BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
M.E. (Civil) - Structural Engineering Odd Semester Examination
December 2011

PRESTRESSED CONCRETE (CE-907)

Full Marks : 100 Duration : 3 hours

Answer any *Three* questions.
All questions carry equal marks. One mark is reserved for neatness.
Assume data suitably if not given.
Use of IS:1343 and other relevant code is permitted.

1. A pre-stressed concrete beam having a rectangular section 150mm wide by 300mm deep has a simply supported span of 4m. The beam is pre-stressed by a straight cable consisting of 6 - 7φ wires stressed to 1200N/mm^2 with an eccentricity of 56mm. The beam is subjected to a service load of 8.5kN/m. Determine the maximum deflection of the beam at the following loading stages: (i) Pre-stress + Self weight, (ii) Pre-stress + Self weight + Service load, (iii) Cracking load and (iv) 1.5 times the service load. Take Young's modulus of concrete as 3.5×10^4N/mm^2, modulus of rupture o concrete as 4N/mm^2 and modular ratio as 6.

2. A post-tensioned pre-stressed concrete rectangular beam of width 300mm and depth 650mm on a simply span of 9m is provided with 633.5mm^2 pre-stressing steel and 569kN pre-stressing force at an eccentricity of 185mm at mid-span. The shape of the tendon is parabolic with zero eccentricity at ends. The total load on beam is 22.68kN/m. Design the beam for limit state of collapse in shear taking concrete grade as M35.

3. Pre-stressed concrete T-beams of flange section 450mmx200mm and web (below flange) section 1000mmx180mm are spaced at 8m center to center and carrying a RC roof load (total) of 2kN/m^2. The beams are simply supported over a span of 20m. Check the adequacy of the sectional dimensions and determine the value of the minimum pre-stressing force with its location at the mid-span of such a beam. Take the permissible compressive stress of concrete at transfer and working stage as 20MPa and 16MPa respectively. Take the permissible tensile stress of concrete at transfer and working stage both as 1.4MPa. Take total losses in pre-stress as 20%.

4. A post-tensioned concrete beam, 100mm wide and 300mm deep, spanning over 10m, is stressed by successive tensioning and anchoring of three cables 1, 2 and 3 respectively. The cable 1 is parabolic with a downward eccentricity of 50mm at mid-span and upward eccentricity of 50mm at supports. The cable 2 is parabolic with a downward eccentricity of 50mm at mid-span and zero eccentricity at support. The cable 3 is straight with a downward uniform eccentricity of 50mm. Estimate the percentage loss of stress in each cable. Take cross sectional area of each cable as 200mm^2, initial pre-stress in each cable as 1200N/mm^2 and modular ratio as 6. Further calculate the jacking force required for each cable if jacking is done from one end only. Take $\mu = 0.35$ and $k = 0.0015$ per m.

5. A beam of size 800mm deep by 500mm wide is pre-stressed with a linearly bent tendon having 100mm downward eccentricity at mid-span and 100mm upward eccentricity at both simply supported ends. The beam is subjected to a UDL of 15kN/m in addition to its self weight on a span of 10m and pre-stressed with 1500kN of force. Calculate the extreme fibre stresses at support and mid-span at transfer and working stage of loading applying stress concept, strength concept and load balancing concept.