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OFFICE OF THE DEPUTY PRINCIPAL

ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

FIRST YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: PHY 111

COURSE TITLE: BASIC PHYSICS II

DATE: 20/07/2021 **TIME:** 0800 – 1100 HRS

INSTRUCTION TO CANDIDATES

(a) **SEE INSIDE**

THIS PAPER CONSISTS OF 4 PRINTED PAGES **PLEASE TURN OVER**

REGULAR- EXAM

PHY 111: BASIC PHYSICS II

STREAM: BSC (COM) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. *Answer question **ONE** and **TWO** in SECTION A and **ANY OTHER THREE** questions in SECTION B.*

ii. *You may use the following constants:*

Electronic charge $e = 1.6 \times 10^{-19} C$,
Permeability of free space $\mu_0 = 4\pi \times 10^{-7}\ N/A^2$
Unified atomic mass unit $1u = 1.6606 \times 10^{-27} kg = 931MeV$,
Mass of a proton $M_P = 1.007267u$,
Mass of a neutron $M_n = 1.008665u$,
Becquerel $1Bq = 1\ decay/Sec$,
Curie $1Ci = 3.70 \times 10^{10} Bq = 3.70 \times 10^{10}\ decay/Sec$,
Rydberg constant $R = 1.097 \times 10^{7} m^{-1}$,
Speed of light $c = 3.0 \times 10^{8}\ m/s$.
Plank's constant $h = 6.626 \times 10^{-34}\ m^2 Kg/s$

SECTION A (24 MARKS)

Question One (12 Marks)

(a) (i) State Coulomb's law (1 Mark)

(ii) A point charges of $+3.0 \times 10^{-6} C$ is 12.0 cm distance from a second point charge of $-1.50 \times 10^{-6} C$. Calculate the magnitude of the force on each charge. (3 Marks)

(b) Explain the significance of Young's double slit experiment (2 marks)

(c) State any TWO of Bohr's postulates within the Bohr's model of the hydrogen atom (2 Marks)

(d) State the laws of reflection (2 Marks)

(e) Using Bragg's condition, calculate the electron wavelength of the third order diffraction of x-rays with a peak at 50° and atomic spacing of 2.15 Å. (2Marks)

Question Two (12 Marks)

(a) What is half life? (1 Marks)

(b) State Ohms law (1 Mark)

(c) A body undergoes blackbody radiation at a temperature of $2000K$ determine the maximum possible wavelength of the radiation given that Wien's displacement constant is $2.89 \times 10^{-3} m.K$ (2 Marks)

(d) An x-ray tube operated at d.c potential difference of $40kV$ produces heat at the target at the rate of $720W$. Assuming 0.5% of the energy of the incident electrons is converted into x-rays, calculate the number of electrons per second striking the target. (3 Marks)

(e) In a Compton scattering experiment, it was found that the fractional change in wavelength is 1.0% when the scattering angle is $30°$. Determine the wavelength of the incident photon. (3 Marks)

(f) State any TWO limitations of the Rutherford model of the atom. (2 Marks)

SECTION B (36 MARKS)

Attempt any *THREE* questions in this section.

Question Three (12 Marks)

(a) With the aid of a schematic set-up of a cathode ray oscilloscope, discuss its working principle. (6 Marks)

(b) Give any three uses of cathode ray oscilloscope. (3 Marks)

(c) Differentiate between hard and soft ferromagnetic materials. Give one example for each (3 Marks)

Question Four (12 Marks)

(a) With aid of a diagram describe how X-ray can be produced (4 Marks)

(b) Find the shortest wavelength present in the radiation from an x-ray machine whose accelerating potential is 50,000V, and its corresponding frequency (4 Marks)

(c) State any **FOUR** properties of X-rays. (4 Marks)

Question Five (12 Marks)

(a) Explain the difference between nuclear fission and nuclear fusion (2 Marks)

(b) Define the term radioactivity (2 Mark)

(c) By denoting the number of nuclides in a radioactive decay process at time $t_0 = 0$ by N_0 and the number of nuclides at the present time t by N' derive the expression connecting N and N_0. (4 Marks)

(d) Determine the number of years it takes for 60 % of a given mass of a radio-isotope whose half-life is 6 *years* to decay. (4 Marks)

Question Six (12 Marks)

(a) With aid of a diagram describe the hysteris loop through a magnetization cycle.

(5 Marks)

(b) Consider capacitors C_1, C_2 and C_3 arranged in parallel as shown in Fig. 1. The applied p.d V is the same across each but the charges are different. Compute the effective capacitance for the network in the Figure. (3 Marks)

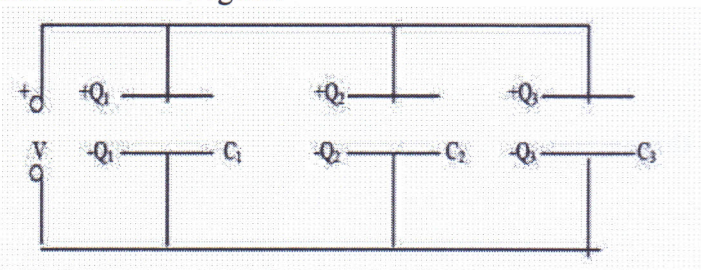

Fig. 1: capacitors in parallel

(c) (i) What is wave rectification? (1 Mark)

(ii) With aid of a diagram describe Half-wave rectification (3 Marks)

Question Seven (12 Marks)

(a) State the three types of radiations (3 Marks)

(b) State any three uses of X-rays (3 Marks)

(c) Describe the two main defects of Lenses, and state how each can be corrected. (6 Marks)

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