Diploma in Civil Engineering

01869

Term-End Examination

December, 2010

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) Which is not the needed requirements of prestressed concrete in terms of various properties given below ?

   (i) A high value of strength of concrete.

   (ii) Low early shrinkage and small creep deformation of concrete.

   (iii) Durability of concrete.

   (iv) High porosity of concrete.

   (b) Which, among the following, is not the time dependent loss in prestressed concrete?

   (i) Elastic shortening.

   (ii) Relaxation.

   (iii) Creep.

   (iv) Shrinkage.

(c) For load balancing of a uniformly distributed load is a simply supported prestressed beam, the tendon profile should be

(i) Parabolic.

(ii) Triangular.

(iii) Trapezoidal.

(iv) Circular.

(d) If the tendon profile in a simply supported prestressed beam is trapezoidal, then the applied load for load balancing is

(i) Uniformly distributed load

(ii) Centrally applied concentrated load

(iii) Two symmetrical point loads

(iv) Triangular load.

(e) Pressure line is :

(i) Locus of the dead load

(ii) Locus of the resultant force

(iii) Locus of the prestressing force

(iv) Locus of live load.

(f) The eccentricity of tendons at a cross section is provided in such a way that

(i) Moment due to prestress tends to increase the effect of live load moment.

(ii) Moment due to prestress tends to lessen the effect of live load moment.

(iii) Moment due to prestress should not affect live load moment.

(iv) none of the above.

(g) In a Simply supported rectangular beam subjected to UDL and prestressed concentrically, combined stresses at support will be :

(i) max at top fibre and min at bottom fibre

(ii) min at top fibre and max at bottom fibre

(iii) Equal at top and bottom fibre

(iv) none of the above.

2. (a) List various types of loss of prestress in pre-tensioned and post-tensioned concrete members. 7

(b) A pre-tensioned concrete beam, 200mm wide and 300mm deep, is prestressed by straight wires carrying an initial force of 200 kN at an eccentricity of 50mm. 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 188mm^2. 7

3. (a) Explain advantages and applications of prestressed concrete. 7

(b) A cylindrical concrete tank, 30m external diameter, is to be prestressed circumferentially by means of high-strength steel wire ($E_s = 2x10^5$ N/mm^2), jacked at 4 points, 90° apart. If the minimum stress in the wire immediately after tensioning is to be 500 N/mm^2 and coefficient of friction is 0.50, 7

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 prestressing force of 250 kN is eccentrically applied, with a constant eccentricity of 50mm towards the soffit of a beam. The beam is of a rectangular cross section of 200mm width and 400 mm depth and is simply supported. The beam is subjected to its self load and an imposed load of 4 kN/m over its entire span of 5m. Compute the stresses at top and bottom fibres at mid span, quarter span and end sections. Density of concrete may be taken as 25 kN/m^3. 14

5. (a) Describe the differences between pre-tensioning and post-tensioning. 7

(b) A simply supported pre-stressed concrete beam with a rectangular cross section, 200mm wide and 400mm deep, is subjected to a prestressing force of 250 kN applied concentrically. 7

Draw the variation of stress and determine the location of resultant force at a cross section if the stressed are :

(i) 5.37 N/mm^2 at top and 0.88 N/mm^2 at bottom fibre.

(ii) 3.125 N/mm^2 each at top and bottom fibres.

6. (a) What do you understand by various limit states ? 7

(b) Explain why post-tensioning is not provided in members which are small in length and are required in great numbers. 7

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

(a) Tensile strength of concrete.

(b) Creep of concrete.

(c) Devices used for tensioning.

(d) Tendon splices.

(e) Chemical prestressing.

(f) Hoyer's long line system.