KAMARAJ COLLEGE (Autonomous)

Accredited with A+ Grade by NAAC

(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(3 Pages) **Reg. No:……**

Question Code: 26E03311 **Course Code : 24PEPH41**

PG Degree - End Semester Examinations, April 2026

Fourth Semester

M.Sc., PHYSICS

Electromagnetic Theory

(For those who joined in July 2024 onwards)

Time : 3Hours **Maximum : 75 Marks**

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer :

CO:1 K:1 1. Which of the following represents the Faraday's law of electromagnetic induction?

(a) $E=-d\phi/dt$ (b) $E=-nd\phi/dt$

(c) $E=nd\phi/dt$ (d) $E=d\phi/dt$

CO:1 K:2 2. When an electromagnetic wave travels inside a conductor _____ is observed.

(a) Skin effect (b) Charge decrease

(c) Charge increase (d) No change in charge

CO:2 K:1 3. The Laplace equation is

(a) $\nabla^2\phi=\alpha$ (b) $\nabla^2\phi=1$

(c) $\nabla^2\phi=0$ (d) $\nabla^2\phi=3$

CO:2 K:1 4. Multipole expansion is expressed in powers of

(a) r (b) R^3

(c) R^2 (d) $1/r$

CO:3 K:2 5. The Ampere's circutal law relates the

(a) B and μ_0 (b) B and Ω

(c) B and ρ (d) B and $\hbar$

CO:3 K:2 6. The magnetic moment is a _____ quantity.

(a) Scalar (b) Vector

(c) Both (a) and (b) (d) Sometimes scalar sometimes vector

CO:4 7. The example of scalar potential is

K:1 (a) Electric potential (b) current

(c) Magnetic dipole (d) Electric flux

CO:4 8. The Lorentz force relates the

K:2 (a) E and q (b) E, B and q

(c) E and B only (d) B and q only

CO:5 9. The linear polarization of e.m. waves can be classified as

K:2 (a) Vertical (b) Horizontal

(c) Oblique (d) All of these

CO:5 10. The waveguides are made up of

K:1 (a) Aluminium (b) Nickel

(c) Brass (d) None of these

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 250 words.

CO:1 11. (a) Derive an expression for Maxwell's equation for free space.

K:3

(OR)

(b) What are waveguides? Explain.

CO:2 12. (a) State and prove uniqueness theorem.

K:4

(OR)

(b) What do you mean by molecular polarizability? Derive an expression for it.

CO:3 13. (a) State and prove Biot-savart's law.

K:2

(OR)

(b) Write short notes on magneto static energy.

CO:3 14. (a) Deduce an expression for Maxwell's displacement current.

K:3

(OR)

(b) What is Lorentz force? Give an expression for it.

CO:4 15. (a) Explain the phenomena of linear polarization of e.m. waves.

K:3

(OR)

(b) Discuss the propagation of e.m. waves in rectangular waveguide.

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).

Answer should not exceed 600 words.

CO:1 K:4 16. (a) Describe the refraction of e.m. waves when they travel through a conductor.

(OR)

(b) Explain about the dispersion of e.m. waves in conductor. Deduce an expression.

CO:2 K:5 17. (a) Derive an expression for Laplace equation in 3D.

(OR)

(b) Derive an expression for electro static energy in the presence of dielectric medium.

CO:3 K:6 18. (a) Discuss about the magnetic field of a localized current distribution.

(OR)

(b) Describe about the boundary conditions of circularly magnetized sphere.

CO:4 K:4 19. (a) Discuss about Gauge invariance.

(OR)

(b) State and explain Poynting theorem.

CO:5 K:4 20. (a) Discuss the propagation e.m. waves in conducting medium.

(OR)

(b) Describe the theory of oscillating electric dipole.