

D 31828

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Name.....

Reg. No.....

**THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION  
NOVEMBER 2022**

Physics/Applied Physics

PHY 3B 03/APH 3B 03—ELECTRODYNAMICS—I

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in question paper have their usual meanings.***Section A (Short Answer Type)***Answer all questions in two or three sentences.**Each correct answer carries a maximum of 2 marks.*

1. What do you mean by the Laplacian of a scalar ? Is it a scalar or a vector ?
2. Write down an expression for the electric field due to a volume charge. Discuss the terms involved.
3. Give Poisson's equation and explain the terms involved.
4. How is the work and energy related in electrostatics ? Is the electrostatic force conservative ?
5. Write down the expression for the torque experienced by a dipole in uniform electric field. What is the effect of the torque ?
6. Write down the relation connecting permittivity and susceptibility in linear dielectrics. Explain the terms involved. What is the susceptibility of vacuum ?
7. Check whether the following statements are true or false : (i) Magnetic forces can alter the direction in which a charged particle moves ; and (ii) Magnetic forces can speed up a charged particle.
8. Write and explain the expressions for the divergence and curl of B in magnetostatics.
9. Explain the equation of continuity.
10. What is the relation connecting magnetic flux density B and magnetic vector potential A ? What is the divergence of A ?
11. When will you say that a medium is magnetically polarized ? Discuss the magnetic polarization in diamagnets.
12. Explain the temperature-driven phase transitions in ferromagnetic materials.

(Ceiling 20)

**Turn over**

**Section B (Paragraph/Problem Type)**

*Answer all questions in a paragraph of about half a page to one page.*

*Each question answer carries a maximum of 5 marks.*

13. Prove that the curl of the gradient of a function is zero.
14. Find the electric field (magnitude and direction) at a distance  $z$  above the midpoint between two equal charges  $q$ , a distance  $d$  apart.
15. Suppose the electric field in some region is found to be  $\mathbf{E} = kr^3\hat{r}$ , in spherical polar coordinates, where  $k$  is some constant. Determine the charge density.
16. Explain why the electric field and charge density vanishes inside a conductor.
17. Compare the curl of  $\mathbf{E}$  and  $\mathbf{D}$  in electrostatics.
18. Give an expression for the field of a magnetized object. Explain the physical meaning of the expression.
19. Explain the hysteresis loop of ferromagnets.

(Ceiling 30)

**Section C (Essay type)**

*Answer in about two pages, any one question.*

*Answer carries 10 marks.*

20. What do you mean by the curl of a vector function? Explain its geometrical interpretation. Explain Stokes' theorem and give its geometrical interpretation.
21. Using suitable figures, discuss the magnetostatic boundary conditions.

(1 × 10 = 10 marks)