

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

Department of Computer Science and Engineering (CSE)

WINTER SEMESTER EXAMINATION

DURATION: 1 Hour 30 Minutes

WINTER SEMESTER, 2015-2016

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.
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. 7
- Define electric and magnetic flux. Write down Gauss's law for electrostatics, for magnetism, for gravitation and incompressible fluid. Derive Coulombs law from Gauss's law. 10
- Two equal positive point charges are separated by a distance $2a$. A point test charge is located in a plane which is normal to the line joining these charges and midway between them. 8
 - Calculate the radius r of the circle of symmetry in this planer for which the force on the test charge has a maximum value.
 - What is the direction of the force, assuming a positive test charge?
- Define Electric field. Discuss how electric field differs from the gravitational field. Calculate the electric field and gravitational field between the electron and the proton in a Hydrogen atom. 7
- Define linear charge density and the surface charge density. Figure 1 shows a section of an infinite line of charge whose linear charge density has the constant value λ . Show that the electric field E at a distance y from the line is given by $E = \frac{\lambda}{2\pi\epsilon_0 y}$, where the symbols have their usual meaning. (Do not use Gauss's law) 10

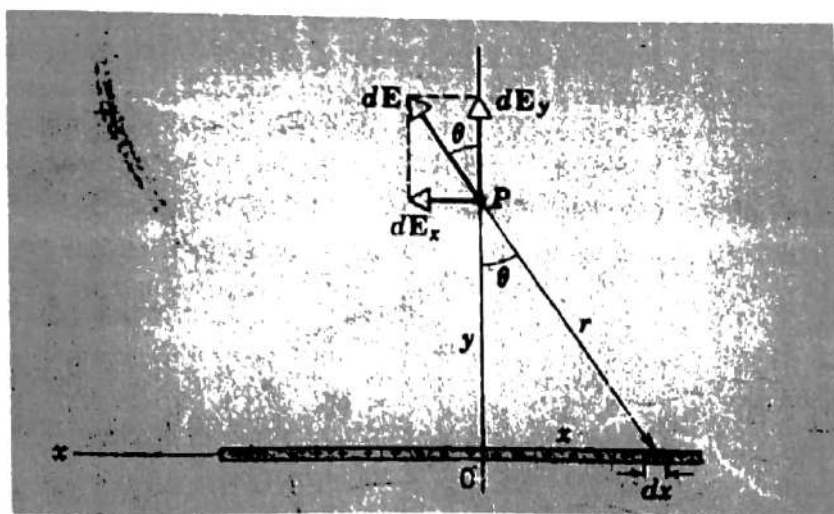


Figure 1: Figure for question no 2 (b)

- c) An electron moving with a speed 5.0×10^8 cm/sec is shot parallel to an electric field of strength 1.0×10^3 nt coul arranged so as to retard its motion.
- How far will the electron travel in the field before coming momentarily to rest?
 - How much time will elapse?
 - If the electric field ends abruptly after 0.8 cm, what fraction of its initial kinetic energy will the electron lose in traversing it?
3. a) Define electric potential V . What are equipotential line and an equipotential surface? Draw the equipotential lines and the electric lines of forces for an electric dipole.
- b) Figure 2 shows an assembly of two charges $+q$ and $-q$ forming an electric dipole. Derive an expression for the electric potential at point P of space due to the dipole provided that the point is not too close to the dipole

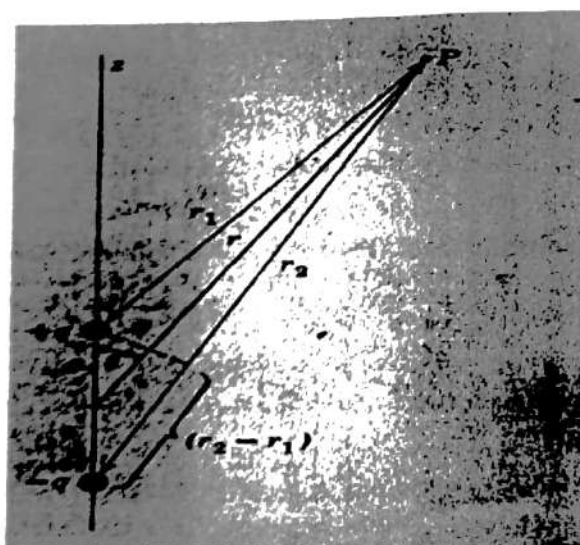


Figure 2 : Figure for question no. 3.(b)

- c) An infinite charged sheet has a surface charge density σ of 1.0×10^{-7} coul/meter². How far apart are the equipotential surfaces whose potentials differ by 5.0 Volts?
4. a) Write down the postulates of Einsteins Special theory of Relativity. What are inertial and non-inertial frames of reference? Give an example of each.
- b) Define Galilean transformation and Lorentz transformation. What are time dilation and length contraction? Derive Lorentz Transformation equations and write down the inverse transformation equations. What does these transformation equations mean?
- c) A spacecraft is moving relative to the earth. An observer on the earth finds that, according to his clock, 3601 sec elapse between 1 P.M. and 2 P.M on the spacecraft's clock. What is the spacecraft's speed relative to the earth?