Reg. No ..... Name **20P1032**

M. Sc DEGREE END SEMESTER EXAMINATION - OCT 2020 : FEBRUARY 2021

SEMESTER 1 : PHYSICS

COURSE : **16P1PHYT03 : ELECTRODYNAMICS**

(For Regular - 2020 Admission and Supplementary - 2016/2017/2018/2019 Admissions)

Time : Three Hours Max. Marks: 75

PART A

Answer All (1 mark each)

1. Magnetic vector potential for volume current is expressed as
   a. $B = \nabla \times A$
   b. $A = \nabla \times B$
   c. $B = \nabla . A$
   d. $A = \nabla .$ B
2. In the case of a linear material medium, which equation can be derived easily from Gauss' law?
   a. Poisson b. Laplace c. Both (a) and (b) d. None of these
3. The amplitudes of E and B fields in an EM wave are related by
   a. $E_0B_0 = c$ b. $B_0 = E_0c$ c. $E_0 = B_0c$ d. $E_0B_0 = c^2$
4. In a TEM wave propagating in z direction, which among the following will be missing
   a. Ez
   b. Hz
   c. both a and b
   d. Ey
5. The vector potential A_4 can be represented in terms of Potential V as
   (a) ic/V
   (b) icV
   (c) i/Cv
   (d) V/ic

(1 x 5 = 5)

PART B

Answer any 7 (2 marks each)

6. Write down the boundary conditions for an electric field for a charge free interface.
7. State Gauss law in differential form. State the advantages of integral form.
8. State and explain Poynting`s theorem.
9. State whether the following statement is true or false with your explanation. *In Lorentz gauge, the potentials satisfy the inhomogeneous wave equation.*
10. Compare the power radiated by electric and magnetic dipoles.
11. Velocity fields cannot contribute to radiation. Why?
12. Give a comparison between the antenna of a mobile phone and a satellite receiver.
13. TEM mode is not supported by a rectangular waveguide. Why?
14. What is the relationship between proper time and ordinary time?
15. What is the relationship between proper velocity and ordinary velocity?

(2 x 7 = 14)

PART C

Answer any 4 (5 marks each)

16. The electric field of an em wave is E= $\hat{i}$ E_0 Cos (kz – ωt) + $\hat{j}$ E_0sin (kz – ωt)
    (a) Obtain the direction and the Magnitude of Poynting's vector.
    (b) Calculate the total energy density.

17. An infinite straight wire carries a current I_0, which is turned on at t = 0. Find the resulting electric and magnetic fields.
18. Find the radiation resistance of a wire joining the two ends of a (electric) dipole.
19. Find the first and second order TM cut off wavelengths of a rectangular waveguide with a = 1.5 cm, b = 2 cm.
20. Show that the diagonal elements in the field tensor is zero.
21. Establish the invariance of electric charge in Lorentz Transformation.

(5 x 4 = 20)

PART D

Answer any 3 (12 marks each)

22.1. State Poynting's theorem and obtain its integral and differential form. Write down Poynting's vector and give its physical meaning.

OR

2. Obtain the reflection and transmission coefficients for a perpendicularly polarized plane electromagnetic wave incident obliquely on the surface separating two dielectric media.

23.1. From Lienard Wiechert potentials, obtain the expression for fields of a moving charge.

OR

2. Starting from the expression for fields of a moving charge, obtain the expression for power radiated by a moving point charge. Hence describe radiation reaction and obtain the Abraham-Lorentz formula. Also discuss the 'disturbing implications' of the Abraham-Lorentz formula.

24.1. Starting with the circuit representation of a transmission line, obtain the expression for distribution of voltage and current along a parallel plate transmission line with loss.

OR

2. Derive the general transformation rules for electromagnetic fields.

(12 x 3 = 36)