KERALA AGRICULTURAL UNIVERSITY
B. Tech. (Agrl. Engg.) 2024 Admission
III Semester Final Examination – January 2026

IDE 2101 **Engineering Mechanics (2+1)** **Marks: 50**
Time: 2 hours

I **Fill in the blanks** **(10x1=10)**

1. If all the forces in a system lie in a single plane, it is called a .....
2. A diagram of the body in which the body under consideration is freed from all the contact surfaces and shows all the forces acting on it (including reactions at contact surfaces), is called a .....
3. The frictional force always acts in a direction ..... to that in which the body tends to move.

Answer the following

4. What is Flexure rigidity?
5. Write the Torsion Equation.

State True or False

6. 1 MPa = 1 N/mm^2.
7. A bar of uniform thickness 't' tapers uniformly from a width of b1 at one end to b2 at other end in a length 'L'. The expression for the change in length of the bar when subjected to an axial force P is $\frac{PL}{tE(b_1-b_2)}(log\frac{b_2}{b_1})$
8. Relation between E & K is E=3K(1+2μ)
9. If the expansion of the member is freely permitted, no temperature stresses are induced in the material.
10. The bending moment that is trying to sag the beam shall be taken as a positive bending moment.

II **Write short notes on ANY FIVE of the following** **(5x2=10)**

1. What are the Characteristics of a Force?
2. State Lami's theorem.
3. Define Polar Moment of Inertia.
4. Explain the terms: coefficient of friction.
5. Define HOOKE'S LAW.
6. Define Point of Contraflexure.
7. Define Principal Planes and Principal Stresses.

III **Answer ANY FIVE of the following** **(5x4=20)**

1. Determine the resultant of the three forces acting on a hook as shown in Fig. 3.1.

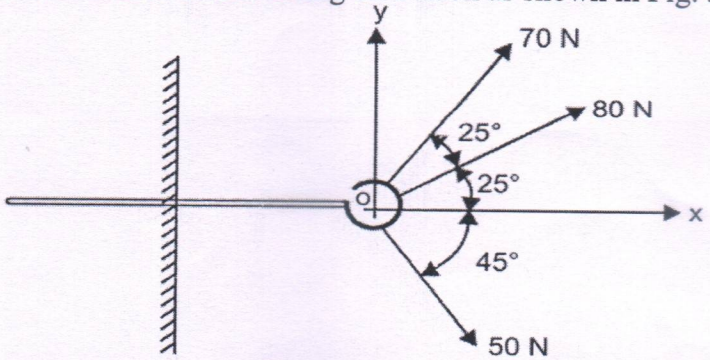

Fig. 3.1

2. Determine the centroid of the area shown in Fig. 3.2 with respect to the axis shown.

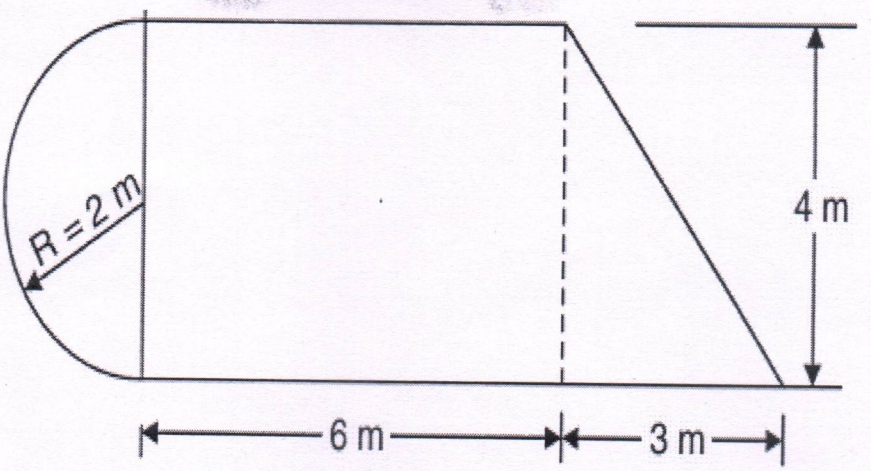

Fig. 3.2

3. What is the value of P in the system shown in Fig. 3.3 to cause the motion to impend? Assume the pulley is smooth and coefficient of friction between the other contact surfaces is 0.2.

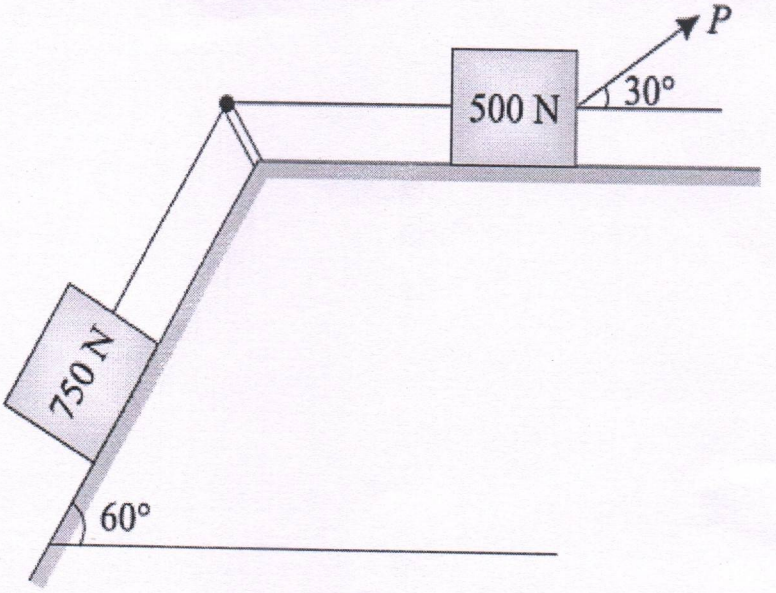

Fig. 3.3

4. A circular rod of diameter 16 mm and 500 mm long is subjected to a tensile force 40 kN. The modulus of elasticity for steel may be taken as 200 kN/mm^2. Find stress, strain and elongation of the bar due to applied load.
5. A compound bar of length 600 mm consists of a strip of aluminium 40 mm wide and 20 mm thick and a strip of steel 60 mm wide × 15 mm thick rigidly joined at the ends. If elastic modulus of aluminium and steel are 1×10^5 N/mm^2 and 2×10^5 N/mm^2, determine the stresses developed in each material and the extension of the compound bar when axial tensile force of 60 kN acts
6. A bar of brass 20 mm is enclosed in a steel tube of 40 mm external diameter and 20 mm internal diameter. The bar and the tubes are initially 1.2 m long and are rigidly fastened at both ends using 20 mm diameter pins. If the temperature is raised by 60°C, find the stresses induced in the bar, tube and pins. Given: $E_s = 2 \times 10^5$ N/mm^2; $E_b = 1 \times 10^5$ N/mm^2; $\alpha_s = 11.6 \times 10^{-6}$/°C $\alpha_b = 18.7 \times 10^{-6}$/°C.
7. A circular steel pipe of external diameter 60 mm and thickness 8 mm is used as a simply supported beam over an effective span of 2 m. If permissible stress in steel is 150 N/mm^2, determine the maximum concentrated load that can be carried by it at mid span

IV **Write an essay on ANY ONE of the following** **(1x10=10)**

1. Determine the forces in all the members of the truss shown in Fig. 4.1 and indicate the magnitude and nature of forces on the diagram of the truss. All inclined members are at 60° to horizontal and length of each member is 2 m.

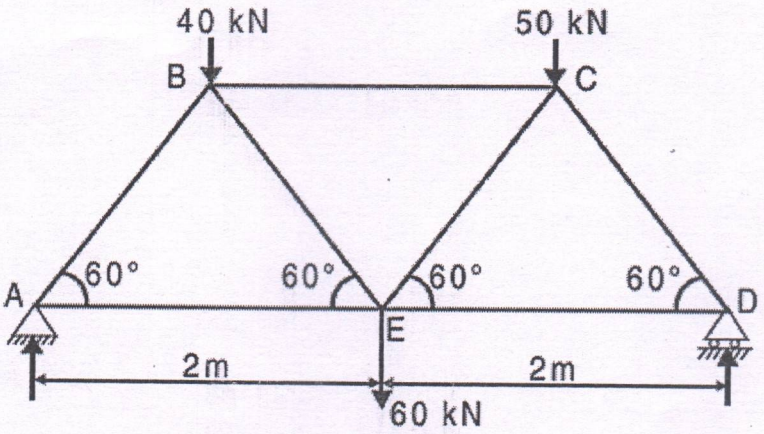

Fig. 4.1

2. Draw the SF and BM diagrams for the beam shown in Fig. 4.2 and find out the position and the magnitude of maximum moment

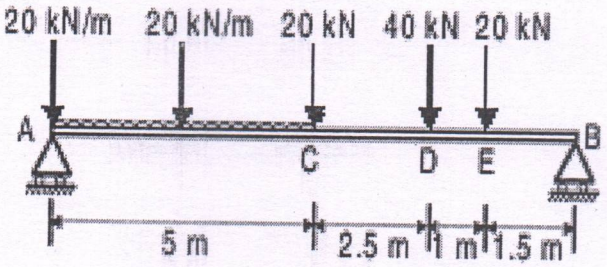

Fig. 4.2

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