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2005 JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY

IV B.TECH I SEMESTER SUPPLEMENTARY EXAMINATIONS
PRE-STRESSED CONCRETE
(CIVIL ENGINEERING)

TIME: 3 HOURS

NOVEMBER 2005

MAX MARKS: 80

Answer any FIVE Questions
All Questions carry equal marks
? ? ? ? ?

1. A pretensioned concrete beam of 300 mm x 600 mm cross section is stressed by 20 - 8 mm high tensile steel wires, located at 200 mm below the centre line of the section. If the characteristic strength of concrete is 45 N/mm2 and the characteristic strength of prestressing steel is 1400 N/mm2, determine the moment of resistance of the section. [16]

2. (a) Derive from first principles for loss of prestress due to elastic deformation of concrete in a prestressed concrete beam having a straight cable with constant eccentricity. [6]

(b) A simply supported concrete section of uniform cross section is prestressed by means of two cables both of which have an eccentricity of 95mm below the centroid of the section at mid span. The first cable is parabolic and is anchored at an eccentricity of 90mm above the centroid at each end. The second cable is straight and parallel to the line joining the supports. If the cross sectional area of each cable is 120mm2 and the beam has cross sectional area of 2.2 x 104 mm2 and the radius of gyration is 125mm. Calculate the loss of stress in the first cable when the second cable is tensioned to a stress of 1200MPa. Take modular ratio = 6. [10]

3. Compute the net initial and final concrete stresses in the extreme top and bottom fibres at the central section of a prestressed concrete beam which is 250mm wide and 350mm deep on a span of 8m. The beam is to support on imposed load of 5 KN/m and is to be prestressed with a final force of 550 KN at an eccentricity of 82mm. Losses may be assumed as 16%. Draw the sketches showing the variation of stresses.
[16]

4. (a) Write in detail the approximate method of design of prestressed concrete. Beams? [8]

(b) Derive the expression for eccentricity to be used in design? [8]

5. A prestressed concrete beam of rectangular section 180 mm wide and 350 mm deep is simply supported over a span of 10 m. The beam is concentrically prestressed by a cable carrying an effective prestressing force of 325 KN. The beam carries an all inclusive load of 9 KN/m. Find the principal tensile stress at the support section. In case the cable has a parabolic profile with an eccentricity of 125 mm at the centre of span. The eccentricity being zero at the supports. Find the percentage reduction in the principal tensile stress at the support section.

6. A prestressed concrete beam is 300mm wide and 600mm deep is subjected to an axial prestressing force of 1500kN. Design the end block by Guyon's method. [16]

7. A composite prestressed beam of T section consists of a cast in situ flange of 800mm× 150mm and precast web of 300mm × 800mm. Both are made of same grade of concrete. If the differential shrinkage is 1.2 × 10-4 mm/mm. Find the shrinkage stress at the extreme edges of the slab and the web. Take Ec = 2.75 × 107 N/mm2 [16]

8. A concrete beam with a rectangular section (300 mm × 500 mm)is pre-stressed by 2 post-tensioned cables of area 600 mm2 each, initially stressed to 1600 N/mm2.The cables are located at a constant eccentricity of 100 mm. Span of the beam is 10 m. Find the central deflection due to pre-stress and self weight. Also allowing for 20% loss in pre-stress, find the final deflection at the centre of span when it carries an imposed load of 18 kN/m. Es =210 kN/mm2, Ec =38 kN/mm2,Density of concrete= 24 kN/m3