25P108 (Pages: 2) Name: .....

Reg.No: .....

FIRST SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2025

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19PPHY1C03 - ELECTRODYNAMICS AND PLASMA PHYSICS

(Physics)

(2019 Admission onwards)

Time : 3 Hours Maximum : 30 Weightage

Section A

Answer ***all*** questions. Each question carries 1 weightage.

1. What do you mean by retarded potentials? Write down the expressions for retarded vector potential.
2. Give the electromagnetic boundary conditions for a general interface.
3. Define intrinsic impedance of a medium. Write the value of intrinsic impedance of the free space.
4. How is standing wave ratio related to reflection coefficient? Explain.
5. What are time harmonic transmission line equations?
6. Define the quality factor of a cavity resonator. What is its significance?
7. It is not useful to consider plasma as a magnetic medium. Justify.
8. Give the expression for Plasma frequency. What inference we derive about group velocity from this expression?

(8 × 1 = 8 Weightage)

Section B

Answer any ***two*** questions. Each question carries 5 weightage.

9. Derive the inhomogenous wave equation for vector potential and then obtain the time-harmonic wave equation for vector potential. Also, discuss about the solution for the above equation.
10. Discuss the propagation of EM waves in a conducting media and bring out the idea of skin depth. Hence explain how frequency affects conductivity.
11. Explain the theory of the propagation of TEM wave in a parallel plane transmission line.
12. Obtain the transformation equations for electromagnetic field vectors and represent them in terms of the field tensor.

(2 × 5 = 10 Weightage)

Section C

Answer any ***four*** questions. Each question carries 3 weightage.

13. Consider a pair of equal and opposite charges seperated by a distance d. Obtain the expression for the potential and electric field for this configuration.

14. Show that for instantanous Poynting vector is a constant quantity independent of time and space for a a cirularly polarized wave.

15. Deduce the law of reflection and Snell's law by considering the incidence of electromagnetic waves on a plane dielectric boundary.

16. Find the cut-off frequency for TE_{10}, TE_{01}, TE_{20}, and TE_{11} modes for a rectangular waveguide having dimension $a = 7.214\text{cm}$ and $b = 3.404\text{cm}$.

17. Discuss magnetism as a relativistic phenomenon by considering the force between current carrying wire and a moving charge.

18. A non - relativistic particle of mass m and charge q is initially moving with velocity $v = vi$ in a uniform magnetic field B = Bk. Show that at subsequent times the particle (neglecting radiation) moves in a circle of Larmor radius R_L in terms of m, v, q and B.

19. The dispersion relation for a certain wave is $\omega = \sqrt{c^2k^2 + m^2}$, where m is a constant. Show that the group velocity is given by $v_g = \frac{c^2}{c^2 + \frac{m^2}{k^2}}$.

(4 × 3 = 12 Weightage)

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