M.TECH. DEGREE EXAMINATION

Model Question Paper

Branch: Civil Engineering

Specialization: Geomechanics and Structures

First Semester

MCEGS 106-4 PRESTRESSED CONCRETE STRUCTURES

(Regular – 2013Admissions)

Time: Three hours Maximum: 100 Marks

Answer all questions

Use of IS: 1343, IS: 3370 and IS: 784 are permitted

Assume suitable data wherever necessary

1. (a) Explain load balancing concept applied to analyse basic behavior of prestressed concrete. (5)

   (b) Design a prestressed concrete beam of rectangular section for a span of 3 m. It is to be designed to support two imposed loads of 3.5 kN each located at one third points over the span. There is to be no tensile stresses in concrete at transfer and service load conditions. (20)

OR

2. (a) Define type – **I**,type – **II** and type – **III** structures. (5)

   (b) Evaluate the ultimate moment capacity of a section 300 x 600 mm with 1000 mm^2 of high tensile steel of 150 mm from bottom. Prestressing force of 1000 kN is transmitted to the cross section after losses. The strength of the concrete is 40 N/ mm^2 and steel has a capacity of fp =1380 N/ mm^2 and fpu = 1200 N/ mm^2**.** (20)

3. (a) Explain the ways by which shear resistance of structural concrete members can be improved. (5)

   (b) The support section of a prestressed concrete beam 100 mm wide and 250 mm deep, is required to support an ultimate shear force of 60 kN. The compressive prestress at the centroidal axis is 5 N/ mm^2. Fck =40 N/ mm^2.Cover to tension reinforcement is 50 mm. fy=250 N/ mm^2. Design the suitable reinforcements at the section using IS: 1343 code provisions. (20)

OR

4. (a) Explain different types of shear failures in prestressed concrete beams. (5)

   (b) Design a non cylinder prestressed concrete pipe of internal diameter 500 mm to withstand a working pressure of 1 N/ mm^2. High tensile wires of 2 mm diameter stressed to 1200 N/ mm^2 at transfer are available for use. The permissible maximum stresses in concrete in transfer and at working load conditions are 13.5 and 0.8 N/ mm^2(compression) respectively. The loss ratio (η) = 0.8. Es =210 kN/ mm^2 and

Ec =35 kN/ mm^2. Calculate (1) minimum thickness of concrete pipe

(2) number of turns of wire per metre length of pipe

(3) the test pressure required to produce a tensile stress of 0.7 N/ mm^2 in concrete. (20)

5. (a) When prestressing is resorted to compression members? (5)
   (b) Design a prestressed concrete column of 4 m high for a combined axial compressive force of 400 kN and a bending moment of 25 kN m. Assume fck =45 N/ mm^2 and fp = 1500 N/ mm^2. (20)

OR

6. (a) State the advantages of composite beam. (5)
   (b)A rectangular pretensioned concrete beam has a breadth of 100 mm and depth of 230 mm and prestress after all losses have occurred is 12 N/ mm^2 at the soffit and zero at the top. The beam is incorporated in a composite I beam by casting a top flange of breadth 300mm and depth 50 mm. Calculate the maximum uniformly distributed live load that can be supported over a span of 4.5 m without any tensile stresses occurring , (1) if the slab is externally supported while casting
   (2) if the pretensioned beam supports the weight of slab while casting. (20)

7. (a) A continuous beam ABC (AB=BC=20m) with an overall depth of 1000mm is prestressed by continuous cable carrying a force of 300 kN. The cable profile is parabnolic between supports with zero eccentricity at ends A and C. The cable has an eccentricity of 100 mm towards the soffit at midspan sections and 200mm towards the top fibre at mid support section. Calculate the reactions developed at supports due to prestress and show that the cable is concordant. (25)

OR

8. A continuous prestress concrete beam with two equal spans AB=BC=10m has a uniform rectangular section 100X300mm.The cable carrying an effective prestressing force of 360kN is parallel to the axis of the beam and located at 100 mm from soffit
   (i)Determine the secondary and the resultant moment at the central support B (25)