

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Regular and Supplementary Examination July 2021

Course Code: CE368**Course Name: PRESTRESSED CONCRETE**

Max. Marks: 100

Duration: 3 Hours

Instructions: Use of all relevant codes are permitted**PART A***Answer any two full questions, each carries 15 marks.*

Marks

- 1 a) Explain the principle of post tensioning. (5)
- b) A rectangular concrete beam 120mm wide by 300mm deep spanning over 10m is prestressed by a straight cable carrying an effective prestressing force of 300kN located at an eccentricity of 50mm. The beam supports a live load of 1.2kN/m.
- i) Calculate the resultant stress distribution for the centre-of-span cross section of the beam assuming the density of concrete as 24kN/m^3 .
- ii) Find the magnitude of the prestressing force with an eccentricity of 50 mm which can balance the stresses due to dead and live loads at the soffit of the centre span section.
- 2 b) A prestressed concrete T-beam is to be designed to support an imposed load of 5kN/m over an effective span of 5.5m. The stress in concrete must not exceed 15N/mm^2 in compression and zero in tension at any stage. The flange has a width of 500mm and thickness of 50mm. The rib is 100mm wide and 250mm deep. Check the adequacy of the section provided and calculate the minimum prestressing force necessary and the corresponding eccentricity. Assume 20% loss of prestress. (15)
- 3 a) List the various types of loss of prestress in pretensioned and post-tensioned members. (5)
- b) What are the inadequacies of working stress and ultimate load design methods? (5)
- c) Explain criteria for limit states with regard to prestressed concrete design. (5)

PART B*Answer any two full questions, each carries 15 marks.*

- 4 a) Explain various modes of failure encountered in prestressed concrete beams subjected to bending moment, shear and torsion. (9)

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- b) Distinguish between web-shear and flexural-shear cracks in concrete beams with sketches (6)
- 5 a) Distinguish between short-term and long-term deflections of prestressed concrete beams. (6)
- b) A rectangular beam 150mm x 300mm has a straight duct 30mm by 50mm with its centre located at 60mm from the soffit of the beam which is prestressed by 10 wires of 8mm diameter stressed to 650N/mm^2 . The beam supports an imposed load of 5kN/m over a span of 6m. The modulus of elasticity of concrete as 40kN/mm^2 . Estimate the central short term deflection of the beam under the action of prestress, self-weight and live load. (9)
- 6 a) A post-tensioned bonded prestressed concrete beam of rectangular cross section of 500 mm x 650 mm is subjected to a working bending moment of 200 kNm, a working torque of 50 kNm and a working shear force of 120 kN. The section has an effective prestressed force determined from the service load requirements of magnitude 500 kN at an eccentricity of 160 mm, provided by 5 numbers of 12.5 mm stands of cross-sectional area 506 mm^2 with an ultimate tensile strength of 1800 N/mm^2 . If the cube strength of concrete is 40 N/mm^2 , design suitable longitudinal and transverse reinforcements in the beam using IS 1343 code recommendations. (15)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) Sketch the typical tensile stress distribution in an end block of a post-tensioned beam with a single anchorage. (4)
- b) Explain the principle and advantages of partial prestressing (6)
- c) The end block of a post-tensioned beam is 90mm wide and 180mm deep. A prestressing wire, 7mm in diameter, stressed to 1100N/mm^2 has to be anchored against the end block at the centre. The anchorage plate is 50mm by 50mm. The wire bears on the plate through a female cone of 20mm diameter. Given permissible stress in concrete at transfer, f_{ci} as 20N/mm^2 and permissible shear in steel as 94.5N/mm^2 , determine the thickness of the anchorage plate. (10)
- 8 a) What are the advantages of using composite construction with prestressed and in situ concrete in structural members? (5)
- b) A rectangular pre-tensioned concrete beam has a breadth of 100mm and depth of 230mm, and the prestress after all losses have occurred is 12N/mm^2 at soffit and zero at top. The beam is incorporated in a composite T-beam by casting a

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top flange of breadth 300mm and depth 500mm. 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

- i) the slab is externally supported while casting, and
 - ii) the pre-tensioned beam supports the weight of the slab while casting.
- 9 a) Write a short note on advantages and disadvantages of continuous members in prestressed concrete structures. (6)
- b) Briefly how prestress is effectively utilised in concrete poles and sleepers. (9)
Explain the behaviour of these members.
- c) Explain the importance of differential shrinkage in composite construction. (5)
