

C 61217

(Pages : 3)

Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2019

(CUCBCSS—UG)

Physics/Applied Physics

PHY 4B 04/APY 4B 04—ELECTRODYNAMICS—I

Time : Three Hours

Maximum : 80 Marks

### Section A

*Answer all questions in a word or phrase.*

*Each question carries 1 mark.*

1. Electric field inside a charged conductor is \_\_\_\_\_.
2. Electric lines of force penetrating normal to unit area of a surface is \_\_\_\_\_.
3. Torque acting on an electric dipole kept in a uniform field is \_\_\_\_\_.
4. The integral form of Ampere's law is \_\_\_\_\_.
5. The relation connecting the magnetic vector potential  $A$  and the current density  $J$  is given by \_\_\_\_\_.

State whether the statement is true or false :

6. Atomic polarizability,  $\alpha = 4\pi\epsilon_0 a^3$ .
7. Hydrogen is an example of a non polar molecule.
8. For diamagnetic substances, susceptibility is independent of temperature.
9. Line integral of static electric field around a closed path is zero.
10. S.I. unit of electric field is V/m.

(10 × 1 = 10 marks)

### Section B

*Answer all questions.*

*Write each answer in two or three sentences.*

*Each question carries 2 marks.*

11. Explain Maxwell's equations of electrostatics.
12. Explain electrostatic boundary conditions.
13. No two electric lines of force intersect each other. Why ?

Turn over

14. What is electric displacement ?
15. Define Ampere's force law.
16. Define Gauss's law of magneto statics.
17. Explain current density.

(7 × 2 = 14 marks)

### Section C

*Answer any five questions.  
Each question carries 4 marks.*

18. Derive the expression for the capacitance of a parallel plate capacitor.
19. Derive the expression for electrostatic energy density.
20. Explain polarizability tensor.
21. What is magnetic vector potential ? Why is it called so ?
22. Explain Laplace equation in two dimensions.
23. State and prove Gauss's law in the presence of dielectric.
24. Explain dielectric strength.

(5 × 4 = 20 marks)

### Section D

*Answer any four questions.  
Each question carries 4 marks.*

25. Calculate the potential at points 10 cm. and 40 cm. from a point charge of  $2.23 \times 10^{-10}$  C. Calculate the potential difference between these two points.
26. An oil drop of mass  $5 \times 10^{-12}$  gm. is held stationary under the electric field applied between the two horizontal plates. Calculate the electric field if the drop carries 8 excess electrons.
27. Dielectric constant of a medium is 5. Calculate the electric susceptibility. Calculate the electric displacement and polarization for applied electric field of strength  $10^6$  V/m.
28. Two long parallel wires separated by 3 cm in air carries a current of 100 A. Find the force on 1 m length of a wire.
29. An electron enters a magnetic field of flux density 3T with a velocity of  $2 \times 10^7$  m/s at an angle of  $30^\circ$  with the field. Calculate the magnitude of force on the electron.

30. Prove that magnetic torque,  $\tau = m \times B$
31. An iron rod of volume  $10^{-6} \text{m}^3$  is placed inside a solenoid of 1000 turns/m carrying a current of 3A. Find the magnetic moment of iron bar if the relative permeability of iron is 1000.

(4 × 4 = 16 marks)

### Section E

*Answer any two questions.*

*Each question carries 10 marks.*

32. State and prove Gauss's law. Derive Laplace and Poisson's equation.
33. (a) What are the three electric vectors? Explain each.  
(a) Explain electric susceptibility, permittivity and derive the relation connecting them.
34. (a) Define electric potential and potential difference.  
(b) Show that electric field is the gradient of scalar potential.
35. (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.

(2 × 10 = 20 marks)