

B.Sc. Physics 1st Year 2nd Semester Examination-2018(Old)

Physics (Paper- SO4)

Time: Two hours

Full Marks: 50

Answer any Four questions

1. (i) State and explain Gauss's theorem.
(ii) Using this theorem, determine the electric field due to a uniformly charged solid sphere at a point both inside and outside the sphere.
(iii) Draw the variation of electric field with distance from the center of the sphere.
(3+7+2 $\frac{1}{2}$)

2. (i) Find the field intensity due to an electric dipole at a point (a) on the axis of the dipole (b) on the perpendicular bisector of the dipole.
(ii) Calculate the torque acting on an electric dipole placed in an electric field $\vec{E}$.
(iii) Give an example of a molecule which shows dipole moment.
(iv) Calculate potential energy of a dipole placed in an electric field.
(6 $\frac{1}{2}$ +3+1+2)

3. (i) Find out the capacitance per unit length of two co-axial cylinders where ϵ is the dielectric constant of the intervening medium and outer cylinder is earthed.
(ii) Calculate capacitance of parallel plate capacitor.

(iii) Hence find the capacitance of a system of three parallel plates, each of area $A \text{ m}^2$, separated by two dielectrics of dielectric constants ϵ_1 and ϵ_2 having thickness d_1 and d_2 meters respectively.

$$(6+4+2\frac{1}{2})$$

4. (i) State and explain Kirchhoff's laws in electricity.

(ii) Obtain an expression for galvanometer current in an unbalanced Wheatstone bridge.

(iii) Twelve wires of equal resistance forms the skeleton of a cube. A battery of emf e and of internal resistance r is connected between two diagonal points. Calculate the equivalent resistance of the circuit between these two points where the battery is connected.

$$(4+4\frac{1}{2}+4)$$

5. (i) State and explain Biot-Savart law.

(ii) Apply this law to find the magnetic field due to a circular current carrying loop at an axial point.

(iii) Show graphically how does this magnetic field change with the distance from its centre.

$$(3+7+2\frac{1}{2})$$

6. (i) State and explain Faraday's law of electromagnetic induction.

(ii) Define co-efficient of self inductance of a circuit.

(iii) Calculate its value for two long parallel wires. Hence explain how non-inductive resistance coils are made.

(iv) Calculate the energy stored in an inductor L carrying a steady current I_0 .

$$(2+2+(5+1)+2\frac{1}{2})$$