ALUPE UNIVERSITY COLLEGE

...Bastion of Knowledge...

P.O.Box 845-50400 Busia(K)
principal@auc.ac.ke
Tel: +254 741 217 185
+254 736 044 469
off Busia-Malaba road

OFFICE OF THE DEPUTY PRINCIPAL

ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR 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: 25th FEBRUARY, 2021   TIME: 0900 – 1200 HRS

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

THIS PAPER CONSISTS OF 4 PRINTED PAGES   PLEASE TURN OVER

REGULAR – MAIN 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*

- *Mass of neutron = $1.67 \times 10^{-27} Kg$*
- *Gravitational constant = $6.67 \times 10^{-11} NM^2 Kg^{-2}$*

SECTION A (28 MARKS)

Question One (14 marks)

  a. Explain the meaning of the term dimensional analysis.   (2 Marks)

  b. Two masses of 0.5Kg and 0.25Kg are connected by a light inextensible string, which passes over a smooth pulley. If the system is released from rest with the string taut. Determine the acceleration of each mass   (3 Marks)

  c. An automobile accelerates uniformly from rest to a speed of 140km/hr in 8 seconds, determine

      i. Its acceleration   (2 Marks)

      ii. Distance traveled in the first 8 seconds   (3 Marks)

  d. With an appropriate example define the term centripetal force.   (2 Marks)

  e. Does a vector of zero magnitude have direction? Explain.   (2 Marks)

Question Two (14 Marks)

  a. State any two examples of bodies exhibiting simple harmonic motion   (2 marks)

  b. The stress in a cylindrical hollow steel column of 0.125m outside diameter and inside diameter of 0.1m is 125,000 KN/m². Determine the force carried by the column. (3 Marks)

  c. A satellite in circular motion orbits the earth at an altitude of 250km above the earth surface where the magnitude of free fall is 9.20m/s². Determine the orbital speed of the satellite   (3 Marks)

  d. State two surface tension phenomena   (2 Marks)

  e. State two characteristics of an ideal liquid   (2 Marks)

f. Define the following terms as used in mechanics (2 Marks)

    i.   Vector resolution

    ii.   Frequency

SECTION B (42 MARKS)

Question Three (14 Marks)

a. Show that $F = \frac{dp}{dt}$, where the terms have their usual meaning, hence state the law of conservation of linear momentum (5 Marks)

b. State any two vector quantities in mechanics (2 Marks)

c. .

    i.   Two particles undergo an elastic collision with one of the masses initially at rest. Given that the masses were $M_1 = 35g$ & $M_2 = 78g$ and initial velocity being 1.9m/s. Determine the final velocity after collision. (4 Marks)

    ii.   Explain what is meant by the term **mass** as used in mechanics. (1 Mark)

d. Distinguish between elastic and inelastic collision (2 Marks)

Question Four (14 Marks)

a. A steel strip, clamped at one end vibrates with a frequency of 20Hz and amplitude of 5mm at the free end where a small mass of 2g is positioned. Find

    i.   Velocity of the end when passing through the zero position (3 Marks)

    ii.   The acceleration at maximum displacement (3 Marks)

b. Show that the relationship between angular and linear velocity is given as $v = r\omega$, where the symbols have their usual meaning. (4 Marks)

c. A neutron in a nuclear reactor travels a distance of 6.5m in a time of 180μs. Determine its final kinetic energy (4 Marks)

Question Five (14 Marks)

a. Given that vector $A = 5i + 3j$ and vector $B = 2i - 4j$. With respect to the x-axis determine.

    i.   The magnitude of the resultant vector $A+B$. (3 Marks)

    ii.   The components of the resultant vector $A+B$. (2 Marks)

b. The pressure difference between two points along a horizontal pipe, through which water is flowing, is 1.4 cm of mercury. Due to non-uniform cross-section, the speed of

flow of water at the point of greater cross-section is 60cm/sec calculate the speed at the other part. (4 Marks)

c. State the Newton's first law of motion. (1 Marks)

d. A sphere of diameter 6.0cm is mould into a thin uniform wire of diameter 0.2mm. Determine the length of the wire in SI units. (4 Marks)

Question Six (14 Marks)

a. 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. By dimensional analysis, deduce an expression for the force. (Take the value of k=1, where k is a dimensionless constant of proportionality) (6 marks)

b. Determine the magnitude of gravitational force acting between two masses of 12Kg and 30Kg separated by a distance of 100cm. (4 marks)

c. Show that Kepler's third law is consistent with the Newton's law of gravitation. (4 marks)

Question Seven (14 Marks)

a. With an example, define the term scalar quantity. (2 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. Giving two examples, define the term **stress** as used in mechanics. (3 marks)

d. 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 10^0 to the vertical. Calculate,

i. The tension in the string. (3 Marks)

ii. The period of motion. (2 Marks)

****