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Question Paper Code : 40822

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018
Seventh Semester
Civil Engineering
CE 6702 – PRESTRESSED CONCRETE STRUCTURES
(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Use of IS 1343, 784, 3370 and other relevant codes are permitted.
Assume any missing data suitably.

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. Why high tensile steel is needed for prestressed concrete construction ?
2. Distinguish between pre tensioned and post tensioned prestressed concrete members.
3. List the different types of flexural failure modes observed in PSC beams.
4. What are the different ways of improving the shear resistance of structural concrete members by prestressing technique ?
5. List the various factors influencing deflections of PSC members.
6. How do you compute the bursting tension in an end block subjected to evenly distributed forces using Guyon's method ?
7. List the advantages of composite construction.
8. Define the term : Concordant cable.
9. List the various stages to be considered in the design of PSC pipes.
10. What is meant by partial prestressing ?

PART – B **(5×16=80 Marks)**

11. a) i) Explain the concept of load balancing with suitable examples.

ii) A PSC beam of section 120mm wide and 300mm deep is used over an effective span of 6m to support a uniformly distributed load of 4kN/m which includes self weight of the beam. The beam is prestressed by a straight cable carrying a force of 180 kN and located at an eccentricity of 50 mm. Determine the location of the pressure line and plot its position.

(OR)

b) i) List the various types of losses of prestress encountered in PSC members. Obtain expressions for them.

ii) A post tensioned concrete beam 100mm wide and 300mm deep is prestressed by three cables each with a cross sectional area of 50 mm^2 and an initial stress of 1200 N/mm^2. All the three cables are straight and located 100 mm from the soffit of the beam. If the modular ratio is 6, calculate the loss of stress in the three cables due to elastic deformation of concrete for the following cases. i) Simultaneous tensioning and anchoring of all the three cables ; ii) Successive tensioning of the three cables, one at a time.

12. a) i) A pre tensioned T section has a flange 1200 mm wide and 150 mm thick. The width and depth of the rib are 300 mm and 1500 mm respectively. The HTS bars has an area of 4700 mm^2 and is located at an effective depth of 1600 mm. If the characteristic cube compressive strength of concrete and tensile strength of steel are 40N/mm^2 and 1600 N/mm^2 respectively, calculate the flexural strength of the T section.

ii) A PSC beam of rectangular section 150 mm wide and 300 mm deep is to be designed to support an ultimate shear force of 130kN. The uniform prestress across the section is 5N/mm^2. Given the characteristic cube strength of concrete as 40N/mm^2 and 8 mm diameter bars of Fe 415 grade, design suitable spacing for the stirrups conforming to IS 1343 recommendations. Assume the cover to the reinforcement as 50 mm.

(OR)

b) A post tensioned PSC beam of rectangular section 250 mm wide and 580 mm depth is to be designed for an imposed load of 12kN/m, uniformly distributed over a span of 12m. The stress in the concrete must not exceed 17N/mm^2 in compression and 1.4 N/mm^2 in tension at any time and the loss prestress may be assumed to be 15%. Check the adequacy of the section provided to resist the loads and find the minimum prestressing force and the eccentricity.

13. a) i) Explain with examples the effect of tendon profile on deflection of PSC beams.

ii) A PSC beam of rectangular section 120 mm wide and 300 mm deep spans over 6 m. The beam is prestressed by a straight cable carrying an effective force of 180 kN at an eccentricity of 50 mm. If it supports an imposed load of 4kN/m and modulus of elasticity of concrete is 38 kN/mm^2, compute the deflection at the following stages : i) upward deflection under prestress + self weight and ii) final downward deflection under prestress + self weight + imposed load including the effect of creep and shrinkage. Assume the creep coefficient as 1.8.

(OR)

b) The end block of a post tensioned PSC beam is 200 mm wide and 300 mm deep. The beam is post tensioned by two Freyssinet anchorages each of 100 mm diameter with their centres located at 75 mm from top and bottom of the beam. The force transmitted by each anchorage being 2000kN. Compute the bursting tension and design suitable reinforcements according to IS 1343 code provisions.

14. a) A precast pre tensioned beam of rectangular section has a breadth of 100 mm and depth of 200 mm. The beam with an effective span of 5 m is prestressed by tendons with their centroids coinciding with the bottom kern. The initial force in the tendon is 150kN. The loss of prestress may be assumed to be 15%. 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/m^2, calculate the resultant stress developed in the precast and in situ cast concrete assuming the pre tensioned beam as propped during the casting of the slab.

(OR)

b) i) Explain the various methods of achieving continuity of PSC members.

ii) A continuous PSC beam ABC (AB=BC=10m) has a uniform rectangular section with a width of 100 mm and depth of 300 mm. The cable carrying an effective prestressing force of 360 kN is parallel to the axis of the beam and located at 300 mm from the soffit. Determine the secondary and resultant moment at the central support. If the beam supports an imposed load of 1.5kN/m, calculate the resultant stresses at top and bottom of the beam at B.

15. a) A PSC pipe is to be designed to withstand a fluid pressure of 1.6 N/mm^2. The diameter of the pipe is 1200 mm and shell thickness is 100 mm. The maximum compressive stress in concrete at transfer is 16 N/mm^2. A residual compression of 1 N/mm^2 is expected to be maintained at service loads. The loss ratio is 0.8 HTS wires of 5mm diameter initially stressed to 1000 N/mm^2 are available for use. Determine the number of turns of wire per metre length and pitch of wire winding.

(OR)

b) i) What are the advantages of prestressing in the design of concrete members subjected to axial tension ? What are the load factors specified against cracking and collapse in such members ? **(8)**

ii) Explain the objectives and methods of partial prestressing. **(8)**

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