
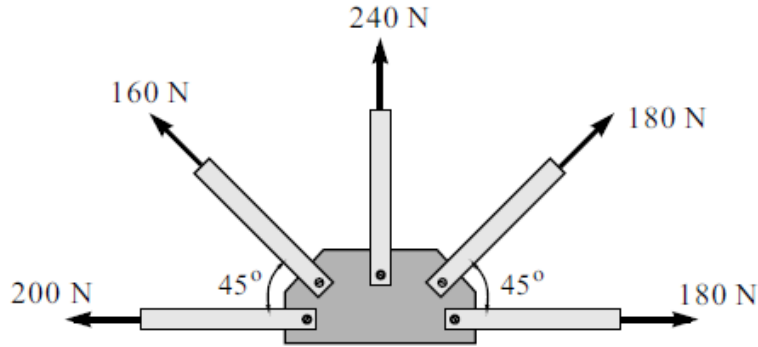
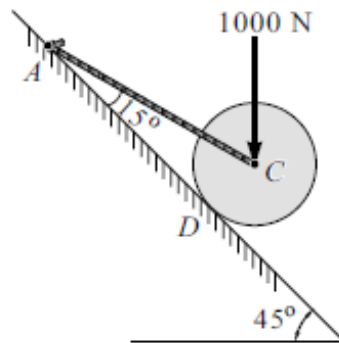


Name:			
Enrolment No:			
UPES End Semester Examination, May 2024			
Course: Introduction to Mechanical Engineering Program: B.Tech. Mechanical Engineering Course Code: MECH1011		Semester: II Time : 03 hrs. Max. Marks: 100	
Instructions:			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Define the following: a) Open and closed system. b) Isobaric and adiabatic process	4	CO1
Q 2	Write the basic difference between a) Hot working process and cold working process b) Welding and brazing	4	CO1
Q 3	What is the role of a runner and riser in sand molding?	4	CO1
Q 4	What is Hook's law for a solid structure? What is the limitation of its application?	4	CO1
Q 5	A bar of 25 mm diameter is tested in tension. It is observed that when a load of 60 kN is applied, the extension measured over a gauge length of 200 mm is 0.12 mm, and the contraction in diameter is 0.0045 mm. Calculate the value of Young's modulus of elasticity for the material.	4	CO3
SECTION B (4Qx10M= 40 Marks)			
Q6	A gusset plate of roof truss is subjected to forces, as shown in the figure. Determine the magnitude of the resultant force and its direction (with respect to the positive x-axis)	10	CO3



OR

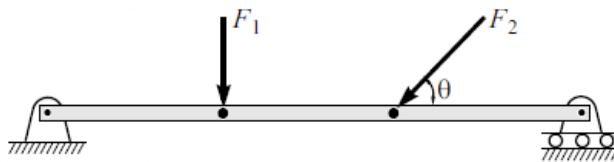
A roller of weight $W = 1000 \text{ N}$ rests on a smooth inclined plane. It is kept from rolling down the plane by string AC as shown in Figure. Find the tension in the string and reaction at the point of contact D.



Q 7

Draw the free body diagram (FBD) of the structure (bar or cylinder) in the following cases and show all the applied and reaction forces, moments acting on it. [4 × 2.5 marks]

a) Draw FBD of the bar

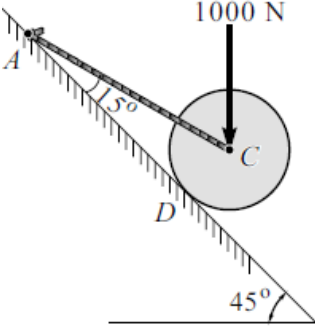
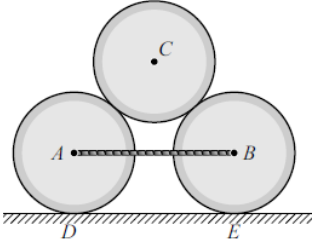


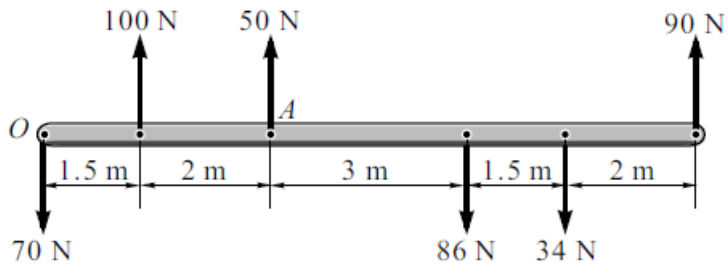
b) Draw FBD of one of the wing of an aircraft standing on ground.



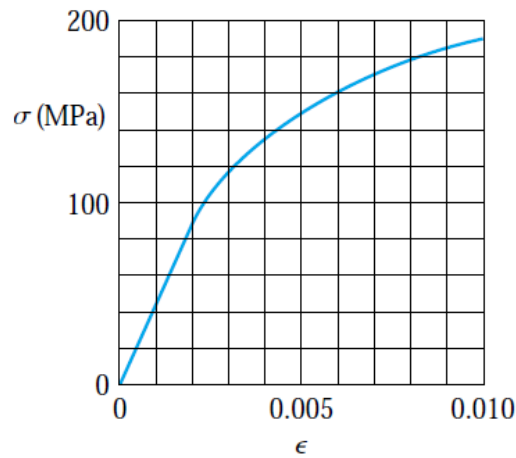
10

CO3

	<p>c) Draw FBD of the cylinder. d) Draw FBD of the three cylinders</p>  		
Q 8	<p>a) What is the Internal energy of a gas? How does the internal energy of a gas change with the change in its temperature?</p> <p>b) A gas is compressed inside a cylinder. The initial volume of the gas is 0.4m^3, and the initial pressure is 105kPa. The final volume is 0.20 m^3, and the final pressure inside the cylinder is 105 kPa. During this compression, 42.5 kJ of heat is transferred from the gas. Calculate the change in internal energy of the gas. Assume that the compression is frictionless.</p> <p style="text-align: right;">[3+7 marks]</p>	10	CO2
Q 9	<p>Write a short note on the following manufacturing processes.</p> <p>a) Forming process b) Fabrication process c) Metal removal or machining process</p>	10	CO1
<p>SECTION-C (2Qx20M=40 Marks)</p>			
Q 10	<p>a) Write a short note on the casting process. Discuss the various procedures/steps followed in sand mold casting.</p> <p>b) A mold sprue is 20 cm long, and the cross-section area at its base is 2.5cm^2. The sprue feeds a horizontal runner leading into a mold cavity whose volume is 1560 cm^3. Determine: i) Velocity of molten metal at the base of the sprue, ii) Volume flowrate of the metal in the runner, iii) estimated time to fill the mold</p> <p style="text-align: right;">[8+12 marks]</p>	20	CO2
Q 11	<p>a) Calculate the resultant of the following force system (shown in figure) and find the equivalent force and couple at point A of this force system.</p>	20	CO2



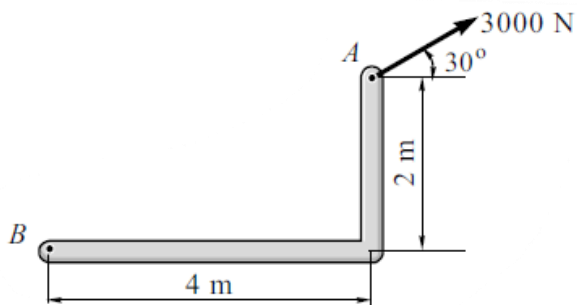
- b) A circular bar of magnesium alloy is 800 mm long. The stress-strain diagram for the material is shown in the figure. The diameter of the bar is 10mm. The bar is subjected to 1000N. Calculate a) the stress induced in the bar, b) the elongation in the bar, c) decrease in diameter of the bar. The Poisson's ratio of the material is 0.3.



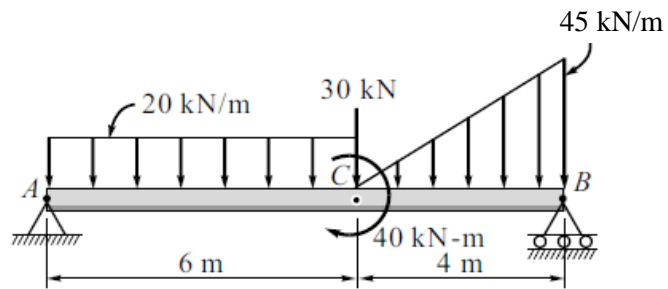
[10+10 marks]

OR

- a) Calculate the moment due to this force about i) Point A; ii) Point B.



- b) Determine the reaction forces at all the supports of the beam/structure shown in figure. Note that there is a point load (30kN) and a couple (40 kN-m) acting at point C, as shown in figure.



[5+15 marks]