UNIVERSITY OF EMBU

2016/2017 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN PHYSICS AND BACHELOR OF EDUCATION SCIENCE

SPH 104: MAN AND THE PHYSICAL WORLD

DATE: APRIL 6, 2017 **TIME: 2:00-4:00PM**

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

Constants:

$c = 3.0\times10^{8}$ m/s

$e = 1.6 \times 10^{-19}$ C

$m_e = 9.1 \times 10^{-31}$ kg

$h = 6.6 \times 10^{-34}$ JS

$\square_0 = 8.86 \times 10^{-12}$ C^2/Nm^2

$\mu_0 = 4\pi \times 10^{-7}$ wb/m^2

$\mu_R = 1.645$ (flinth glass)

$\mu_r = 1.523$ (Crown glass)

QUESTION ONE (30 MARKS)

a) Two blocks of masses m_1 and m_2 are connected by a thread and lie on a smooth horizontal surface. Find the tension in the threads linking the blocks given that the masses of the blocks are 400 g and 600 g respectively. Neglect friction between the blocks and the surface. (4 marks)

b) Differentiate between an asteroid and a comet. (1 mark)

c) Briefly explain why Pluto's orbit is the most unique. (2 marks)

d) What is the composition of the interplanetary space? (3 marks)

e) Using an example describe the universe beyond the solar system. (3 marks)

f) A star is one and one eighth light years from an observer on the North Pole. Calculate how far the observer is from the star in meters. (2 marks)

g) Explain the origin of the earth's magnetic field. (2 marks)

h) Explain the plate's tectonic theory. (2 marks)

i) In a tug of war, team x pulled team y with a force of 10,000N a distance of 50 m. Team y did not win because they were only able to exert a force of 8000 N. Calculate the work done by each team. (4 marks)

j) The potential energy function for the force between two atoms in diatomic molecule may be expressed as:

$$V(x) = \frac{a}{x^{10}} - \frac{b}{x^5}$$

Where a and b are positive constants and x is the distance between the two atoms. Calculate the distance x at which potential energy is at a minimum. (4 marks)

k) Two spheres charged with equal but opposite charges experience a force of 103 N when they are placed 10 cm apart in a medium of relative permittivity of 5. Find the charge on each sphere. (3 marks)

QUESTION TWO (20 MARKS)

a) Show that the Kinetic energy KE per unit volume of progressive wave is given by:

$$Ek = \frac{1}{2}\omega^2 a^2 e_0$$

Where symbols have usual meaning. (14 marks)

b) A particle executing S.H.M. describes 120 vibrations per minute and has a velocity of 5 ms^{-1}. Find the length of its path. (6 marks)

QUESTION THREE (20 MARKS)

a) A prism of crown glass with a refracting angle of 5^0 and mean refractive index = 1.51 is combined with one flinth glass prism of refractive index = 1065 to produce no deviation. Find the angle of the flint glass and the net dispersion. (10 marks)

b) The object O is at a distance 2R from the surface of larger radius of curvature. The distance between the apexes of the end is 3R. show that the image point O is formed a distance of

$$\frac{(9-4\mu)R}{(10\mu-9)(\mu-2)}$$

From the right hand vertex. (10 marks)

QUESTION FOUR (20 MARKS)

a) Briefly describe the waves produced by an earth quake. (14 marks)

b) A point mass m is suspended at the end of a massless wire of length l and cross-sectional area A. if v is the young modulus of the wire, obtain the frequency of oscillation for simple harmonic motion along the vertical line. (6 marks)

QUESTION FIVE (20 MARKS)

a) Briefly describe the various uses of the waves found in electromagnetic spectrum. (20 marks)

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