TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied & Health Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:

DEGREE IN BACHELOR OF SCIENCE IN CIVIL ENGINEERING
DEGREE IN BACHELOR OF ELECTRICAL & ELECTRONIC ENGINEERING

SPH 2170: PHYSICS I

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: OCTOBER 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Mathematical tables*
- *Scientific Calculator*

This paper consist of **FIVE** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (Compulsory)

a) Find the values of x, y and z in the expression:

$$F = km^x v^y \alpha^z$$

where F is the force, m the mass r the radius and k a dimensions constant.
(3 marks)

b) For an object of mass m moving in a circular path of radius r with speed v, prove that Given that:

$$a = \frac{v^2}{r}$$

(5 marks)

c) A particle is moving in a straight line with a constant acceleration of 6m/s^2. As it passes a point A, its speed is 20m/s. What is its speed 10s after passing A? **(3 marks)**

d) (i) Differentiate between static and kinetic friction. **(1 mark)**

(ii) An object is placed on a plant which is then raised from one end. If the object starts to slip when the plank is at an angle of θ to horizontal, obtain the expression for the coefficient of static friction in terms of θ **(4 marks)**

e) (i) State the Kinetic theory of matter **(1 mark)**

(ii) While at 0°C, a square steel bar of 20m side is fixed at both ends so that it cannot expand. If the temperature is raised to 20°C, what force would be exerted on the support at the ends?

$y = 2\times10^{12}\, N/m^2$

and coefficient of linear expansion of steel is $10^{-5o}C^{-1}$ **(5 marks)**

f) A ray of light is incident in air at an angle of 40° to the normal to one face of a 60° glass prism. Calculate the angle through which the ray has been deviated by the time it emerges from the prism. (reflaction index of glass with respect to air = 1.5) **(4 marks)**

g) In a young's double slit experiment a total of 23 bright fringes occupying a distance of 3.9 mm were visible in the travelling microscope. Te microscope was focused on a plane which was 31cm from the slit and the wavelength of light being used was 5.5 x 10^{-7}m. What was the separation of the double slit? **(4 marks)**

Question Two

a) A gas bubble from an underwater explosion oscillates with a period which is proportional to $p^a\, d^b\, E^c$ where p is hydrostatic pressure, d is the density of water and E is the energy of the explosion. Find the value of a, b and c **(5 marks)**

b) Derive the formula for angular momentum of a rigid body **(4 marks)**

c) A 1kg stone attached to the end of a 60cm chain is revolving at C rate of 3 rev/s

(i) What is its angular momentum **(3 marks)**

(ii) If after 30s it is making only 1 rev/s, find the mean torque. **(3 marks)**

d) Show that the intermolecular force and the potential energy between molecules is related by the equation:

$$F = \frac{-dE}{dv}$$

Explain what the negative sign represents. **(5 marks)**

Question Three

a) (i) Define S.H.M **(1 marks)**

(ii) Draw a graph showing how y varies with t for S.H.M. **(2 marks)**

(iii) Prove that the period of S.H **(4 marks)**

$$T = 2\pi\sqrt{\frac{L}{g}}$$

b) (i) State Newton's Laws of motion **(3 marks)**

(ii) Show that: F = ma **(3 marks)**

c) A body of mass 5kg is pulled up a rough inclined plane inclined at 30^{o} to the horizontal by a force of 40N acting parallel to the plane. If a frictional force of 5N exists between the plane and the body:
(i) Draw a diagram showing all the forces acting on the body. **(2 marks)**
(ii) Find the acceleration of the body **(2 marks)**

Question Four

a) Define the following terms:
(i) Perfectly elastic body **(1 mark)**
(ii) Plastic body **(1 mark)**

b) What is meant by the term strain? How does it differ from stress? Name THREE types of strains. **(5 marks)**

c) What force is required to stretch a steel wire to double its length when its area of cross-section $1cm^2$ and $Y = 2 \times 10^{-11}N/m^2$ **(3 marks)**

d) Use dimensional analysis to derive Stroke's Law **(10 marks**

Question Five

a) (i) State the laws of refraction **(2 marks)**
(ii) An object is placed infront of a converging lens of focal length 30cm. If a virtual image is formed 60cm from the lens, find the position of the object. **(3 marks)**

b) What are the conditions necessary for:
(i) Dark interference fringes **(1 mark)**
(ii) Bright interference fringes **(1 mark)**

c) List 3 differences between interference and diffraction. **(3 marks)**

d) (i) Define magnifying power of a microscope **(1 mark)**
(ii) With the aid of a ray diagram, describe the working of a compound microscope. **(5 marks)**

e) (i) Define the term beat **(1 mark)**
(ii) What is Doppler effect? **(1 mark)**

f) Explain what happens to apparent pitch when:
(i) Source of sound approaches stationery observer **(1 mark)**
(ii) An observer moves away from stationery source of sound **(1 mark)**