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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 Gauss's 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  $E a_x 100 \cos(10^7 \pi t)$  (V/m) at  $Z = 0$ . The constitutive parameters of seawater are  $\epsilon_r = 72$ ,  $\mu_r = 1$  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 width  $W$  of the metal strip in order for the strip line to have 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  $n = 10^6 \text{ m}^{-3}$  and temperature 100K. Calculate Debye length?
19. Write a note on cavity resonators.

(4 × 3 = 12 weightage)