN/m, Modulus of elasticity for precast and cast-in-situ concrete = 30 kN/mm^2. **(10 Marks)**

OR

10 a. Explain propped construction in composite construction in PSC. **(05 Marks)**

b. List the advantages of composite construction in PSC. **(05 Marks)**

c. A proposed pretensioned beam of rectangular section has a breadth of 150 mm and a depth of 250 mm. The beam with an effective span of 6 m is prestressed by tendons with their centroids coinciding with bottom kern. The initial force in the tendon is 200 KN. The loss of prestress may be assumed as 15%. The beam is incorporated in a composite T beam by casting a top flange of breadth 450 mm and thickness of 50 mm. If the composite beam supports a live load of 8 kN/m^2. Calculate the resultant stresses developed in the precast insitu cast concrete assuming the pretensioned beam as unpropped during the casting of slab. Assume the same modulus of elasticity for concrete in precast beam and insitu cast slab. **(10 Marks)**

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