

(i) Printed Pages: 3

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(ii) Questions : 7

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B.A./B.Sc. (General) 1<sup>st</sup> Semester

(2122)

PHYSICS

Paper-C : Electricity & Magnetism—I

Time Allowed : Three Hours]

[Maximum Marks : 44

Note :— Attempt FIVE questions in all, selecting TWO questions each from Units I and II. Unit-III is compulsory. Use of non-programmable calculator is allowed.

UNIT—I

1. (a) State and prove Stoke's theorem. 6
- (b) Two point charges ' $q$ ' and ' $Q-q$ ' are placed on the x-axis separated by distance ' $d$ '. Find the relation between  $Q$  and  $q$  so that the force of repulsion between them is maximum. 3
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 sphereShow the variation graphically. 9

3. (a) Derive an expression for the electric field, due to the electric dipole located at the origin, at a point on its equatorial line. 5

(b) Given a vector  $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ . Show that  $\oiint_s \vec{r} \cdot d\vec{s} = 3V$  where  $V$  is the volume enclosed by surface. 4

### UNIT—II

4. (a) Show that electric field can be expressed as negative gradient of potential. 5

(b) The electric field in  $xy$ -plane is given by  $\vec{E} = y\hat{i} + x\hat{j}$  N/c. Find the potential difference between two points A and B having coordinates (0,0) and (2,2), respectively. 4

5. (a) What is the concept of electric images? Calculate electric potential and electric field due to a point charge placed near an infinitely conducting sheet. 6

(b) Define polar and non-polar molecules. 3

6. (a) Derive differential form of Gauss's law for dielectric. 4

(b) Show that surface charge density of charges developed on surface of polarized dielectric is given by  $\sigma_p = \vec{P} \cdot \hat{n}$  where  $\hat{n}$  is unit normal to the surface. 5

### UNIT—III

7. Attempt any **eight** parts :—

- (i) What are limitations of Coulomb's law ?
- (ii) What do you mean by polarization of dielectric ?
- (iii) Show that curl of conservative field is zero.
- (iv) Show that the potential  $V = xyz$  satisfies Laplace's equation.
- (v) Define electric line of force.
- (vi) Differentiate between free and bound charges.
- (vii) What is a solenoidal field ? Give an example.
- (viii) What is physical significance of electric susceptibility ?
- (ix) State Green's theorem in a plane.
- (x) If the electric field is zero at a point P, is it necessary that electric potential should also be zero there ? Explain.

1×8=8