14. a) Calculate the characteristic impedance of free space.

[OR]

b) Obtain the wave equation of electromagnetic wave in one dimesion.

15. a) Distinguish Coulomb Gauge and Lorentz Gauge.

[OR]

b) Give Jefimenko's equation.

SECTION – C **[3 X 10 = 30]**

Answer Any THREE Questions.

16. Explain the polarization of a dielectric material and derive the expression for field inside and outside the dielectrics.

17. Derive the expressions for magnetic flux intensity due to solenoid of the coil.

18. With necessary explanation, derive the Maxwell's equation in differential and integral form.

19. Show that in a good conductor the magnetic field lags the electric filed and find there ratio of their amplitudes.

20. An infinite straight wire carries the current $f(x) = \begin{cases} -0, & t \leq 0 \\ I_0, & t \geq 0 \end{cases}$ that is a constant current I_0 is turned on abruptly at t = 0. Find the resulting electric and magnetic fields.

Reg. No: | | | | | | | | | |

G.T.N. ARTS COLLEGE (AUTONOMOUS)

(Affiliated to Madurai Kamaraj University)
(Accredited by NAAC with 'B' Grade)

END SEMESTER EXAMINATION – APRIL 2021

Programme: M.Sc. Physics **Date: 17.6.2021**
Course Code:19PPHC42 **Time: 10 am. to 1 pm.**
Course Title : Electromagnetic Theory **Max. Marks :75**

SECTION – A **[10 X 1 = 10]**

Answer ALL the Questions.

Choose the Correct Answer.

1. The device which work based on electrostatics principle is _____.

[a] GM Counter [b] Michelson Interferometer
[c] Ion drive rocket engine [d] Automobile Engines

2. Consider four equal charges placed at the corners of square. What is the value of electric field where potential is non-zero?

[a] definite maximum [b] definite minimum
[c] Infinity [d] zero

3. In the presence of both electric and magnetic fields, the net force on any point charge Q is _____.

[a] $F = Q(v \times B)$ [b] $F = Q\{E + (v \times B)\}$
[c] $F = Q\{E - (v \times B)\}$ [d] $F = -Q(v \times B)$

4. $\oint B.dI$=_____

[a] $\mu_0 \int J.da$ [b] $E + \mu_0 \int J.da$
[c] Zero [d] $\mu_0/4\pi$

5. The bound current is _____.

[a] $J_b = \nabla \times M$ [b] $J_b = \nabla \times B$

[c] $J_b = \nabla . D$ [d] $J_b = \nabla . B$

6. Integral form of Maxwell's third equation is _____.

[a] $\oint E.dI = -\frac{d}{dt}\int J.da$ [b] $\oint E.dI = -\frac{d}{dt}\int H.da$

[c] $\oint H.dI = -\frac{d}{dt}\int B.da$ [d] $\oint E.dI = -\frac{d}{dt}\int B.da$

7. A wave whose amplitude is the same at any point in a plane perpendicular to specified direction is called _____.

[a] Sinusoidal wave [b] Square wave

[c] Plane wave [d] Rectangular Wave

8. Fresnel's equation for the reflection amplitude for the case of polarization in the plane of incidence is _____.

[a] $\tilde{E}_{0R} = \left(\frac{\alpha+\beta}{\alpha-\beta}\right)\tilde{E}_{0I}$ [b] $\tilde{E}_{0R} = \left(\frac{\alpha-\beta}{\alpha+\beta}\right)\tilde{E}_{0I}$

[c] $\tilde{E}_{0R} = \left(\frac{\alpha-\beta}{\alpha-\beta}\right)\tilde{E}_{0I}$ [d] $\tilde{E}_{0R} = \left(\frac{\alpha+\beta}{\alpha+\beta}\right)\tilde{E}_{0I}$

9. Consider magnetic vector potential A and scalar potential Φ which define the magnetic field B and electric field E. If one adds $-\nabla\lambda$ to A for a well-defined λ, then what should be added to Φ so, that E remains unchanged up to an arbitrary function of time f(t), _____

[a] $\frac{\partial\lambda}{\partial t}$ [b] $-\frac{\partial\lambda}{\partial t}$

[c] $\frac{1}{2}\frac{\partial\lambda}{\partial t}$ [d] $-\frac{1}{2}\frac{\partial\lambda}{\partial t}$

10. If the vector potential $\vec{A} = \alpha x\hat{x} + 2y\hat{y} - 3z\hat{z}$, satisfies the Coulomb gauge, the value of the constant α is _____.

[a] 0 [b] 2

[c] -3 [d] 1

SECTION – B **[5 X 7 = 35]**

Answer ALL the Questions.

11. a) Obtain the relationship between the net electric flux through a closed surface and the charge enclosed by the surface.

[OR]

b) Explain Poisson and Laplace's equations in electrostatics.

12. a) State Ampere circuital law. Derive the relation between relative permeability and susceptibility.

[OR]

b) Discuss about magnetostatic boundary conditions.

13. a) Prove that energy stored in the magnetic field in the amount of ($B^2/2\mu_0$) per unit volume.

[OR]

b) Sea water at frequency $v = 4 \times 10^8$Hz has permittivity$\epsilon = 81\epsilon_0$, permeability $\mu = \mu_0$, and resistivity $\rho = 0.23\ \Omega$.m. What is the ratio of conduction current to displacement current?