QP CODE: 24803775

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Reg No : .....

Name : .....

INTEGRATED MSC DEGREE EXAMINATION, JUNE 2024

Second Semester

INTEGRATED MSC BASIC SCIENCE-PHYSICS

CORE - IPH2CR04 - ELECTROSTATICS AND MAGNETOSTATICS

2021 Admission Onwards

68993107

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. Write short note on conservation of charge.
2. Define electric dipole. Illustrate with examples.
3. Discuss the properties of electric field lines.
4. State and explain fundamental theorem for divergences.
5. Discuss electric potential due to a group of charges.
6. Write briefly on electrostatic boundary conditions.
7. What is Lorentz force? Write down the relation.
8. Give the cyclotron motion equation.
9. Find the magnetic field at the ends of a one meter long solenoid carrying current of I Amp and having N turns.
10. Define coefficient of self-induction of a coil.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Five identical charges Q are placed equidistant on a semicircle as shown in the figure. Another point charge q is kept at the center of the circle of radius R. Calculate the electrostatic force experienced by the charge q.
12. State and prove Gauss's law in electrostatics. Get its differential form from its integral equation.

13. One of the following is an impossible electrostatic field. Which one?
$(a). E = k[xy\hat{x} + 2yz\hat{y} + 3xz\hat{z}]$;
$(b). E = k[y^2\hat{x} + (2xy + z^2)\hat{y} + 2yz\hat{z}]$.

14. Write a short note on equipotential surfaces.

15. Derive an expression for the magnetic field due to a circular loop carrying steady current along the axis of the coil.

16. Derive the relation between magnetic flux and magnetic vector potential.

17. Derive the integral and differential forms of Faraday's law.

18. Derive an expression for the energy stored in a magnetic field.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

*Weight **5** each.*

19. Find the electric field at a distance z above the center of a flat circular disk of radius R, which carries a uniform surface charge σ. Also get the formula for the following cases
(a) when $z \gg R$,
(b) in the limit $R \to \infty$

20. Find the electric field inside a sphere which carries a charge density proportional to the distance from the origin, $\rho = kr$, for some constant k.

21. Get the idea of Poisson's and Laplace's equations in electrostatics. Check that the equation $\frac{1}{4\pi\epsilon_0}\int \frac{\rho(r')}{r} d\tau'$ satisfies Poissson's equation.

22. Use Ampere's circuital law to find the magnetic field induction B at a point within a current carrying (i) long solenoid (ii) toroid.

(2×5=10 weightage)