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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2020-2021**

DURATION: 1 Hour 30 Minutes **FULL MARKS: 75**

PHY 4141: PHYSICS

Answer all **three (3)** questions.
Figures in the right margin indicate marks

N.B. The name of the pdf must be in the following format <Student ID Course Code MID>
If it becomes evident that you have copied any answer from any other source without prior instruction, evaluators can reject that answer altogether at the time of evaluation.

1. a) Write down the postulates of Einstein's Special Theory of Relativity. Distinguish Galilean and Lorentz transformation. Define inertial and non-inertial frame of reference with suitable examples. 7
   b) Derive Lorentz transformation and write down the inverse form. Discuss what you understand from these transformation equations. What happens to these transformation equations at classical speed ? 10
   c) An observer detects two explosions, one that occurs near her at a certain time and another that occurs 2.00 ms later 100 km away. Another observer finds that the two explosions occur at the, same place. What time interval separates the explosions to the second observer? 8

2. a) What is an electric dipole and a electric dipole moment ? Compare an electric and a magnetic dipole. Water molecule has a permanent electric dipole moment. Name a device in which this dipole moment is used with a brief description of the device. 7
   b) An electron is assumed to be symmetric charge cloud spinning on its axis. How would you compare this spinning charge to a magnetic dipole ? Define a Bohr magneton in the light of a spinning charge. An electron is orbiting a central nucleus with a frequency of 10^9 Hz. Calculate the current in this orbit. 10
   c) In a typical lightning flash the potential difference between discharge points is about 10^9 volts and the quantity of charge transferred is about 30 Coul. How much ice would it melt at 0^o C if all the energy released could be used for this purpose ? 8

3. a) Define electric potential V. How V is related to the electric field E ? Identify the vector quantities in electro-magnetism from the given list : I , R, j, V, ρ, E , B, H, p 7
   b) Derive Gauss's law from Coulomb's law. Write down Gauss's law for a dielctric medium. What are free and polarized charges ? Derive an equation relating the free charge and the induced charge to show that the induced charge is always less in magnitude than the free charge. 10
   c) Suppose you have several 2.0 micro.farad capacitors. Each of these capacitors are capable of withstanding 200 Volts without breakdown. How would you assemble a combination having an equivalent capacitance of (i) 0.40 micro.farad or of (ii) 1.2 micro.farad, each capable of withstanding 1000 volts ? 8