Q 8335

M.E. DEGREE EXAMINATION, MAY/JUNE 2006.

Elective

Structural Engineering

ST 1632 — PRESTRESSED CONCRETE

(Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

Use of relevant IS Codes permitted.

PART A — (10 × 2 = 20 marks)

1. Why high strength concrete is needed for prestressing?

2. How the loss due to elastic shortening can be adjusted for post tensioned beams?

3. What is Load balancing concept?

4. What is pressure line?

5. What are the different ways of improving the shear resistance of a prestressed member?

6. Why are end blocks necessary for prestressed concrete beams?

7. What do you mean by linear transformation?

8. When a cable profile is considered to be concordant?

9. What do you mean by unpropped construction?

10. What do you mean by partial prestressing?

PART B — (5 × 16 = 80 marks)

11. (i) A prestressed concrete beam of rectangular cross section of size 300 mm wide and 500 mm deep is prestressed with 750 kN at an eccentricity of 100 mm from the centre of gravity of the gross section with 500 mm^2 of prestressing steel stressed to 1500 N/mm^2. Analyse the section for stresses due to the effect of prestress and self weight of the beam.

(ii) A prestressed concrete member is post tensioned by four tendons of 250 mm^2 each. The tendons are tensioned one after another to the stress of 1000 N/mm^2. compute the loss of pre stress due to elastic shortening of concrete. How can the loss be counteracted?

12. (a) A post tensioned prestressed concrete beam of rectangular section 250 mm wide is to be designed for an imposed load of 12 kN/m uniformly distributed over a span of 12 m. The stress in the concrete must not exceed 17 N/mm^2 in compression or 1.4 N/mm^2 in tension at any time and the loss of prestress may be assumed to be 1.5%. Calculate the depth of the beam, prestressing force and eccentricity.

Or

(b) A small precast prestressed concrete beam is to be designed to cover a span of 12 m and to carry a super imposed load of 15 kN/m. The permissible stress in compression can be 14 N/mm^2 and in tension 1.4 N/mm^2. Loss of prestress = 15% f_{ck} = 45 N/mm^2. Design the beam using stress range approach.

13. (a) (i) The support section of a prestressed concrete beam 150 mm wide and 300 mm deep is required to support an ultimate shear force of 100 kN. The compressive prestress at the centroidal axis is 5 N/mm^2, f_{ck} = 40 N/mm^2, cover = 45 mm. Design suitable shear reinforcement at the section using IS 1343 recommendation.

(ii) Explain the Hoyer effect in the phenomenon of bond in pretensioned beam.

Or

(b) (i) Explain the significance of anchorage zone reinforcement.

(ii) The end block of a post tensioned prestressed concrete beam 300 mm wide and 300 mm deep is subjected to a concentric anchorage force of 832 kN by a Freyssinet anchorage of area 11700 mm^2. Design and detail the anchorage reinforcement for the end block.

14. (a) (i) Outline the advantages of continuity in prestressed concrete construction.

(ii) Explain how a non–concordant cable profile may be transformed in to a concordant cable profile.

Or

two span prestressed concrete continuous beam of size mm × 800 mm. has spans AB = BC = 15 m. The beam is prestressed a cable having linear profile in span AB and a parabolic profile in span C carrying an effective force 1200 kN. The cable has an eccentricity of 0 mm below the centroidal axis at support A, 240 mm below the centroidal axis at a distance of 9 m from support A, 120 mm above the centroidal axis at support B and 270 mm below the centroidal axis at mid span BC. Calculate the secondary moment induced at support B. Also locate the line of thurst if the beam carries a UDL of 5 kN/m.

(i) Explain the design procedure of PSC cylindrical water tank.

(ii) Discuss the shear in composite beams. What are the provisions usually made to counteract the effects.

Or

(b) (i) What are the advantages of prestressed concrete poles.

(ii) Design a precast pretensioned column to carry an axial load of 100 kN and Bending moment of 12 kNm. Its actual length is 3 m with bottom end rigidly fixed and the top imperfectly fixed. f_{ck} = 40 N/mm^2 7 mm diameter prestressing wires are stressed to 1500 N/mm^2, loss of prestress = 20%.
