

ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
ORGANISATION OF ISLAMIC COOPERATION (OIC)

Department of Computer Science and Engineering (CSE)

MID SEMESTER EXAMINATION

TIME: 1 Hour 30 Minutes

WINTER SEMESTER, 2013-2014

FULL MARKS: 75

Phy 4105: 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.

- Discuss charge and matter in electrostatics. With the help of a suitable example, show that electric charge is quantized. 10
- Define electric and magnetic flux? Write down Gauss's law for Electrostatics, for Magnetism, for Gravitation, and for incompressible fluid. Derive Coulombs law from Gauss's law. 10
- Protons in the cosmic rays strike the earth's upper atmosphere at a rate, averaged over the earth's surface, of $0.15 \text{ protons/cm}^2\text{-sec}$. What total current does the earth receive from beyond its atmosphere in the form of incident cosmic ray protons? (Earth's radius = 6.4×10^6 meters). 5
- Define electric field E. Show the charge distribution in a neutral atom with the help of a neat diagram. What does happen when the atom is placed in an electric field? 10
- Define linear charge density λ , surface charge density σ and the volume charge density ρ . Figure 1 shows an assembly of two charges, one positive and the other negative of equal magnitude q separated by a distance $2a$ apart (an electric dipole). Derive an expression for the electric field E due to these charges at a point x, that is placed at a distance r along the perpendicular bisector of the line joining the charges. 10
- The electric field between the plates of a cathode-ray oscilloscope is $1.2 \times 10^4 \text{ nt/coul}$. What deflection will an electron experience if it enters at right angles to the field with a kinetic energy of 2000 eV ($=3.2 \times 10^{-16} \text{ joule}$)? The deflecting assembly is 1.5 cm long. 5
- Discuss Gauss's law and Coulomb's law in electrostatics. Show with an example that an excess charge put on a metallic conductor will move onto the outer surface of the conductor. 10
- Describe the phenomenon of Einstein's Photo-electric effect with a clear circuit diagram. Discuss photocurrent, stopping potential, threshold frequency, and the work function. 10
- A point charge of $1.0 \times 10^{-6} \text{ coul}$ is at the center of a cubical Gaussian surface 0.50 meter on edge. Calculate electric flux Φ_E for the surface. 5

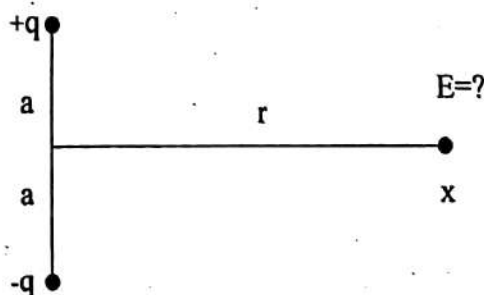


Figure 1. For question 2.(b)

- a) Write down the postulates of Special theory of relativity. Discuss Galilean transformation and Lorentz transformation in Special theory of Relativity. What are Inertial and non-inertial frames of reference?
- b) Derive Lorentz Transformation equations. Write down the inverse transformation equations.
- c) A spacecraft is moving in the x-direction at a velocity $0.8c$ with respect to a rest frame and fires a missile which moves at a velocity $0.7c$ with respect to the moving space craft. Apply Lorentz transformation equations to find out the velocity of the missile.