Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– II(Old course) • EXAMINATION (Remedial) – WINTER- 2015

Subject Code: 712007N **Date: 15/12/2015**

Subject Name: Prestressed Concrete

Time:10:30 am to 01:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Explain the Load Balancing Concept. Suggest suitable cable profile (draw sketch) w.r.t. Load Balancing Concept for a PSC beam of following cases. **07**

1-) Simply supported beam with one side overhang subjected to u.d.l.

2-) Simply supported beam with two point load applied at equal distance.

(b) Explain the load resisting mechanism of PSC Beam as compare to RCC beam along with suitable sketch. **07**

Q.2 **(a)** Determine the central Point load corresponding to the Pressure line of a simply supported beam as shown in fig.1 **07**

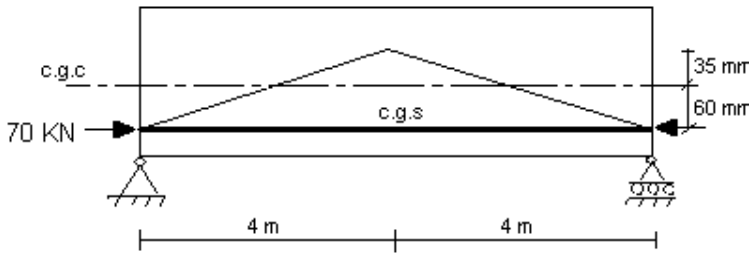

Fig-1

(b) A simply supported post-tensioned prestressed concrete beam of 30 m span is subjected to a transfer prestress force of 2500 KN at 28 days strength. The profile of the cable is parabolic with maximum eccentricity of 200 mm at mid span and concentric at support. **07**

The beam is 500 mm x 800 mm in cross-section and is prestressed wit 9 cables, each cable consisting of 12 wires of 5 mm diameter. Determine the total percentage loss of prestress, if jacking is done from one end and all the wires are tensioned at a time simultaneously.

Take Es = 2.1 x 10^5 N/mm^2,

Ec = 3.5 x 10^4 N/mm^2,

Co-efficient of friction $\mu = 0.3$,

Anchorage slip = 2 mm.

Wave co-efficient k = 15 x 10^{-4} per meter,

Ultimate tensile strength of 5 mm wire is 1600 N/mm^2.

OR

(b) Answer the following: **07**

1- Suggest different ways of reducing the friction losses in PSC beam.

Justify the use of high strength steel and concrete in Prestressed Concrete. What is the minimum grade of concrete recommended by IS:1343-1980 for pretension and posttensioned prestress concrete.

Q.3 **(a)** Design a simply supported (Type-II) pretensioned prestressed concrete beam for flexure only as per IS:1343-1980 with total moment M_T=450 kN-m (including an estimated self-weight moment M_{sw} = 50 kN-m). The prestress at transfer is 1100 N/mm^2 and at service is 900 N/mm^2. **07**

Based on grade of concrete, the allowable compressive stresses are 13 N/mm2 at transfer and 11 N/mm^2 at service. The allowable tensile stresses are 2.4 N/mm2 at transfer and 1.8 N/mm^2 at service.

The properties of the prestressing strands are given below:

- Type of prestressing tendon : 7 – wires strand
- Nominal diameter : 12.8 mm
- Nominal area : 99.3 mm^2

(b) An unsymmetrical I section has an overall depth of 2000 mm. The top flange width and depth are equal to 1200 and 300 mm respectively and the bottom flange width and depth are equal to 750 and 200 mm respectively. The thickness of the web is 300 mm. The tendons having a cross sectional area of 7000 mm^2 is located 200 mm from the soffit. If the ultimate compressive strength of the concrete and the tensile strength of the steel are 42 and 1750 N/mm^2 respectively, and the tendons are effectively bonded to concrete, estimate the flexural strength of the section as per IS:1343-1980(Appendix- B). **07**

OR

Q.3 **(a)** A post-tensioned, prestressed concrete girder is of T-section with an effective flange width and depth of 1500 mm and 250 mm respectively. Thickness of the web is 200 mm. The area of prestressing steel is 5000 mm2, located at an effective depth of 1600 mm. Given fpu = 1600 N/mm2, fcu = 40 N/mm2 and fpe = 960 N/mm2 (with usual notation), estimate the ultimate resistance of T-section as per approximate method suggested by IS: 1343-1980. Assume the effective span of the girder as 32 m. **09**

(b) Explain the deflection behavior of PSC beam at various stages. Also clearly explain the terms: Short term deflection and Long term deflection. State the limiting value of deflection as per IS:1343-1978. **05**

Q.4 **(a)** A rectangular cross section post-tensioned beam of size 300 mm x 800 mm is subjected to an effective prestressing force of 1500 kN at the centroid of the section. **07**

Take f_{ck} = 35 MPa

Permissible punching shear capacity in plate is 90 MPa.

The cables are placed symmetrically over a mild steel plate in an area of 200 mm x 350 mm. Design a bearing plate required to transfer the prestressing force. Also design and detail the reinforcement for bursting force as per IS:1343-1980.

(b) Draw a typical variation of Bursting Tensile Stress in the anchorage zone of a post tensioned beam and mention the region over which its effect is to be consider as per IS:1343-1980. **07**

OR

Q.4 **(a)** The support section of a prestressed concrete beam, 200 mm wide and 400 mm deep, is required to support an ultimate shear force of 200 KN. The compressive prestress at the centroidal axis is 4.5 N/mm^2. The characteristic cube strength of the concrete is 40 N/mm^2. The cover to the tension reinforcement is 50 mm. Design suitable reinforcements at the section using IS: 1343-1980 provision. **08**

(b) Answer the following w.r.t. end zone in pretensioned PSC beam. **06**

1-) Define the term: Transmission Length.

2-) State the importance of Transmission Length and the codal provision for the same.

3-) Draw typical variation of stresses in prestressing cable over a Transmission Length.

4-) Draw a typical variation of transverse tensile stresses in prestress concrete over a Transmission Length.

Q.5 **(a)** Draw typical sketches of various cable profiles used for continuous PSC beam in order to achieve continuity. **05**

(b) Define and explain the term: Concordant cable Profile. **09**

Also explain the principle of linear transformation in PSC beam by giving suitable example.

OR

Q.5 A cylindrical prestressed water tank of internal diameter 27 m is required to store a water over a depth of 7 m. The permissible compressive stress in concrete at transfer is 13 N/mm^2 and the minimum compressive strength under working pressure is 0.7 N/mm^2. The loss ratio is 0.8. Wires of 6 mm diameter with initial stress of 1000 N/mm^2 are available for circumferential winding and Freyssinet cables made up of 12 wires of 8 mm diameter stressed to 1200 N/mm^2 are to be used for vertical prestressing. Design the tank walls assuming the base as fixed. The cube strength of concrete is 40 N/mm^2. **14**

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