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Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)

B. Tech (Second Semester - Regular) Examinations, April 2026

25FYES10002 – Elements of Mechanical Engineering

(Aeronautical Engineering)

Time: 3 hrs | Maximum: 60 Marks

(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 zeroth law of thermodynamics.	CO4	K2
b.	Explain any two assumptions used in truss analysis.	CO2	K2
c.	A person designed a temperature scale whose ice point is 60°C and steam point is 200°C. How much will be 85°F in the new scale?	CO4	K4
d.	At what value of 'n', the polytropic process becomes isochoric.	CO5	K3
e.	Illustrate a free body diagram for a block resting on a horizontal surface and identify the forces acting on it.	CO1	K2

PART – B **(10 x 5 = 50 Marks)**

Answer ***ALL*** the questions

		Marks	CO #	Blooms Level
2. a.	Calculate the resultant force of the two forces given in Fig. 1 by using Parallelogram Law of Forces.	5	CO1	K3
b.	Calculate the reaction forces at A and B for the given element in Fig. 2 where A is subjected to hinge support and D is subjected to roller support.	5	CO1	K3

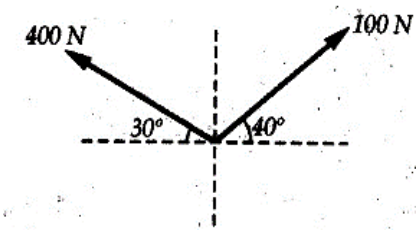


Fig. 1

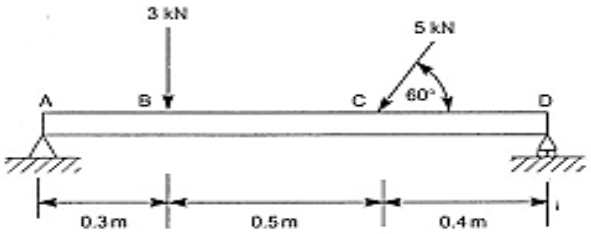
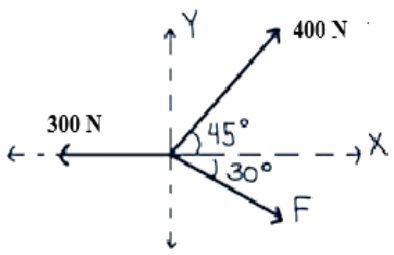


Fig. 2

(OR)

c.	State Lami's theorem. Determine the value of unknown force F in the given system which is under equilibrium.	5	CO1	K2



d.	Determine the magnitude and direction of resultant force for the following system of forces- a) 30N, 30^O inclined towards North of West b) 40N towards North-East c) 45 N, 40^O inclined towards South of West d) 60 N East	5	CO1	K3
3.a.	Explain truss and classify the truss on the basis of number of members.	5	CO3	K2

b.	Calculate the centroid of given shape in Fig. 3.	5	CO2	K3

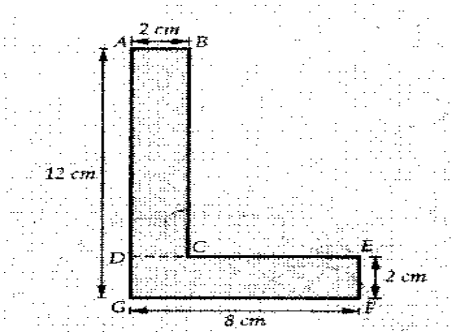


Fig. 3

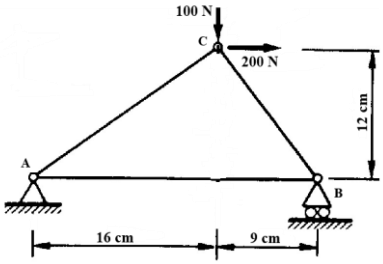


Fig. 4

(OR)

c.	Calculate the forces in the members AB, BC and AC of the given truss in Fig. 4.	10	CO3	K3
4.a.	Calculate the capillary effect in mm of glass tube having 3mm diameter when immersed in water. The fluid is at 20 ^{O}C and the surface tension of water is 0.0736 N/m. The contact angle of water and mercury are 0^{O}.	5	CO4	K2
b.	Explain thermodynamic system and its types with suitable examples.	5	CO5	K2

(OR)

c.	Explain the different modes of heat transfer with examples.	5	CO5	K2
d.	If $5m^3$ of a certain oil weighs 40kN, calculate the specific weight, mass density and specific gravity of oil.	5	CO4	K2
5.a.	A nozzle has a following parameter at inlet: Specific enthalpy is 3000 kJ/kg, velocity 60 m/s, and at the outlet Specific enthalpy is 2762 kJ/kg. The nozzle is horizontal and there is negligible heat loss. Calculate exit velocity, mass flow rate if the inlet area is 0.1 m^2 and specific volume is 0.187 m^3/kg. The specific volume at exit is 0.498 m^3/kg. Calculate the cross sectional area at outlet.	10	CO6	K3

(OR)

b.	Calculate the work done, change in internal energy, heat transfer when 4.6 kg of air is compressed from 1.01 bar, 25 ^{o}C to 0.54 MPa. The compression takes place according to $PV^{1.27}$ = Constant.	10	CO6	K3
6.a.	A mass of 8 kg gas expands within a flexible container so that the p–v relationship is of the from $PV^{1.2}$ = constant. The initial pressure is 1000kPa and the initial volume is 1 m3. The final pressure is 5 kPa. If specific internal energy of the gas decreases by 40 kJ/kg, find the heat transfer in magnitude and direction.	10	CO5	K3

(OR)

b.	An investigator designed a temperature scale (X) on two fixed points as 60^{o}N and 300^{o}N. What will be the value of temperature 375 K and 85^{o}F in new scale (X).	5	CO5	K3
c.	A plate 0.025 mm distance from a fixed plate moves at 60 cm/sec and requires a force of $2N/m^2$. To maintain its speed, determine the fluid viscosity between the plates.	5	CO5	K3

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