(6 pages)   Reg. No. : ....

Code No. : 20444 E   Sub. Code : CMPH 31

B.Sc. (CBCS) DEGREE EXAMINATION,
NOVEMBER 2023.

Third Semester

Physics — Core

ELECTRICITY AND ELECTROMAGNETISM

(For those who joined in July 2021-2022 onwards)

Time : Three hours   Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. Electric field $E = $ —————
    (a) Fq^2 (b) F/q
    (c) qF (d) q/E

2. $\nabla \cdot E = $ —————
    (a) $\rho \, \epsilon_0$ (b) $\dfrac{\rho}{\epsilon_0}$
    (c) $\rho^2 \, \epsilon_0$ (d) $\dfrac{q}{E}$

3. One kilo ohm = ————— ohm.
    (a) 10^2 (b) 10^4
    (c) 10^1 (d) 10^3

4. Capacitance of capacitor $C = $ —————
    (a) $\dfrac{V}{Q}$ (b) $\dfrac{Q}{V}$
    (c) $V^2 Q$ (d) VQ

5. The magnetic induction $B = $ —————
    (a) $\dfrac{F}{qv}$ (b) $\dfrac{F}{qv \sin \theta}$
    (c) $\dfrac{F}{q \sin \theta}$ (d) $\dfrac{F}{V \sin \theta}$

6. For a paramagnetic material, the dependence of the magnetic susceptibility ψ on the absolute temperature T is
    (a) $\psi \propto T$ (b) $\psi = const \times T$
    (c) $\psi \propto \dfrac{1}{T}$ (d) $\psi = const$

7. The law of electromagnetic induction was given by
    (a) Faraday   (b) Henry
    (c) Fleming   (d) Newmann

8. The coefficient of coupling between two coils of self inductance L_1 and L_2
    (a) $\sqrt{\dfrac{L_1}{L_2}}$ (b) $\sqrt{L_1 L_2}$
    (c) $\sqrt{\dfrac{L_2}{L_1}}$ (d) $\dfrac{M}{\sqrt{L_1 L_2}}$

9. The poynting vector P is
    (a) $P = E \times H$ (b) $P = B \times H$
    (c) EH (d) BH

10. According to wave equation for electric field $\overline{E}$
    (a) $\nabla \cdot \overline{E} = \mu_0 \varepsilon_0 \left(\dfrac{\partial^2 E}{\partial t^2} \right)$
    (b) $\nabla \times \overline{E} = \mu_0 \varepsilon_0 \left(\dfrac{\partial^2 E}{\partial t^2} \right)$
    (c) $\nabla^2 E = \mu_0 \varepsilon_0 \left(\dfrac{\partial^2 E}{\partial t^2} \right)$
    (d) $\nabla \cdot \overline{E} = \dfrac{1}{\mu_0 \varepsilon_0} \left(\dfrac{\partial^2 E}{\partial t^2} \right)$

PART B — (5 × 5 = 25 marks)

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

Each answer should not exceed 250 words.

11. (a) Obtain expression for potential due to an electric dipole.

    Or

    (b) Explain seebeck effect.

12. (a) Derive an expression for the decay of current in L-R circuit.

    Or

    (b) How will you determine high resistance by leakage?

13. (a) Obtain the relation between B, H and M.

    Or

    (b) State the properties of diamagnetism.

14. (a) State and explain the laws of electromagnetic induction.

    Or

    (b) Explain mutual inductance.

15. (a) Derive an expression for the poynting vector.

Or

(b) Write the Maxwell's equation in material medium.

PART C — (5 × 8 = 40 marks)

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

Each answer should not exceed 600 words.

16. (a) State and prove Gauss's law.

Or

(b) Describe Kohlransh bridge experiment to determine the specific conductivity of a electrolyte.

17. (a) Derive an expression for the growth of charge in LCR circuit.

Or

(b) Obtain an expression for the growth and decay of charge in a capacity through a resistance.

18. (a) Give the theory, construction and working of a B.G.

Or

(b) Explain about magnetic permeability.

19. (a) State and explain Faraday's law of electromagnetic induction.

Or

(b) Draw Owen's bridge circuit and state the condition for balance.

20. (a) Obtain Maxwell's equations and explain their significance.

Or

(b) Explain the Hertz experiment for the production and detection of EM waves.

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