ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)

ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2022-2023**

DURATION: 1 HOUR 30 MINUTES **FULL MARKS: 75**

Phy 4141: Physics I

Programmable calculators are not allowed. Do not write anything on the question paper.

Answer **all 3 (three)** questions. Figures in the right margin indicate full marks of questions whereas corresponding CO and PO are written within parentheses.

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1. a) Describe the effect of the frequency of incident radiation on photoelectric effect along with a graphical illustration. 5 (CO1) (PO1)

   b) Why the scattered radiation has a longer wavelength than the incident radiation when an incident X-ray radiation collides with a valence electron in the graphic target? Explain in qualitative terms following Compton model. 15 (CO2) (PO2)

   c) The work function for tungsten metal is $4.52eV$. Answer the following questions: 5 (CO3) (PO1)
      i. What is the cut-off wavelength for tungsten?
      ii. What is the maximum Kinetic Energy (K.E.) of the electron when radiation of wavelength $198nm$ is used?

2. a) Define radioactivity and state the characteristics of radioactive substances. 5 (CO1) (PO1)

   b) "A radioactive nuclide spontaneously emits a particle, transforming itself in the process into a different nuclide, occupying a different square on the nuclide chart"- associate this statement with a law governing the radioactive disintegration process. Extend your answer to find out the half-life of the radioactive nuclei. 10+5 (CO2) (PO2)

   c) Consider that the masses of proton and neutron are 1.00728μ and 1.00866μ, respectively. Calculate the average binding energy per nucleon in units of mega-electron volts for an atom of Lithium-7 with an observed mass of 7.01435μ. 5 (CO3) (PO1)

3. a) Explain electric field and electric flux. 5 (CO1) (PO1)

   b) Describe Gauss's law for electrostatics. Using Gauss's theorem, show that the electric field intensity due to a thin infinite long wire with cylindrical symmetry is expressed as 6 + 9 (CO2) (PO2)

$$E = \frac{\lambda}{2\pi\epsilon_0 r}$$

   c) Two equally charged particles are held $3.2 \times 10^{-3}m$ apart and then released from rest. The initial acceleration of the first particle is observed to be $8.2m/s^2$ and that of the second to be $9.5m/s^2$. If the mass of the first particle is $6.4 \times 10^{-7}kg$, calculate the mass of the second particle and the magnitude of the charge of each particle. 5 (CO3) (PO2)