

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



B.Tech. (First Semester) Examinations, December – 2024
23BBSES10002 – Elements of Mechanical Engineering
(Common to all branches)

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

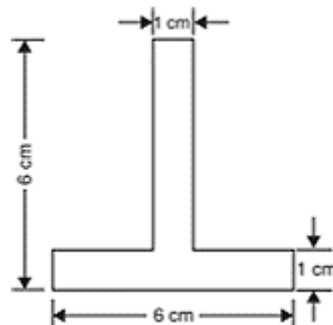
- Define Lami's theorem.
- Distinguish centroid and center of gravity.
- State Zeroth law of Thermodynamics.
- Define limiting friction.
- Define pressure and write four units.

CO #	Blooms Level
CO1	K1
CO2	K1
CO4	K1
CO3	K1
CO6	K1

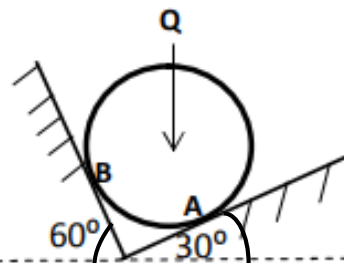
PART – B**(10 x 5 = 50 Marks)**Answer **ALL** the questions

- Determine the magnitude and direction of the resultant force of the two forces having magnitude 9 N and 12 N acting at a point, if the angle between them is 30° .
 - Calculate the centroid of the given composite shape. **(Fig 1.)**

Marks	CO #	Blooms Level
4	CO1	K2
6	CO2	K3

**(Fig 1.)**

(OR)

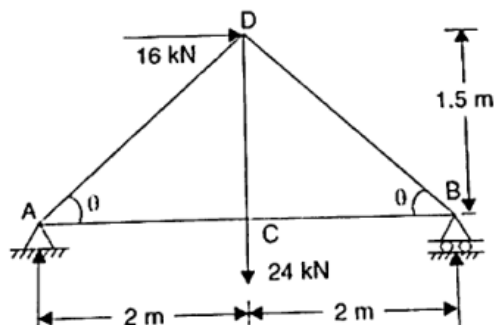
**(Fig 2.)**

- A ball of weight $Q = 53.4$ N rest in a right-angle trough as shown in above figure **(Fig.2)**. Determine reactions at A & B if all surface is perfectly smooth.
 - A quarter of circle area is removed from square. Find out the centroid of remaining area. The radius of the circle is same as the side of square.
- A body of weight 450 N is pulled up on an inclined plane, by a force of 300 N. The inclination angle of the plane is 30° to the horizontal and the force applied is parallel to the plane. Determine coefficient of friction.
 - Explain Perfect, Imperfect, Plane and Space Truss.

5	CO1	K2
5	CO2	K2
6	CO3	K2
4	CO1	K1

(OR)

- c. Calculate the forces in all the members of the truss.



- d. Write the different laws of friction. 3 CO3 K1
- 4.a. Define thermodynamic system. Explain the different thermodynamic systems with examples. 2+3 CO4 K1
- b. 4 kg of gas undergo an isothermal process at pressure 2 bar and temperature 300 K. Determine the work done by the gas if the volume of the increased by 2 times. Take R for the gas as 287 J/kgK. 5 CO4 K2

(OR)

- c. Write two similarities between heat transfer and work transfer. Explain the different modes of heat transfer with examples. 1+4 CO4 K1
- d. A mass of 8 kg gas expands within a flexible container so that the p-v relationship is in the form of $pV^{1.4} = \text{const}$. The initial pressure is 1000kPa and initial volume is 1m^3 . The final pressure is 5kPa. The internal energy decreases by 320kJ, find the work transfer and heat transfer. 5 CO4 K2
- 5.a. The enthalpy and velocity of the fluid at the inlet to the nozzle are 3000 kJ/kg and 60 m/s. At the discharge, the enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss from it. Calculate the velocity at the exit of the nozzle. 5 CO5 K3
- b. Explain the important components of steam power plant. 5 CO5 K2

(OR)

- c. Write Kelvin Planck Statement and Clausius statement. 3+3 CO5 K3
A reversible heat engine receives heat from a thermal reservoir at 870K and rejects 50kW of heat to a sink at 290K. If the engine output is 85kW, make calculations for engine efficiency and heat supplied by the reservoir.
- d. (i) Difference between Turbine and Compressor. 4 CO5 K1
(ii) Difference between Nozzle and Diffuser.
- 6.a. Define surface tension. 2+3 CO6 K2
A liquid of density 900 kg/m^3 rises to a height of 7 mm in a capillary tube of 2 mm internal diameter. If the angle of contact of the liquid in the glass is 25° , find the surface tension of the liquid. $g=9.8\text{ m/s}^2$.
- b. Write the advantages, disadvantages and applications of Industrial Robots. 2+1+2 CO6 K1

(OR)

- c. Convert the following readings of pressure to kPa, assuming that the barometer reads 760 mmHg: (i) 90 cm Hg gauge (ii) 40 cm Hg vacuum 5 CO6 K2
- d. Write short notes on Flexible Manufacturing System. 5 CO6 K2

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