D 131329 **(Pages : 2)** **Name.....**

Reg. No.....

FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2025

(CBCSS)

Physics

PHY IC 03—ELECTRODYNAMICS AND PLASMA PHYSICS

(2019 Admission onwards)

Time : Three Hours Maximum : 30 Weightage

Section A

8 *Short questions, each answerable within* 7.5 *minutes.*
Answer **all** *questions, each question carries weightage* 1.

1. Write down the expression for Gausses law.
2. Explain free space wave number with equation.
3. What is the condition for a tensor $t^{\mu\nu}$ to be symmetric ?
4. What is the equation of plasma frequency explain the symbols.
5. Define Poynting theorem ?
6. What is a wave front ?
7. What is TEM wave ?
8. Write down an equation for magnetic field of a point charge moving at constant velocity ?

(8 × 1 = 8 weightage)

Section B

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

9. Explain Maxwell's equations in matter.
10. Derive the equations for two cases of oblique incident of a wave at a plane conducting boundary.

Turn over

11. Derive equations for a transverse EM wave along a parallel plate transmission line.

12. Explain the motion of plasma in a uniform a) E field ; and b) B field.

(2 × 5 = 10 weightage)

Section C

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

13. Derive the equation for the electric field of a dipole

14. The electric field intensity of a linearly polarized uniform plane wave propagating in the positive z direction is in seawater is $E a_x\ 100 \cos\left(10^7\ \pi t\right)\ (\mathrm{V/m})$ at $Z = 0$. The constitutive parameters of seawater are $\varepsilon_r = 72$, $\mu_r = 1$ and $\sigma = 4$ (S/m). Determine the attenuation constant, phase constant, intrinsic impedance, phase velocity ,wavelength and skin depth.

15. Derive and explain the average power density of a propagating wave.

16. Explain field tensor.

17. Neglecting losses and fringe effect and assuming the substrate of a strip-line to have a thickness 0.4 mm and a dielectric constant 2.25 a) determine the with W of the metal strip in order for the strip line to a characteristic resistance of 50 ohm. B) determine L and C of the line

18. What is Debye shielding ? A distant galaxy contains a cloud of protons and antiprotons each with density $n = 10^6\ \mathrm{m}^{-1}$ and temperature 100K. Calculate Debye length ?

19. Write a note on cavity resonators.

(4 × 3 = 12 weightage)