2012

B.A./B.Sc. (General) First Semester

Physics

Paper – C: Electricity and Magnetism - I

Time allowed: 3 Hours

Max. Marks: 44

NOTE: *Attempt five questions in all, including Question No. 7 (Unit-III) which is compulsory and selecting two questions each from Unit I - II. Use non- programmable calculator is allowed.*

x-x-x

UNIT – I

1. (a) State and prove Stoke's theorem. (7)
    (b) Show that curl of conservative field is zero. (2)

2. Using Gauss law, find the electric field due to a uniformly charged solid sphere at a point that lies, (i) inside the sphere, (ii) outside the sphere. Show the variation graphically. (9)

3. (a) Find electric field due to uniformly charged infinite wire at a point on a line perpendicular to the wire. (6)
    (b) Find the increase in electric flux on the closed surface when a point charge Q is moved from inside the closed surface to outside. (3)

UNIT – II

4. (a) Prove that the potential due to electric dipole, having dipole moment $\vec{p}$ and located at the origin, at any point is

$$V = \frac{\vec{p}.\vec{r}}{4\pi\epsilon_0 r^3},$$

where $\vec{r}$ is the position vector of observation point. (6)

    (b) Find an expression for the electric field in the region where the potential is given by $V = -b\,x\,y$, where b is a constant. (3)

5. (a) Define electric potential. Show that the potential difference between two points can be expressed as the line integral of electric field between these points. (6)

    (b) Prove that the function, $V = \frac{A}{\sqrt{x^2+y^2+z^2}} + B$, where A and B are constants, satisfies Laplace's equation. (3)

6. (a) Drive differential form of Gauss's law for dielectric. (5)
    (b) Explain electric susceptibility. Find the relation between dielectric constant and electric susceptibility. (4)

UNIT – III

7. Attempt any eight parts:
    (i)   What is the angle between electric dipole moment and electric field due to a dipole on equatorial line?
    (ii) Discuss the effect of external electric field on non-polar molecule.
    (iii) How does electric field intensity E due to uniformly charged plane sheet vary with distance r from the sheet? Show graphically also.
    (iv) Discuss the advantage of the concept of electric images?
    (v)   Write Poisson's and Laplace's equation.
    (vi) What is the physical significance of divergence of vector field?
    (vii) What do you mean by polarization of dielectric?
    (viii) What is the shape of equipotential surface for a given point charge?
    (ix) State Green's theorem.
    (x)   Prove that $D = \epsilon_0 E + P$ where the letters have usual meaning for dielectric.

(1 x 8 = 8)

x-x-x