



# **MAASAI MARA UNIVERSITY**

**REGULAR UNIVERSITY EXAMINATIONS**

**2023/2024 ACADEMIC YEAR**

**FIRST YEAR SECOND SEMESTER**

**SCHOOL OF PURE, APPLIED AND HEALTHY  
SCIENCES**

**BACHELOR OF SCIENCE AND BACHELOR OF  
EDUCATION**

**COURSE CODE: PHY 1104-1**

**COURSE TITLE: MECHANICS**

**DATE: 20/5/2024**

**TIME: 1100-1300 HRS**

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## **INSTRUCTIONS TO CANDIDATES**

- **Question One is Compulsory (20 Marks)**
- **Answer Any Other Two (15 Marks Each)**

*This paper consists of **three** printed pages. Please turn over.*

### **Question one [20 Marks]**

- (a) Define the following terms [3marks]
- (i) Kinematics
  - (ii) Precision
  - (iii) Dimensional Analysis

(b) A woman is standing on a set of bathroom scales in a stationary lift (a normal everyday occurrence!). The reading on the scales is 500 N. When she presses the ground floor button, the lift accelerates downwards and the reading on the scales at this moment is 450 N. Find the acceleration of the lift. [3marks]

(c) State and explain the law of conservation of Baryon Number and Lepton Number [2marks]

(d) State the three Kepler's Laws of Planetary Motion. [3marks]

(e) A body moving with uniform acceleration of  $20 \text{ m/s}^2$  covers 640 m. If its initial velocity was 60 m/s. Calculate its final velocity. [3marks]

(f) Differentiate between static and dynamic equilibrium. [2marks]

(g) Consider a coplanar vector below

Find: Let  $\vec{P} = 3\hat{i} + 4\hat{j}$  and  $\vec{Q} = -2\hat{i} + 6\hat{j}$ .

- (i) composition [2marks]
- (ii) resolution [2marks]

### **QUESTION TWO [15 MARKS]**

- (a)(i) A car of mass 1200 kg travelling at  $10 \text{ ms}^{-1}$  collides with a stationary car of mass 1000 kg. If the cars lock together find their combined speed. [3marks]
- (ii) By comparing the kinetic energy before and after the collision, find out if the collision is elastic or inelastic. [3marks]

(b) State and explain three applications of Free-Body Diagram (FBD) [3marks]

(c) State Newtons second law of motion [2marks]

- (d) A man pulls a garden roller of mass 100 kg with a force of 200 N acting at  $30^\circ$  to the horizontal. If there is a frictional force of 100 N between the roller and the ground, what is the acceleration of the roller along the ground? [4marks]

**QUESTION THREE [15MARKS]**

- (a) Show that the third law of motion is given as  $v^2 = u^2 + 2as$  [3marks]
- (b) A trolley of mass 1 kg is released down a slope from a height of 0.3 m. If its speed at the bottom is found to be  $2 \text{ ms}^{-1}$  (take  $g = 9.8 \text{ ms}^{-2}$ ), find
- (i) the energy difference between the  $E_p$  at top and  $E_k$  at the bottom. [3marks]
- (ii) the work done by friction [2marks]
- (c) Explain two applications of uniform circular motion [2marks]
- (d) Differentiate between Moments, Couple and Torque [3marks]
- (e) Explain two advantages of dimensional analysis [2marks]

**QUESTION FOUR [15MARKS]**

- (a) Distinguish between a vector and a scalar quantity. State an example for each [4marks]
- (b) In a snooker game, the cue ball, of mass 0.2 kg, is accelerated from the rest to a velocity of  $2 \text{ ms}^{-1}$  by a force from the cue which lasts 50 ms. What size of force is exerted by the cue? [3marks]
- (c) At the take-off, the thrust on a rocket of mass 8000 kg is 200,000 N. Find the acceleration of the rocket. [3marks]
- (d) A body moving with uniform acceleration of  $10 \text{ m/s}^2$  covers a distance of 320 m. If its initial velocity was 60 m/s. Calculate its final velocity. [3marks]
- (e) Differentiate between centripetal and centrifugal forces [2marks]

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