No. of Printed Pages : 4

BICEE-002

B.Tech. CIVIL ENGINEERING (BTCLEVI)

Term-End Examination

00713 **December, 2016**

BICEE-002 : PRESTRESSED CONCRETE

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. All questions carry equal marks. Assume any missing data, if necessary. Use of scientific calculator is permitted.*

1. (a) Why are high strength materials needed in the construction of prestressed components ? Explain briefly considering some important characteristics of concrete and steel. 7

(b) What are the different principles on which various post-tensioning anchorage systems are based ? Give an example for any one type. 7

2. (a) Discuss the loss of prestress during the tensioning process due to friction. 7

(b) A pre-tensioned concrete beam, 200 mm wide and 300 mm deep, is prestressed by straight wires carrying an initial force of 150 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 $0{\cdot}33 \times 10^5$ N/mm^2, respectively. Estimate the percentage loss of stress in steel due to elastic deformation of concrete, if the area of steel wires is 188 mm^2. 7

3. (a) Describe the stress concept for the analysis of prestressed concrete beams. 7

(b) Discuss the effect of tendon profile on deflection for the following two cases : 7

(i) Straight tendons

(ii) Trapezoidal tendons

4. A simply supported prestressed concrete beam of rectangular cross-section, 200 mm wide and 400 mm deep, is prestressed with a prestressing force of 250 kN. This force is eccentrically applied with a constant eccentricity of 50 mm towards the soffit of the beam. The beam is subjected to its self-load and an imposed load of 4 kN/m over the entire span of 5 m. Calculate the combined stresses at top and bottom fibers at sections A-A, B-B and C-C as shown in Figure 1. *14*

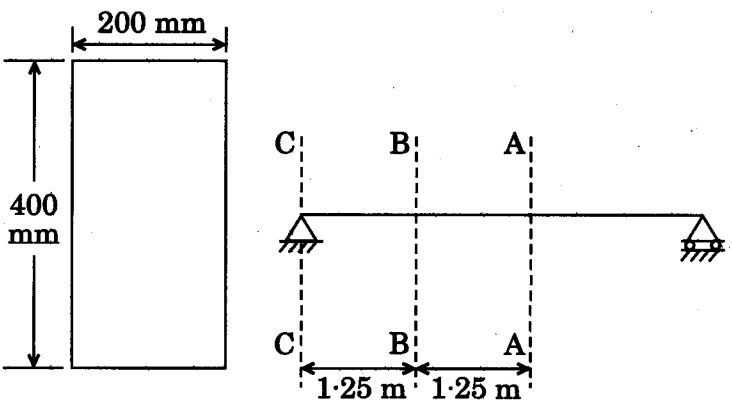

Figure 1

5. A concrete beam of rectangular cross-section, 300 mm wide and 500 mm deep, is prestressed by two post-tensioned cables of area 600 N/mm^2 each, initially stressed to 1600 N/mm^2. The cables are located at a constant eccentricity of 100 mm throughout the length of the beam of 10 m span. The modulus of elasticity of steel and concrete are 210 and 38 kN/mm^2 respectively.

(a) Neglecting all losses, find the deflection at the centre of span when it is supporting its own weight.

(b) Allowing for 20% loss in prestress, find the final deflection at the centre of span when it carries an imposed load of 18 kN/m. Take density of concrete as 24 kN/m^3. *7+7=14*

6. A post-tensioned prestressed beam of rectangular section 250 mm wide is to be designed for an imposed load of 12 kN/m, uniformly distributed on a span of 12 m. The stress in the concrete must not exceed 17 N/mm^2 in compression or 1·4 N/mm^2 in tension at any time and the loss of prestress may be assumed to be 15%.

(a) Calculate the minimum possible depth of the beam.

(b) For the section provided, calculate the minimum prestressing force and the corresponding eccentricity. *7+7=14*

7. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

(a) Tensioning Devices

(b) Concept of Load Balancing

(c) Hoyer's Long Line System of Pre-tensioning

(d) Limit State of Serviceability

(e) Stress Distribution in End Block