Question Bank B.Sc. (Physics) Sem –II (GE)
Paper- PHY-GE-2T (Electricity & Magnetism)

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Group A: Short Answer Type Questions

1. Define scalar and vector products (and related numericals).
2. Define gradient of a scalar function (and related numericals) .
3. Define divergence and curl of vector function (and related numericals).
4. Define line, surface and volume integrals.
5. State Gauss's divergence theorem.
6. State Stoke's theorem.
7. What do you mean by electric field intensity ? Write its unit.
8. Calculate the electric field due to surface charge distribution.
9. What do you understand by equipotential surface ?
10. Define electric potential . Show that in an electric field $\vec{E}$, the potential difference between two points ' a' and ' b' along any path is
$$V_a - V_b = \int_a^b \vec{E} \cdot \vec{dl}$$
11. Establish the relationship between $\vec{E}$, $\vec{P}$ and $\vec{D}$.
12. Write down the Gauss's law in integral form.
13. Difference between magnetic susceptibility and magnetic permeability.
14. What is the physical meaning of polarisation of dielectrics ?
15. Distinguish between dia, para and ferro-magnetic materials.
16. Show that $\vec{B} = \mu_0\vec{H} + \mu_0\vec{M}$
17. State Biot-Savart's law.
18. Define capacitance and capacitor.
19. State Ampere's circuital law
20. What are polar and non-polar molecules. Give examples.
21. Explain Gauss law in di-electrics.
22. What do you mean by magnetization?
23. Distinguish dia-, para- and ferro-magnetic materials.
24. Differentiate between magnetic intensity and magnetic induction.
25. State Lenz's law of electromagnetic induction.
26. Obtain an expression for energy per unit volume in charged conductor.
27. What is self- inductance ? Define coefficient of self-induction.
28. Define electromagnetic induction.

29. State Faraday's law of electromagnetic induction.
30. What do you mean by mutual inductance ?
31. Define the terms (a) Displacement current and (b) Poynting vector

Group B: Long Answer Type Questions

1. Find expressions for electric field and potential at a point due to an electric dipole.
2. Write down the integral form of Gauss law and using this find the field intensity due to
    a. uniformly charged spherical shell.
    b. solid sphere
    c. plane charged sheet
    d. parallel charged conductor
3. Define polarisation and polarisability of dielectric. Find relation between $\vec{E}$, $\vec{P}$ and $\vec{D}$.
4. Describe electric displacement vector and deduce Gauss's law for dielectrics.
5. Define $\vec{E}$, $\vec{P}$ and $\vec{D}$and show that $\vec{\nabla}.\vec{D} = \rho_f$
6. Calculate the capacity of a following
    a. parallel plate condenser
    b. spherical capacitor
    c. cylindrical capacitor
7. Define uniform and non-uniform magnetization. Show that for non-uniform magnetization $\vec{\nabla X}\vec{M} = \vec{J}$.
8. Obtain an expression for energy and force of attraction between parallel plate capacitor.
9. Define B, H and M. Establish a relation between them.
10. Define permeability and magnetic susceptibility and show that
$$\mu = \mu_0(1 + \chi_m).$$
11. State Ampere's circuital law. Show that the intensity of magnetic field at a point due to an infinite straight current carrying wire is $\frac{\mu_0 I}{2\pi r}$.
12. What is Biot-Savart's law? Using this law find an expression for the magnetic field due to
    a. straight conductor
    b. circular coil
    c. solenoid carrying current
13. Deduce Faraday's law of electromagnetic induction in the form
$$\text{Curl } \mathbf{E} = -\frac{\partial \boldsymbol{B}}{\partial t}$$
14. Obtain an expression for energy density in magnetic field.
15. Define co-efficient of self-induction of a coil. Deduce a mathematical expression for the self inductance of a solenoid.

16. Define mutual inductance. Show that the energy required to build up a current in the circuit of self inductance L is $\frac{1}{2}LI^2$.
17. Set up Maxwell's field equations and explain the physical significance of each.
18. State Maxwell's equations and solve them to obtain the velocity of the E.M. waves in a homogeneous isotropic dielectric medium.
19. Deduce Maxwell's equation for free space and prove that electromagnetic waves are transverse.