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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Eighth Semester, B.E. - Civil Engineering

Semester End Examination; Aug. / Sep. - 2020

Design of Pre-Stressed Concrete Structures

Time: 3 hrs Max. Marks: 100

***Note**: i) Answer **TWO** full questions, selecting **ONE** full question from **UNIT - I** and **UNIT - II**.*

*ii) Answer any **THREE** full questions, choosing from **UNIT - III, UNIT - IV** and **UNIT - V**.*

iii) Use IS: 1343 - 2012 is permitted.

UNIT - I

1 a. Explain the principle of pre-stressing of concrete. 6

b. What are tensioning devices? Explain them briefly. 10

c. What are the advantages of pre-tensioning over post-tensioning? 4

OR

2 a. Explain load balancing concept and cable profile in PSC. 10

b. Explain load carrying mechanism of PSC structures over RCC structures. 10

UNIT - II

3 a. How do you estimate resultant stresses in concrete due to concentric and eccentric pre-stressing force with external loads at; 14

i) Transfer of pre-stress ii) Working load conditions

b. Rectangular concrete beam 250 x 600 mm is pre-stressed by means of 4 – 14 mm diameter high tensile bars located 200 mm from the soffit of the beam. If the effective stress in the wires is 700 N/mm^2, what is the maximum bending moment that can be applied to the section without causing tension at the soffit of the beam? 6

OR

4. An unsymmetrical I-section beam is used to support an imposed load of 2 kN/m over a span of 8 m. The sectional details are top flange 300 mm wide and 60 mm thick, bottom flange 100 mm wide and 60 mm thick, thickness of the web = 80 mm, overall depth of the beam = 400 mm. At the quarter of the span, the effective pre-stressing force of 100 kN is located at 50 mm from the soffit of the beam. Estimate the stresses at the quarter of span section of the beam for the following load conditions. Sketch stress diagrams. 20

i) Pre-stress + Self weight

ii) Pre-stress + Self weight + Live load

UNIT - III

5 a. Explain the loss of pre-stress due to Elastic shortening of concrete and friction. 6

Contd....2

b. A post tensioned concrete beam 100 mm x 300 mm spanning over 10 m is stressed by successive tensioning and anchoring of 3 cables 1, 2 and 3 respectively. The cross sectional area of each cable is 200 mm^2 and initial stress in the cable is 1200 N/mm^2 and m = 6. The first cable is parabolic with eccentricity 50 mm below centroidal axis at center of span and 50 mm above the centroidal axis at support sections. The second cable is parabolic with zero eccentricity at the support and the eccentricity of 50 mm at the center of span. The third cable is straight with uniform eccentricity of 50 mm below the centroidal axis. Estimate the % loss of stress in each of the cable, if there are successively tensioned and anchored due to elastic deformation of concrete. 14

6 a. Distinguish between short term deflection and long term deflection. Explain camber. 8

b. A rectangular concrete beam of cross section 150 x 300 mm is simply supported over a span of 6 m. It is pre-stressed by means of symmetric parabolic cable at a distance of 120 mm from bottom fibres at support section and at a distance of 60 mm from bottom fibres at mid span section. Initial Pre-stress in the cable is 300 kN. Determine ; 12

i) Maximum deflection of the beam at transfer

ii) Central concentrated force to be applied to nullify the above deflection

Take; $E_C = 3.8 \times 10^4 N/mm^2$

UNIT - IV

7 a. Formulate the expression for obtaining flexural strength of flanged sections when NA lies in the Web. 10

b. A Pre-stressed concrete beam rectangular in cross section 200 x 500 mm deep is pre-stressed by tendons having an area of 600 mm^2 located at 100 mm from soffit of the beam. Given; $f_{ck} = 40 N/mm^2$ and $f_p = 1600 N/mm^2$. Estimate the ultimate flexural strength of the beam for the following cases as per IS code provisions: 10

i) If the beam is Pre-tensioned ii) If the beam is Post-tensioned with effective bond

8 a. Discuss the ultimate shear resistance of the concrete sections at both un-cracked and cracked in flexure conditions. 8

b. The support section of a PSC beam 150 x 300 mm is to resist a shear of 100 kN. The pre-stress at centroidal axis is 5 N/mm^2, $f_{ck} = 40 N/mm^2$. The cover to tension reinforcement is 45 mm. Check the section for shear and design suitable shear reinforcement $f_t = 1.5 N/mm^2$. 12

UNIT - V

9 a. Explain Transmission of pre-stress in pre-tensioned member with figure. 8

b. Define end block. Discuss stress distribution in end block of post-tensioned member. 12

10 a. Summarize anchorage zone reinforcement. 5

b. A Freyssinet anchorage 100 mm dia carrying 12 wires of 7 mm dia is embedded concentrically in the web of an I-section of web thickness 225 mm. Using IS code method determine the tensile stress and bursting tensile force in the end block. Design the end block and sketch the reinforcement details. 15

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