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GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (First Semester – BACK PAPER) Examinations, February – 2022

BESBS1031 – Elements of Mechanical Engineering

(Common to All Branches)

Time: 3 hrs

Maximum: 70 Marks

Answer ALL Questions

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions)

(1 x 10 = 10 Marks)

Q.1. Answer ALL questions

- | | [CO#] | [PO#] |
|--|-------|-------|
| a. The Lami's Theorem is applicable only for | CO1 | PO1 |
| (i) Coplanar forces | | |
| (ii) Concurrent forces | | |
| (iii) Coplanar and concurrent forces | | |
| (iv) Any type of forces | | |
| b. Theorem of perpendicular axis is used in obtaining the moment of inertia of a | CO1 | PO1 |
| (i) triangular lamina | | |
| (ii) square lamina | | |
| (iii) circular lamina | | |
| (iv) semi-circular lamina | | |
| c. The centre of gravity of an equilateral triangle with each side (a) is from any of the three sides. | CO1 | PO1 |
| (i) $\frac{a\sqrt{3}}{2}$ | | |
| (ii) $\frac{a\sqrt{2}}{3}$ | | |
| (iii) $\frac{a}{3\sqrt{2}}$ | | |
| (iv) $\frac{a}{2\sqrt{3}}$ | | |
| d. A couple consists of | CO1 | PO1 |
| (i) two like parallel forces of same magnitude. | | |
| (ii) two like parallel forces of different magnitudes. | | |
| (iii) two unlike parallel forces of same magnitude. | | |
| (iv) two unlike parallel forces of different magnitudes | | |
| e. A redundant frame is also calledframe | CO2 | PO1 |
| (i) perfect | | |
| (ii) imperfect | | |
| (iii) deficient | | |
| (iv) none of these | | |
| f. Which of the following statements is false? | CO3 | PO1 |
| (i) Work is a state function | | |
| (ii) Temperature is a state function | | |
| (iii) Change in the state is completely defined when the initial and final states are specified | | |
| (iv) Work appears at the boundary of the system | | |
| g. When two bodies are in thermal equilibrium with a third body they are also in thermal equilibrium with each other. This statement is called | CO3 | PO1 |
| (i) Zeroth law of thermodynamics | | |
| (ii) First law of thermodynamics | | |
| (iii) Second law of thermodynamics | | |
| (iv) Kelvin Planck's law | | |
| h. The characteristic equation of gases $pV = mRT$ holds good for | CO3 | PO1 |
| (i) monoatomic gases | | |
| (ii) diatomic gas | | |
| (iii) real gases | | |
| (iv) ideal gases | | |
| i. The main objective(s) of Industrial robot is to | CO4 | PO1 |
| (i) To minimise the labour requirement | | |
| (ii) To increase productivity | | |
| (iii) To enhance the life of production machines | | |
| (iv) All of the above | | |
| j. Which of the following system has feedback system? | CO4 | PO1 |
| (i) Open loop system | | |
| (ii) Closed loop system | | |
| (iii) Direct loop system | | |
| (iv) None of the above | | |

PART – B: (Short Answer Questions)**(2 x 10 = 20 Marks)**Q.2. Answer ALL questions

	[CO#]	[PO#]
a. Define Free body diagram	CO1	PO1
b. State and prove Perpendicular axis theorem	CO1	PO1
c. What are the assumptions in Truss?	CO2	PO1
d. State the laws of dry friction	CO2	PO1
e. How method of joint differs from the method of section	CO2	PO1
f. Consider as a system, the gas in the cylinder is fitted with a piston on which number of small weights is placed. The initial pressure is 200 kPa, and the initial volume of the gas is 0.04 m ²	CO3	PO2
g. What is meant by thermodynamic system? How do you classify it?	CO3	PO1
h. Write the expression for COP of a heat pump and a refrigerator?	CO3	PO1
i. Asimov's laws of robotics?	CO4	PO1
j. What is NC part programming?	CO4	PO1

PART – C: (Long Answer Questions)**(10 x 4 = 40 Marks)**Answer ALL questions

	Marks	[CO#]	[PO#]
3. a. Two smooth spheres of weight W and radius r each are in equilibrium in a horizontal channel of A and B vertical sides as shown in Fig. 1. Find the force exerted by each sphere on the other. Calculate these values, if $r = 250$ mm, $b = 900$ mm and $W = 100$ N.	6	CO1	PO1, PO2

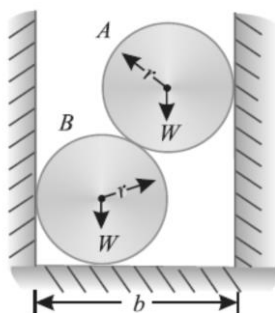


Figure 1

b. State and prove the Theorem of varignon.	4	CO1	PO1
(OR)			
c. The following forces act at a point : (i) 20 N inclined at 30° towards North of East, (ii) 25 N towards North, (iii) 30 N towards North West, and (iv) 35 N inclined at 40° towards South of West. Find the magnitude and direction of the resultant force.	4	CO1	PO1, PO2
d. With respect to coordinate axes x and y , locate the centroid of the shaded area shown in Fig.2	6	CO1	PO1, PO2

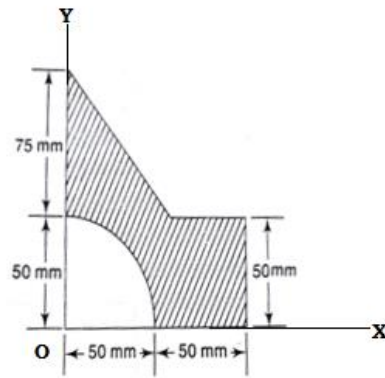
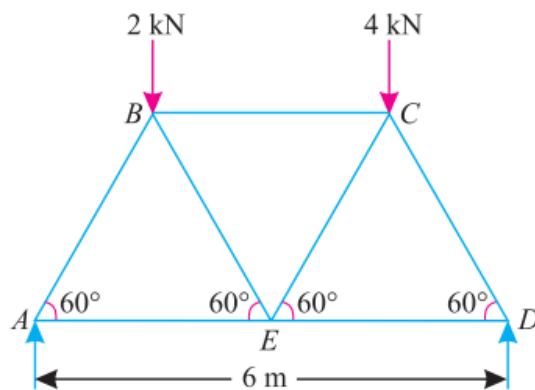


Figure 2

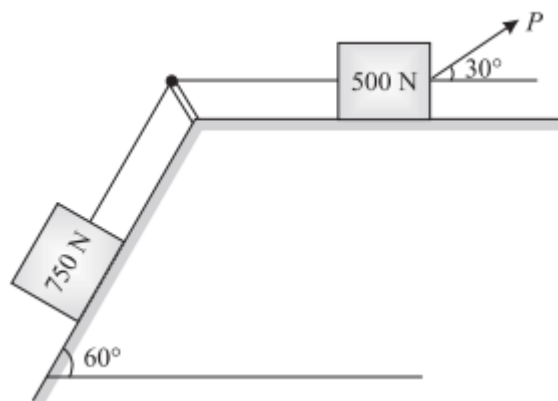
4. a. Find the axial force in any four members of the truss with the loading as shown in Fig.

5 CO2 PO1, PO2



- b. What is the value of P in the system shown in Fig. 5.9(a) to cause the motion to impend? Assume the pulley is smooth and coefficient of friction between the other contact surfaces is 0.2.

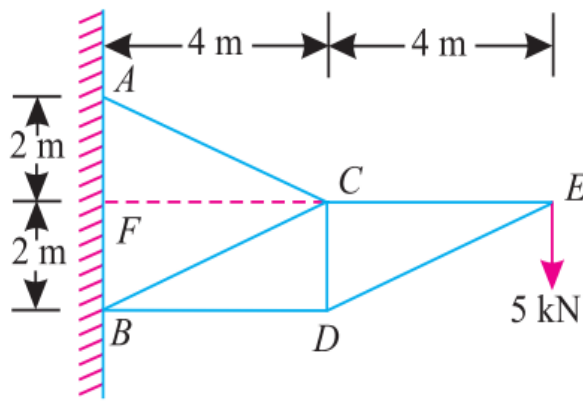
5 CO2 PO1, PO2



(OR)

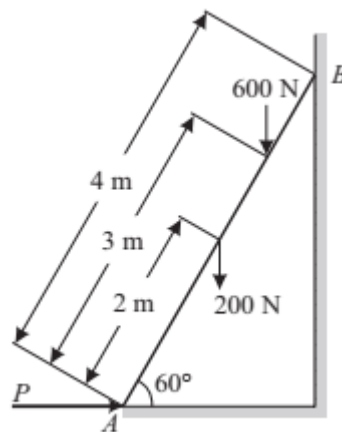
- c. A truss shown in Fig 3 is carrying a point load of 5 kN at E. Find the forces in all the members the truss?

5 CO2 PO1, PO2



- d. A ladder of length 4 m, weighing 200 N is placed against a vertical wall as shown in Fig. 5.14(a). The coefficient of friction between the wall and the ladder is 0.2 and that between floor and the ladder is 0.3. The ladder, in addition to its own weight, has to support a man weighing 600 N at a distance of 3 m from A. Calculate the minimum horizontal force to be applied at A to prevent slipping.

5 CO2 PO1, PO2



5. a. Distinguish between Macroscopic & microscopic approaches 4 CO3 PO1
- b. A heat engine receives heat at the rate of 1500 kJ/min and gives an output of 8.2 kW. Determine : (i) The thermal efficiency ; (ii) The rate of heat rejection 6 CO3 PO1, PO2
- (OR)
- c. Write the comparison between external combustion engine and internal combustion engine 4 CO3 PO1
- d. When a stationary mass of gas was compressed without friction at constant pressure its initial state of 0.4 m³ and 0.105 MPa was found to change to final state of 0.20 m³ and 0.105 MPa. There was a transfer of 42.5 kJ of heat from the gas during the process. How much did the internal energy of the gas change ? 6 CO3 PO1, PO2
6. a. Explain the types Robotic arm configurations? 5 CO4 PO1
- b. Write the difference between NC and CNC 5 CO4 PO1
- (OR)
- c. Define FMS? Explain benefits of FMS? 5 CO4 PO1
- d. Explain various components of NC with neat diagrams? 5 CO4 PO1

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