

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2012

(CCSS)

Physics—Core Course

PH 4B 07—ELECTRODYNAMICS—I

Three Hours

Maximum : 30 Weightage

*Symbols used in the question paper have their usual meanings.***Section A**Objective type questions. Each question carries a weightage of $\frac{1}{4}$.

Questions 1–4 : Choose the correct alternative from the given list.

1. Which of the following has the same dimension as that of electric potential ?

- (a) Electric field. (b) Work.
(c) Work done per unit charge. (d) Force per unit charge.

2. For an electric dipole electric field varies as :

- (a) r^{-2} . (b) r^{-3} .
(c) r^{-1} . (d) r^{-4} .

3. Unit of magnetic flux is :

- (a) Weber. (b) Henry/m.
(c) Weber/m². (d) Weber/m.

4. The magnetic susceptibility of a diamagnetic material is :

- (a) zero. (b) less than zero.
(c) greater than zero. (d) Complex.

Questions 5 – 8 : Fill in the blanks.

5. The method of Images is used to determine _____.

6. The general solution of one dimensional Laplace's equation is a _____.

7. According to magnetostatic boundary conditions normal components of \mathbf{B} are _____.8. The magnetic flux density at the centre of a current carrying circular coil $\mathbf{B} =$ _____.

Questions 9 – 12 : Give very brief answers.

9. The flux through one face of a cube carrying a charge = q at its centre is _____.

10. Write down equation of continuity.

11. What is the force experienced by a test charge moving along the perpendicular bisector of an electric dipole ?

12. Give an example for a ferromagnetic material.

(12 \times $\frac{1}{4}$ = 3 weightage)

Turn over

Section B

II. Questions 13 – 21 : Answer all *nine* questions. Each question carries a weightage of 1.

13. Show that the electrostatic field inside a charged hollow sphere is zero.
14. Show that electric potential obeys superposition principle.
15. Write down the integral form of Gauss' law in presence of dielectrics.
16. State the first Uniqueness theorem.
17. What is a linear dielectric ?
18. A charged particle is subjected to a uniform electric field along X-axis and uniform magnetic field along Z-axis. Sketch the trajectory of the particle.
19. Write down any one contrasting feature of Electrostatics and Magnetostatics.
20. An electron is revolving in a circular orbit of radius r with frequency f . Find the magnitude and direction magnetic dipole moment developed.
21. What is the physical significance of H ?

(9 × 1 = 9 weightage)

Section C

III. Questions 22– 28 : Answer any *five* questions. Each question carries a weightage of 2.

22. Find the electric field due to a uniformly charged solid cylinder both inside and outside the cylinder.
23. Calculate the potential due to an electric dipole of dipole moment = 4.5×10^{-10} Coul/m at a distance of 1m from it (a) on the axis; (b) on perpendicular bisector of the dipole.
24. A point charge q is situated at a distance r from the centre of a grounded conducting sphere of radius R . Find the potential inside and outside the sphere using the method of images.
25. A potential difference 100 V is applied to a 1 and 5 μ F capacitors connected in series. Find the charge and potential across each other.
26. Find the magnetic flux density B of a square wire loop of side 10 cm, carrying 1 Amp in clockwise direction.
27. A uniform magnetic field of 1.5 Wb/m^2 points horizontally from north to south. A proton of energy 5.0 MeV moves vertically downward through this field. Find the force on it. Mass of proton = 1.7×10^{-27} kg Charge of proton = $+1.6 \times 10^{-19}$ Coul.
28. The magnetic susceptibility of a linear medium is 948×10^{-11} . Calculate the permeability and relative permeability. If it is subjected to a uniform field of 1 Tesla, find M and B .

(5 × 2 = 10 weightage)

Section D

IV. Questions 29 – 31 : Answer any *two* questions. Each question carries a weightage of 4.

29. Explain the electrostatic properties of a conductor. Derive an expression for force on surface of a charged conductor.
30. Derive Clausius-Mossotti equation.
31. Define bound current densities J_b and K_b . Explain their physical significance.

(2 × 4 = 8 weightage)