Reg. No.										

MANIPAL ACADEMY OF HIGHER EDUCATION

FIRST SEMESTER B.TECH. EXAMINATIONS – FEBRUARY-MARCH 2022

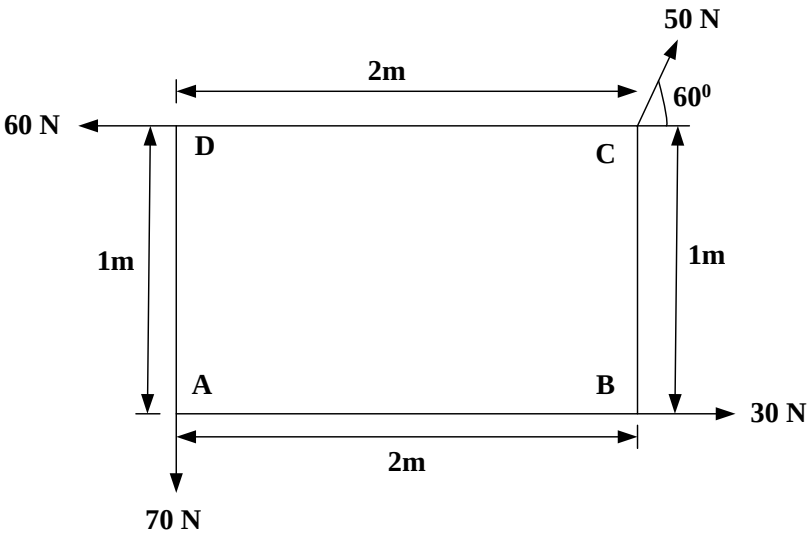
SUBJECT: CIE 1051: MECHANICS OF SOLIDS (DTQ)

Wednesday, February 23, 2022

Time: 10:30 – 12:10 Hrs. Maximum Marks: 40

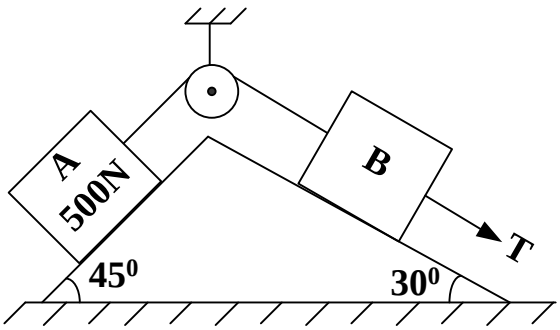
PART - B

1A. Determine the magnitude, direction and position (with respect to A) of the resultant of a force system shown in the below figure.



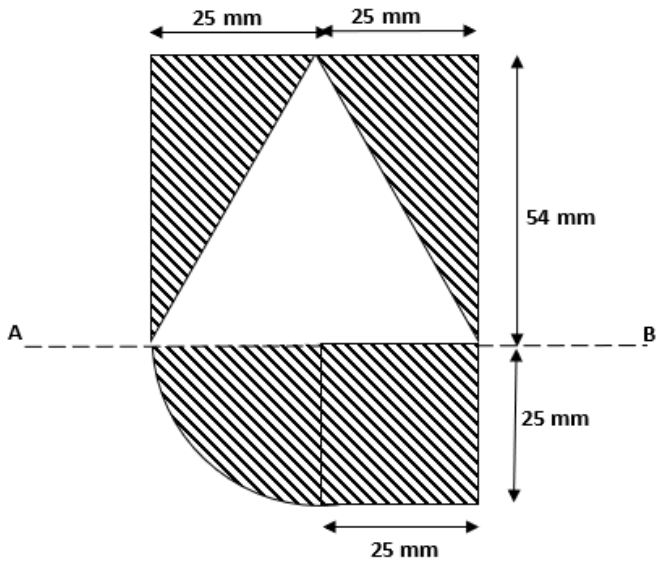
(5 Marks)

1B. Block A (weight 500 N) and Block B are connected by a flexible cable that passes over a frictionless pulley, as shown in the below figure. The coefficient of friction between the blocks and the planes is 0.5. Determine the weight of the block B if motion impends down the plane when a pull (T) of 500 N is exerted on it.



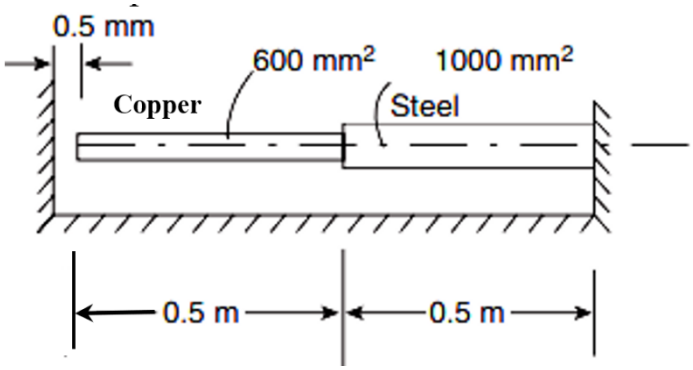
(5 Marks)

2A. Determine the moment of inertia of the shaded area with respect to the reference axis AB as shown in the below figure.



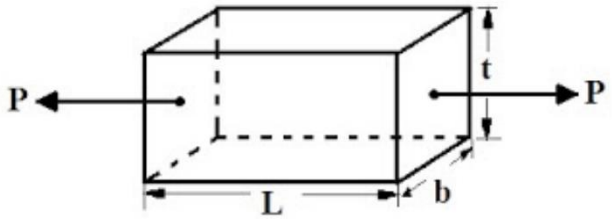
(5 Marks)

2B. The below figure shows a composite bar of steel and copper. If the temperature of the bars is raised by 80°C, determine the compressive force developed in the bars after the rise in temperature. Also find the change in length of the copper bar. The area of the copper bar is 600 mm^2 and that of the steel bar is 1000 mm^2. Take E_c = 105 GPa, E_s = 210 GPa, $\alpha_s = 11 \times 10^{-6}$/°C, $\alpha_c = 18 \times 10^{-6}$/°C. Initially the clearance between the support and composite bar is 0.5 mm.



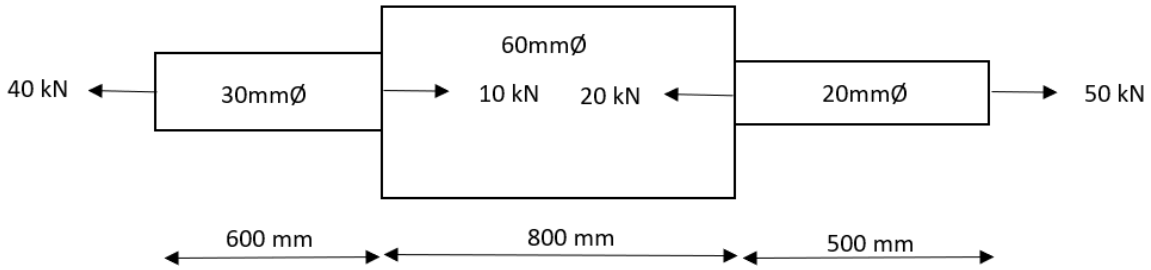
(5 Marks)

3A. A mild steel flat of width b= 150 mm, thickness t = 20 mm and length L= 6000 mm carries an axial pull P = 300 kN. If modulus of elasticity of mild steel is 200 GPa and Poisson's ratio is 0.25, calculate the change in length, width and thickness of the flat.



(4 Marks)

3B. A stepped bar made of brass is subjected to axial loads as shown in the below figure. Determine the total change in length of the bar. Take E =100 GPa.

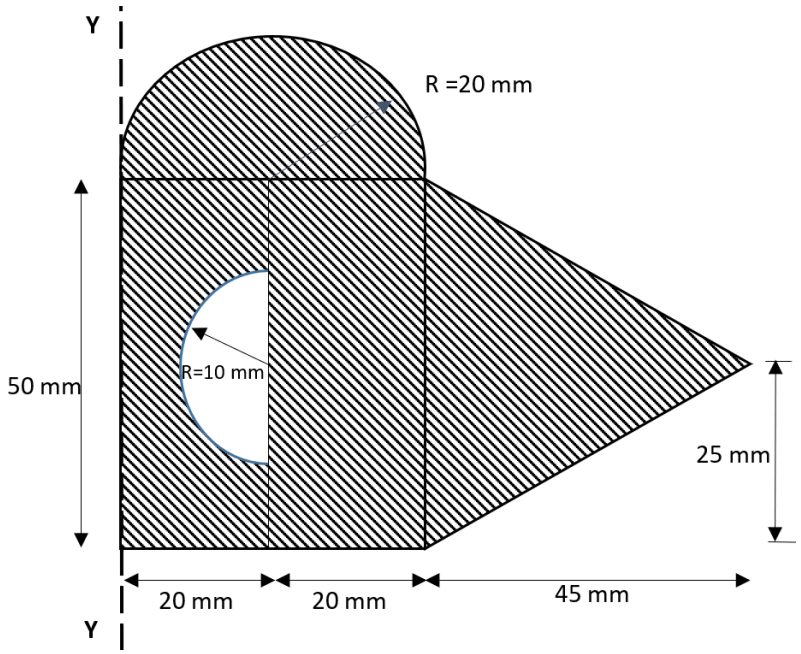


(4 Marks)

3C. A thin cylinder of external diameter 820 mm, length 3 m and wall thickness of 10 mm is subjected to an internal pressure of 2.5 N/mm^2. Determine the change in diameter and length. Take Young's modulus = 2×10^5 N/mm^2 and Poisson's ratio = 0.25.

(2 Marks)

4A. Determine the second moment of area of the shaded portion about the reference axis Y-Y shown in the below figure.

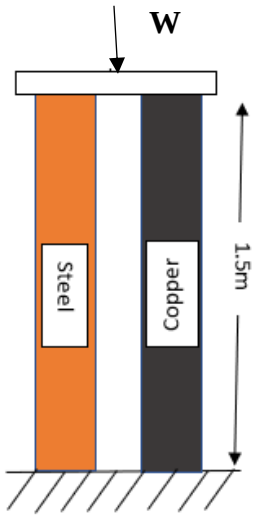


(5 Marks)

4B. A bar of a certain material has 50 mm x 50 mm cross-section. When it is subjected to an axial pull of 150 kN, the reduction in each side is observed to be 0.00625 mm. Determine the modulus of elasticity and Poisson's ratio of the material. The modulus of rigidity of the material is 50 GPa.

(3 Marks)

4C. A steel bar 60 mm in diameter and copper bar of 50 mm in diameter having lengths of 1.5 m each are rigidly fixed at one end as shown in figure. Determine the stresses in bars which causes shortening of compound bar by 0.9 mm from its original length due to the external load W. For steel, E_s= 200 GPa, and for copper, E_c = 100 GPa.



(2 Marks)