Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Course: Basics of Mechanical Engineering — **Semester: II**

Program: B.Tech. FSE, B.Tech. Civil Engineering — **Time : 03 hrs.**

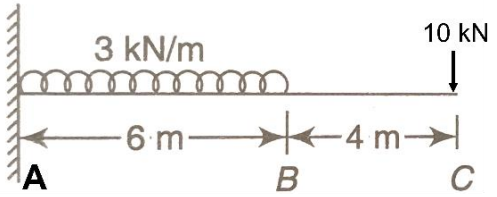
Course Code: MECH1008 — **Max. Marks: 100**

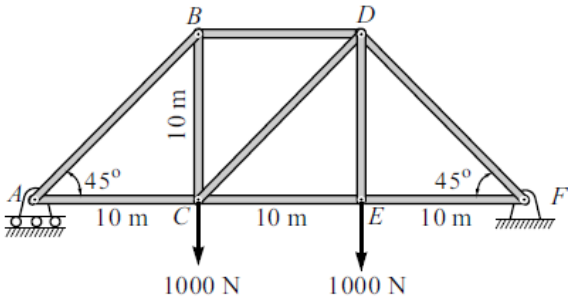
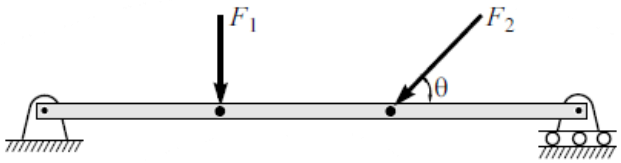
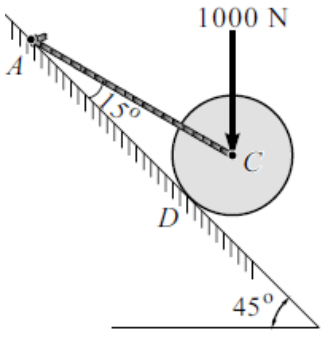
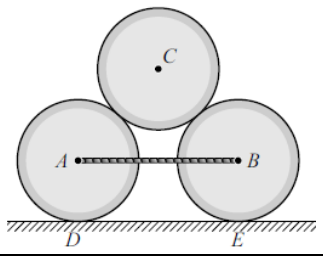
Instructions:

SECTION A
(5Qx4M=20Marks)

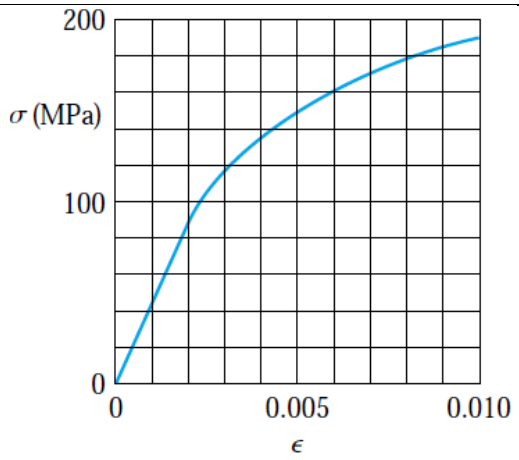
S. No.		Marks	CO
Q 1	Define the following: a) Open and closed system. b) Isothermal process and adiabatic process	**4**	**CO1**
Q 2	Write the basic difference between a) Welding and brazing b) Elastic and plastic deformation of a structure	**4**	**CO1**
Q 3	Write the first and second laws of thermodynamics.	**4**	**CO1**
Q 4	What is reaction force? With the help of free body diagram, show the reaction forces for a cantilever and simply supported beam under UDL.	**4**	**CO1**
Q 5	What do you understand by simple stress, shear stress and bending stress. Discuss with the help of sketch.	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q6	Find the reaction forces and moment at supports A . 	**10**	**CO2**

	OR For the truss shown in the figure, calculate the reaction forces at supports A and F.  		
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.  c) Draw FBD of the cylinder. d) Draw FBD of the three cylinders   	**10**	**CO2**

Q 8	a) What is the Internal energy of a gas? How does the internal energy of a gas change with the change in its temperature? 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. [3+7 marks]	**10**	**CO2**
Q 9	a) Write the equation of state for an ideal gas and its limitations. b) Consider a room with a rectangular floor that is 5 m by 10 m, and a 3 m high ceiling. The air pressure and temperature in the room are 100kPa and 25◦C, respectively. Calculate the density and the mass of the air inside the room. Take the value of gas constant for air R = 287 J/kg-K [5+5 marks]	**10**	**CO2**
SECTION-C (2Qx20M=40 Marks)			
Q 10	Write a short note on the following manufacturing processes. a) Casting process b) Forming process c) Fabrication process d) Metal removal or machining process	**20**	**CO1**
Q 11	a) Write the Hooks Law for a solid structure. How can you experimentally obtain Young's modulus of a solid material? b) 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. c) 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 i) the stress induced in the bar, ii) the total elongation in the bar.	**20**	**CO2**

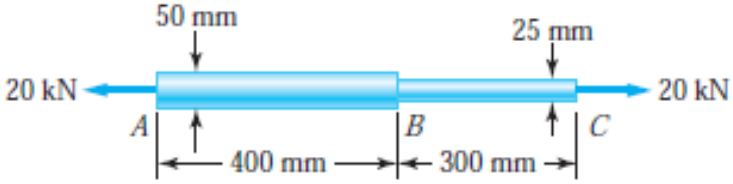


[5+5+10 marks]

OR

A circular bar is subjected to a tensile force of 30 kN (as shown in the figure). The value of E is 200 GPa.

a) Calculate the stress in each segment
b) The total elongation in the bar.
c) If the yield stress (the maximum allowable stress) of the bar's material is 200MPa, which section of the bar is likely to fail under this loading condition . Justify your answer based on stress analysis.



[20 marks]