BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH **SEMESTER : II**
BRANCH: Civil & Environmental Engineering **SESSION : SP/22**

SUBJECT: PRESTRESSED CONCRETE, CE 547

TIME: 2.00 HOURS **FULL MARKS: 50**

INSTRUCTIONS:
1. The question paper contains 10 questions each of 5 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
6. IS 1343:1980 is allowed in the examination hall.

Q.1 A rectangular concrete beam, 250 mm wide and 600 mm deep, is prestressed by means of four 14 mm diameter high-tensile bars located 200 mm from the soffit of the beam, If the effective stress in the wires is 700N/mm^2, what is the maximum bending moment that can be applied to the section without causing tension at the soffit of the beam. **[5]**

Q.2 A prestressed concrete beam of section 200 mm wide by 300 mm deep is used over an effective span of 6 m to support an imposed load of 4kN/m. The density of concrete is 24kN/m^3, At the centre of span section of the beam, find the magnitude of: **[5]**
(a) the concentric prestressing force necessary for zero fibre-stress at the soffit when the beam is fully loaded

Q.3 What is "Pressure or Thrust line"? Explain its significance with sketches. **[5]**

Q.4 List the various types of loss of prestress in pretensioned and post tensioned members. **[5]**

Q.5 A prestressed concrete beam (span= 10 m) of rectangular section, 120 mm wide and 300 mm deep, is axially prestressed by a cable carrying an effective force of 180 kN. The beam supports a total uniformly distributed load of 5kN/m which includes the self-weight of the member. Compare the magnitude of principal tension developed in the beam with and without the axial prestress. **[5]**

Q.6 The support section of a prestressed concrete beam, 100 mm wide and 250 mm deep is required to support an ultimate shear force of 60 kN. The compressive prestress at the centroidal axis is 5 N/mm^2. The characteristic cube strength of concrete is 40N/mm^2. The cover to the reinforcement is 50 mm. If the characteristic tensile strength of steel in stirrups is 250 N/mm^2, a design suitable reinforcement at the section using the Indian standard code IS: 1343 recommendations. Given data: **[5]**

b_w = 100mm, h =250mm, d=200mm, V=60kN, $f$cp =5N/mm^2, $f$ck=40N/mm^2, fy = 250 N/mm^2.

Q.7 A continuous prestressed concrete beam ABC (AB = BC = 10 m) has a uniform rectangular cross section with a width of 100 mm and depth of 300 mm. The cable carrying an effective prestressing force of 360 kN is parallel to the axis of the beam and located at 100 mm from the soffit. **[5]**
(a) Determine the secondary and resultant moment at the central support B.

Q.8 A precast pre-tensioned beam of rectangular section has a breadth of 100 mm and a depth of 200 mm. The beam with an effective span of 5 m, is prestressed by tendons with their centroids coinciding with the bottom kern. The initial force in the tendons is 150 kN. The loss of prestress may be assumed to be 15 percent. The beam is incorporated in a composite T beam by casting a top flange of breadth 400 mm and thickness 40 mm. If the composite beam supports a live load of 8kN/m^2, calculate the resultant stresses developed in the precast and in situ cast concrete assuming the pre tensioned beam as: (a) unpropped **[5]**

Q.9 A pretensioned girder having a T-section is made up of a flange 200 mm wide and 60 mm thick. The overall depth of the girder is 660 mm. The thickness of the web is 60 mm. The horizontal prestress at a point 300 mm from the soffit is 10 N/mm^2 The shear stress due to transverse load acting at the same point is 2.5 N/mm^2 Determine the increase in principal tensile stress at this point if the T-section is subject to a torque of 2kN m. **[5]**

Q.10 Design a non – cylinder prestressed concrete pipe of 600 mm internal diameter to withstand a working hydrostatic pressure of 1.05 N/mm^2, using a 2.5 mm high tensile wire stressed to 1000 N/mm^2 at transfer. Permissible maximum and minimum stresses in concrete at transfer and service loads are 14 and 0.7 N/mm^2. The loss ratio is 0.8. Calculate also the test pressure required to produce a tensile stress of 0.7 N/mm^2 in concrete when applied immediately after tensioning and also the winding stress in steel if Es =210 kN/mm^2 and Ec = 35 kN/mm^2 **[5]**