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Name.....

Reg. No.....

**FIRST SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2015**

(CUCSS)

Physics

**PHY IC 03—ELECTRODYNAMICS AND PLASMA PHYSICS**

(2012 Admission onwards)

Time : Three Hours

Maximum : 36 Weightage

**Section A**

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

1. State Maxwells equations and show that e.m. waves are transverse waves.
2. Show that in a conducting medium the magnitude of magnetic vector is greater than that of electric field and that the magnetic field lags the electric field by  $45^\circ$ .
3. Discuss about electromagnetic potentials.
4. Explain the meaning of various terms involved in the law of conservation of energy for the electromagnetic field.
5. Explain, why Brewster's angle is also called polarising angle.
6. Discuss the minimum frequency of wave and write down the on expression for the same for propagation through rectangular wave guide.
7. Compare and contrast the working of wave guide and transmission lines.
8. Discuss the advantage of representing electrodynamics in tensor notation.
9. Suppose the magnetic field at some point in one system is zero. Is it possible to find another system in which electric field at that point is zero. Explain.
10. Show that antisymmetry of a tensor is preserved by Lorentz transformation.
11. Write down the expression between dielectric constant and Alfven velocity.
12. Define Plasms. Give its properties.

(12 × 1 = 12 weightage)

Turn over

## Section B

Answer any **two**. Each question carries 6 weightage.

13. (a) Show that wave equation for the electric field in free space is given by  $\nabla^2 \times \mathbf{E} = \mu_0 \epsilon_0 \frac{\partial^2 \bar{\mathbf{E}}}{\partial t^2}$ .
- (b) Show that the plane electromagnetic waves follows the laws of reflection.
14. What is skin depth ? Establish Maxwell's equations for the propagation of electromagnetic waves in a conducting medium at normal incidence and obtain an expression for the skin depth.
15. What are cavity resonators ? What application do they have Derive the universal formula for group velocity.
16. Discuss with necessary theory the behaviour of motion of charged particle in uniform electric and magnetic field.

(2 × 6 = 12 weightage)

## Section C

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

17. A wave from free space strikes a lossless water surface ( $\epsilon_r = 81$ ) at an angle of  $25^\circ$  from the normal. Calculate the angle of reflection and refraction.
18. Assuming that all the energy from 1000 watt lamp is radiated uniformly, calculate the average intensifier of electric and magnetic field of radiation at a distance of 2m from the lamp.
19. Calculate the plasma frequency and maximum penetration depth for a plasma density  $10^{18}$  electron/m<sup>3</sup>.
20. Electromagnetic waves are incident normally on a metal surface of refractive index 'n' and extinction coefficient k. Show that the ratio of the reflected intensity to the incident are is :

$$R = \frac{n^2 + k^2 - 2n + 1}{n^2 + k^2 + 2n + 1}$$

21. Prove that E.B. is invariant under Lorentz transformation.
22. A rectangular wave guide has breadth 10 cm. Find the wavelength for a signal frequency 2.5 GHz for the dominant mode.

(4 × 3 = 12 weightage)