**CHUKA**                                                    **UNIVERSITY**

## UNIVERSITY EXAMINATIONS
## THARAKA CAMPUS

### EXAMINATION FOR THE AWARD OF DIPLOMA IN COMPUTER SCIENCE

**PHYS 0111: PRINCIPLES OF PHYSICS**

**STREAMS :DIP (COMP SCI)**                               **TIME: 2 HOURS**

**DAY/DATE:  THURSDAY 7/12/2017**                         **8.30 A.M – 10.30 A.M**

**INSTRUCTIONS:**
- **Answer question one and any other two questions.**

**Question One**

a.  Define the following terms

    i.  Kilogram                                                    (1mark)

    i.  Metre                                                       (1mark)

    ii.  Physical quantities                                        (1mark)

    iii.  System of  units                                         (1mark)

b.  Give two supplementary quantities stating the respective units     (4marks)

c.  State the principle of energy conservation                         (2marks)

d.  state two conditions for total internal reflection to take place    (2marks)

e.  A 3.0kg mass undergoes an acceleration given by a = $(2.0\mathbf{i} + 5.0\mathbf{j})$ m/s$^2$.Find the resultant force F and its magnitude.                                            (3marks)

f.  Calculate the angle of refraction for a ray of light from air striking an air-glass interface, making an angle of $60^0$ with the interface. (ang = 1.5)                   (4marks)

g.  Consider a simple pendulum, having a bob attached to a string that oscillates under the action of the force of gravity. Suppose that the period of oscillation of the simple pendulum depends on its length

(*l*), mass of the bob (*m*) an acceleration due to gravity (*g*).Derive the expression for its time period using method of dimensions.

(4marks)

h.  A truck of mass 2,000 kg starts from rest on horizontal rails. Find the speed 3 seconds after starting if the tractive force by the engine is 1,000 N. (4marks)

i.  An object is placed 10cm in front of a concave mirror of radius of curvature 15 cm. Find the position, nature, and magnification of the image in eachcase

(3marks)

**Question Two**

a.  Give two differences between electric and magnetic circuits (2marks)

b.  A coil of 200 turns is wound uniformly over a wooden ring having a mean circumference of 600 mm and a uniform cross-sectional area of 500mm$^2$. If the current through the coil is 4A, calculate

   i.   The magnetic field strength (2marks)

   ii.  The flux density (2marks)

   iii. The total flux density (3marks)

c.  The circuit diagram below shows how a student set up a circuit using three identical lamps. Assume that the resistance of each lamp does not change with the brightness of the lamp. Each lamp is labelled 12 V, 2.0 A.
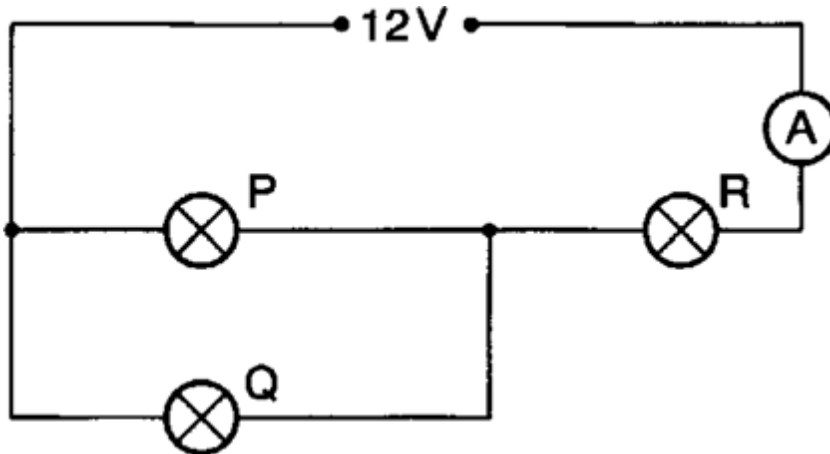


   i. Calculate the resistance of lamp Q (2marks)

   ii. Calculate the combined resistance of the three lamps as connected in Fig. 1

(2marks)

   iii. Calculate the current which would be shown on the ammeter in Fig. 1

(2marks)

   iv. Explain why lamp A is less bright than normal and why lamps P and Q are both equally very dim. (3marks)

v. In the space below draw a circuit diagram which shows P, Q and R connected so that they will all work at normal brightness. (2marks)

## Question Three

a. State the three Newton's laws of motion giving the equations governing them (3marks)
b. Derive the Newton's second equation of motion. (4marks)
c. A wooden box of mass 30 kg rests on a rough floor. The coefficient of friction between the floor and the box is 0.6. Calculate
    i. The force required to just move the box (2marks)
    ii. If a force of 200 N is applied the box with what acceleration will it move? (2marks)

d. Differentiate between elastic and inelastic collisions (4mrks)

e. Find the distance traveled by a car in the 7th second if it has an initial velocity of 10m/s and accelerating at the rate of 3 m/sec$^2$ (5 marks)

## Question Four

a. Give the three equations of linear motion (3marks)

b. Given that the velocity of a particle is $V = m + nt^2$ where $m = 10cm\ s^{-1}$ and $n = 2cm\ s^{-1}$

    i. Find the change in velocity of the particle in the time internal between $t_2 = 2s$ and $t_2 = 5s$. (3marks)
    ii. Find the average acceleration in this time interval. (2marks)
    iii. Find the instantaneous acceleration at time $t_1 = 2s$ (2marks)

c. A car starts from rest and accelerates at $10m/s^2$ in 20 seconds. Find the final velocity of this car (3marks)

d. A boy rolls a ball along a flat straight platform. The ball possesses an initial velocity of $2ms^{-1}$ when the boy release it and it shown down with a constant negative acceleration of $-2m\ s^{-2}$ How far does the ball rollbefore stopping, and how long does it take to stop? (4marks)

e. The mass of the moon is about one eighty-first, and its radius one fourth, that of the earth. What is the acceleration due to gravity on the surfaceof the moon? (3marks)

## Question Five

a. Briefly explain three application of total internal reflection (6marks)

b. what do you understand by the following terms as used in reflection of light:

    i. center of curvature (2marks)

    ii. radius of curvature (2marka)

iii. focal length (2marka)

iv. lateral inversion (2marka)

c. state the principle of the duality nature of light (2marks)

d. An electron moving along the x axis has a displacement given by $x = (16te^{-t})$ where t is in seconds. How far is the electron from the origin when it momentarily stops? (4marks)

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