M.Sc. DEGREE EXAMINATION,NOVEMBER 2018
I Year II Semester
Core Major - VI
ELECTRO MAGNETIC THEORY AND PLASMA PHYSICS

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. What is meant by molecular polarizability?
2. Define displacement vector. Mention its importance.
3. State Ampere's law.
4. Define magnetic vector potential.
5. Write equation of continuity.
6. State Faraday's law of electromagnetic induction.
7. Define cutoff wavelength in wave guides.
8. Explain TE and TM modes.
9. State any two conditions for the existence of plasma.
10. Define plasma waves.
11. Define Lorentz Gauge.
12. Define D' Alembertian operator.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Explain briefly the boundary conditions on field vectors **D** and **E**.
14. Derive Biot-Savart law.
15. Establish Maxwell's electromagnetic equations in integral form and discuss its physical meaning.
16. Discuss reflection and refraction of electromagnetic waves at the interface of non-conducting medium and hence derive Snell's law
17. Discuss propagation of electromagnetic waves through rectangular waveguides. For transverse electric waves, find the cutoff wavelength.
18. Derive an expression for the potential energy of charge distribution in the presence of dielectrics.
19. What are Alfven waves? Derive an expression for Alfven velocity.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Derive an expression for the total field acting on a molecule inside an isotropic dielectric medium and hence show that, where $\frac{K-1}{K+2} = \frac{N\alpha}{3\epsilon_0}$ dielectric constant, α, polarisability and N, number of molecules per unit volume.
21. Derive an expression for magnetic vector potential and magnetic field of a localised current distribution.
22. Write Maxwell's equations in terms of scalar and vector potentials. Show that these equations are invariant under gauge transformations. Discuss the significance of this invariance.
23. Derive wave equation for a plane electromagnetic wave moving in a conducting medium.
24. What do you mean by plasma in general? Derive the magneto-hydro dynamical equations. Discuss magnetic confinement of plasma.

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