

D 32732

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Name.....

Reg. No.....

**FIRST SEMESTER M.Sc. (CBCSS) REGULAR/SUPPLEMENTARY DEGREE
EXAMINATION, NOVEMBER 2022**

Physics

PHY 1C 03—ELECTRODYNAMICS AND PLASMA PHYSICS

(2019 Admission onwards)

Time : Three Hours

Maximum Weightage : 30

Section A (Short Answers)

*Answer All questions..Each question carries a weightage 1
8 short questions answerable within 7.5 minutes*

1. Write down the integral forms of Maxwell's equations. What are its significance ?
2. Distinguish between group velocity and phase velocity.
3. Define standing wave ratio. How does it vary with reflection coefficient ?
4. Explain the characteristic impedance of a transmission line.
5. What are cavity resonators ?
6. Give the electromagnetic field tensor.
7. Explain the phenomenon of Debye shielding.
8. What are plasma oscillations ?

(8 × 1 = 8 weightage)

Section B (Essays)

*Answer any two questions..Each question carries a weightage 5
4 essay questions answerable within 30 minutes.*

9. Derive the inhomogeneous wave equations for potentials A and V. Solve these equations to obtain the retarded scalar and vector potentials.
10. Obtain the instantaneous field expressions for TM modes in a rectangular waveguide of sides a and b .
11. Derive Maxwell's equations in relativistic form.
12. Derive the Vlasov equation in kinetic theory.

(2 × 5 = 10 weightage)

Turn over

Section C

Answer any four questions..Each question carries a weightage 3
7 problems answerable within 15 minutes..

13. A sinusoidal electric intensity of amplitude 50 (V/m) and frequency 0.1 (GHz) exists in a lossy dielectric medium that has a relative permittivity of 2.25 and a loss tangent of 0.01. Find the average power dissipated in the medium per cubic meter ?
14. Derive an expression for instantaneous Poynting vector in the case of a time harmonic electromagnetic field.
15. A uniform plane wave ($E = z E_z$) is propagating through a lossless medium along $+x$ direction. The field E_z is sinusoidal and has a maximum value of 10^5 V/m at $t = 0$ and $x = 0.2$ m. Obtain the instantaneous expressions for E and H ? Assume the frequency of the field as 120 MHz, and the medium is with ($\epsilon_r = 3.6, \mu_r = 1, \sigma = 0$).
16. Prove that TEM waves cannot exist in a single-conductor hollow waveguide of any shape.
17. What is the electric field of a point charge q in a system S which moves with a speed v_0 with respect to reference system S_0 ? The point charge is assumed to be at rest in the system S_0 .
18. Obtain an expression for convective derivative ? Explain its significances.
19. Compute the Larmor radius for a 8 keV electron in the earth's magnetic field of 3.8×10^{-5} Tesla. How does it vary for a proton streaming with velocity 300 km/s. ?

(4 × 3 = 12 weightage)