(FOR THE CANDIDATES ADMITTED   SUBJECT CODE | 22 PPS 205 |

DURING THE ACADEMIC YEAR 2022-23 ONLY)   REG.NO. | |

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS : MAY – 2023

M.Sc. – PHYSICS   **MAXIMUM MARKS: 50**

II SEMESTER   **TIME : 3 HOURS**

ELECTROMAGNETIC THEORY AND ELECTRODYNAMICS
SECTION – A   (10 X 1 = 10 MARKS)
ANSWER THE FOLLOWING QUESTIONS.

1. A dielectric needs to be converted to a conductor. How can we do it?

   a) By freezing it   b) By doping it

   c) By compressing it   d) By heating it

2. A gauge is one in which a vector potential has ____

   a) No momentum   b) No divergence

   c) No temperature   d) No electron number

3. For a perfect dielectric, which parameter will be zero?

   a) Conductivity   b) Frequency

   c) Permittivity   d) Permeability

4. When an electromagnetic wave moves form one medium to another medium then which of the following quantity will not change?

   a) Frequency   b) Speed

   c) Temperature   d) Wavelength

5. Which of the following is not the Maxwell's equation?

   a) $\Delta.D = \rho$ b) Div B= U.J

   c) $\Delta \bar{E} = \partial B/\partial t$ d) curl H = J + $\partial D/\partial t$

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES.   (K2)

6. What is a non-polar molecule?

7. Define displacement current.

8. Define dynamical conductivity.

9. What is a scattering process?

10. What is the rank of an electromagnetic field tensor?

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SECTION – B   **(5 X 3 = 15 MARKS)**

ANSWER EITHER (a) OR (b) IN EACH OF THE
FOLLOWING QUESTIONS.   **(K3)**

11. a) Explain the polarization of polar and non-polar molecules in uniform electric field.
    (OR)
    b) State and explain Ampere's circuital law and highlight its salient features.
12. a) Establish Maxwell's equations in terms of electromagnetic potential.
    (OR)
    b) Discuss the concept of Lorentz gauge and Coulomb gauge.
13. a) What are ionized media? Discuss the propagation of electromagnetic waves in ionized media.
    (OR)
    b)   Give an account of the dynamic value of conductivity.
14. a) Highlight the different scattering parameters. Discuss their significance.
    (OR)
    b) Discuss the propagation of electromagnetic waves between conducting planes.
15. a) Derive transformation equations for ρ and **J** using relativistic electrodynamics.
    (OR)
    b) Write brief notes on covariance and transformation law of Lorentz force.

SECTION – C   **(5 X 5 = 25 MARKS)**

ANSWER EITHER (a) OR (b) IN EACH OF THE
FOLLOWING QUESTIONS.   **(K4 (Or) K5)**

16. a) With relevant theory deduce expression for Claussius - Mossotti equation in electrostatics.
    (OR)
    b) Briefly discuss magnetic scalar and vector potential in magnetostatics. Give its applications to magnetic dipoles.
17. a)   Briefly explain (i) Poynting vector (ii) Equation of continuity.
    (OR)
    b) Derive expressions for retarded potential and Lienard Wiechart potentials.
18. a) Explain the propagation of electromagnetic waves in conducting media. How do the characteristics of wave propagation in a conducting media differ from those of wave propagation in free space?
    (OR)
    b) What is an anisotropic dielectric material?   Explain how electromagnetic waves propagate in anisotropic dielectrics.
19. a) With relevant theory deduce the Fresnel's formula for reflection and refraction of light at uniform planar interfaces.
    (OR)
    b) Explain the Brewster's law and polarization of electromagnetic waves.

20. a) Derive transformation equations for vector and scalar potentials A and φ using relativistic electrodynamics. Give its importance.
    (OR)
    b) Briefly discuss the covariance of Maxwell's equations and deduce its four tensor form.

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