



ALUPE UNIVERSITY

**OFFICE OF THE DEPUTY VICE CHANCELLOR
ACADEMICS, RESEARCH AND STUDENTS AFFAIRS**

**UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR**

**FIRST YEAR FIRST SEMESTER REGULAR MAIN
EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF
COMPUTER SCIENCE AND BACHELOR OF
EDUCATION SCIENCE**

COURSE CODE: PHY 110/112

COURSE TITLE: BASIC PHYSICS I/MECHANICS

DATE: 13TH, DECEMBER 2023

TIME: 9:00AM – 12:00PM

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 4 PRINTED PAGES

PLEASE TURN OVER.

REGULAR EXAMINATION

PHY 110/112: BASIC PHYSICS I/MECHANICS

STREAM: Comp Sc., & Bed Sc.

DURATION: 3 Hours

INSTRUCTIONS TO CANDIDATES

- i. Answer Question **ONE** and **TWO** in **SECTION A** and any other **THREE** questions in **SECTION B**.
- ii. Use the following constants where applicable:
 - Gravitational constant = $6.6741 \times 10^{-11} \text{m}^3/\text{Kgs}^2$
 - Mass of the earth = $5.972 \times 10^{24} \text{Kg}$
 - $g = 9.81 \text{N/Kg}$

SECTION A (28 MARKS)**Question One (14 marks)**

- a. Briefly describe **dimensional analysis** as used in physics (2 Marks)
- b. With appropriate illustrations show that in vector addition $(\mathbf{a}+\mathbf{b}) + \mathbf{c} = \mathbf{a} + (\mathbf{b}+\mathbf{c})$, where a, b, and c are vectors. (4 Marks)
- c. Distinguish between **phase** and **period** in simple harmonic motion. (2 marks)
- d. An automobile of mass 5 tones, accelerates with an average force of 200N along a straight road for 2.7 kilometers. Determine the
 - i. automobile's kinetic energy. (2 marks)
 - ii. velocity at the end of the acceleration. (2 marks)
- e. State two hazards of Bernoulli's effect. (2 marks)

Question Two (14 Marks)

- a. With an appropriate example define the term centripetal force. (2 Marks)
- b. Given that vector $\mathbf{A} = 4\mathbf{i} + 2\mathbf{j}$ and vector $\mathbf{B} = 2\mathbf{i} - 3\mathbf{j}$. With respect to the x-axis determine.
 - i. The magnitude of the resultant vector $\mathbf{A}+\mathbf{B}$. (3 Marks)
 - ii. The components of the resultant vector $\mathbf{A}+\mathbf{B}$. (2 Marks)
- c. A ball is thrown vertically into the air at 50m/s, calculate.
 - i. The maximum height it reaches. (2 Marks)
 - ii. The time it takes to reach the maximum height. (2 Marks)

- d. State the laws of friction. (3 Marks)

SECTION B (42 MARKS)

Question Three (14 Marks)

- a. Define the term **elasticity** as used in mechanics (2 Marks)
- b. A homogeneous liquid flows along a horizontal pipe of cross sectional area 55.0cm^2 , with a constriction of cross sectional area 6.0cm^2 . The speed of the constriction is 7.5m/s . Determine:
- The speed in the wider part. (4 marks)
 - Mass flux. (2 marks)
- c. The force F acting on a body moving in a circular path depends on the mass of the body (m), velocity (v) and radius (r) of the circular path. Obtain the expression for the force by dimensional analysis method. (Take the value of $k=1$, where k is a dimensionless constant of proportionality). (6 marks)

Question Four (14 Marks)

- a. Using two examples, define the term scalar quantity. (3 Marks)
- b. Compute the least acceleration with which a 45kg woman can slide down a rope if the rope can withstand a tension of only 300N . (4 Marks)
- c. A pendulum bob of mass 50g is attached to one end of a string of length 1.5m . The bob moves in a horizontal circle in such a way that the string is inclined at 10° to the vertical. Calculate,
- The tension in the string. (3 Marks)
 - The period of the motion. (4 Marks)

Question Five (14 Marks)

- a. Show that the relationship between angular and linear velocity is given as $v = r\omega$, where the symbols have their usual meaning. (4 Marks)
- b. A stone of mass 0.4kg is tied to a string of length 0.5m and whirled in a circle. If the stone revolves uniformly and makes one complete revolution per second, determine its:
- Acceleration. (3 Marks)
 - The force exerted on the stone by the string. (2 Marks)
- c. State Kepler's laws of planetary motion. (3 Marks)

- d. The weight of a person on earth is 600N. Determine the weight of the same person in the moon, given that the gravitational field strength of the moon is $1/6^{\text{th}}$ that of the earth. (2 Marks)

Question Six (14 Marks)

- a. Give two examples of forces. (2 Marks)
- b. Deduce the expression $F = Ma$, where the symbols have their usual meaning. (5 Marks)
- c. A 600N object is to be given an acceleration of 0.7m/s^2 . How large an unbalanced force must act upon it? (3 Marks)
- d. A person of weight W is moved up by an elevator with an acceleration a , deduce an expression for his weight as he moves up. (4 Marks)

Question Seven (14 Marks)

- a. Show that $F = \frac{dp}{dt}$, hence state the law of conservation of linear momentum (7 Marks)
- b. Two particles undergo an elastic collision with one of the masses being initially at rest. Given that the masses were $M_1 = 35\text{g}$ & $M_2 = 78\text{g}$ and initial velocity being 1.9m/s . Determine the final velocity after collision. (5 Marks)
- c. Distinguish between elastic and inelastic collision. (2 Marks)
