THARAKA UNIVERSITY COLLEGE

(A CONSTITUENT COLLEGE OF CHUKA UNIVERSITY)

FIRST YEAR EXAMINATION FOR AWARD OF A CERTIFICATE IN COMPUTER SCIENCE

PHYS 00111: FUNDAMENTALS OF PHYSICS

TIME: 2HRS

Instructions: Answer question one and any other two questions

Question one

a. In the SI system there are seven base quantities and two supplementary quantities. Name the two supplementary quantities and state theirSIunits.   (4marks)

b. Give two uses of dimensional analysis.   (2marks)

c. Give two classifications of errors.   (2marks)

d. A motor car is uniformly retarded and brought to rest from a speed of 180km/hr. in 5 sec. find its acceleration.   (3marks)

e. Work has got both vector definition and physical definition. Give the two definition   (2marks)

f. Calculate the angle of refraction for a ray of light from air striking an air-glass interface, making an angle of 60° with the interface. (ang = 1.5)   (3marks)

g. A van of mass 3 metric tons is travelling at a velocity of 72 km/h. Calculate the Momentum of the vehicle   (3marks)

h. Define the following types of vectors:

   i.   Coplanar vectors.   (2mark)

   ii. Collinear vectors.   (2mark)

   iii. Localized vectors   (2mark)

i. A car travelling at a speed of 72 km/h is uniformly retarded by an application of brakes and comes to rest after 8 seconds. If the car with its occupants has a mass of 1,250 kg.

   Calculate;

   i) The breaking force   (3marks)

   ii) The work done in bringing it to rest   (2marks)

Question two

   a. State the three Newton's laws of motion   (3marks)

   b. State and explain the two types of linear collisions   (2marks)

   c. State any three applications of friction force   (3marks)

   d. A minibus of mass 1,500 kg travelling at a constant velocity of 72 km/h collides head-on with a stationary car of mass 900 kg. The impact takes 2 seconds before the two move together at a constant velocity for 20 seconds. Calculate:

      i. The common velocity   (3marks)

      ii. The distance moved after the impact   (3marks)

      iii. The impulsive force   (3marks)

      iv. The change in kinetic energy   (3marks)

Question three

   a. Explain the dual nature of light and state when each of them is exhibited.   (3mark)

   b. Define critical angle as used in refraction of light   (2mark)

   c. The magnification produced by a mirror is +1.what does this mean   (2marks)

   d. State the two laws of refraction   (2markss)

   e. A concave lens forms a real and inverted image of a needle at a distance of 50cm from it. Where is the needle placed in front of the concave lens if the image is equal to the size of the object? Also find the lens focal length.   (5marks)

   f. Explain briefly three applications of total internal reflection   (6marks)

Question four

   a. 100 kg wooden crate rests on a wooden ramp with an adjustable angle of inclination.

      i. Draw a free body diagram of the crate.   (2marks)

      ii. If the angle of the ramp is set to 10°, determine :

         I   the component of the crate's weight that is perpendicular to the ramp   (3marks)

         II   the component of the crate's weight that is parallel to the ramp   (3marks)

         III   the normal force between the crate and the ramp   (3marks)

         IV   the static friction force between the crate and the ramp   (3marks)

iii. At what angle will the crate just begin to slip? (3marks)

b. State three states of equilibrium (3marks)

Question five

a. Define the following terms giving the mathematical expression for each of them.

     i. Potential energy (2mark)

     ii. Kinetic energy (2mark)

     iii. Electrical energy (2mark)

b. Determine the work done when a force of 50 N pushes an object 1.5 km in the same direction as the force. (4mks)

c. A constant force of 2kN pulls a crate along a level floor a distance of 10 m in 50s.What is the power used? (4mks)

d. A machine; the load moves 2 m when the effort moves 8 m. If an effort of 20 N is used to raise a load of 60 N, determine,

     i. Mechanical advantage (2mks)

     ii. Velocity ratio (2mks)

     ii. Efficiency (2mks)