GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech (Second Semester – Regular/Supplementary) Examinations, April – 2025

23BBSES10002 – Elements of Mechanical Engineering
(Common to All)

Time: 3 hrs   Maximum: 60 Marks

Answer ALL questions
**(The figures in the right hand margin indicate marks)**

PART – A	(2 x 5 = 10 Marks)

Q.1. Answer *ALL* questions

		CO #	Blooms Level
a.	Define resolution and composition of forces.	CO1	K1
b.	Explain limiting friction.	CO3	K1
c.	Define quasi-static process.	CO4	K1
d.	Difference between Turbine and Compressor.	CO5	K1
e.	Define centroid. Can the centroid be outside the shape?	CO2	K1

PART – B	(10 x 5 = 50 Marks)

Answer *ALL* the questions

			Marks	CO #	Blooms Level
2.	a.	Calculate the centroid of the given shape (**Fig. A.**)	5	CO1	K2
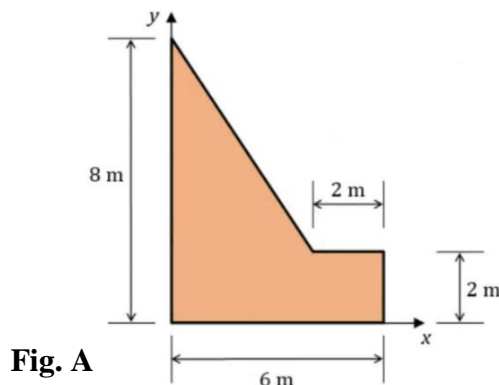
Fig. A
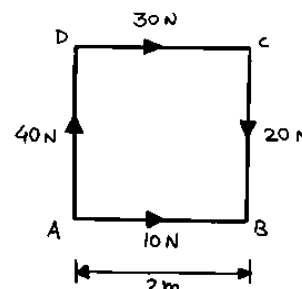
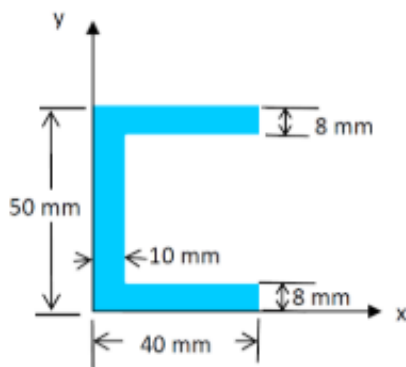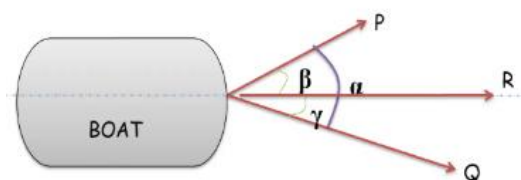**Fig. B**

	b.	A square ABCD is of 2m side in which along AB, CB, DC & AD forces of 10N, 20N, 30N & 40N are acting as shown in **Fig. B**. Find magnitude, direction & position of the resultant from point A.	5	CO1	K3

(OR)

	c.	Calculate the centroid of the given shape. (**Fig. C**).	5	CO1	K2

Fig. C

Fig. D

	d.	A boat is moving uniformly along a canal by two horses pulling with P = 890 N and Q = 1068 N acting at an angle α = 60° as shown in figure (**Fig. D**). Determine the resultant force and angles β and ¥.	5	CO1	K2

3.a. A block of weight 200 N rests on a rough horizontal surface. Find the magnitude of the force to be applied at the angle of 30° to the horizontal in order to move the block on the surface. Assume coefficient of friction is 0.3.   **4   CO1   K3**
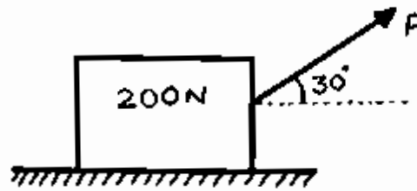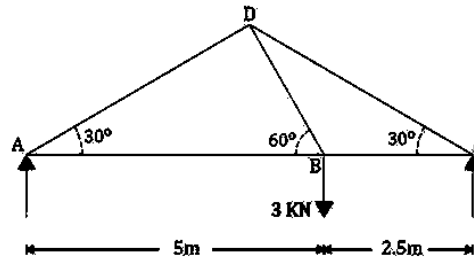

b. Explain plane truss, perfect truss, deficient truss.   **6   CO3   K2**

(OR)

c. Determine the forces in all the members of the truss and the reactions at A and B. the external load at joint B is 3kN.   **7   CO1   K3**

d. Write the different laws of friction.   **3   CO3   K1**

4.a. Calculate the absolute of the following pressures. Take atmospheric pressure is 760 mm of Hg.   **5   CO4   K2**
i) 25 cm of water   ii) 450 mm of mercury.

b. Explain the various modes of heat transfer with examples.   **5   CO4   K1**

(OR)

c. A gas undergoes a polytropic process with a polytropic index (n = 1.4). The initial state of the gas is defined by a pressure of 150 kPa and a volume of 0.5 m³. The gas expands to a final volume of 1.0 m³. Calculate the work done by the gas during the expansion.   **5   CO4   K2**

d. An investigator designed a temperature scale (X) having freezing point and boiling point as 60°N and 300°N. What will be the value of temperature 375 K and 85°F in new scale (X).   **5   CO4   K2**

5.a. A steam turbine receives steam at a pressure of 1.5 MPa and a temperature of 350°C. The specific enthalpy of the steam at the inlet is 2800 kJ/kg. The steam exits the turbine at a pressure of 0.2 MPa, with a specific enthalpy of 500 kJ/kg. The inlet velocity of the steam is 25 m/s, and the exit velocity is 10 m/s. There is a heat loss to the surroundings of 50 kW. Calculate the net power output of the turbine if the mass flow rate of steam is 4 kg/s and the change in elevation is negligible.   **6   CO5   K3**

b. State Kelvin Planck statement and Clausius statement.   **4   CO5   K2**

(OR)

c. Write the working principle of 4 stroke IC Engine with sketch   **8   CO5   K2**

d. List out the assumptions of Steady Flow Energy Equation.   **2   CO6   K1**

6.a. Define surface tension. Find out the minimum size of glass tube that can be used to measure water level if the capillary rise in the tube is to be restricted to 2mm. Consider surface tension of water in contact with air as 0.073575 N/m.   **5   CO6   K2**

b. Explain the components of industrial robots.   **5   CO6   K2**

(OR)

c. Explain the working of CNC machine with block diagram.   **6   CO6   K2**

d. Calculate the mass, specific weight, density and specific gravity of 1 litre of liquid which weighs 7 N.   **4   CO6   K2**

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