

Reg. No

Name

MSc DEGREE END SEMESTER EXAMINATION - OCTOBER 2019**SEMESTER 1 : PHYSICS****COURSE : 16P1PHYT03 : ELECTRODYNAMICS***(For Regular - 2019 Admission and Supplementary - 2016/2017/2018 Admissions)*

Time : Three Hours

Max. Marks: 75

Section A**Answer any 5 (1 marks each)**

1. Tangent loss can be described as
 - (a) The ratio of real part of the dielectric constant to the imaginary part of the dielectric constant.
 - (b) The ratio of imaginary part of the dielectric constant to the real part of the dielectric constant.
 - (c) real part of the dielectric constant
 - (d) imaginary part of the dielectric constant
2. The Laplacian of the magnetic vector potential will be
 - a) $-\mu J$ b) $-\mu I$ c) $-\mu B$ d) $-\mu H$
3. An EM wave passing through vacuum is described by $E = E_0 \sin(kx - \omega t)$ and $B = B_0 \sin(kx - \omega t)$. Then
 - a. $E_0 k = B_0 \omega$ b. $E_0 B_0 = \omega k$ c. $E_0 \omega = B_0 k$ d. none of these
4. In a waveguide the principal wave will be
 - a. TEM
 - b. TE
 - c. TE or TEM
 - d. none of these
5. The four vector X_4 represents
 - (a) Cartesian coordinate x
 - (b) Cartesian coordinate y
 - (c) Cartesian coordinate z
 - (d) ict

(1 x 5 = 5)

Section B**Answer any 7 (2 marks each)**

6. Show that displacement current is the same as the conduction current through the leads of a capacitor.
7. Maxwell's equations beg for a "magnetic monopole to exist". Comment upon this statement.
8. How we can classify heavy loss, medium loss and low loss materials.
9. What are advanced potentials? Why do advanced potentials have no physical significance?
10. State whether the following statement is true or false with your explanation. *Among two identical masses moving under the influence of the same force, the charged one move slowly than the uncharged one.*
11. What is the physical basis for radiation reaction?
12. How can we achieve impedance matching using a quarter wave line?
13. Only TEM modes are considered while designing waveguides for low frequencies. Why?
14. Explain the idea of "proper time".
15. Explain the properties of electromagnetic field sensor.

(2 x 7 = 14)

Section C

Answer any 4 (5 marks each)

16. Obtain the current density J corresponding to the magnetic vector potential given by $A = (y^2 \hat{i} + x^2 \hat{j})$
17. Find the charge and current distributions that would give rise to the potentials $V=0$, $A = \mu_0 m/4c (ct - |x|)^2 \mathbf{k}$ (for $|x| < ct$) and $A = 0$ (for $|x| > ct$), where \mathbf{k} is unit vector and m is a constant.
18. Plot the electric and magnetic fields of a charge moving with constant velocity.
19. Find the first and second order TE cut off wavelengths of an infinite parallel plate waveguide with plate separation of 1.5 cm.
20. Obtain Lorentz force law in Potential form.
21. Write electromagnetic field tensor in terms of four vector potential. Show that $F_{24} = \frac{E_2}{iC}$.
(5 x 4 = 20)

Section D

Answer any 3 (12 marks each)

22. Explain Coulomb gauge and Lorentz gauge. Obtain Lorentz force law in potential form.
1.

OR

2. Obtain the reflection and transmission coefficients for a plane electromagnetic wave incident normally on a plane boundary between two linear dielectric media and hence show that their sum is unity.

- 23.1. Obtain the expression for power radiated by an electric dipole.

OR

2. Obtain the expression for power radiated by a magnetic dipole.

- 24.1. Discuss antenna parameters.

OR

2. Discuss the magnetism as a relativistic phenomenon and prove that the magnetic force on a test particle in the laboratory frame is just the electric force observed in a moving frame.

(12 x 3 = 36)