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DCPH201

Reg. No.

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II Semester B.Sc. Degree Examination, September - 2023

PHYSICS

Electricity and Magnetism

Paper : Phy DSCT2

(NEP) (Freshers - 2021-22 and Onwards)



Time : 2½ Hours

Maximum Marks : 60

Instructions to Candidates:

1. Follow the instructions under **each** part.
2. Use of non - programmable scientific calculators is allowed.

PART - AAnswer **ALL** the questions. Each question carries 1 mark.

(5×1=5)

1. The electric flux from a Gaussian surface enclosing a charge q is

a. $\frac{q}{\epsilon_0}$

b. $\frac{\epsilon_0}{q}$

c. $\frac{1}{\epsilon_0 q}$

d. $q \epsilon_0$

2. The variation of potential V with distance r in a region with $E = 0$, is

a. $V \propto r$

b. $V \propto 1/r$

c. $V \propto 1/r^2$

d. $V = \text{constant.}$

3. A current carrying loop in a magnetic field behaves like a

a. Magnetic dipole

b. Magnetic material

c. Magnetic pole

d. Non - magnetic material

4. The average value of alternating current/voltage over one complete cycle is

a. I_m/π

b. $2I_m/\pi$

c. zero

d. one

5. The value of magnetic susceptibility for super conductor is

a. 0

b. ∞

c. +1

d. -1

[P.T.O.]



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PART - B

Answer any **THREE** questions. Each question carries 10 marks.

(3×10=30)

6. a. What is an electric line of force?
b. State and explain Gauss's theorem. Using the theorem, derive the expression for electric field intensity at a point due to a spherical charge distribution. (2+8)
7. a. What are polar and non - polar dielectrics?
b. Obtain the expression for the capacitance of a parallel plate capacitor with dielectrics. (4+6)
8. a. State Ohm's law. Write its vector form.
b. State and prove Thevenin's theorem. (2+8)
9. a. State the Faraday's laws of electromagnetic induction.
b. Derive an expression for the force on a current carrying conductor placed in a magnetic field. (2+8)
10. a. State and explain Poynting theorem.
b. Derive the expression for velocity of electromagnetic waves in terms of electric and magnetic fields. (5+5)

PART - C

Answer any **THREE** questions. Each question carries 5 marks.

(3×5=15)

11. A spherical conductor of radius 5 cm is charged uniformly to 10 μ C. If the sphere is placed in air, find electric potential at (a) 10 cm and (b) 4 cm from the center of the sphere.
12. A 12 μ F capacitor is connected to a 50 V battery. How much energy is stored in the capacitor? Also, find the charge on the capacitor.
13. A proton moving with a speed of 3.4×10^7 m/s enters a uniform magnetic field in a direction perpendicular to the field. The strength of the magnetic field is 2T. Calculate the force acting on the proton and acceleration produced in it. Given : charge on proton is 1.6×10^{-19} C and its mass is 1.67×10^{-27} kg.
14. A plane electromagnetic wave travelling along X - direction in a dielectric medium of $\mu_r = 2$ and $\epsilon_r = 5$. Calculate the velocity of the wave in free space and dielectric medium. Given: $\epsilon_0 = 8.854 \times 10^{-12}$ Fm⁻¹ and $\mu_0 = 4\pi \times 10^{-7}$ Hm⁻¹.
15. Find the relative permeability and susceptibility of a ferromagnetic material if the field of strength 300 A/m produces a magnetization of 4200 A/m in it.



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PART - D

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

(5×2=10)

16. a. Is electric dipole moment a scalar or a vector quantity? Explain.
- b. State Kirchhoff's laws.
- c. What is meant by dielectric polarization?
- d. State superposition theorem.
- e. Distinguish between steady state and transient state.
- f. Define Q-factor of a coil? What is its significance?
- g. What is displacement current? Explain.
- h. Define magnetic induction and intensity of magnetization.
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