



**M.E DEGREE EXAMINATIONS: JUNE 2015**

(Regulation 2014)

Second Semester

**STRUCTURAL ENGINEERING**

P14SETE03: Prestressed Concrete

(Use of IS: 784, 1343, 3370, 3935 and all relevant codes are permitted)

**Time: Three Hours**

**Maximum Marks: 100**

**Answer all the Questions:-**

**PART A (10 x 1 = 10 Marks)**

1. High tensile steel is basically [K<sub>2</sub>]
  - a) Low carbon steel
  - b) Low manganese steel
  - c) High carbon steel
  - d) High manganese steel
2. Curved cables can be used in [K<sub>2</sub>]
  - a) Pretensioned members
  - b) Externally prestressed member
  - c) Post tensioned member
  - d) Internally prestressed member
3. High tensile bars threaded at ends are used in [K<sub>2</sub>]
  - a) Freyssinet system
  - b) B.B.R.V System
  - c) Gifford Udall system
  - d) Lee-McCall system
4. Match List I and List II [K<sub>2</sub>]

List I	List II
A. Pretensioning	i. Initial strength of concrete
B. Post tensioning	ii. final strength of concrete
C. Shrinkage loss	iii. time independant
D. Creep loss	iv. time dependant

- |    | A  | B  | C   | D   |
|----|----|----|-----|-----|
| a) | i  | ii | iii | iv  |
| b) | ii | i  | iii | iv  |
| c) | i  | ii | iv  | iii |
| d) | iv | i  | iii | ii  |



17. Describe the different ways of improving shear resistance of structural members by prestress. [K<sub>2</sub>]
18. Explain what is meant by unpropped construction. [K<sub>2</sub>]
19. Explain when a cable profile is considered to be concordant. [K<sub>2</sub>]
20. Describe the causes of differential shrinkage in composite construction. [K<sub>2</sub>]

**PART C (10 x 5 = 50 Marks)**

21. A rectangular concrete beam, 100mm wide by 250mm deep, spanning over 8m is prestressed by a straight cable carrying an effective prestressing force of 250kN located at an eccentricity of 40mm. The beam supports a live load of 1.2kN/m. Calculate the resultant stress distribution for the central cross section of the beam. The density of concrete is 24kN/m<sup>3</sup>. Estimate the magnitude of the prestressing force with an eccentricity of 40mm which can balance the stresses due to dead and live loads at the bottom fibre of the central section of the beam. [K<sub>4</sub>]
22. Explain Magnel's Investigations on anchorage zone stresses [K<sub>3</sub>]
23. Explain what are cap cables. Where are they used? [K<sub>3</sub>]
24. Explain the Indian Code recommendations for the design of reinforcements considering shear, bending and torsion [K<sub>3</sub>]
25. The cross-sectional area of an unsymmetrical pre-stressed I beam designed to carry a central point load on a simply supported span of 15m is 194000 mm<sup>2</sup>. The second moment of area is equal to 197 x 10<sup>8</sup> mm<sup>4</sup>. The overall depth of the section is 900 mm, with the centroid located at 520 mm from the soffit. The maximum permissible stresses are 14 N/mm<sup>2</sup> in compression and zero in tension. The loss ratio is 0.8. Estimate the breadth of a rectangular section, having the same depth designed for the same loading. [K<sub>3</sub>]
26. A continuous beam ABC (AB=BC=10m) has a rectangular section 400 mm wide by 650 mm deep. The beam is pre-stressed by a concordant cable having a cross-sectional area of 1200 mm<sup>2</sup>, located 50 mm from the soffit at mid-span points and 50 mm from the top of beam at B. If the beam supports two concentrated loads of 200 kN each at mid-span points, Estimate the load factor against collapse assuming elastic distribution of moments [K<sub>3</sub>]
27. A two span continuous prestressed concrete beam, each span being 8 m. The cross section is rectangle 150 x 300 mm. The prestressing cable is parallel to the axis of the beam, located at 100 mm from the soffit. It carries an effective prestressing force of 400 kN. Locate the pressure line. [K<sub>4</sub>]
28. Design a prestressed concrete pile, carrying an axial load of 3000 kN. The length of the pile is 10m. The specified cube strength of concrete  $f_{ck} = 40 \text{ N/mm}^2$ . The permissible effective prestress should not exceed 5 N/mm<sup>2</sup> [K<sub>5</sub>]

29. Explain what are the various types and cross-sectional shapes of pre-stressed concrete piles? [K<sub>3</sub>]
30. Explain the advantages of pre-stressed concrete piles. [K<sub>3</sub>]

**PART D (2 x 10 = 20 Marks)**

31. Two simply supported beams AB, BC = 10m of rectangular section 200 mm x 600 mm each post tensioned by means of two parabolic cables,  $P=300\text{kN}$ , with  $e=0$  at the support and 150 mm at midspan are converted in to continuous beam by tensioning a parabolic cap cable carrying a force of 300 kN. The ends of the cap cable are located at 3m from the central support. The cable center is 50 mm from the top of the beam over the central support B. Calculate the secondary moment at B. Locate the thrust line. Evaluate the resultant stress along the top and bottom of the beam [K<sub>4</sub>]
32. Design a non cylinder prestressed concrete pipe of 600mm internal diameter to withstand working hydrostatic pressure of  $1.0\text{ N/mm}^2$  using 2.5 mm high tensile wire stressed to  $1000\text{ N/mm}^2$  at transfer. Permissible max and min stresses in concrete at transfer and service loads are  $14\text{ N/mm}^2$  and  $0.7\text{ N/mm}^2$ . Loss ratio is 0.8. Calculate also the test pressure required to produce a tensile stress of  $0.7\text{ N/mm}^2$  in concrete when applied immediately after tensioning and also the winding stress in steel if  $E_s = 210\text{ KN/mm}^2$  and  $E_c = 35\text{ N/mm}^2$ . [K<sub>3</sub>]

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