CBCS SCHEME

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15CV82

Eighth Semester B.E. Degree Examination, Feb./Mar. 2022
Design of Pre-Stressed Concrete Elements

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Use of IS1343 is permitted.

Module-1

1 a. Define pre stressed concrete. Explain briefly pre tensioned and post tensioned members. **(03 Marks)**

b. A PSC unsymmetrical I section beam 8m support a load 20kN/m Top flange 300 × 60mm bottom flange 100 × 60mm web 80 × 280 mm P = 100kN located at 50mm from bottom. Find stress at mid span. Given A = 46.4 × 10^3mm^2 NA 156mm from top I_{XX}, 760.45 × 10^6mm^4. **(05 Marks)**

c. A PSC inverted T beam web 300 × 900mm flange 300 × 600mm simply supported over a span of 15m. It is tensioned by 3 cable each containing 12 wires of 7mm diameter placed at 150mm from soffit calculate max UDL the beam can carry if max tension and compression is limited to 1MPa and 15MPa. Loss of pre stress 15%. **(08 Marks)**

OR

2 a. Explain load balancing concept. **(03 Marks)**

b. A PSC section 400 × 600mm is prestressed by 1920kN by a parabolic cable having max eccentricity 200mm at mid span 100mm at support below NA Find stress at mid span, ONLY by load balancing concept. **(07 Marks)**

c. A PSC beam with single over hanging is simply supported at A continuous over B span AB 8m and over hanging BC 2m C/S of beam 300 × 900 mm live load 3.52kN/m suggest suitable cable profile Take P = 500kN. **(06 Marks)**

Module-2

3 a. Define loss of pre stress. Explain briefly different types of loss with suitable formula. **(05 Marks)**

b. A post tensioned PSC beam 250 × 400mm is pre stressed by 12 wires of 7mm diameter stressed to 1200N/mm^2. The cable is parabolic with eccentricity 120mm at centre and zero at support span 10m. Calculate the loss of prestress and % loss of pre stress. Take μ = 0.55, K = 0.0015/m ε_{CS} = 1.354 × 10^{-4}, ϕ = 1.6, E_S = 2 × 10^5N/mm^2, E_C = 31.62 × 10^3N/mm^2, Relaxation 5% slip 2mm. **(06 Marks)**

c. A post tensioned PSC member 400 × 400mm span 12m is pre stressed by 4 cable each having area 200mm^2 initial pre stress 1000N/mm^2. Find the loss of pre stress due to elastic deformation, when cable is tensioned one by one. Take ε_{CS} = 0.003, ϕ = 2.5, m = 6, Δ = 3mm, E_{CS} = 2.1 × 10^5N/mm^2 eccentricity of cable zero. **(05 Marks)**

OR

4 a. A simply supported 6m beam post tensioned by two cable having 100mm eccentricity below NA at centre. The first cable is parabolic with an eccentricity 100mm above NA at support. The second cable is straight C/S of each cable is 100mm^2 initial pre stress is 1200N/mm^2 A = 2 × 10^4mm^2 radius of gyration 120mm. The beam support a load of 20kN each at middle third point E_C = 38kN/mm^2. Calculate short term and long term deflection, ϕ = 2 loss of prestress 20% **(10 Marks)**

b. A PSC beam 200 × 400mm span 10m is prestressed by a parabolic cable at 80mm from bottom at mid span and 125mm from top at support force in the cable 400kN E_C = 35kN/mm^2. Calculate: i) Deflection at mid span to support its self weight ii) Point load to be applied at centre for zero deflection. **(06 Marks)**

Module-3

a. A pretensioned T section Flange 1200 × 150mm web 300 × 1500mm area of steel 4700mm^2 located at a depth 1600mm M40 concrete. Find ultimate moment tensile strength of steel 1600N/mm^2. **(10 Marks)**

b. A post tensioned unbounded rectangular beam 400mm × 800mm effective depth. Cross sectional area of cable 2840mm^2 effective pre stress 900N/mm^2 span 16m. Find ultimate moment. Take M40 concrete. **(06 Marks)**

OR

6 Design a PSC beam E-span 15m live load 20kN/m loss of pre stress 20% permissible comp stress in concrete at transfer and at working load 15N/mm^2 and 12N/mm^2 no tensioned is allowed at any stage. Take b = 400mm. **(16 Marks)**

Module-4

7 a. Explain shear failure in PSC members. **(04 Marks)**

b. A post tensioned beam 200 × 400mm span 10m load 8kN/m P = 500kN parabolic cable with 140mm eccentricity at mid span and zero at support. Calculate: i) Principal stress at support ii) Principal stress in the absence of pre stress. **(12 Marks)**

OR

8 a. The cross section of a bridge girder T beam top flange 600 × 230mm web 150mm NA is at 545mm from top C/S area 328500mm^2 MI = 665 × 10^{8}mm^{8}mm^4 second moment of area $a\bar{y} = 665\times10^5\,mm^4$ span 25m cable area 2300mm^2 parabolic cable with e = 650mm at mid span and 285 at support. Effective pre stress 900N/mm^2, tensile stress in concrete 1.6N/mm^2. Find max UDL the beam can carry and load factor is 2.0. Assume no loss of prestress. **(08 Marks)**

b. A PSC beam 250mm × 1500mm carries an effective prestress 1362kN shear force 771kN slope of cable at support θ = 1/6 extreme fiber stress 7N/mm^2 at top zero at bottom permissible tensile stress 0.7N/mm^2. Design shear reinforcement. **(08 Marks)**

Module-5

9 a. Explain anchorage zone and stress distribution in end block with suitable figure. **(04 Marks)**

b. What are the methods available for calculating anchorage stress? Explain Indian code provision. **(04 Marks)**

c. The end block of post tensioned beam 300mm × 300mm subjected to anchorage force 832.8kN by Freyssinet anchorage area 11720mm^2. Design anchorage reinforcement. **(08 Marks)**

OR

10 a. Explain composite construction in PSC mention the advantages of pre cast PSC member. **(04 Marks)**

b. A pre cast pre tensioned beam 100mm × 200mm E span 5m is prestressed by a force 150kN loss of pre stress is 15%. The beam is incorporated in a composite T beam by casting a top flange of breadth 400mm thickness 40mm live load 8kN/m^2. Assuming unpropped condition. Find the stress developed. **(12 Marks)**

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