MAY 2016 **P/ID 40007/PPHG**

Time : Three hours Maximum : 100 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

1. Define 'atomic polarizability'.

2. How does the electric potential and field intensity of a 2^l – pole at a distance 'r' vary?

3. State 'Biot-Savart's law'.

4. If a charge 'q' moves with a velocity 'v' in a magnetic induction '$\vec{B}$' and electric field intensity $\vec{E}$, what is the total force acting on the change?

5. Write down the Lorentz gauge condition.

6. State the Faraday law of induction.

7. What are retarded potentials?

8. Write down Boltzmann's equation and briefly explain the quantities in this equation.

9. Give the condition for the existance of plasma.

10. Write a note on 'Alfven Waves'.

PART B — (5 × 6 = 30 marks)

Answer ALL questions.

11. (a) Find the relation between Polarisation $\vec{P}$, Electric field $\vec{E}$ and Displacement vector $\vec{D}$. Explain the physical significance of these vectors.

Or

(b) Calculate the energy of an electrostatic field in the presence of a dielectric.

12. (a) Give the laws of magnetostatics and explain the same.

Or

(b) Find the force between two conductors carrying currents in the same direction.

13. (a) Show that $\overline{\nabla}.\vec{J} + \frac{\partial p}{\partial t} = 0$, where the quantities have usual meaning.

Or

(b) Prove $\vec{E} = -\vec{\nabla}Q - \frac{\partial \vec{A}}{\partial t}$.

14. (a) Write a note on 'Poynting theorem'.

Or

(b) Discuss conservation laws for a system of charges and electromagnetic fields.

15. (a) Obtain an expression for 'Debye length'.

Or

(b) Give the theory of charged particle moving in a homogenous magnetic field.

PART C — (5 × 10 = 50 marks)

Answer ALL questions.

16. (a) Demonstrate that a dielectric sphere in a uniform magnetic field acts like a simple dipole.

Or

(b) Show that at a change of dielectric medium, field lines are refracted according to Snell's law. $\frac{\in_1}{\in_2} = \frac{\tan \alpha_1}{\tan \alpha_2}$ where α_1 and α_2 are angles of incidence and refraction and $\in_1$ and $\in_2$ are permittivities of the two media.

17. (a) Show that $\vec{A} = \frac{\mu_0}{4\pi} \int \frac{\vec{J}}{|\vec{r}|} dv$, where the quantities have usual meaning.

Or

(b) Find the magnetic induction $\vec{B}$ at an interior point of a magnetised material.

18. (a) Obtain Maxwell's equation in integral form.

Or

(b) Discuss the propagation of electromagnetic wave in a conducting medium.

19. (a) Obtain the expression for the power radiated by an oscillating dipole.

Or

(b) Demonstrate that retarded potentials are the solutions of inhomogenous wave equation.

20. (a) Discuss the behaviour of charged particles in homogenous magnetic and electric fields.

Or

(b) Discuss the Debye shielding problem and plasma confinement in a magnetic field.

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