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Question Paper Code: 1064314

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024
Fourth Semester
Electronics and communication Engineering
U20EC403 – ELECTROMAGNETIC FIELDS
(Regulation 2020)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Define Coulomb's Law and mention its importance.

2. State Helmholtz theorem and explain its use in electromagnetic theory.

3. What is the difference between scalar and vector potentials in magneto statics?

4. What is the significance of the magnetic scalar potential?

5. State Poisson's and Laplace equations.

6. List the factors affecting the inductance of a transmission line.

7. Write Maxwell's equations in point form.

8. What is the role of time-harmonic fields in Maxwell's equations?

9. State the wave equation for a uniform plane wave.

10. What is the significance of oblique incidence in electromagnetic wave reflection?

PART – B (5 x 16 = 80 Marks)

11. (a) Apply Gauss's law to derive an expression for the electric field intensity due to an infinite line charge. (16)

(OR)

(b) Apply the concept of the electric scalar potential to derive the relationship between electric field intensity and potential. Solve for the electric field due to a point charge at a distance r. (16)

12. (a) With neat diagrams, explain the Lorentz force equation and analyze the forces acting on a moving charge in both electric and magnetic fields. (16)

(OR)

(b) Describe magnetic boundary conditions and derive the conditions for the normal and tangential components of B and H at the boundary of two media. (16)

13. (a) Analyze the concept of capacitance in parallel plate capacitors and coaxial cables. Compare the two in terms of design, efficiency, and applications. (16)

(OR)

(b) Apply Faraday's law of electromagnetic induction to derive the induced EMF in a loop due to a time-varying magnetic field. (16)

14. (a) Explain and derive the Poynting theorem. Illustrate how it is used to calculate the power flow in an electromagnetic field. (16)

(OR)

(b) Describe the electromagnetic boundary conditions and derive the expressions for tangential and normal components of electric and magnetic fields. (16)

15. (a) Discuss plane wave propagation in a low-loss dielectric and compare it with propagation in good conductors. Include derivations and examples. (16)

(OR)

(b) What is Brewster's angle? Derive the condition for Brewster's angle in electromagnetic wave reflection and illustrate with a diagram. (16)

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