

(FOR THE CANDIDATES ADMITTED

SUBJECT CODE **25 PPS 205**

DURING THE ACADEMIC YEAR 2025-26 ONLY)

REG.NO.: **N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI****END-OF-SEMESTER EXAMINATIONS : MAY– 2026****M.Sc. – PHYSICS****MAXIMUM MARKS: 75****II SEMESTER****TIME : 3 HOURS****ELECTROMAGNETIC THEORY AND ELECTRODYNAMICS****SECTION – A****(10 X 1 = 10 MARKS)****ANSWER THE FOLLOWING QUESTIONS.****(K1)**

1. In an octopole potential is directly proportional to **(K1)**
a) r b) r^2 c) r^3 d) r^4
2. Which of the following represents momentum per unit volume stored in the fields?
a) S (Poynting vector) b) $\text{curl } S$ c) $\mu_0 \epsilon_0 S$ d) $\text{div } S$ **(K1)**
3. Maxwell's equation $\nabla \times B = \mu_0 J + \mu_0 \epsilon_0 \frac{\partial E}{\partial t}$ is known as
a) Gauss's law b) Faraday's law c) Coulomb's law d) Ampere's law **(K1)**
4. If the energies of incident and scattered radiations are equal, then the scattering is called _____ scattering
a) elastic b) inelastic c) Raman d) Thomson **(K1)**
5. Which of the following quantities is invariant under Lorentz transformations?
a) charge b) current c) charge density d) current density **(K1)**

ANSWER THE FOLLOWING QUESTIONS IN ONE OR TWO SENTENCES.

6. State Ampere's circuital law. **(K2)**
7. Define retarded potential. **(K2)**
8. Find the value of wave impedance of free space. **(K2)**
9. Write the boundary condition for electric displacement vector D . **(K2)**
10. Write the transformation equations for electromagnetic potential A . **(K2)**

SECTION – B**(5 X 5 = 25)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)**

11. (a) Obtain the expression for magnetic scalar potential.
(OR)

(b) Explain the polarization of non polar molecules.

(CONTD 2)

12. (a) Interpret the physical significance of Poynting vector.
(OR)
(b) What is gauge invariance? Explain the Lorentz gauge.
13. (a) Obtain the plane wave solutions of an electromagnetic wave in an isotropic dielectric medium.
(OR)
(b) Determine the value of dynamic conductivity of a medium.
14. (a) Explain the phenomenon of Thomson scattering.
(OR)
(b) Describe the total internal reflection when an electromagnetic wave travels from denser to rarer medium.
15. (a) Show that the scalar product of two four vectors is invariant.
(OR)
(b) Obtain the expression for Lorentz force in covariant form.

SECTION – C (5 X 8 = 40)

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

16. a) Derive Clausius - Mossotti relation using for the concept of molecular field.
(OR)
b) Determine the Langevin – Debye formula for polar molecules.
17. a) Derive Maxwell's equations in differential form.
(OR)
b) Discuss the concept of Coulomb gauge.
18. a) Discuss about the propagation of electromagnetic waves in a conducting medium.
(OR)
b) Summarize the propagation of plane electromagnetic waves in an ionized gases.
19. a) Interpret the theory of scattering of electromagnetic waves and obtain the expression for differential cross section.
(OR)
b) Investigate Fresnel's equations for reflection and refraction of electromagnetic waves.
20. a) Derive Maxwell's field equations in four vector form.
(OR)
b) Obtain the transformation equations for charge density ρ and current density J .
