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B.Sc. Engg. / HD CSE 1st Semester (106) 13 March 2017 (Afternoon)

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

MID SEMESTER EXAMINATION **WINTER SEMESTER, 2016-2017**

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

Phy 4141: Physics

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

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Discuss charge and matter in electrostatics. With the help of a suitable example show that the charge is quantized and conserved. 7

   b) State and explain Coulomb's law. Describe Millikan's Oil drop experiment to measure the value of the elementary charge **e**. 10

   c) Three small balls, each of mass 10 gm, are suspended separately from a common point by silk threads, each 1.0 meter long . The balls are identically charged and hang at corners of an equilateral triangle 0.1 meter long on a side. What is the charge on each ball? 8

2. a) State and explain Gauss's law in electrostatics. Discuss the nature of electric flux Φ_E and the magnetic flux Φ_B . 7

   b) Apply Gauss's law to calculate the electric field (i) at a distance **r** in front of a sheet of charge of surface charge density σ and (ii) for points a short distance above the surface of a charged conductor of surface charge density σ. 10

   c) What is an electric dipole ? Discuss what happens when an electric dipole is placed in turn in a dc electric field E , and an ac electric field $E = E_0 \sin\omega t$ ($\omega = 2\pi f$). An electric dipole consists of two opposite charges of magnitude $q = 1.0 \times 10^{-6}$ coulomb separated by d=2.0 cm. The dipole is placed in an external field $E = 1.0 \times 10^5$ nt/coul. Calculate the maximum torque exerted by the field on the dipole. 8

3. a) Discuss Ether hypothesis. What is the nature of Ether medium according to this hypothesis ? Why was this hypothesis proven to be wrong ? 7

   b) Describe Michelson-Morley experiment. How did Michelson and Morley convincingly proved that the speed of Light in free space has the constant value $c = 3.0 \times 10^8$ m/s, and that there is no preferred universal frame of reference? 10

   c) A spacecraft which is 5.0 m in length is travelling out of earth at a speed of 0.85 c towards a planet far away. What will be the length of the spacecraft measured by an observer on earth? 8

4. a) Discuss the particle properties of wave. Describe how an electron is regarded as a particle and also a wave. 7

   b) Discuss photo-electric effect. Draw a neat circuit diagram to explain the working of a photo-electric device. What are the experimental observations of this device and how do they support the quantum nature of light? Draw photoelectron current vs retarding potential (frequency= constant) curve, and photoelectron vs retarding potential(Light intensity =constant) curves. 10

   c) The threshold frequency for photo-electric emission in copper is 1.1×10^{15} sec^{-1}. Find the maximum energy of the photoelectrons (in joules and in electron volts) when light of frequency 1.5×10^{15} sec^{-1} is directed on a copper surface. 8