No. of Printed Pages : 5

BCEE-061

00652

Diploma in Civil Engineering

Term-End Examination

June, 2011

BCEE-061 : PRESTRESSED CONCRETE

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt **five** questions including question **No.1**, which is **compulsory**. Use of calculator is allowed. Assume any required data suitably.*

1. Choose the most appropriate answer from the options given in each case. **2x7=14**

(a) The main advantage of light-weight aggregate concrete for prestressed concrete is

(i) It increases the self weight of structural component.

(ii) It reduces the self weight of structural component.

(iii) It does not affect the self weight of structural component.

(iv) None of the above.

(b) Which is not a type of prestressing steel ?

(i) plain hard-drawn steel wire

(ii) cold-drawn indented wire

(iii) HYSD bars

(iv) uncoated stress relieved strands

(c) Which is not the cause for immediate loss of prestress ?

(i) Elastic - shortening

(ii) Creep

(iii) Friction

(iv) Anchorage slip

(d) Compared to pre-tensioning concrete total loss of prestress is generally

(i) lower in post-tensioned concrete

(ii) higher in post-tensioned concrete

(iii) equal in post-tensioned concrete

(iv) none of the above

(e) For load balancing of a point load in a simply supported prestressed beam, the tendon profile should be

(i) Parabolic

(ii) Triangular

(iii) Trapezoidal

(iv) Circular

(f) If the tendon profile in a simply supported beam is parabolic, then the applied load for load balancing is

(i) uniformly distributed load

(ii) centrally applied concentrated load

(iii) two point loads

(iv) triangular load

(g) The tensile stresses of the tendons are transferred to concrete in the form of compressive stress

(i) due to bond between tendons and concrete is pre-tensioned elements

(ii) through end anchorages in post-tensioned elements

(iii) both (i) and (ii)

(iv) none of above

2. (a) Describe loss of prestress due to Elastic shortening of concrete. 7

(b) A pre-tensioned concrete beam, 250 mm wide and 350 mm deep, is prestressed by straight wires carrying an initial force of 250 kN at an eccentricity of 50 mm. Assume modulus of Elasticity of steel as 2×10^5 N/mm^2 and that of concrete as 0.33×10^5 N/mm^2 respectively. Estimate the percentage loss of stress in steel due to elastic deformation of concrete if area of steel wires is 188 mm^2. 7

3. (a) Explain pre-tensioning systems of concrete. 7

(b) A cylindrical concrete tank, 25 m external diameter, is to be prestressed circumferentially by means of high strength steel wire ($Es = 2 \times 10^5$ N/mm^2), jacked at 4 points, 90° apart. If the minimum stress 7

in the wire immediately after tensioning is to be 450 N/mm^2 and coefficient of friction is 0.50, Calculate :

(i) The maximum stress to be applied to the wires at the jack, and

(ii) The expected extension at the jack. Take e = 2.7. Tendons are stretched from one end only.

4. A pre stressing force of 300 kN is concentrically applied in a beam of a rectangular cross section of 250 mm width and 450 mm depth. The beam is simply supported and has a span of 5 m. It is subjected to its self load and an imposed load of 5 kN/m over its entire span. 14

Compute the stresses at top and bottom fibres at the mid span, quarter span and end sections. Density of concrete may be taken as 25 kN/m^3.

5. (a) Describe the variation in tendon stress in pre-tensioned and post-tensioned prestressed concrete. 7

(b) A simply supported pre-stressed concrete beam with a rectangular cross section, 250 mm wide and 450 mm deep is subjected to a prestressing force of 300 kN applied concentrically. Draw the variation of stress and determine the locations of resultant force at a cross section if the stresses are 7

(i) 4.84 N/mm^2 at top and 0.50 N/mm^2 at bottom fibre.

(ii) 2.67 N/mm^2 each at top and bottom fibres.

6. (a) What do you understand by tendon splices ? 7

(b) A prestressed concrete beam, of cross section 250 mm × 400 mm and 6 m span, is prestressed with a parabolic tendon having a prestressing force of 1800 kN. The tendon has a sag of 100 mm at the mid span. The eccentricity of tendon at the ends of beam is zero. Find the extreme fibre stresses at the mid span section of the beam using the load balancing concept if it is subjected to a total load of 240 kN applied as UDL on the beam. 7

7. Write short notes on ***any four*** of the following. **4x3½=14**

(a) Modulus of Elasticity of Concrete

(b) Relaxation of Stress in Steel

(c) Limited or Partial Prestressing

(d) Eccentric Prestressing

(e) Untensioned Reinforcement in prestressed concrete construction.

(f) Limit state of serviceability of cracking in prestressed concrete construction.