Hall Ticket No | | | | | | | | | | | Question Paper Code: ACEB46

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal-500043, Hyderabad

B.Tech VII SEMESTER END EXAMINATIONS (REGULAR/SUPPLEMENTARY) - DECEMBER 2022
Regulation: R18

PRESTRESSED CONCRETE STRUCTURES

Time: 3 Hours **(CIVIL ENGINEERING)** **Max Marks: 70**

Answer FIVE Questions choosing ONE question from each module
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

MODULE – I

1. (a) Explain why high strength concrete and high strength steel are needed for prestress concrrete stucture (PSC) construction. [BL: Understand| CO: 1|Marks: 7]

   (b) A PSC beam of 120 mm wide and 300 mm deep is used over a span of 6m to support a UDL of 4kN/m including its self weight. The beam is prestressed by a straight cable carrying a force of 180 kN and located at an eccentricity of 50mm. Determine the location of the thrust line in beam and plot its position at quarter and central span sections. [BL: Apply| CO: 2|Marks: 7]

2. (a) Describe in detail the pre-tensioning and post-tensioning systems with neat diagrams. [BL: Understand| CO: 1|Marks: 7]

   (b) A rectangular concrete beam 250 mm wide by 300 mm deep is prestressed by a force of 540 kN at a constant eccentricity of 60mm.The beam supports a concentrated load of 68 kN at the centre of the span of 3 m. Determine the location of the pressure line at the centre, quarter span and support sections of the beam. Neglect the self weight of the beam. [BL: Apply| CO: 2|Marks: 7]

MODULE – II

3. (a) Identify the provisions made in IS: 1343 for relaxation loss. List the factors affecting loss of stress due to creep of concrete. [BL: Understand| CO: 3|Marks: 7]

   (b) A pretensioned concrete beam, 100mm wide and 300mm deep, is prestresssed by straight wires carrying an initial force of 225kN at an eccentricity of 55mm. The modulus of elasticity of steel and concrete are 210 and 35kN/mm^2 respectively. Estimate the percentage loss of stress in steel due to elastic deformation of concrete if area of steel wires is 188 mm^2. [BL: Apply| CO: 3|Marks: 7]

4. (a) Summarize the various losses in prestress in pre-tensioning and post-tensioning systems. [BL: Understand| CO: 3|Marks: 7]

   (b) A rectangular concrete beam, 360mm deep and 200mm wide, is prestressed by means of fifteen 5mm diameter wires located 65mm from the bottom of the beam and three 5mm wires, located 25mm from the top of the beam. If the wires are initially tensioned to a stress of 840kN/mm^2, calculate the percentage loss of stress in steel immediately after transfer, allowing for the loss of stress due to elastic deformation of concrete only. [BL: Apply| CO: 3|Marks: 7]

MODULE – III

5. (a) What are the tendon splices? Distinguish between web shear and flexural shear cracks in PSC concrete beams with neat sketch. [BL: Understand| CO: 4|Marks: 7]

   (b) A pretensioned T section has a flange width of 400mm and 200mm thick. The width and depth of the rib are 120mm and 340mm respectively The effective depth of cross section is 700mm. Given $A_p = 250mm^2$, $f_{ck} = 50N/m^2$ and $f_p = 1250N/m^2$, estimate the ultimate moment capacity using the IS code regulations. [BL: Apply| CO: 4|Marks: 7]

6. (a) Explain with neat sketches the IS1343 code method of computing the moment of resistance of rectangular section. [BL: Understand| CO: 4|Marks: 7]

   (b) A pretensioned T section has a flange width of 1200mm and 150mm thick. The width and depth of the rib are 300mm and 1500mm respectively. The high tension steel has an area of 4700mm^2 and is located at an effective depth of 1600mm. If the characteristic cube strength of the concrete and the tensile strength of steel are 40 and 1600MPa respectively; calculate the flexural strength of the section. [BL: Apply| CO: 4|Marks: 7]

MODULE – IV

7. (a) Discuss Guyon's method of computing bursting tension in the case of end blocks subjected to forces not evenly distributed with multiple anchorages. [BL: Understand| CO: 5|Marks: 7]

   (b) A PSC beam 250mm wide and 650mm deep is subjected to an effective prestressing force of 1360kN along the centroidal axis. The cable is placed symmetrically over the mild steel anchor plate of area 150mm × 350mm. design the end block. Take $f_{ck} = 30N/mm^2$. Assume initial prestressing force is 1.2 times the effective prestressing force [BL: Apply| CO: 5|Marks: 7]

8. (a) Outline the various methods by which bond between concrete and steel tendons can be improved. [BL: Understand| CO: 5|Marks: 7]

   (b) The end block of a PSC beam with rectangular cross section is 100mm wide and 200mm deep. The prestressing force of 100kN is transmitted to the concrete by a distribution plate of 100mm x 50mm, concentrically loaded at the ends. Calculate the position and the magnitude of tensile stress on the horizontal section through the centre and edge of the anchor plate. Compute the bursting tension on the horizontal planes [BL: Apply| CO: 5|Marks: 7]

MODULE – V

9. (a) Write about the general design considerations in the design of composite prestressed concrete member constructions. [BL: Understand| CO: 6|Marks: 7]

   (b) A composite beam of rectangular section is made up of a pre-tensioned inverted T-beam having a thick slab of 160mm and width of 1100mm.The rib size is 160mm×800mm. the cast in-situ concrete has a thickness and width of 1100mm with a modulus of elasticity of 30kN/mm^2. If the differential shrinkage is 100×10^{-6} units, estimate the shrinkage stresses developed in the precast and cast in-situ units. [BL: Apply| CO: 6|Marks: 7]

10. (a) Summarize the nature of stresses caused by differential shrinkage and creep of concrete in composite sections. [BL: Understand| CO: 6|Marks: 7]

    (b) The cross-section of a composite beam consists of a 300mm x 900mm precast stem and cast-in-situ flange 900mm x 150mm. The stem is a post-tensioned unit with an initial prestressing force of 2500kN. The effective prestress available after making deduction for losses is 2200kN. The dead load moment at mid span due to the weight of the precast section is 250kNm. The dead load moment due to the weight of the flange is 125kNm. After hardening of the flange concrete, the composite section has to carry a live load which produces a bending moment of 700kNm. Examine the stress distribution in concrete at the various stages of the loading. [BL: Apply| CO: 6|Marks: 7]