

D 52839

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Name.....

Reg. No.....

**FIRST SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY)  
EXAMINATION, NOVEMBER 2023**

(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 1 weightage.*

1. What is the intrinsic impedance of the free space ? Give the equation.
2. Define group velocity.
3. What is Poynting vector ?
4. Define total reflection, critical angle and the equation for critical angle.
5. Define a) Propagation constant ; b) Attenuation constant ; and c) Phase constant.
6. What is the constitution of ionosphere ?
7. What is Plasma ?
8. Define displacement current

(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 polarization of a plain wave and derive the equation .Explain circularly polarized waves what is meant by negative circularly polarization.
10. Analyse the behaviour of transverse magnetic waves allow uniform guiding structures.

**Turn over**

11. Explain plasma fluid equations.
12. Explain Maxwell's equations. In detail, explain boundary conditions of electrodynamics.

(2 × 5 = 10 weightage)

### Section C

*7 problems answerable within 15 minutes.*

*Answer any **four** questions, each question carries weightage 3.*

13. Prove that a linearly polarized plain wave can be resolved into a right hand circularly polarized wave and left hand circularly polarized wave of equal amplitude
14. It has been estimated that the spacecraft reenters the Earth's atmosphere the surrounding atoms and molecules create plasma, electron density is in the neighborhood of  $2 \times 10^8$  per  $\text{cm}^3$ . Discuss the plasmas effect on frequency usage in radio communication between the spacecraft and the mission controllers on earth.
15. A uniform plane wave in a loss less medium with intrinsic impedancet  $\eta_1$  incident normally on to another lossless medium with intrinsic impedance  $\eta_2$  through a plane boundary. Obtain the expression for the time average power densities in both media.
16. Write a transmission line equations for a loss plus parallel plate line supporting TEM waves.
17. Derive the motion of plasma in time varying B field.
18. Compute  $\lambda_D$  and  $\lambda_{De}$  for the following cases :
  - a) A glow discharge with  $n = 10^{16} \text{ m}^{-3}$   $KTe = 2 \text{ eV}$
  - b) Earth's ionosphere with  $n = 10^{12} \text{ m}^{-3}$   $KTe = 0.1 \text{ eV}$
  - c) A  $\theta$  pinch with  $n = 10^{23} \text{ m}^{-3}$   $KTe = 800 \text{ eV}$
19. With figure explain Debye shielding

(4 × 3 = 12 weightage)