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)**

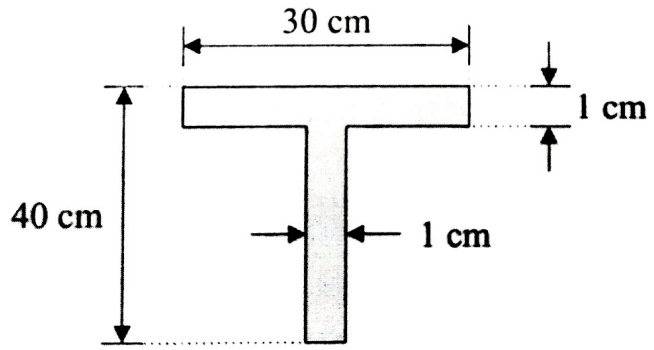
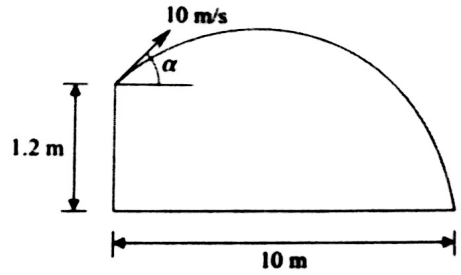


Figure 1: T-section

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.

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

MAR ATHANASIUS COLLEGE OF ENGINEERING

(Government Aided Autonomous Institution)
Kothamangalam, Kerala – 686 666

DEPARTMENT OF MECHANICAL ENGINEERING

B24ME2T01 – MECHANICS OF SOLIDS

First Sessional Examination – August 2026

Duration: 1 hour 30 minutes **S3 ME A & B Batch** **Max. Marks: 40**

Part A

(1) Differentiate between (i) Normal stress and shear stress (ii) Young's modulus and Rigidity modulus (iii) Poisson's ratio and volumetric strain.(CO1) (3)

(2) Illustrate the stress-strain curve for mild steel and indicate all the key points on the diagram.(CO1) (3)

(3) Define the terms: Principal stress and principal planes. (CO2) (3)

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

Part B

(5) a. Determine the elongation of a 4-meter-long rod as its temperature increases from 15°C to 100°C. Calculate the stress generated in the rod if the thermal expansion is constrained. The material properties are, $\alpha = 0.000012/°C$ and $E = 1 \times 10^5 MN/m^2$. (CO1) (7)

b. The A-36 steel bar shown in Fig. is made from two segments AB and BD, having cross-sectional areas $A_{AB} = 600$ mm^2 and $A_{BD} = 1200$ mm^2. Determine the vertical displacement of end A and the displacement of B relative to C. (CO1) (7)

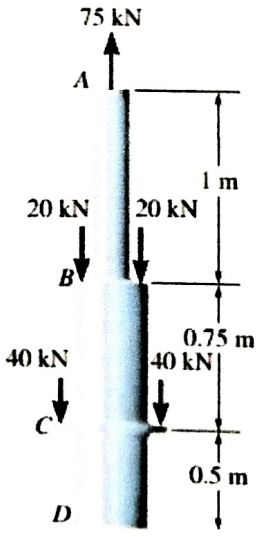


Figure 1: A-36 steel bar

P.T.O.

(6) a. Given the stress tensor:

$$\sigma = \begin{bmatrix} 10 & 6 & 4 \\ 6 & 20 & 2 \\ 4 & 2 & 24 \end{bmatrix}$$

(i) Write the characteristic equation for σ.

(ii) Find the three principal stresses (eigenvalues)

(iii) Any one unit normals of the principal planes.(CO2) (7)

b. Derive Cauchy's stress equation.(CO2) (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.