CBCS SCHEME

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17CV82

Eighth Semester B.E. Degree Examination, Feb./Mar. 2022
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. Define Prestressed concrete and explain different types of prestressing. **(07 Marks)**

b. What is Pressure Line? Explain its significance. **(07 Marks)**

c. Explain Load balancing concept with example. **(06 Marks)**

OR

2 a. State the assumptions made in the analysis of PSC members. **(04 Marks)**

b. A pre – stressed concrete T – beam of flanges 1200mm wide and 200mm thick, rib 240mm wide and 100 deep, carries live load of 12kN/m , over a span of 16m. The stress in concrete must not exceed $12N/mm^2$ at bottom fiber and zero at top fiber due to self weight and prestressing force. Evaluate the prestressing force and its eccentricity. Also evaluate the resulting stresses after live load in applied. Assume $D_C = 24kN/m^3$. **(16 Marks)**

Module-2

3 a. Explain loss of pre – stress due to friction and slip in post – tensioned members. **(05 Marks)**

b. A post tensional beam 250mm × 650mm, simply supported over a span of 11m and is prestressed with 12 – numbers of 7mm diameter with zero eccentricity at support and 150mm at mid span calculate the total percentage of losses due to different causes for following data : M_{40} grade of concrete , Initial prestress 1050 MPa , Coefficient of curvature effect $\mu = 0.5$, $K = 0.003/m$, Slip = 4mm at jacking , Creep coefficient = 1.6 , Shrinkage strain of concrete = 0.00025 , Relaxation of steel stress = 3.5% , $E_S = 2.1 \times 10^5$ MPa , $E_C = 0.375 \times 10^5$ MPa. **(15 Marks)**

OR

4 a. Using Mohr's theorem obtain expression for central deflection in a PSC beam due to prestress produced by an parabolic cable with eccentricities e_2 above the centroidal axis at supports and eccentricity e_1 below the centroidal axis at midspan. **(05 Marks)**

b. A concrete beam of span 10m with a cross section 100mm × 300mm is prestressed by 2 – cables carrying an effective stress of $1000N/mm^2$. Each cable is composed of 6 – wires of 7mm diameter. The beam carry a LL of 2kN/m.

Cable – 1 : Is parabolic , located at 90mm from bottom of the beam at midspan and 210mm from bottom of beam at supports.

Cable – 2 : Is bent, located at eccentricity of 60mm below the centroidal axis at midspan and 60mm above the centroidal axis at supports.

i) Estimate the short term deflection neglecting the losses of prestress.

ii) Estimate the long term deflection assuming loss factor = 0.85 , Creep coefficient = 1.8 $E_C = 38kN/mm^2$, $D_C = 24\ kN/m^3$. **(15 Marks)**

Module-3

5 a. Explain different types of flexural failures of PSC beams. **(05 Marks)**

b. A pre – tensioned PSC beam of I – section with 160mm × 70mm flanges, with thickness of web 50mm and overall depth 320mm. The beam is prestressed with 4 – HTS wires of 7mm diameter at an effective depth of 265mm, $f_{ck} = 50N/mm^2$ and $f_y = 1600\ N/mm^2$. Determine the ultimate flexural strength. **(15 Marks)**

OR

6 A post tensioned bridge girder with unbounded tendon is of box section of overall dimensions 1200mm width and 1800mm depth, with a wall thickness of 150mm. The HTS has a C/s $4000mm^2$ and is located at an effective depth of 1600mm. The effective prestress after all losses is $1000N/mm^2$ effective span of girder is 24m, $f_{ck} = 40N/mm^2$, $f_y = 1600\ N/mm^2$. Estimate the ultimate flexural strength using IS : 1343 provisions. **(20 Marks)**

Module-4

7 a. Explain modes of Shear failure. **(05 Marks)**

b. The support section of a prestressed concrete beam of rectangular section 120mm × 250mm, supports a super imposed load of 15kN/m excluding self weight spanning over 10m. The cable is parabolic with maximum eccentricity of 75mm at center of span and zero at supports. Design the shear reinforcement using IS – Code recommendations for the following data. The prestressing force is 150kN , $f_{ck} = 40N/mm^2$, $D_C = 24kN/m^3$ and $f_y = 415\ N/mm^2$. **(15 Marks)**

OR

8 A cross – section of a PSC beam is an T – section with following details :

- Overall depth = 1500mm ;
- Thickness of web and flange = 120mm
- Width of flange = 800mm ;
- At a particular section the beam is subjected to an ultimate moment M = 2500 kN – m and SF V = 350 kN.
- Effective depth d = 1300mm ;
- $f_{ck} = 45\ N/mm^2$;
- Effective prestress at extreme tensile fiber of the beam = $20\ N/mm^2$.
- Area steel in steel in section = $2550\ N/mm^2$.
- Effective stress in tendons after all losses = $990\ N/mm^2$.

Check for flexural shear resistance of the section. Use IS – Code recommendations. **(20 Marks)**

Module-5

9 A precast pretension unit of rectangular section of size 100mm × 200mm is used as a part of composite beam to a span of 5.0m. This unit is pre-stressed by tendons with their centroids coinciding with the bottom keen point. The initial force in the tendon is 150kN. The loss of prestress may be assumed to be 15%. The unit is incorporated as web of a composite beam by casting a slab of flange width of 400mm and thickness of 40mm. On top of the precast unit the composite beam supports a LL of 8kN/m. Compute the resultant final stresses developed in the precast and cast in situ concrete assuming the pre – tensional unit as propped construction. Draw the resultant stress diagrams. **(20 Marks)**

OR

10 A composite T – girder of span 5m is made up of a pre – tensioned rib 100mm × 200mm, with an insitu cast slab 400mm wide and 20mm thick. The rib is prestressed by a parabolic cable having eccentricity of 33.33mm at center of span and zero at supports carrying an initial force of 150kN. The loss of pre-stress may be assumed to be 15%. Check the composite T – beam for the limit state of deflection if it, supports an imposed load of 3.2kN/m for

a. Un propped construction.
b. Propped construction.

Assume modulus of elasticity of 35kN/mm^2 for pre-cast beam and insitu cast elements.

(20 Marks)

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