MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.
Tel: +254(0) 799 529 958, +254(0) 799 529 959, +254 (0)712 524 293
Website: www.must.ac.ke Email: info@mucst.ac.ke

UNIVERSITY EXAMINATIONS 2024/2025

SECOND YEAR FIRST SEMESTER EXAMINATION FOR DEGREE OF BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING

EMT 3201: ENGINEERING MECHANICS

DATE: JANUARY 2025 **TIME: 2 HOURS**

INSTRUCTIONS: Answer Question ONE and any other TWO questions.

QUESTION ONE (30 MARKS)

a) Briefly explain the following terms:

i. Mechanics (2 marks)

ii. Statics (2 marks)

iii. Dynamics (2 marks)

b) State the "Systeme International d'unite's "(SI) units for each of the following:

i. Length (1 Mark)

ii. Mass (1 Mark)

iii.Force (1 Mark)

c) What is a vector quantity? (4 Marks)

d) What is conservation of momentum? (3 Marks)

e) Figure Q1(e) shows a steel ball restrained on a wall by a string fixed at B. Draw a diagram of forces acting on the ball and express the force acting on the string and that acting on the wall in terms of w. (7 marks)

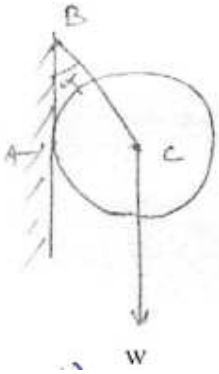


Figure Q1(e)

f) Define the following terms as used in engineering mechanics;

i. A radian (2marks)

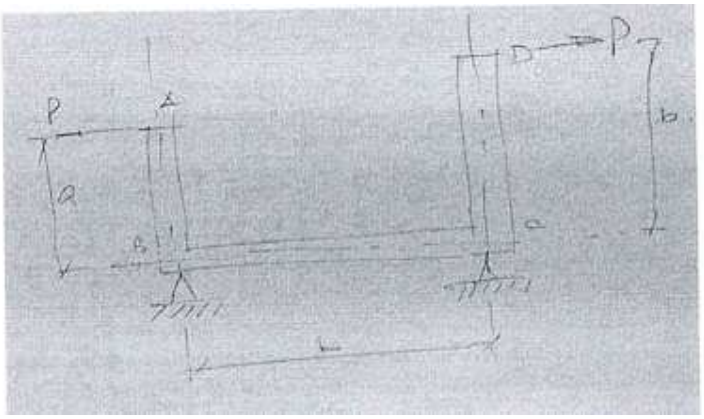
ii. Angular velocity 2marks)

g) What is a moment of inertia? (3marks)

QUESTION TWO (15 MARKS)

a) Briefly explain the meaning of a couple as used in relation to forces. (3 Marks)

b) A rigid bar ABCD acted by two equal and opposite forces P is supported at B and C as shown in Figure Q2(b). Obtain expressions for the reactions at the supports. Assume L=1.2 m, a = 0.6 m and b = 0.9 m. (6 marks)



Q2(b)

c) A man weighing 50 kg carries a load of 10 kg on his head. Find the work done when he goes:

i. 15 m vertically up (3 marks)

ii. 15 m on a levelled path on the ground. (3 Marks)

QUESTION THREE (15 MARKS)

a) Differentiate "Rectilinear" motion from "Curvilinear" motion. (3 Marks)

b) A bullet fired from the breech of an AK41 rifle of exits the muzzle with a velocity of 700 m/s. If the barrel is 900 mm long and assuming the bullet travels at constant acceleration, determine:

i. The acceleration. (3 marks)

ii. The time taken by the bullet to exit the barrel (3 marks).

c) Determine the centroid of Figure Q3(c) shown below. (6 marks)

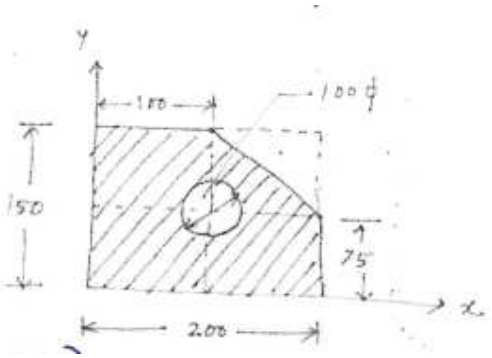


Figure Q3(c) Dimensions in mm.

QUESTION FOUR (15 MARKS)

a) A planing machine has moving parts of mass 2.5 tonnes and is brought to a rest from a speed of 0.10 m/s in 1.2 seconds. Calculate the average retarding force. (3 Marks)

b) A load is pulled 35 m along the horizontal by a force of 0.5 kN at an angle of 60^0 to the horizontal. Calculate the work done. (4 Marks)

c) Derive the fundamental dimensions of the following quantities:

i. Density (2 marks)

ii. Power (2 marks)

iii. Momentum (2 marks)

iv. Modulus of elasticity (2 marks)

QUESTION FIVE (15 MARKS)

a) Discuss the aspects of power as used in engineering mechanics. (4 Marks)

b) Determine the power required to pump 60 tonnes of water to a height of 20 m in 125 seconds. (4 Marks)

c) A certain vehicle having a mass of 4 tonnes travels at a speed of 110 km per hour round a circular track of 100 m radius. Determine the side thrust on the tires.

(7 Marks)