

**THIRD SEMESTER (CBCSS—UG) DEGREE EXAMINATION
NOVEMBER 2020**

Physics/Applied Physics

PHY 3B 03/APH 3B 03—ELECTRODYNAMICS—I

Time : Two Hours

Maximum : 60 Marks

Section A (Short Answer Type)

Answer atleast eight questions.

Each question carries 3 marks.

All questions can be attended.

Overall Ceiling 24.

1. What do you mean by the cross product of two vectors ? Mention two properties of cross product.
2. Give the geometrical interpretation of the gradient of a quantity.
3. Give the basic features of a one dimensional Dirac delta function.
4. Write down the relation connecting electric field and electric potential. Write its differential form.
5. Prove that the potential difference between two points a and b is equal to the work done per unit charge required to carry the particle from a to b .
6. List the basic electrostatic properties of ideal conductors.
7. What happens when a dielectric made of non-polar molecules is placed in an electric field ? What do you mean by the term polarization ?
8. Write down the relation connecting electric field, polarization and electric displacement. Can we express electric displacement as the gradient of a scalar potential ?
9. What happens when a dielectric is placed near the plates of a parallel plate capacitor ? Explain the term fringing field.
10. Write down Lorentz force law. Why magnetic forces do no work ?
11. Write down Maxwell's equations for magnetostatics.
12. Compare the behavior of paramagnetic and diamagnetic materials in a non-uniform magnetic field.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem Type)

Answer at least five questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Using the expression for an infinitesimal volume element in spherical polar co-ordinates, determine the volume of a sphere.
14. Explain the Gauss's divergence theorem. Discuss its geometrical interpretation.
15. Obtain Poisson's and Laplace's equations in electrostatics.
16. A metal sphere of radius a carries a charge Q . It is surrounded, out to radius b , by a linear dielectric material of permittivity ϵ . Determine the potential at the centre (relative to infinity).
17. Find the magnetic field at a distance z above the centre of a circular loop of radius R , which carries a steady current I .
18. An infinitely long cylinder carries a uniform magnetization M parallel to its axis. Determine the magnetic field due to M inside and outside the cylinder.
19. Draw and explain a typical ferromagnetic hysteresis curve.

(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any one question.

The question carries 11 marks.

20. Explain Gauss's law. Obtain the differential form of Gauss's law. Using Gauss's law, determine the field outside a uniformly charged solid sphere of radius R and total charge q .
21. Obtain the equation of continuity in magnetostatics. Explain the Bio-Savart Law.

(1 × 11 = 11 marks)