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DCPH201

Reg. No.

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II Semester B.Sc. Degree Examination, July/August - 2024

PHYSICS

Electricity and Magnetism

(NEP Semester Scheme 2021-22 and Onwards Freshers, Repeaters)

Paper : II - PHY DSCT2



Time : 2½ Hours

Maximum Marks : 60

Instructions to Candidates:

1. Follow the instructions under each Part.
2. Use of non-programmable scientific calculator is allowed.

PART - A

Answer ALL the questions. Each question carries 1 mark.

(5×1=5)

1. The direction of electric field \vec{E} is always _____ to the electric field line at every point
a) parallel b) tangential c) perpendicular d) circular.
2. If dielectric medium of constant ϵ_r is filled between the plates of a parallel plate condenser, then its capacity increases
a) $\frac{1}{\epsilon_r}$ b) ϵ_r c) $(\epsilon_r)^2$ d) $\frac{1}{(\epsilon_r)^2}$.
3. The time constant of an RL transient circuit is
a) LR b) $\frac{1}{LR}$ c) $\frac{R}{L}$ d) $\frac{L}{R}$.
4. Lenz's law can be explained on the basis of law of conservation of
a) energy b) momentum c) charge d) mass.
5. Magnetic permeability, μ , of a diamagnetic material is
a) $\mu = 0$ b) $\mu > 1$ c) $\mu < 1$ d) $\mu = \infty$.

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PART - B

Answer any THREE questions. Each question carries 10 marks.

(3×10=30)

6. a) What is an electric dipole? Write the expression for the dipole moment.
b) State and explain the Gauss's law. Derive an expression for the electric field intensity at a point due to spherical charge distribution. (2+8)
7. a) What are polar and non-polar dielectrics?
b) State and explain Thevenin's theorem. (2+8)
8. a) What is Hall effect? Obtain an expression for Hall voltage in conductors.
b) What is self-inductance? Obtain an expression for the energy stored in an inductor. (3+7)
9. a) Define the average value and rms value of ac voltage, write the relation between the two.
b) Derive an expression for impedance and current in a series LCR circuit by j operator method. (3+7)
10. a) Derive the Maxwell's field equation $\nabla \cdot B = 0$.
b) What is hysteresis curve? Explain. (4+6)

PART - C

Answer any THREE questions. Each question carries 5 marks.

(3×5=15)

11. An infinite line charge produces a field of $9 \times 10^4 \text{ NC}^{-1}$ at a distance of 0.02 m. Calculate the linear charge density. Given $\epsilon_0 = 8.854 \times 10^{-12} \text{ Fm}^{-1}$.
12. A parallel plate capacitor with air between the plates has a capacitance of 5 pF. Calculate the capacitance of the capacitor if the distance between the plates is reduced to half and the space between them is filled with a substance of dielectric constant 6.
13. A steady current of 20 A flows through a coil of inductance 0.03 H when connected to a 200 V dc supply. When the coil is connected to 200V, 50 Hz supply, calculate the current and the power factor.
14. An electromagnetic wave in free space has a wavelength of 0.2m. When this same wave enters a perfect dielectric, the wavelength changes to 0.09 m. Assuming that $\mu_r = 1$, determine ϵ_r and the wave velocity in the dielectric. Given: $\mu_0 = 4\pi \times 10^{-7} \text{ Hm}^{-1}$, $\epsilon_0 = 8.854 \times 10^{-12} \text{ Fm}^{-1}$.



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15. A magnetic material has a magnetization of 2300 Am^{-1} and produces a flux density of 0.00314 Wbm^{-2} . Calculate the magnetizing field and relative permeability of the material.
Given $\mu_0 = 4\pi \times 10^{-7} \text{ Hm}^{-1}$

PART - D

Answer any **FIVE** questions. Each question carries 2 marks.

(5×2=10)

16. a) What is gradient of a scalar function?
b) What is the work done in moving a charge on an equipotential surface? Explain.
c) Mention any two factors responsible for the energy losses in a dielectric.
d) State maximum power transfer theorem. Write the expression for maximum power.
e) State Lenz's law. Mention its significance.
f) The average value of an ac voltage taken over a full cycle is zero. Explain.
g) Write the expression for the velocity of an electromagnetic wave in free space and the explain the terms in it.
h) Distinguish between soft and hard magnetic materials.
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