UNIVERSITY OF EMBU

2016/2017 ACADEMIC YEAR

SECOND SEMESTER EXAMINATION

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN ANALYTICAL CHEMISTRY AND BACHELOR OF SCIENCE IN INDUSTRIAL CHEMISTRY

SCI 101: ELEMENTS OF PHYSICS I

DATE: APRIL 4, 2017 **TIME: 11:00AM-1:00PM**

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

$\cdot_0 = 8.86 \times 10^{-12}$ C^2/Nm^2

Y for steel $= 2 \times 10^{11}$ Nm^{-2}

Y for brass $= 10^{11} Nm^{-2}$

QUESTION ONE (30 MARKS)

a) Explain why an electric current and finite rotations of a rigid, one rotation after another are not vector quantities. (2 marks)

b) A jet develops a thrust of 270 N when the velocity of the exhaust gases relative to then engine is 300 m/s. find the mass of the gas ejected per second. (3 marks)

c) A 2 ton truck moving at 24 m/s was stopped in 16s by the action of brakes. Find the average force applied by the brakes. (4 marks)

d) A uniform rod of 4 m long and weight 15 kg is supported in a horizontal position on a fulcrum with weights of 20 kg and 25 kg suspended from its ends. Find the position of the fulcrum. (4 marks)

e) A fluid flows at 0.563 m/s through a 3.20 cm diameter hose that terminates in a 0.295 cm diameter nozzle. Assuming laminar non- viscous steady state flow, find the speed with which the fluid passes through the nozzle. (2 marks)

f) Water is flowing in a fire hose with a velocity of 1.0 m/s and a pressure of 2.0×10^5 Pa. at the nozzle after the pressure decreases to atmospheric pressure and there is no change in height. Calculate the velocity of the water exiting the nozzle. (3 marks)

g) If the frequency of a running fork is 500 Hz and the velocity of sound is 300 m/s, find how far the sound travels when the fork completes 25 vibrations (4 marks)

h) In the spectrum of light, a luminous heavenly body, whose wavelength of a particular line was measured to be 3737×10^{-10m}. Find the relative velocity of the heavenly body with respect to the earth. (4 marks)

i) Electrons are emitted with zero velocity from a certain surface when exposed to radiation of $\lambda = 6800 \times 10^{-10}$ m. Calculate the threshold frequency and work function of the metal. (4 marks)

QUESTION TWO (20 MARKS)

a) If in a two stage rocket the two parts weigh 200 kg and 20 kg separately and contain 1600 kg and 180 kg of fuel separately, find the velocity that can be achieved at an exhaust velocity of 2 Km/s. (6 marks)

b) In an experiment a tungsten cathode which has a threshold of 2300×10^{-10} m in wavelength was irradiated by ultra violet light of wavelength 1800×10^{-10} m. Find the work function of tungsten. (9 marks)

c) Explain five short comings of Bohr's hydrogen atomic model. (5 marks)

QUESTION THREE (20 MARKS)

a) Explain the properties of matter waves. (7 marks)

b) Describe the various types of light. Give an example for each. (8 marks)

c) Suppose F is a force acting on a particle which is moving with a velocity v, show that for such a particle angular momentum is conserved. (5 marks)

QUESTION FOUR (20 MARKS)

a) The distance between the slit and biprism and between the biprism and the screen are 50 cm each. The angle of biprism is 179^0 and its refractive index is 1.5. If the distance between successive fringes is 0.0135 cm, calculate the wavelength of light. (7 marks)

b) Calculate the distance between the two successive positions of a movable mirror of a Michelson's interferometer giving best fringes in the case of sodium having lines of wavelength 5890 $\dot{A}$ and 5896 $\dot{A}$ (5 marks)

c) A proton of wavelength 3310 x $1^{-10}10$ -^{10}m fell on a photocathode and ejected an electron of energy 3 x 10^{-19} J. if the wavelength of incident photon is changed to 5 x 10^{3} x 10^{-10}m, the energy of the ejected electron is 0.972 x 10^{-19} J. calculate the value of:

i) Threshold wavelength (4 marks)

ii) Work function for the photocathode (4 marks)

QUESTION FIVE (20 MARKS)

a) Explain the applications of laser light. (12 marks)

b) A light rod of length 200 cm is suspended from a ceiling horizontally by means of two vertical wires of equal length tied to its ends. One of the wires is made of steel and is of cross section 0.1 cm^2 and the other is of brass of cross sectional area 0.2 cm^2. find the position along the rod at which a weight may be hung to produce equal stresses on both wires. (8 marks)

--END--