ELECTRODYNAMICS

CC-13

Q.A Answer in one sentence

1. What do you mean by Maxwell's Displacement Current?
2. Write the Maxwell's equaition in differential form.
3. Write the Maxwell's equaition in integral form.
4. Write the boundary condition at interface of electric field
5. Write the boundary condition at interface of magnetic field
6. Write the boundary condition at interface of diectric.
7. State Poynting theorem
8. Write an expression for energy stored in electric and magnetic fields?
9. Write an expression for skin depth in case of good conductor.
10. Write an expression for skin depth in case of poor conductor.
11. Define electromagnetic wave.
12. Electromagnetic waves are transverse in nature. Comment?
13. Write the condition of Lorentz Gauge and Coulomb Gauge

QB. Write short note on.

1. Boundary conditions on E and, D and H at the interface between two media
2. Differntial and integral forms of Maxwell's Equaition
3. Poynting's Theorem
4. Skin depth and Skin effect
5. Boundary conditions on E
6. Boundary conditions on B
7. Boundary conditions on D
8. Gauge transformation
9. Define a Wave.
10. Mention the properties of uniform plane wave.
11. Write down the wave equation for E and H in free space.

12. Write down the wave equation for E and H in a conducting medium

13. Define intrinsic impedance or characteristic impedance.

14. Calculate the characteristic impedance of free space.

15. Define propagation constant.

16. Define skin depth.

17. Define Pointing vector.

18. State Poynting Theorem.

19. What is lossy dielectric medium?

20. For a loss dielectric material having μr=1 , r=48, =20s/m. calculate the Propagation constant at a frequency of 16 GHz.

21. Define Polarization.

22. Define Circular Polarization.

23. Define Elliptical polarization.

24. Define Linear Polarization.

Q.C Short Answer Questions.

1. Find the ratio of skin depth in copper at 1 KHz to 100 MHz

2. State and prove the boundary conditions at the interface of electric field medium.

3. For plane electromagnetic waves propagating in k direction we have that $B = K \times E\, \omega$ show that $E = -\omega k^2\, k\, XB$

4. Show that ratio electrostatic and magneto static energy densities are equal to unity.

5. Obtain an expression for Fresnel's equaition if the electric field vectors are perpendicular to the plane of incidence.

6. An electron is moving at a speed of 1.8 X 10^8 m/s .Find the ratio of its effective mass to its rest mass.

7. Write the expressions for Lorentz ad Coulombs gauges. Hence explain the two conditions.

8. State and prove the boundary conditions at the interface of dielectric

9State and prove the boundary conditions at the interface of magnetic medium.

10. Calculate the frequency at which the skin-depth in sea water is 1 meter.
Given: $\mu_0 = 4\pi \times 10^{-7} WbAm\ and\ \sigma = 4.3 mhom$
11. Explain the Ampere's circuital law and Maxwell's fourth equaition of electromagnetic field.

12. Using Maxwell's equaition. $\nabla\, xE = -\partial B/\partial$,prove that $\nabla.B = 0$

13. Uniform electric and magnetic fields $E = E_z$ and $B = B_x$ are present everywhere .If at t=0, particle of charge q and mass m starts at the origin with velocity $v_0 = E_0^2 B_0^2$. Find the equation of trajectory of the particle.

Q.D Long answer questions

1. Starting with Maxwell's equations, derive inhomogeneous wave equations in terms of scalar potential $\phi$and vector potential A

2. State and prove Poynting's Theorem.

3. Starting from Maxwells's equaition , establish the equaition of continuity.

4. Suppose V=0 and $A = A_0 sin\ (kx - \omega t)$, where A_0, $and\ \omega$ are constants .Find and check that they satisfy Maxwell's equaition in vacuum.

5.Write the Maxwell's equations involving the scalar and vector potentials. Explain the gauge transformation used. What are Lorentz and Coulomb's gauge?

6. State Maxwell's equation for the electromagnetic field and obtain the wave equations for **E** and **B** in homogeneous isotropic non-conducting media.

7. Discuss the propagation of plane monochromatic waves in an isotropic dielectric medium. Show that **P**, **E** and **H** are perpendicular to each other.

8. Obtain an expression for plasma frequency when e.m. wave propagates in an ionized media.

9. Determine the boundary conditions satisfied by **B**, **H**, **E** and **D** at the interface between two media of different permeabilities and dielectric constants.

10. Derive Fresnel's equations for reflection and refraction of e.m. waves at a plane boundary separating the two media. Discuss the phenomenon of total internal reflection.

11. Describe the reflection phenomenon and obtain an expression for reflection coefficient for a monochromatic electromagnetic wave incident normally on a metallic surface.

12. Describe the reflection phenomenon and obtain an expression for reflection coefficient of a monochromatic e.m. wave incident on a metallic surface, with its electric vector E parallel to the plane of incidence.

13. Deduce Brewster's law on the basis of electromagnetic theory. What is degree of polarization?

14. Discuss the propagation of e.m. wave in an anisotropic medium.

15. Give an account of the phenomenon of double refraction. Illustrate the geometry of calcite crystal. Define its optic axis and principal plane.

16. Describe and explain the construction of Nicol prism and its action as polarizer and analyser.

17. Give an account of Huygen's theory of double refraction. Sketch and explain the path of ordinary and extra ordinary rays when light falls on a calcite crystal placed in different situations.

18.How would you produce and detect the following with the help of a Nicol prism and a quarter wave plate:

(a) plane polarized (b) circularly polarized and (c) elliptically polarized

19. Describe construction details of a Babinet compensator. How is it used for analyzing elliptically polarized light?

20. Explain the principle and working of an optical fiber.

21. Explain the construction and working of a step-index fiber. Discuss the propagation of light ray through it.

22. Distinguish between single mode and multimode fibre.

23. Distinguish between step index fiber and graded index fiber.