Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE AND COMMERCE, BARAMTI

An Autonomous status

(Affiliated to Savitribai Phule Pune University, Pune)

DEPARTMENT OF PHYSICS

CHAPTER -1 : Electrostatics [PHY1102]

1. The test charge used to measure electric field at a point should be vanishingly small. Why?
2. At what points dipole field intensity is parallel to the line joining the charges?
3. Is the force acting between two point charges q1 & q2 at some distance in air, attractive or repulsive when (i) $q1q2 > 0$ (ii) q1 & $q2 < 0$?
4. State Coulomb's law in electrostatics.
5. Express Coulomb's law in vector form.
6. State principle of superposition in electrostatics.
7. Define electric intensity at a point in an electric field. Give its SI unit.
8. What do you mean by electrostatic field.
9. Define electric flux.
10. Sate the law of conservation of charge. Give two examples to illustrate it.
11. State Gauss theorem in electrostatics.
12. What do you mean by Gaussian surface?
13. What are advantages of Gauss law over Coulombs law?
14. Give limitations of Gauss law.
15. Electric field is zero at appoint. Can electric potential be zero at this point?
16. Name the physical quantity whose SI unit is (i) coulomb/ volt (ii) newton/coulomb
17. What is an ideal electric dipole?
18. What is the net electric field at the mid- point between the charges
19. Can we have non-zero electric potential in the space, where electric field strength is zero?
20. If the radius of the Gaussian surface enclosing a charge halved, how does the electric flux through the Gaussian surface change?
21. Obtain an expression for the electric potential at a point due to group of N point charges.
22. A 10μC charge is at the centre of a square of side 10 cm. Find the work done in moving the charge of 4 C between two diagonally opposite points on the square .

23. Define electric field intensity . Write its S.I. unit . Write the magnitude and direction of electric field intensity due to an electric dipole of length 2a at the midpoint of the line joining the two charges.
24. The force of attraction between two point charges placed at distance d apart in a medium is F. What should be the distance apart in the same medium so that the force of attraction between them becomes F/4.
25. A hollow metal sphere of radius 10 cm is charged such that the potential on its surface is 5V. What is the potential at the centre of the sphere ?
26. If electric field at a point is zero, can it have some value of electric potential and vice versa ?
27. Draw the plot showing variation of a) electric field and b) electric potential with distance 'r' due to point charge 'Q'.
28. Using Gauss theorem in electrostatics, deduce an expression for electric field intensity due to the charged spherical shell at a point a) inside the sphere b) on the surface of sphere c) outside the sphere.
29. State the Gauss theorem in electrostatics. Apply this theorem to derive an expression for electric field intensity at a point near an infinitely long straight charged wire.
30. Two point charges 4Q, Q are separated by 1 m in air. At what point on the line joining the charges is the electric field intensity zero? Also calculate the electrostatic potential energy of the system of charges, taking the value of charge, $Q = 2 \times 10{-}7$ C.
31. Three point charges of + 2 μC, − 3 μC − 3μC kept at the vertices A, B and C respectively of an equilateral triangle of side 20 cm as shown in the figure. What should be the sign and magnitude of the charge to be placed at the mid-point (M) of side BC so that the charge at A remains in equilibrium?
32. A thin conducting spherical shell of radius R has charge Q spread uniformly over its surface. Using Gauss law, derive an expression for an electric field at a point outside the shell. Draw a graph of electric field E(r) with distance r from the centre of the shell for $0 \leq r \leq \infty$.
33. State principle of superposition in electrostatics and obtain an expression for force on any one charge due to all other charges.
34. Explain concept of electric flux.

35. Define electric intensity at a point in an electric field and obtain an expression for electric intensity due to a point charge at any point.
36. Obtain an expression for electric intensity near the surface of metallic conductor..
37. Using Gauss theorem obtain an expression for electric intensity at any point due to uniformly charged non conducting sphere.
38. Using Gauss theorem obtain an expression for the electric intensity at any point due to a line charge.
39. Obtain an expression for electric intensity due to an electric dipole at a distance r from it.
40. Obtain an expression for electric field intensity at an axial point at distance r from the centre of uniformly charged ring.
41. Obtain an expression for electric field intensity at an axial point at distance r from the centre of uniformly charged disc.

Chapter -2 : DIELECTRICS

1. Define electric dipole moment. Write its SI unit.
2. Define polar molecules.
3. Define non polar molecules.
4. What do you mean by dielectric materials?
5. Define electric polarization vector.
6. Define electric displacement vector.
7. Write the relation between three electric vectors.
8. State Gauss law in dielectrics.
9. What do you mean by polarization of dielectric materials.
10. Define dielectric constant of the materials.
11. What is an ideal electric dipole?
12. On what factors does capacitance of parallel plate capacitors depends.
13. Write a relation for polarization of a dielectric material in the presence of external electric field.
14. Show that the electric field within the dielectric reduces by a factor k than the external field.
15. Write a note on electric polarization of dielectric.
16. Obtain an expression for electric potential at any point due to an electric dipole.
17. Derive an expression for electric intensity at any point due to electric dipole.
18. Obtain an expression for torque on a dipole placed in an uniform electric field.
19. State and prove Gauss law in dielectrics.
20. Show that in the presence of dielectric, the induced charge q' due to polarization is always less than the free charge q.
21. Deduce the expression for the electrostatics energy stored in a capacitor of capacitance C, and having a charge Q .How will the (i) energy stored (ii) electric field inside the

capacitor be affected when it is completely filled with a dielectric material of dielectric constant K .

22. A capacitor is charged from a battery. Assuming that the capacitor is disconnected from the charging battery, explain how; (a) the capacitance, (b) p. d. across the plates and Energy stored in the capacitor change, when a medium of dielectric constant K is introduced between the plates.
23. A parallel plate capacitor with air between the plates has a capacitance of 8 pF. The separation between the plates is now reduced by half and the space between them is filled with a medium of dielectric constant 5. Calculate the value of capacitance of parallel plate capacitor in second case.
24. At what point is the electric dipole, field intensity (i) parallel and (ii) antiparallel to dipole moment of the dipole?
25. An electric dipole of length 2 cm is placed with its axis making an angle 60 degrees with respect to a uniform electric field of 105 N/C. If it experiences a torque of 8 $\sqrt{3}$ Nm, calculate the (i) magnitude of charge on the dipole, and (ii) potential energy of the dipole.
26. An electric dipole of length 10cm having charges ± 6 X 10^{-3} C, placed at 30^{o} with respect to a uniform electric field, experiences a torque of 6 Nm. Calculate (a) magnitude of electric field (b) the potential energy of the dipole.
27. Two point charges qA = 3 μC and qB = -3 μC are located 20 cm apart in vacuum. What is the electric field at the mid-point O of the line joining the two charges?
28. In a parallel plate capacitor, capacitance increases from 4 μF to 80 μF on introducing a dielectric slab of thickness equal to plate separation. Calculate the dielectric constant of the medium. (Hint: $C=\varepsilon A/d$).
29. A parallel plate capacitor with air between the plates has a capacitance of 8 pF . The separation between the plates is now reduced by half and the space between them is filled with a medium of dielectric constant 5. Calculate the value of capacitance of parallel plate capacitor in second case.
30. Two parallel plate capacitors of 20 μF and 30 μF are charged to 30 V and 20 V respectively. If the plates of these capacitors with same type of charge are connected together. Find a) The common potential of the capacitor (b) Charges on the capacitor at

common potential (c) Loss of energy in the process (V=24volt, 480μC,720 μC, 6 x 10^{-4}J).

Chapter -3 : Magnetostatics

1) What do you mean by magnetic field?

2) State Biot-Savart's Law.

3) State Ampere's Circuital law.

4) What are the advantages of Ampere's law over Biot-savart's law?

5) Give importance of Ampere's law.

6) What is solenoid? Where it is used?

7) What is toroid? State two applications of it.

8) Define magnetic flux with its unit.

9) State Gauss's law for magnetism.

10) Using Formula $F = qV \times B$ and B= $\frac{\mu_0 i}{2\pi r}$, show that the S.I. units of the magnetic field B and permeability constant may be written as N/A and N/A^2 respectively.

11) Magnetic field lines show the direction at every point which a small magnetized needle takes up at that point. Do the magnetic field lines also represent the lines of force on moving charged particle at every point?

12) Magnetic field lines can be entirely confined within the core of a toroid, but not within solenoid, why?

13) A proton is projected with speed of 6 X 10^6 m/s horizontally from east to west. A uniform magnetic filed B of strength 4 X 10^{-3} T exists in vertically upward direction. Find force on proton just after its projection. Also calculate acceleration produced. (given: Mass of proton= 1.67 X 10^{-27} Kg).

14) Aluminium wire of diameter 0.4 cm carries current of 25 ampere. Find magnetic field at the surface of wire.

15) If two long parallel straight wires carrying electric currents 10A in opposite directions. The separation between wires is 6 cm. Then find magnetic field at point P midway between the wires.

16) A charge of 3.0 μC moves with speed 3 X 106 m/s along positive X-axis. A magnetic field of strength $(0.10\ j\ + 0.20\,k\ )$ T exists in space. Find the magnetic force acting on the charge.

17) A coil made of 200 circular loops with radius 0.60 m carrying an electric current of 2.5A. Find the magnetic field at a point along the axis of coil which is at a distance 0.80 m from the centre.

18) A solenoid of length 0.5 m has a radius of 1 cm and is made of 500 turns. It carries current of 3A. What is the magnitude of magnetic field inside the solenoid?

19) A coil of 20 cm radius has 15 turns and carries a current of 3A. Find magnetic field at the centre of the coil. ($\mu_0=4\pi X\ 10^{-7}\ WbA^{-1}m^{-1}$)

20) Define magnetic field and hence explain it's properties.

21) Using Biot-Savart's law, obtain expression for magnetic field produced in long straight conductor.

22) Obtain an expression for B on the axis of a current carrying circular coil.

23) State and prove Ampere's circuital law.

24) Obtain an expression for the magnetic field on the axis of solenoid.

25) What is toroid? Derive an expression for the magnetic field at a point inside the winding of toroid.

26) What is magnetic flux? Hence explain Gauss's law for magnetism.

27) Explain the term magnetic field lines. Draw field lines produces by permanent magnet, C shaped magnet and straight conductor carrying current.

28) Using Biot-Savart's law, obtain expression for magnetic field produced in infinitely long straight conductor or wire.

29) Obtain an expression for magnetic induction at the centre 'O' of a current carrying circular coil or loop.

30) A solenoid of length 100 cm is wound uniformly with 10000 turns of wire. It carries a current of 4A. What is the value of (i) magnetic field on the axis of the solenoid at the centre, (ii) magnetic field on the axis at an end?

31) Using ampere's law, find magnetic field at a point inside and outside the long straight cylindrical current carrying wire.

Chapter-4 : Magnetostatics

1) What do you mean by electromagnetic induction?

2) State Lenz's Law.

3) State Faraday's law of EMI.

4) What is difference between magnetic field and magnetic flux?

5) What do you mean by self inductance?

6) What do you mean by mutual inductance?

7) Give the equation of transformer emf.

8) State and explain Lenz's law in relation with electromagnetic induction.

9) Draw diagram showing left hand and right hand thumb rule showing directions of quantities in EMI.

10) Explain difference between magnetic field and electric field.

11) Explain what is transformer?

12) Explain eddy currents.

13) Write Maxwell's equations.

14) Write short note on Faraday's law of electromagnetic induction.

15) define the term (a) Self inductance (b) Mutual inductance

16) Derive the equation of continuity of current.

17) Explain practical applications of eddy currents.

18) Obtain an expression for energy stored in the inductor of inductance L.

19) What are the disadvantages of the eddy currents? How they can be minimized?

20) Draw schematic sketch of an ac generator describing its basic elements. State its working principle.