APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE(HONS.) EXAMINATION DEC 19

Course code:04 CE 6415
Course Name: Prestressed Concrete Structures

Use of IS 1343, IS 456, IS 3370 and IS 784 permitted.

Max. Marks : 60 **Duration: 3 Hours**

PART A

Answer All Questions.
Each question carries 3 marks.

1. Illustrate the resultant stresses at mid-span section of a concrete beam.
2. Write a short on short term deflection in pre-stressed members.
3. What are the different ways of improving the shear resistance of structural concrete members by prestressing techniques?
4. When is prestressing resorted to in compression members ?
5. How do we compute resultant stresses in composite members.
6. Distinguish between propped and unpropped construction methods in composite construction using stress diagrams for various stages of construction
7. What are the benefits of using statically indeterminate prestressed concrete structures
8. Define the following terms used in continuous PSC members:

(a) primary moment (b) Secondary moment (c) Resultant moment (8x3=24 marks)

PART B

9. A pretensioned beam of rectangular section 400mm wide by 1000mm overall depth is prestressed by 800mm2 of high tensile steel wires at an eccentricity of 300mm. If fck=40N/mm2 and fy=1600 N/mm2, estimate the ultimate flexural strength of the section as per IS 1343 Code provisions.

OR

10. A pretensioned T-section has a flange 1200mm wide and 150mm thick. The width and depth of web are 300mm and 1500mm respectively. The high tensile steel has an area of 4700mm2 and is located at an effective depth of 1600mm. If fck=40N/ mm2 , and fp=1600 N/ mm2 . Calculate the flexural strength of T-section.

11. A simply supported concrete beam of span 8m and rectangular cross-section, 125mm wide and 250mm deep, is prestressed by a single cable in which the total tensile force is 220kN. The centerline of the cable is parallel to the axis of the beam and 75mm above the soffit over middle

third span and is curved upwards in a parabola over the outer third of the span to a distance of 175mm above the soffit at supports. If the modulus of elasticity of concrete is 30kN/mm2 and density of concrete is 24kN/m3, calculate (a)the upward deflection at mid-span due to prestress only. (b) deflection when the beam is supporting its own weight – deflection due to prestress + self-weight.

OR

12. Design a post-tensioned prestressed concrete two way slab 6m by 9m with discontionuous edges to support an imposed load of 3kN/ m2 cables of 4 wires of 5mm dia carrying an effective force of 100kN are available for use. Design the spacings of cables in two direction.

13. The support section of a prestressed concrete beam, 120mm wide and 250mm deep is required to support an ultimate shear force of 60kN. The compressive prestress at the centroidal axis is 5N/mm2. If fck= 40N/mm2, characteristic tensile strength of steel stirrup is 250N/mm2 and cover to tension reinforcement is 50mm, design suitable reinforcements at the section using IS 1343 code provisions.

OR

14. A prestressed concrete pipe is to be designed to withstand a fluid pressure of 1.6 N/ mm2 . The dia of the pipe is 1200mm and shell thickness is 100mm. The maximum compressive stress in concrete at transfer is 16 N/ mm2 . A residual compression of 1 N/ mm2 is expected to be maintained at service loads. Loss ratio of 0.8 high tensile wire of 5mm dia initially stressed to 1 N/ mm2 are available for use. Determine a) The number of turns of wire per metre length; b) The pitch of wire winding .

15. Design a prestressed concrete column 4m high for a combined axial compressive force of 400kN and a bending moment of 25kNm. Assume fck=45N/mm2 and fp=1500N/mm2.

OR

16. The column is to be supported on prestressed piles of 10m length. Each pile is to be subjected to an axial load of 2500kN. The specified cylinder strength of concrete is 30 N/ mm2 . The permissible effective prestress is not to exceed 4.9 N/ mm2 . Design a suitable pile of square section also design the number of spans (7-12.5mm) required for piles of the ultimate tensile strength of strand is 165kN.

17. A rectangular pretensioned concrete beam has a breadth of 200mm and depth of 230mm. Prestress after all losses have occurred is 12N/mm2 at the soffit and zero at the top. The beam is incorporated in a composite beam by casting a top flange of breadth 300mm and depth 50mm. Calculate the maximum uniformly distributed live load that can be supported on a simply supported span of 4.5m, without any tensile stresses occurring if the slab is externally supported while casting.

OR

18. A composite T-section girder consist of a pretensioned rectangular beam, 120mm wide and 240mm deep with an insitu cast slab, 360mm wide and 60mm deep, 120mm wide and 240mm deep with an insitu cast slab, 360mm wide and 60mm deep laid over the beam. The pretensioned beam contains 8 wires of 5mm dia located 30mm from the soffit. The tensile strength of high tensile steel is 1600 N/ mm2 and cube strength of concrete in the top slab is 20 N/ mm2 . a) Estimate the flexural strength of the composite section.

19. A two span continuous beam ABC (AB=BC= 10m) is of rectangular section 200m wide and 500mm deep. The beam is prestressed by a parabolic cable, concentric at end supports and having an eccentricity of 100mm towards soffit of the beam at the centre of spans and 200mm towards the top of the beam at mid support B. the effective prestressing force if 500kN. Show that the cable is concordant.

OR

20. A continuous pretensioned concrete beam ABC (AB=BC=10m) has a uniform rectangular cross-section with width of 100mm and depth of 300mm. The cable carrying an effective prestressing force of 360kN is parallel to axis of the beam and located at 100mm from soffit. Determine the secondary and resultant moment at the central support B. 2) If the beam supports an imposed load of 1.5kN/ m. Calculate the resultant stress at top and bottom of beam at B.

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