Reg. No ..... Name **18P132**

M.Sc DEGREE END SEMESTER EXAMINATION - NOVEMBER 2018

SEMESTER 1 : PHYSICS

COURSE : **16P1PHYT03 : ELECTRODYNAMICS**

(For Regular - 2018 Admission & Supplementary - 2016 / 2017 Admissions)

Time : Three Hours Max. Marks: 75

Section A
Answer any 5 (1 marks 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 wave guide the velocity of energy propagation will be ..... relative to the wave velocity.
   a. same
   b. different
   c. a or b
   d. none of these
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)

Section B
Answer any 7 (2 marks each)

6. Write down the boundary conditions for a magnetic field at an interface.
7. Maxwell's equations beg for a "magnetic monopole to exist". Comment upon this statement.
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. What is generalized Coulomb field?
11. Velocity fields cannot contribute to radiation. Why?

12. What is a TEM wave?
13. Give a comparison between the antenna of a mobile phone and a satellite receiver.
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. The electric field of an em wave is $E= \hat{i}\ E_0 \cos(kz - \omega t) + \hat{j}\ E_0 \sin(kz - \omega t)$
    (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 potential of a point 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. Establish the invariance of electric charge in Lorentz Transformation.

(5 x 4 = 20)

Section 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 plane electromagnetic wave incident normally on a plane boundary between two linear dielectric media and hence show that their sum is unity.

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. Explain Minkowski space. Discuss proper time, proper velocity and Minkowski's force. Obtain relationship between them.

(12 x 3 = 36)