Roll no.................................

Name of the Course: B.TECH./CE
Semester: III
Name of the Paper: Mechanics of Solids
Paper Code: TCE303
Time: 1.5 hour   **Maximum Marks: 50**

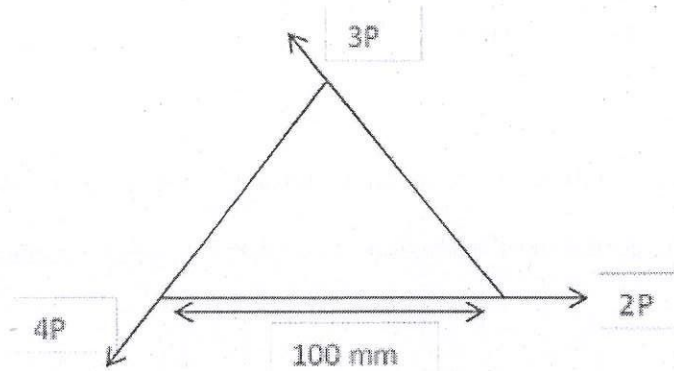**Note:**
(i) Answer all the questions by choosing any one of the sub-questions
(ii) Each question carries 10 marks.

Q1.   (10 Marks) –CO-I

a. Three forces of 2P, 3P and 4P act along the three sides of an equilateral triangle of side 100 mm taken in order. Find the magnitude and position of the resultant force.

OR

b. Find the expression for the extension of bar due to self-weight.

Q2.   (10 Marks)- CO-I
a. Define the terms: Elasticity, elastic limit, young's modulus, modulus of rigidity and strain energy.

OR

b. Two vertical rods one of steel and other of copper are each rigidly fixed at the top and 50 cm apart. Diameters and lengths of each rod are 2 cm and 4 m respectively. A cross bar fixed to the rods at the lower ends carries a load of 5000 N such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar. Take E for the steel = 2 x 10^5 N/mm^2 and E for copper = 1 x 10^5 N/mm^2.

Q3.   (10 Marks)-CO-II

a. (i) State Hook's law.

(ii) Define: Poisson's ratio, creep, toughness, hardness and proof resilience.

OR

b. A rod is 2 m long at a temperature of 10 ^{0}C. Find the expansion of the rod, when the temperature

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is raised to 80 ^{0}C. If this expansion is prevented, find the stress induced in the material of the rod. Take E for the steel = 1 x 10^5 MN/m^2 and temperature coefficient = 0.000012 per degree centigrade.

Q4.   (10 Marks) CO-II

a. A steel rod of 20 mm diameter passes centrally through a copper tube of 50 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 50 ^{0}C, calculate the stresses developed in copper and steel. Take E for the steel = 200 MN/m^2 and for copper = 100 MN/m^2 and temperature coefficient for steel and copper are 12 x10^{-6} per degree centigrade and 18 x 10^{-6} per degree centigrade respectively.

<div align="center">OR</div>

b. A bar of cross-section 8 mm x 8 mm is subjected to an axial pull of 7000 N. The lateral dimension of the bar is found to be changed to 7.9985 mm x 7.9985 mm. If the modulus of rigidity of the material is 0.8 x 10^5 N/mm^2, determine the Poisson's ratio and modulus of elasticity.

Q5.   (10 Marks) CO-II

a. Derive the equation of extension of uniformly tapering circular rod.

<div align="center">OR</div>

b. Derive the equation of extension of uniformly tapering rectangular bar.