(i) Printed Pages: 3 Roll No. .....

(ii) Questions : 7

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B.A./B.Sc. (General) 1st 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 sphere

Show 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 $\oiint_S \vec{r}.\vec{ds} = 3V$ 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 $\sigma_p = \vec{P}.\hat{n}$ 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.

$1 \times 8 = 8$