QP CODE: 25802166

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Reg No : .....

Name : .....

INTEGRATED MSC DEGREE EXAMINATION, APRIL 2025

Second Semester

INTEGRATED MSC BASIC SCIENCE-PHYSICS

CORE - IPH2CR04 - ELECTROSTATICS AND MAGNETOSTATICS

2021 Admission Onwards

4BB48C44

Time: 3 Hours Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. State the principle of superposition of electric charges.
2. Discuss Coulomb's law in electrostatics.
3. Define Electricflux
4. An infinite plane carries a uniform surface charge σ. Using Gaussian pillbox, find its electric field.
5. Discuss the advantages of the potential formulation in electrostatics.
6. Get the idea of Poisson's equation in electrostatics.
7. What is Lorentz force, write down the relation.
8. Two thin long parallel wires seperated by a distance R are carrying current I Amp each. Find the magnitude of force per unit length exerted by one wire on the other.
9. Describe the physical significance of magnetic vector potential.
10. Explain three different forms of Faraday's law and explain the symbols.

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Find the electric field a distance z above one end of a straight line segment of length L, which carries a uniform line charge λ. Check that the the result is consistent for the case $z \gg L$.

12. Calculate $\nabla \times E$, if $E(r) = \frac{1}{4\pi\epsilon_0}\int_\nu \frac{\rho(r')}{r^2}\hat{r}\,d\tau'$.

13. Charges $+10^{-8}C, -2\times10^{-8}C, +3\times10^{-8}C$ and $+2\times10^{-8}C$ are placed at the four corners of square side of 1 meter. Find the potential at the point of intersection of the diagonals.

14. Write a short note on equipotential surfaces.

15. An electron has a velocity of 106 ms^{-1} in the X direction in a magnetic field B =0.2î -0.3ĵ +0.5k̂ T. What is the electic field present if no net force is experienced by the electon.

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

17. An electron revolves around the nucleus in a circular path of radius 5x 10^{-11} m with frequency 6x 10^{15} revolutions per second. Calculate the magnetic field at the centre and magnetic dipole moment of the electron.

18. A solenoid having an air core and 10 cm long has 100 turns and its area of cross section is 5 cm^2. Find the coefficient of self-inductance of the solenoid.

(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 a distance z from the center of a sphere of radius R, which carries a uniform volume charge density ρ. Treat the case for Z < R (inside) as well as z > R (outside). Express the answers in terms of the total charge q on the spherical surface. Draw a graph of |**E**| as a function of the distance from the center.

21. Use Gauss's law to find the electric field inside and outside a long hollow cylindrical tube, which carries a uniform surface charge σ. Check that this result is consistent with electrostatics boundary conditions.

22. Derive the magnetostatic boundary conditions of the tangential component of the magnetic field.

(2×5=10 weightage)