Name :.....
Roll No:.....

MAR ATHANASIUS COLLEGE OF ENGINEERING

(Government Aided Autonomous Institution)
Kothamangalam, Kerala - 686 666
DEPARTMENT OF MECHANICAL ENGINEERING

B24ME1T02 STATICS AND DYNAMICS FOR ENGINEERS

Second Sessional Examination April 2026

Duration: 1 hour and 30 minutes | S2 ME A & B BATCH | Max mark: 40

Part A

1. What is the physical significance of the area moment of inertia? Using this concept, explain why beams are designed to be deeper rather than wider. (CO3) **(3)**

2. Derive the expression for the centroid of a rectangular area of breadth b and height h. (CO3) **(3)**

3. Differentiate Kinematics and Kinetics. (CO4) **(3)**

4. An electric train starting from rest attains a maximum speed of 100 kmph in 20 seconds. Determine the distance covered during this time period. (CO4) **(3)**

Part B

5. Determine the centroid of the structural steel section shown in Fig.1. (CO3) **(7)**

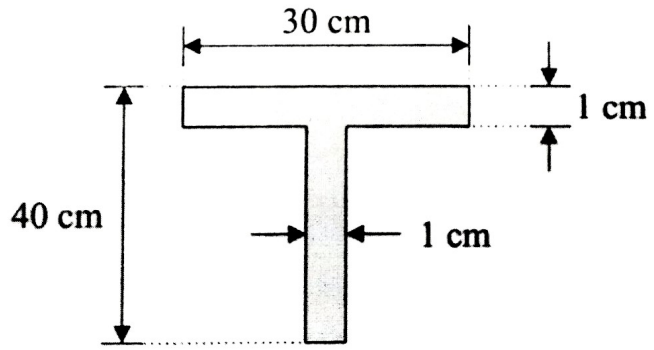
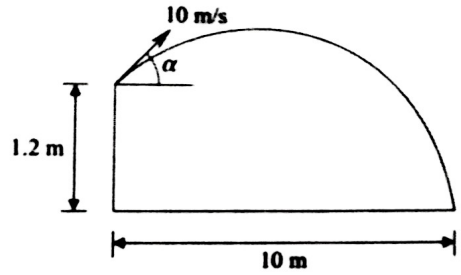


Figure 1: T-section

6. Determine the moment of inertia of the T-section shown in Fig.1 about its centroidal axis and base. (CO3) **(7)**

7. A helicopter used for relief activities drops food packets to the relief camp. If the food packets reach the ground after 3 seconds, determine the height from which they were dropped and the velocity with which they strike the ground. (CO4) **(7)**

8. In a shot-put game, a man throws an iron ball with an initial velocity of 10 m/s. What should be the angle of projection if he has to reach a record of 10 m? Take the height at which the ball is released as 1.2 m. (CO4) **(7)**



Vision

Mentoring to Ensure Excellence

Mission

1. To facilitate comprehensive and integrated development of students by providing quality education that encourages sustainable practices.
2. To mould disciplined and socially committed engineers capable of assuming professional leadership upholding national integrity.

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DEPARTMENT OF MECHANICAL ENGINEERING

B24ME2T01 MECHANICS OF SOLIDS

First Sessional Examination August 2025

Duration: 1 hour and 30 minutes | S3 ME A & B BATCH | Max mark: 40

Part A

(1) Why do we define the term stress instead of using force to describe material behaviour? Define stress.(CO1) **(3)**

(2) Draw the engineering stress–strain and true stress–strain curves for mild steel, labelling all key points. Explain the material behaviour in the different regions of the curves.(CO1) **(3)**

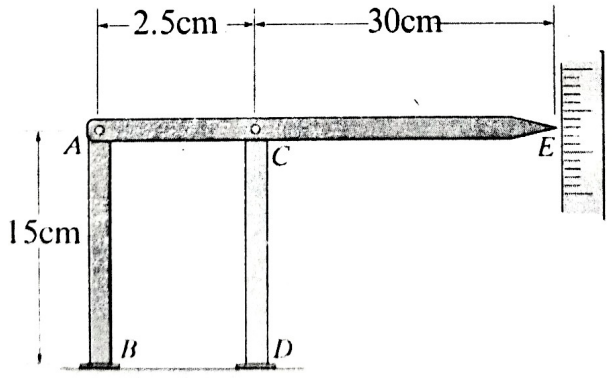
(3) Define stress at a point. (CO2) **(3)**

(4) Write the components of the stress tensor and represent it in the faces of the cubic element.(CO2) **(3)**

Part B

(1) a. Derive the relation $E = 2G(1 + \mu)$ for isotropic materials. (CO1) **(7)**

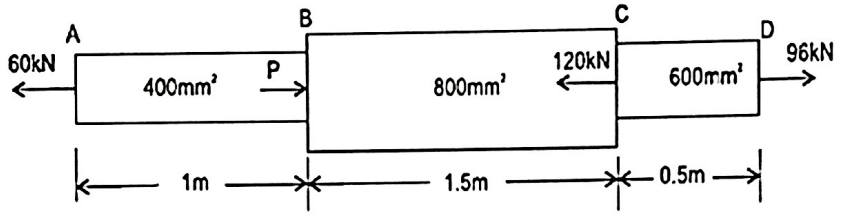
b. The device is used to measure a change in temperature. Bars AB and CD are made of A-36 steel and 2014 T6 aluminium alloy, respectively. When the temperature is at 75°C, ACE is in the horizontal position. Determine the vertical displacement of the pointer at E when the temperature rises to 150°C. Take $\alpha_{\text{A-36 steel}} = 11.7 \times 10^{-6}$ /°C, $\alpha_{\text{2014-T6 Al alloy}} = 23.2 \times 10^{-6}$ /°C (CO1) **(7)**



(2) a. Rails are laid such that there is no stress in them at 24°C. If the rails are 32 m long, determine
(i) the stress in the rails at 80°C, when there is no allowance for expansion.

(ii) the stress in the rails at 80°C, when there is an expansion allowance of 8 mm per rail.
(iii) the expansion allowance for no stress in the rails at 80°C.
(iv) the maximum temperature for no stress in the rails when the expansion allowance is 8 mm. Take coefficient of linear expansion 11 $\times 10^{-6}$ /°C and E = 205 GPa (CO1) (7)

b. A steel bar ABCD of varying section is subjected to axial force as shown in figure. Find the value of P necessary for equilibrium. Determine the total deformation of the bar. What will be the axial load which will produce the same strain if the bar is replaced by another bar of uniform cross-section with the same length and 20 mm diameter? Take E=200 GPa. (CO1) (7)



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