Reg. No. : | | | | | | | | | | |

Question Paper Code: 52623

M.E. DEGREE EXAMINATION, NOV 2016

Second Semester

Structural Engineering

15PSE203 – DESIGN OF PRESTRESSES CONCRETE STRUCTURES

(Use of code books are permitted)

(Regulation 2015)

Duration: Three hours — Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 20 = 100 Marks)

1. (a) (i) A post tensioned concrete beam of 16m span is subjected to an initial prestress of 1458 *KN* profile of the cable is parabolic with the maximum eccentricity of 520mm at the centre of the span $f_{ck}=40N/mm^2$ @28 days. Take the following additional data: A = $2.42\text{x}10^5 mm^2$; $I=0.382\text{x}10^5 mm^4$; $A_s=1386mm^2$; $fs=1059N/mm^2$ at transfer; $E_s=2.1x10^5N/mm^2$; $E_c=0.382\text{x}10^5 N/mm^2$, μ = friction coefficient = 0.25; wobble correction factor, k = 0.0015/*m*. Determine the following losses in prestress (i) Loss duo to elastic shortening (ii) Loss duo to Shrinkage in concrete (iii) Friction loss and (iv) Creep in concrete . (15)

   (ii) Explain the systems and methods of prestressing with neat sketching. (5)

Or

   (b) (i) A prestressed concrete beam of span 8*m* having a rectangular section of 150*mm*x300*mm*, the beam is prestressed by a parabolic cable having an eccentricity of 75*mm* below the centroidal axis at the center of the span and an eccentricity of 25*mm* above the centroidal axis at the support sections. The initial force in the cable is 350 *kN*. The beam supports three concentrated loads of 10*kN* each at intervals of 2*m*. $E_c=38kN/mm^2$.

(a) Neglecting losses of prestress, estimate the short term deflection due to (prestress+ self-weight).

(b) Allowing for 20% loss in prestress, estimate long term deflection under (prestress+ self- weight+live load), assume creep co-efficient as 1.80. (15)

(ii) Why high strength steel is essential for prestressed concrete? (5)

2. (a) (i) A post tensioned beam of rectangular c/s, 200*mm* wide and 400*mm* deep, is 10*m* long and carries an applied of *8kN/m*, udl on the beam. The effective prestress force in the cable is 500*kN*. The cable is parabolic with zero eccentricity at the supports and the maximum eccentricity of 140*mm* at the centre of span. Calculate the principal stresses at supports. (10)

(ii) A pretensioned, *T* section has a flange which is 300 wide 200*mm* thick. The rib is 150*mm* wide by 350*mm* deep. The effective depth of the cross section is 500*mm*.Given $A_p = 200mm^2$ $f_{ck} = 50N/mm^2$ and $f_p = 1600N/mm^2$, estimate the ultimate moment capacity of the *T*- section using the Indian standard code regulation. (10)

Or

(b) (i) The end block of a pre-stresed concrete girder is 200*mm* wide by 300*mm* deep. The beam is post-tensioned by two Freyssinet anchorages each of 100*mm* diameters with their centres located at 75*mm* from the top and bottom of the beam. The force transmitted by each anchorage being 2000*kN*. Compute the bursting force and design suitable reinforcements according to the IS 1343. (15)

(ii) Briefly outline the Magnel's method of computing the horizontal and transverse stresses in end blocks subjected to concentrated force from anchorage. (5)

3. (a) A two span continuous prestressed concrete beam *ABC* (*AB = BC = 20m*) has a uniform cross section with a width of 300*mm* and a depth of 600mm. A cable carrying an effective prestressing force of 500 *kN* is parallel to the axis of the beam and a located at an eccentricity of 200 mm. (i) Determine the secondary and resultant moment developed at the mid support (ii) If the beam supports an imposed load of 2.5 *kN/m*. Calculate the resultant stress. (20)

Or

(b) (i) Briefly explain the various steps involved in the design of continuous pre-stressed concrete beam. (10)

(ii) Explain the terms (a) Primary moment (b) Secondary moment (c) Resultant moment. (10)

4. (a) A prestressed concrete pipe of 1.2*m* diameter, having a core thickness of 75*mm* is required to withstand a service pressure intensity of 1.2N/mm^2.Estimate the pitch of 5*mm* diameter high tensile wire winding if the initial stress is limited to 1000N/mm^2Permissible stresses in concrete being 12N/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 load factor against cracking. (20)

Or

(b) (i) What are the different types of junctions between tank wall and base slab? Explain. (10)

(ii) What is meant by composite construction? And define the concept of composite in prestress concrete member. (10)

5. (a) (i) A rectangular pre-tensioned concrete beam has a breadth of 100*mm* and depth of 230*mm* and the pre-stress 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 T-beam by casting a top flange of breadth 300*mm* and depth 50*mm*. Calculate the maximum UDL that can be supported on a simply supported span of 4.5*m* without any tensile stresses occurring, if (i) slab is supported while casting, and (ii) The pre-tensioned beam supports the weight of the slab while casting. (10)

(ii) A composite beam of rectangular section is made of rectangular section is made up of a pretensioned inverted T-beam having a slab thickness and width of 250 and 1500*mm* respectively. The rib size 250*mm* by 1000*mm* the cast in situ concrete has a thickness and width of 1500*mm* with a modulus of elasticity of 30KN/mm^2.If the differential shrinkage is $100X10^{-6}$ units. Estimate the shrinkage stresses developed in the precast and cast in situ units. (10)

Or

(b) (i) What is partial pre-stressing? Explain its advantages and disadvantages. (5)

(ii) A precast pretensioned beam of rectangular section has a breadth of 100*mm* and a depth of 200*mm*. The beam with an effective span of 5*m*, is prestressed by tendons with their centroids coinciding with bottom kern. The initial force in the tendons is 150*kN*. The loss of prestress may be assumed to be 15 percent. The beam is incorporated in a composite T- beam by casting a top flange of breadth

400*mm* and thickness 40*mm*. If the composite beam supports a live load of $8kN/mm^2$, calculate the resultant stresses developed in the precast and in situ cast concrete assuming the pretensioned beam as (a) Unpropped and (b)propped during the casting of the slab. Assume the same modulus of elasticity for concrete in precast beam and insitu cast slab. (15)
