2024/TDC (CBCS)/EVEN/SEM/ PHSHCC–201T/087

TDC (CBCS) Even Semester Exam., 2024

PHYSICS

(2nd Semester)

Course No. : PHSHCC–201T

(Electricity and Magnetism)

Full Marks : 50
Pass Marks : 20

Time : 3 hours

The figures in the margin indicate full marks for the questions

UNIT—I

1. Answer any *two* of the following questions : 2×2=4

(a) State first uniqueness theorem.

(b) Two point charges are placed at a certain distance apart. The electric field intensity is zero at a point between them. What can you conclude about the charges?

(c) Discuss how electric flux through a closed surface is related to charge enclosed.

2. Answer any *one* of the following questions : 6

(a) Discuss conservative nature of electrostatic field. Hence, show that $\vec{\nabla} \times \vec{E} = 0$. 4+2=6

(b) Find the expression for electric potential due to a dipole at an arbitrary point. Hence, find the electric field. 4+2=6

UNIT—II

3. Answer any *two* of the following questions : 2×2=4

(a) Write the significance of electric displacement vector.

(b) Show that the energy stored in a capacitor is $\frac{1}{2}CQ^2$.

(c) What is dielectric polarization?

4. Answer *either (a)* and *(b)* or *(c)* and *(d)* of the following questions : 3×2=6

(a) Find an expression for force per unit area acting on the surface of a conductor.

(b) Define electric susceptibility. Show how it is related to dielectric constant.

(c) Find an expression for capacitance of a cylindrical capacitor.

(d) Obtain a relation connecting electric field ($\vec{E}$), polarization vector ($\vec{P}$) and electric displacement vector ($\vec{D}$).

UNIT—III

5. Answer any *two* of the following questions : 2×2=4

(a) What is the meaning of $\vec{\nabla} \cdot \vec{B} = 0$?

(b) Derive the relation between B, H and M.

(c) Define magnetic field induction $\vec{B}$. Give its SI unit.

6. Answer *either (a)* and *(b)* or *(c)* and *(d)* of the following questions : 6

(a) What is Biot-Savart law? 2

(b) Use Biot-Savart law to find the magnetic field at the centre of a circular coil carrying current. 4

(c) State and prove Ampere's circuital law. 3

(d) Obtain an expression for magnetic field due to a solenoid using Ampere's circuital law. 3

UNIT—IV

7. Answer any *two* of the following questions : 2×2=4

(a) What are magnetization vector and magnetic intensity?

(b) Explain how Lenz's law is in accordance with the law of conservation of energy.

(c) Give Faraday's laws of electromagnetic induction.

8. Answer any *one* of the following questions : 6

(a) What is hysteresis? Show that area enclosed by a hysteresis loop gives the measure of energy loss per cycle. 2+4=6

(b) What are mutual induction and self-induction? Find the expression for mutual inductance between two current-carrying coils. 2+4=6

UNIT—V

9. Answer any *two* of the following questions : 2×2=4

(a) State Kirchhoff's laws.

(b) What do you mean by bandwidth and quality factor?

(c) State maximum power transfer theorem.

10. Answer any *one* of the following questions : 6

(a) What do you mean by ideal constant voltage and current sources? State and prove Thevenin's theorem of network analysis. 2+4=6

(b) Discuss the working principle and use of ballistic galvanometer.

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