Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

Total No. of Questions : 11

PIT M.Sc (Physics) (Sem.-3)

CLASSICAL ELECTRODYNAMICS

Subject Code : PHS-532

Paper ID : [51121]

Time : 3 Hrs. Max. Marks : 70

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains SEVEN questions carrying FIVE marks each and students have to attempt any SIX questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. a. What is the advantage of Laplace equation over Coulomb's law in determining electric field?

   b. Define molecular polarizability and mention its unit.

   c. Draw the field lines of a "physical" dipole.

   d. With figure state a law to measure the magnetic field of a steady current.

   e. State the first uniqueness theorem.

   f. Explain the basic concept of Earnshaw's theorem.

   g. Write two types of Gauge transformation and mention their significance.

   h. What is the use of the Hertz potential?

   i. What is the relation of skin depth with frequency?

   j. Does refractive index of a material has any role in polarization? If yes state the same.

SECTION-B

2. Describe the models of molecular polarizability.

3. Find $\vec{\nabla}.\vec{A} = ?,$ where $\vec{A}$ is the vector potential. Also rewrite Ampere's law in terms of $\vec{A}$.

4. Find the maximum torque on a 200-turn square loop of a wire of 121 cm^2 area that carries 15.0 A of current in a field of 2.50Tesla.

5. Define and compare Dirichlet and Neumann boundary conditions with examples.

6. Suppose *q* charge is held at a height *d* above a grounded infinite conducting plane. What is the potential in the region above the plane?

7. A parallel plate capacitor is filled with a material having permittivity $\varepsilon = 70\varepsilon_o$ and permeability $\mu = \mu^0$ and resistivity 0.3 Ωm. An alternating signal $V = V_0 \, Sin \, (2 \, \pi \, \nu \, t)$ is applied across the plates of the capacitor. Calculate the ratio of conduction current density to displacement current density.

8. A light of wavelength 5600Å incidents on a glass plate (refractive index is 1.48) kept in air. Determine the reflection and transmission coefficient and draw a conclusion from your result.

SECTION-C

9. Do multipole expansion of the energy of a charge distribution in an external field and identify the contribution of monopole, dipole and quadrupole.

10. State and prove Poynting theorem. Mention its significance.

11. a) What are the characteristics of an EM waveguide? Define TE and TM modes. Show whether TEM modes can occur in a hollow metallic waveguide.

    b) Write a brief note on cavity resonators.