Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– I • EXAMINATION – SUMMER 2014

Subject Code: 712007N **Date: 24/06/2014**

Subject Name: Prestressed Concrete

Time: **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: 456, IS: 1343-1980, IS: 3370-Part-I, II, III and IS: 784-2001 is permitted.**

Q.1 Answer the following

(a) The process of introducing stresses in member before an application of load is referred as _____. **01**

(b) In Pre-tensioned member, the prestress is transfer from steel wires to concrete through _____ while in case of Post-tensioned member it is through _____. **02**

(c) The minimum grade of concrete recommended by IS: 1343-1980 for pre-tensioned prestress concrete is _____ . **01**

(d) With respect to load resisting mechanism of a flexural beam member, in RCC beam the lever arm is _____ while in PSC beam the lever arm is _____. **02**

(e) When we use load balancing concept to beam, the stresses in beam is _____ . **01**

(f) The limiting value of initial camber of a PSC beams as per IS: 1343-1980 is _____. **01**

(g) If all the wires are tensioned simultaneously in post tensioned beam, the losses due to elastic shortening are _____. **01**

(h) Using straight cable profile in posttensioned beam, we can minimize _____ type of losses. **01**

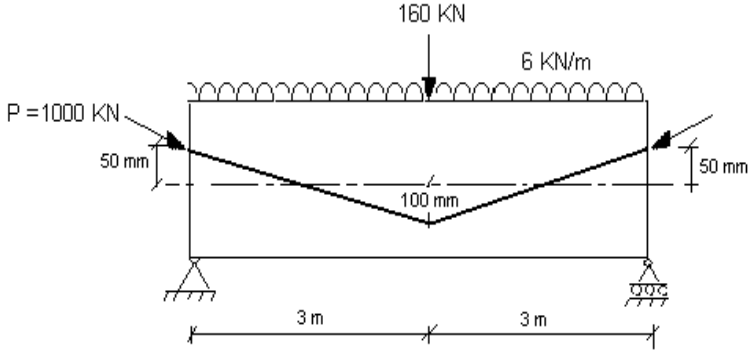
(i) The distance required at the end of a pretensioned tendon for developing the maximum tendon stress by bond is referred as _____. **01**

(j) Due to concordant cable profile, the reaction at support in a continuous beam due to secondary moment is _____. **01**

(k) A group of prestressing wires is called _____ while the group of strands is called _____. **02**

Q.2 **(a)** Explain the Pressure line concept by giving suitable example. Also explain its importance. **07**

(b) Fig. shows a prestressed concrete beam having a rectangular cross section 400 x 600 mm provided with inclined tendon. Determine and plot the stresses distribution at the mid-span and at support section (Neglect the self wt.). **07**



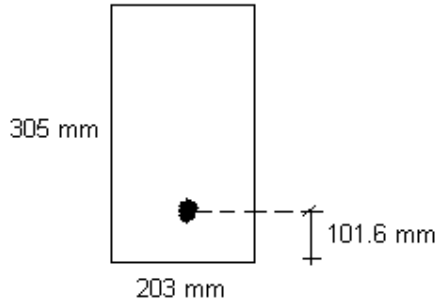
OR

(b) A pretensioned member as shown in fig., 203 mm by 305 mm deep. It is eccentrically prestressed with 516 mm^2 of high tensile steel wire which is anchored to the bulkheads at unit stress of 1034 N/mm^2. The c.g.s is 101.6 mm above the bottom fibre. The modular ratio is 6. Cmpute the stresses in the concrete immediately after transfer due to prestress only,using **07**

1-) Transform section,

2-) gross section.

Also find the % error in final results.



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=435 kN-m (including an estimated self-weight moment M_{sw} = 55 kN-m). The prestress at transfer is 1035 N/mm^2 and at service is 860 N/mm^2. **07**

Based on grade of concrete, the allowable compressive stresses are 12.5 N/mm^2 at transfer and 11 N/mm^2 at service. The allowable tensile stresses are 2.1 N/mm^2 at transfer and 1.65 N/mm^2 at service.

The properties of the prestressing strands are given below:

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

(b) Fig.1 shows a post-tensioned beam of uniform cross section anchoring by 3 cables 1,2, and 3 respectively. Estimate the percentage loss of stress due to elastic deformation of concrete in each of the cable if they are successively tensioned and anchored.

Take, Ŭ= 6,

Initial stress in the cable = 1200 N/mm2.

Cross section area of each cable = 200 mm2.

Cross section area = 100 mm x 300 mm.

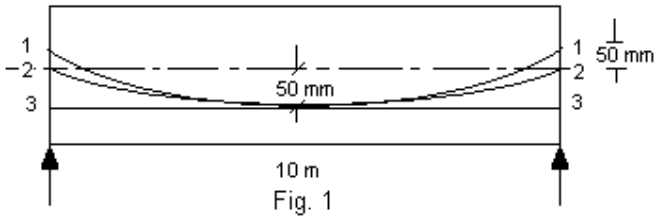


Fig. 1

Q.3 **(a)** An unsymmetrical óIô 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 mm2 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/mm2 respectively, and the tendons are effectively bonded to concrete, estimate the **07**

flexural strength of the section as per IS:1343-1980 (Appendix- B).

(b) A simply supported pre tensioned pre stressed concrete beam of 9 m span has a cross section 400 mm x 800 mm and is subjected to a transfer pre-stress force of 2400 KN at 28 days strength. The cable has a cross section area of 2000 mm2 and is parabolic with concentric at end support and eccentricity of 120 mm below the neutral axis at mid span section. Determine the total percentage loss of pre-stress. **07**

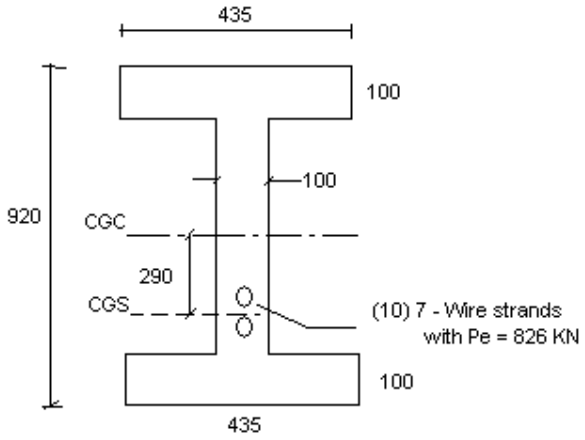
Concrete grade M30,
Es = 2.1 x 105 N/mm2,
Ultimate tensile strength of pre-stressing steel is 1500 N/mm2.

Q.4 **(a)** Draw typical sketches of various cable profiles used for continuous PSC beam in order to achieve continuity. **07**

(b) Explain step wise procedure (along with formula) for designing the axially loaded (tensile) prestressed member. **07**

OR

Q.4 **(a)** Design the stirrups(for shear only) for the type 1 prestressed beam with the following cross section (all dimension in mm) **07**



The properties of the sections are as follows $A = 159{,}000\ mm^2$
$I = 1.7808 \times 10^{10}\ mm^4$.
$Ap = 960\ mm^2$.

The grade of concrete is M35 and the characteristic strength of the prestressing steel (f_{pk}) is 1470 N/mm^2. The effective prestress (f_{pe}) is 860 N/mm^2. The uniformly distributed load including self-weight is 30.2 KN/m. The span of the beam is 10m and is simply supported at both ends. The width of the support bearing is 400 mm. The clear cover to the longitudinal reinforcement is 30 mm.

(b) A beam of cross section 800 mm x 300 mm is subjected to an eccentric prestressing force of 1600 kN with 100 mm eccentricity in the end zone of a post tensioned PSC beam. Assuming an anchor plate of size 400 mm x 200 mm. Determine the bursting stress and necessary reinforcement as per IS: 1343-1980 in end zone. Also give the detailing of same reinforcement in end zone. **07**

Q.5 Check the capacity of a prestress concrete pipe for longitudinal stress as per IS: 784-2001 for all possible load combinations. The data of a prestressed concrete pipe is listed below: **14**

- Diameter of pipe = 400 mm
- Effective length of pipe = 4500 mm
- Core thickness = 35 mm

- Coat thickness = 20 mm
- Minimum compressive strength of core concrete at various stages are:
    (a) Characteristic compressive design strength = 40 N/mm^2
    (b) At winding = 25 N/mm^2
    (c) At detensioning of longitudinals = 15 N/mm^2
- Diameter of longitudinal wire = 4 mm
- Ultimate tensile strength of a wire = 1700 N/mm2
- Initial compressive stress induced in core = 10 N/mm^2
- Number of longitudinals consider in design = 14

OR

Q.5 A cylindrical prestressed water tank of internal diameter 30 m is required to store a water over a depth of 7 m. The permissible compressive stress in concrete at transfer is 14 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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