

**FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2016**

(CUCBCSS—UG)

Core Course—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. Potential energy of a system of two charges,  $U = \text{—————}$ .
  2. Electric potential is ————— across any boundary.
  3. Intensity of magnetic field at the center of a current carrying circular coil,  $B = \text{—————}$ .
  4. Laplace equation in two dimension is —————.
  5. ————— is the S.I. unit of magnetic field strength.
- State whether the statement is True or False :
6. Dipole moment is a vector quantity.
  7. Permeability of diamagnetic substance is always greater than unity.
  8. Permanent magnetic material must have high coercivity.
  9. Area is a vector quantity.
  10. If the centre of gravity of the positive nuclei and the electron cloud coincide, the molecule is called polar molecule.

(10 × 1 = 10 marks)

**Section B**

*Answer all questions.*

*Write each answer in two or three sentences.*

*Each question carries 2 marks.*

11. During lightening, we are safe inside a car. Why ?
12. Why electrostatic force is considered as a conservative force ?
13. What's the working principle of a cyclotron ?
14. State the Gauss's theorem in magnetostatics.

Turn over

15. Explain magnetizing field and magnetic field.
16. Can a system have magnetic moment even if its net charge is zero? Explain.
17. Explain electrostatic pressure.

(7 × 2 = 14 marks)

### Section C

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

18. Explain Maxwell's equations of electrostatics.
19. How is atomic polarizability and polarization related?
20. Explain bound charge.
21. Derive Poisson's equation.
22. Derive the expression for the energy of a charged capacitor.
23. Explain hysteresis.
24. Distinguish between para, dia and ferromagnetic materials.

(5 × 4 = 20 marks)

### Section D

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

25. A dielectric slab of thickness 0.75 cm and dielectric constant 4 is placed between the plates of a parallel plate capacitor of area  $0.02 \text{ m}^2$  and separation 2 cm. Calculate the change in capacitance on the introduction of a dielectric.  
What would be the change if the slab were conducting?
26. Three point charges, each of  $+250 \mu\text{C}$  are placed at the three corners of an equilateral triangle. Calculate the resulting electric potential at the center of the triangle, which is at a distance of 18 cm from each corner.
27. The electron in a hydrogen atom circles around the proton with a speed of  $2 \times 10^6 \text{ m/s}$  in an orbit of radius  $5.3 \times 10^{-11} \text{ m}$ . Calculate :
  - (a) The equivalent current.
  - (b) Magnetic field strength produced at the proton.

28. An iron rod of  $0.2 \text{ cm}^2$  area of cross-section is subjected to a magnetizing field of  $1200 \text{ Am}^{-1}$ . If the susceptibility of iron is 599, calculate :
- Permeability.
  - Magnetic flux produced.
29. A horizontal overhead power line carries a current of 60 A from south to north. Calculate the magnitude and direction of magnetic field due to the current at a point 2.5 m above the line.
30. Derive the expression of torque experienced by a dipole in a non-uniform electric field.
31. Current passing through a solenoid is 2 A. What is the magnetizing field (H) if it is 2 m long and contains 400 turns. Find intensity of magnetic field (B) in free space.

(4 × 4 = 16 marks)

### Section E

*Answer any two questions.  
Each question carries 10 marks.*

32. Discuss electrostatics boundary conditions and first and second uniqueness theorem.
33. (a) State Ampere's law.  
(b) Derive the expression for the magnetic field due to :
- Solenoid.
  - Toroid.
34. (a) State and prove Gauss's law in the presence of dielectric.  
(b) What are the three electric vectors ? Derive the relation connecting them.
35. Derive the expression for :
- The energy of a continuous charge distribution.
  - Electrostatic energy density.

(2 × 10 = 20 marks)