ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)
Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2019-2020**

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.

There are **4 (four)** questions. Answer any **3 (three)** of them including **Question no 4**.

Figures in the right margin indicate marks.

Use single answer script

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1. a) State and explain Coulomb's law in electrostatics. With the help of an example show that electric charge is conserved. 7

   b) State Gauss's law in electrostatics. Write down Gauss's law for electricity, magnetism and the gravitation. A hypothetical cylinder of radius R is immersed in a uniform electric field E, the cylinder axis being parallel to the field. Show that the electric flux ϕ_E for this closed surface is zero. 10

   c) The distance r between the electron and proton in hydrogen atom is about 5.3×10^{-11} meter. Calculate the magnitude of electrical force and the gravitational force between these two particles. ($G = 6.7 \times 10^{-11}$ nt-m^2/kg^2 , $\varepsilon_0 = 8.85$ x 10-12 coul^2/nt-m^2) 8

2. a) Define electric field E . Obtain an expression for the electric field E at a distance y from an infinitely long line charge of linear charge density λ. 7

   b) What is an electric dipole and the dipole moment? Find the electric field E due to a dipole at a distance r along the perpendicular bisector of the dipole. Plot E for a point charge and a dipole as function of r with E being on the Y-axis and r along the X-axis. 10

   c) Calculate the magnitude of the electric field strength E such that an electron placed in the field, would experience an electric force equal to its weight ? 8

3. a) Define electric potential V. How is V related to the electric field E? What is an equipotential surface ? Draw equipotential surfaces for a point charge and an electric dipole. 7

   b) Show that potential due to a point charge is given by $V \frac{1}{4\pi\varepsilon_o}\frac{q}{r}$ where the symbols have their usual meaning. 10

   c) Calculate the electric potential at the surface of a gold nucleus. The radius of gold nucleus is 6.6 x 10-15 meter and the atomic number of gold Z = 79. 8

[Mandatory]

4. a) What is Fresnel biprism? How did Fresnel construct a biprism in order to study interference of light? 7

   b) Give a diagram showing clearly how coherent sources are produced in a biprism. How is the separation between such coherent sources measured in the experiment with biprism. Explain how you determined the wave length of light using biprism experiment. 10

   c) In a biprism experiment the eyepiece is placed at a distance of 1.2 m from the source. The distance between the virtual sources was found to be 7.5×10^{-4} m. Find the wavelength of light, if the eyepiece is to be moved transversely through a distance of 1.89 cm for 20 fringes. 8