Reg. No. : | | | | | | | | | | |

Question Paper Code: 92061

M.E. DEGREE EXAMINATION, DECEMBER 2013.

Elective

Structural Engineering

01PSE510 - PRESTRESSED CONCRETE STRUCTURES

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

(Use of IS 3370 and 1343 may be permitted.)

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Enumerate the types and systems of prestressing.
2. What are the assumptions in the design of prestressed concrete members?
3. Define load balancing concept.
4. What do you mean by wobbling effect?
5. Write about strains in prestressed concrete tension members.
6. Define gap cable.
7. Define the term linear transformation.
8. What do you mean by circular prestressing?
9. List out the advantages of composite construction.
10. Write down the advantages of partial prestressing.

PART - B (5 x 14 = 70 Marks)

11. (a) Describe the losses of prestress that takes place in a prestressed concrete member. (14)

Or

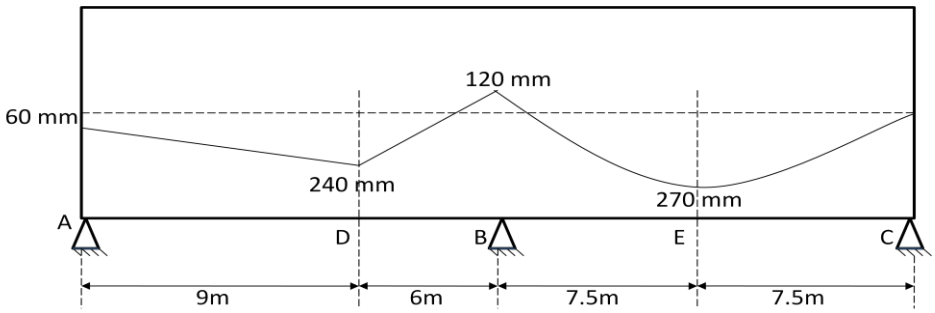
(b) A prestressed concrete beam section is 250 mm wide and 300 mm deep. The initial prestressing force is 450 kN at an eccentricity of 60 mm. The beam has a span of 5.75 m and has to carry a superimposed load of 7.5 kN/m. Analyse the beam section for the stresses produced at mid-span before and after application of the live load. Allow a loss of prestress of 15%. Take weight of concrete equal to 24 kN/m. (14)

12. (a) A prestressed concrete beam 400 mm x 600 mm in section has a span of 6 m and is subjected to a uniformly distributed load of 16 kN/m, including the self weight of the beam. The prestressing tendons are located at the lower third point and provide an effective prestressing force of 960 kN. Determine the extreme fiber stresses in concrete at the mid-span section. (14)

Or

(b) A prestressed concrete beam size 250 mm wide and 600 mm deep is subjected to an axial prestressing force of 1500 kN. Design the end block. Assume that the various cables provided pass through one duct and are anchored to one anchor plate with an overhang at 25 mm on all sides. (14)

13. (a) A continuous prestressed concrete beam is shown in figure. The tendon has an eccentricity at A and is bend sharply at D and B and has a parabolic profile for the span BC. Locate the line of pressure (C-line) due to prestress alone. The prestressing force is 1000 kN. (14)



Or

(b) A post-tensioned continuous beam consist of two spans each 20 m long. External loading other than the dead load of the beam is 20 kN/m. Design the beam. (14)

14. (a) Design a free edge water tank of diameter 36 m to store water to a depth of 5 m. Assume ultimate stress in steel= 1500 N/mm^2, Stress in steel at transfer = 70% of the ultimate stress. Safe stress in concrete in compression at transfer = 0.5 f_{ck}. Compressive stress in concrete at service condition = 0.1 f_{ck}. Final stress in steel = 0.8 x stress in steel at transfer. Modular ratio = 5.5, f_{ck} = 45 N/mm^2. (14)

Or

(b) A straight tension member 250 mm x 250 mm is provided with 750 mm^2 of high tension steel wires which are subjected to stress of 900 N/mm^2. Allowing a factor of safety of 1.5 against cracking of concrete, find the safe tension for the member. Assume a cracking tensile stress of 3 N/mm^2. Find also the residual compressive stress under working load. Take m = 6. (14)

15. (a) A composite beam consist of 300 mm x 900 mm precast stem and a cast-in-situ flange 900 mm x 150 mm. The stem is a post tensioned unit with an initial prestressing force of 2500 kN. The effective prestress available after making deduction for losses is 2200 kN. The dead load moment at mid-span due to the weight of the precast section is 250 kNm. The dead load moment due to the weight of the flange is 125 kNm. After the hardening of the flange concrete, the composite section has to carry a live load which produces a bending moment of 700 kNm. The tendons are placed at a distance of 200 mm from the base of the stem. (14)

Or

(b) Design a beam of composite construction to the following requirements:

i. Flange width provided by slab = 1500 mm
ii. Thickness of the slab = 100 mm
iii. Prefabricated unit shall be a steel beam section.
iv. Span of the beam = 12 m
v. Total load on the beam = 24 kN/m (14)

PART - C (1 x 10 = 10 Marks)

16. (a) Explain the Fressynet's system of prestressing with neat sketches. (10)

Or

(b) Discuss about partial prestressing and its applications. (10)