Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– II EXAMINATION – SUMMER 2015

Subject Code: 2722011 Date:30/05/ 2015

Subject Name: Prestressed Concrete

Time: 2:30 Pm to 5:00 pm

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of IS: 1343 and IS: 3370 is permitted.**
5. **Assume density of concrete as 24 kN/m^3 until otherwise stated.**

Q.1 **(a)** Write the advantages and disadvantages of Prestressed Concrete. **07**

(b) A simply supported prestressed concrete beam spanning over 10 m is of rectangular section 500 mm wide by 750 mm deep. The beam is prestressed by a parabolic cable having an eccentricity of 200 mm at the center of the span and zero at the end supports. The effective force in the cable is 1600 kN. **07**

(i) Evaluate the extreme fibre stresses at the mid-span section using the concept of load balancing, if the beam supports a total uniformly distributed load of 40 kN/m (including self-weight).

(ii) Calculate the force required in the cable having the same eccentricity to balance a total uniformly distributed load of 50 kN/m (including self-weight) on the beam.

Q.2 **(a)** State different types of losses encountered in the pre-tensioning and post-tensioning systems. Explain any one **07**

(b) A simply supported prestress concrete beam spanning over 6 m is of rectangular section, 150mm wide and 300 mm deep. The beam is prestressed by a parabolic cable having an eccentricity of 75 mm below the centroidal axis at the center of 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 2 concentrated loads of 10 kN each at intervals of 2 m. The modulus of elasticity of concrete is 38 kN/mm^2. **07**

(i) Neglecting losses of prestress, estimate the short-term deflection due to (Prestress + self-weight) and

(ii) Allowing for 20% loss in prestress, estimate the long-term deflection under (Prestress + self-weight + live load), assuming creep coefficient as 1.80.

OR

(b) In a post-tensioned beam of length 12 m, a cable is laid symmetrically, with its central 6 m length horizontal and the two straight end-portions sloping up at an angle with the horizontal whose tangent is equal to 0.075. The cable is tensioned by jacking at one end and is anchored at the remote end of the beam. At the jacking end, the measured stress is 1040 N/mm^2. The ówobbleô coefficient K may be assumed as 0.004/m. Calculate the stress in the cable at the remote end and at the two points where the alignment of the cable changes. Assume coefficient of friction between cable and duct as 0.40. What is the percentage loss of prestress between the jacking end and the anchored end ? **07**

Q.3 **(a)** A pretensioned, T-section has a flange 800 mm wide and 150 mm thick. The rib is 150 mm wide by 400 mm deep. The effective depth of the cross-section is 500 mm. The high-tensile steel has an area of 400 mm^2. If the characteristic cube strength of the concrete and tensile strength of steel are 40 and 1600 N/mm^2 respectively, calculate the flexural strength of the T-section. **07**

(b) The support section of a prestressed concrete beam, 100 mm wide by 250 mm deep, is required to support an ultimate shear force of 80 kN. The compressive prestress at the centroid axis is 5 N/mm^2. The characteristic cube strength of concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. If the characteristic tensile strength of stirrups is 415 N/mm^2, design suitable shear reinforcements in the section. **07**

OR

Q.3 **(a)** The mid-span section of a composite T-beam comprises a pretensioned beam, 300 mm wide and 900 mm deep, and an *in situ* cast slab, 900 mm wide and 150 mm deep. The effective prestressing force located 200 mm from the soffit of the beam is 2180 kN. The moment due to the weight of the precast section is 273 kN m at mid-span. After this is erected in place, the top slab is cast producing a moment of 136.5 kN m at mid-span. After the slab concrete is hardened, the composite section is to carry a maximum live load moment of 750 kN m. Compute the resultant final stresses at, **07**

(i) the top of slab and

(ii) the top and bottom of the precast section

Assume the same modulus of elasticity for concrete in precast beam and *in situ* cast slab.

(b) A simply supported post-tensioned prestressed concrete beam of a symmetrical I-section is to be designed to support an imposed load of 6 kN/m over an effective span of 7m. The width and thickness of top and bottom flanges are 190 mm and 70 mm, respectively. The thickness of web is 40 mm. The overall depth of the beam is 380 mm. The stress in the concrete must not exceed 14 MPa in compression and zero in tension at any stage. Loss ratio is 0.8. Calculate the minimum prestressing force and the corresponding eccentricity. Density of concrete is 24 kN/m^3. **07**

Q.4 **(a)** A continuous concrete beam ABC (AB=BC=10 m) has a uniform rectangular cross section, 100 mm wide and 300 mm deep. A cable carrying an effective prestressing force of 360 kN varies linearly with an eccentricity of 50 mm towards the soffit at the end supports to 50 mm towards the top of beam at mid-support B. **07**

(i) Determine the resultant moment at B due to prestressing only.

(ii) If the eccentricity of the cable at B is + 25mm, show that the cable is concordant.

(b) Briefly explain the advantages of prestressing long span shell structures. **07**

OR

Q.4 **(a)** Explain the Pressure line concept by giving suitable example. Also explain its significance. **07**

(b) The end block of a post-tensioned beam is 500 mm wide and 1000 mm deep. Two cables, each comprising 55 high-tensile wires of 7 mm diameter, are anchored using square anchor-plates of side length 305 mm. The anchor plate centres are located symmetrically at 500 mm from the top and bottom edges of the beam. The jacking force in each cable is 2800 kN. Using Fe415 grade HYSD bars, design suitable anchorage zone reinforcement. **07**

Q.5 **(a)** Enumerate the advantages of prestressed concrete piles. **07**

(b) Explain partial prestressing and its advantages. **07**

OR

Q.5 **(a)** A cylindrical prestressed concrete water tank is required to store 3.5×10^6 litres of water. Ratio of diameter to height = 4. The maximum compressive stress in concrete at transfer is 14 MPa (Compression) and the minimum compressive stress under working load is 1 MPa. The loss ratio is 0.75. Wires of 5 mm diameter with an initial stress of 1000 MPa are available for circumferential winding and Freyssinet cables made up of 12 wires of 7 mm diameter stressed to 1200 MPa are to be used for vertical prestressing. Design the tank walls assuming the base as hinged. The cube strength of the concrete is 40 MPa. **12**

(b) State the difference between RCC beam and PSC beam with respect to its load resisting mechanism. **02**

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