

22U303

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Name: .....

Reg.No: .....

**THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2023**

(CBCSS - UG)

(Regular/Supplementary/Improvement)

**CC19U PHY3 B03 / CC20U PHY3 B03 - ELECTRODYNAMICS - I**

(Physics - Core Course)

(2019 Admission onwards)

Time : 2.00 Hours

Maximum : 60 Marks

Credit : 3

**Part A** (Short answer questions)

Answer *all* questions. Each question carries 2 marks.

1. What is the physical interpretation of divergence of a vector field?
2. State and explain stokes theorem.
3. Express elemental displacement and elemental volume in spherical polar coordinates.
4. Discuss about different types of charge distributions. Give their units.
5. Show that the electric field inside a conductor is zero.
6. What do you mean by the polarization vector P? What is its value for free space?
7. Write the significance of electric displacement.
8. What are the integral and differential forms of Ampere's law?
9. What are the differences between the electrostatic potential and magnetic potential?
10. Define magnetisation.
11. Write the relation connecting M, B and H.
12. Describe magnetic hysteresis curve and the various terms used in describing the curve.

**(Ceiling: 20 Marks)**

**Part B** (Short essay questions - Paragraph)

Answer *all* questions. Each question carries 5 marks.

13. Find the angle between the face diagonals of a cube of side 1 unit.
14. Find the electric field outside, on the surface and inside a charged metallic cylinder (solid/hollow) of infinite length and radius 'a'.
15. Show that the energy density of a charge distribution is  $[\frac{1}{2}\rho V]$ .

16. Find an expression for the force acting on a dipole in a non-uniform electric field.
17. A metal sphere of radius 'a' carries a charge Q. It is surrounded out to radius 'b' by a linear dielectric material of permittivity  $\epsilon$ . Find the potential at the center relative to infinity. Also calculate the polarization and bound charge inside the dielectric.
18. An electron accelerated by 100 V enters a magnetic field of 0.05 T at an angle of  $45^\circ$ . Find (i) radius of the helical path of electron (ii) angular velocity (iii) pitch of the helical path.
19. Derive  $J_M = \nabla \times M$

**(Ceiling: 30 Marks)**

**Part C (Essay questions)**

Answer any *one* question. The question carries 10 marks.

20. With the help of suitable diagrams, derive the boundary conditions for electric field vector E. Also obtain the boundary conditions for electric potential.
21. (a) State Biot-Savart law  
(b) Derive an expression for the magnetic field due to a current carrying conductor at a point near to it.

**(1 × 10 = 10 Marks)**

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