E

Max. Marks: 60   Duration : 3 hours

Part A

(Answer any two questions : 9 x 2 = 18 Marks)

1. a) What are tendon splices? Sketch some common types of tendon splices?

    (5 marks)

    b) Why Post tensioned members do not suffer the loss of stress due to elastic shortening?

    (4 marks)

2. A concrete beam of rectangular section 250mm wide 650mm overall depth is subjected to a torque of 20kNm and a uniform prestressing force of 150kN.Calculate the maximum principal tensile stress. Assuming 15 percent loss of prestress, calculate the prestressing force necessary to limit the principal tensile stress to $0.4N/mm^2$.

3. A rectangular concrete beam,100mm wide by 250mm deep spanning over 8m is prestressed by a straight cable carrying an effective prestressing force of 250kN located at an eccentricity of 40mm.The beam supports a live load of 1.2kN/m.

a) Calculate the resultant stress distribution for the central cross section of the beam. The density of concrete is $24kN/m^3$.

b) Find the magnitude of the prestressing force with an eccentricity of 40mm which can balance the stresses due to dead and live loads at the bottom fibre of the central section of the beam.

Part B
(Answer any two questions : 9 x2 = 18 Marks)

4. A prestressed concrete beam with a cross section 120mm wide and 300mm deep is used to support a uniformly distributed live load of 3 kN/m over an effective span of 6m.The beam is prestressed by a straight cable carrying an effective prestressing force of 180kN at a constant eccentricity of 50mm.Given $Ec=38kN/mm^2$,the modulus of rupture=$5N/mm^2$,area of the cable=$200mm^2$ and modular ratio=6,estimate the deflection of the beam at the following stages:

    a) working load b)cracking load c)1.5 times cracking load.

5. Design a pre tensioned symmetrical I beam for an effective span of 7m to support a superimposed load of 6kN/m.The beam is to be precast in a factory and is to be designed for

handling at any point along its length during transport and erection. Load factors against failure by bending or shear:

For dead load =1.5

For live load= 2.5

Permissible stresses:

At transfer,

Compressive stress = 14N/mm^2

Tensile stress=1.4N/mm^2

At working load,

Compressive stress=16N/mm^2

Tensile stress=1.4N/mm^2

The specified 28 day strength of concrete is 50N/mm^2.The prestressing force is to be provided by 5mm diameter high tensile wires having an ultimate tensile strength of 1600N/mm^2.The loss ratio is 0.8.

6. What are salient design features of prestressed concrete one way slab and two way slab panels?

Part C
(Answer any two questions : 12 x2 = 24 Marks)

7. A rectangular pretensioned concrete beam has a breadth of 100mm and depth of 230mm and the prestress after the losses have occurred is 12N/mm^2 at the soffit and zero at the top. The beam is incorporated in a composite T-beam by casting a top flange of breadth 300mm and depth 50mm.Calculate the maximum uniformly distributed live load that can be supported on a simply supported span of 4.5m,without any tensile stresses occurring ,if
   a) the slab is externally supported while casting and
   b) the pretensioned beam supports the weight of the slab while casting.

8. a) What are cap cables ? Where are they used?
   b) What are the advantages of Partial or limited Prestressing ?

9. A prestressed concrete pipe of 1.2m diameter and a core thickness of 75mm is required to withstand a service pressure intensity of 1.2N/mm^2.Estimate the pitch of a 5mm diameter high tensile wire winding if the initial stress is limited to 1000N/mm^2.Permissible stresses in concrete are 12.5N/mm^2 in compression and zero in tension. The loss ratio is 0.8.If the direct tensile strength of concrete is 2.5N/mm^2, Estimate the load factor against cracking.