Mid-West University

Examinations Management Office

End Semester Examinations 2081

Master level/ M. Sc. (Structural Engineering)/ 3rd Semester — Full Marks: 60

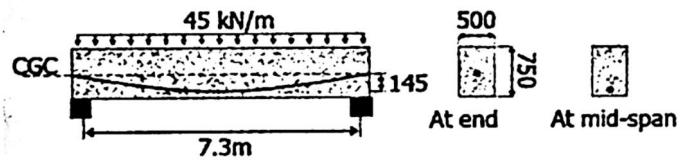
Time: 3 hours — Pass Marks: 30

Subject: Pre-Stressed Concrete (ELE531)

- *Attempt all the questions.*
- *Figures in the margin indicate full marks.*
- *Assume suitable values, with a stipulation, if necessary.*
- *Candidates are required to answer the questions in their own words as far as possible.*
- *Allowable code IS456:2000 IS13920 and IS1343:2012/2016*

1. Why is the high strength of concrete and high grade of steel required for pre-stressed concrete? Explain any two methods of pre-stressing system. Also list out advantage and application of prestress concrete in case of our infrastructure development. **[10]**

2. What is load balancing concept? A concrete beam pre-stressed with parabolic tendons as shown in figure. The pre-stress force applied 1940KN. The uniform distributed load includes the self-weight. Compute the extreme fibre stress at mid span of beam by stress concept and verify by force concept and Load balancing method. Also draw stress diagram. **[10]**

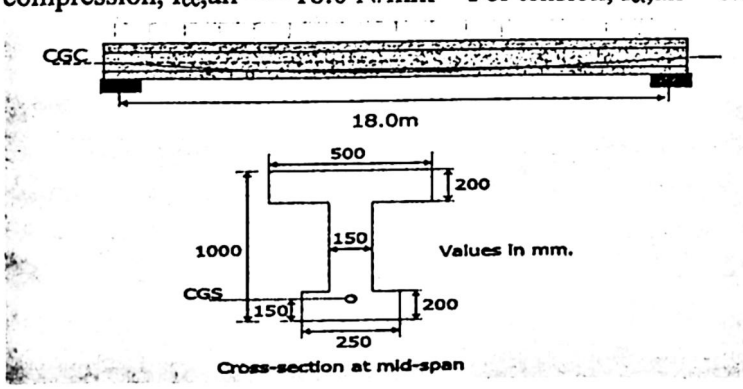


3. Explain the pre tensioning and post tensioning of losses in pre stress Concrete? A pre tensioned beam 500 mm wide and 800 mm deep is pre stressed by 16 wires each of 10 mm diameter initially stressed to 1600 N/mm^2 with their centroids located 150 mm from the soffit. Estimate the final percentage loss of stress due to elastic deformation, creep, shrinkage and relaxation using the following data: Relaxation of steel stress = 90 N/mm^2, E_s =210 kN/mm^2, E_c = 35 kN/mm^2, Creep coefficient = 1.6, Residual shrinkage strain = 2×10^{-4}. **[10]**

4. Explain the cracking moment and kern zone in prestress flexural analysis. For the post-tensioned beam with a flanged section as shown, the profile of the CGS is parabolic, with no eccentricity at the ends. The live load moment due Service loads at mid-span (MLL) is 648 kNm. The prestress after transfer (P0) is 1800 kN. Assume 15% loss at service. Grade of concrete is M30. Evaluate the following quantities. **[10]**

a) Kern levels b) Cracking moment c) Location of pressure line at mid-span at transfer and at service. d) The stresses at the top and bottom fibres at transfer and at service.

Compare the stresses with the following allowable stresses at transfer and at service. For compression, f_{cc},all = – 18.0 N/mm^2 For tension, f_{ct},all = 1.5 N/mm^2.



5. Design a simply supported Type 1 pre-stressed beam with MT = 435 kNm (including an estimated MSW = 55 kNm). The height of the beam is restricted to 920 mm. The prestress at transfer f_{po} = 1135 N/mm^2 and the prestress at service f_{pe} = 960 N/mm^2. Based on the grade of concrete, the allowable compressive stresses are 12.5N/mm^2 at transfer and 11.0 N/mm^2 at service. The properties of the pre-stressing strands are given below. **[10]**

Type of pre-stressing
Tendon: 7-wire strand
Nominal diameter = 12.8 mm
Nominal area = 99.3 mm^2

6. In recent various bridges are collapse before the operation and implementation due to various reasons. Besides that, some opinions are focused on application of pre-stress to the bridge which is also major presentation to reduce the collapses of bridge. Which is the solution of above problem? Justify with your opinion. List out the favourable condition of pre-stress design over RCC design. **[10]**

The End