

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
 Fourth Semester B.Sc Degree Examination, March 2018
 PH4B04 – Electrodynamics I
 (2016 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

SECTION A**(Answer in a word or phrase)****Answer ALL questions: Each question carries 1 mark**

1. What is the trajectory of a charged particle moving in a magnetic field \mathbf{B} , making an acute angle?
2. What is the expression for the energy of a magnetic dipole(\mathbf{m}) in an uniform magnetic field(\mathbf{B})?
3. Induced electric dipole moment per unit volume is called
4. What is the expression for the volume bound current density in terms of the magnetisation?
5. What is the relation between surface charge density of a conductor and the normal derivative of the potential.

Questions 6 to 10: Write True or False

6. Electrostatic energy obeys superposition principle.
7. Surface current density is the current per unit area in a direction perpendicular to the flow.
8. Magnetostatic forces do no work.
9. When the space between two charges is filled with a medium having higher permittivity, the force between them decreases.
10. When an electric dipole is placed in an uniform electric field in which dipole moment is parallel to the electric field will experience a torque.

(10x1 = 10 marks)**SECTION B****(Answer in two or three Sentences)****Answer ALL questions: Each question carries 2 marks.**

11. What is electrostatic pressure? Write down the expression for it.
12. What is Ampere's circuital theorem?
13. What is atomic polarizability?
14. State Gauss's law. Write down its integral form.
15. What is Magnetisation?
16. Write down Laplace's equation. What is the general solution to one dimensional Laplace's equation?
17. What is curie point?

(7x2 = 14 marks)

SECTION C

(Answer in a paragraph of about half a page to one page)
Answer any FIVE questions: Each question carries 4 marks.

18. Obtain Ampere's law in magnetized objects.
19. Obtain the expression for the force experienced by a dielectric inserted between the plates of a parallel plate capacitor maintained at a potential of V volts.
20. Deduce the expression for the electrostatic energy of a continuous charge distribution in terms of intensity of the electric field, starting from the energy due to a point charge.
21. State and prove first and second uniqueness theorem.
22. What is electric potential? Show that electric field is negative gradient of potential.
23. Distinguish between Paramagnets, Diamagnets and Ferromagnets.
24. Define volume current density. Obtain the continuity equation.

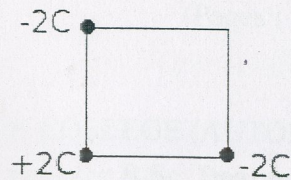
(5x4 = 20 marks)

SECTION D

(Problems – Write all relevant formulas. All important steps carry separate marks)
Answer any FOUR questions: Each question carries 4 marks.

25. Find the electric field intensity due to an uniformly charged sphere having charge density ' ρ ' at a point
 - i) inside the sphere
 - ii) outside the sphere.
26. An electron with energy 50 keV enters in an uniform magnetic field of 0.05 Tesla. Find the cyclotron frequency and radius of the circle it will describe. ($m_e = 9.1 \times 10^{-31}$ Kg, $q = 1.6 \times 10^{-19}$ C).
27. A parallel plate capacitor having capacitance $C = 10 \mu\text{F}$ is charged by a battery of 5 V. A dielectric medium having dielectric constant $\epsilon_r = 3$ is inserted into the plates, such that it fills the upper half of the plates. Find the energy of the new configuration.
28. A point charge $q = +3 \text{ C}$ is held at a distance (0,0,20cm) above an infinite grounded conducting surface in the XY plane. What is the potential at a point (-10cm, -20cm, 30cm) from the centre of the plane.
29. An infinitely long solenoid (number of turns per unit length, $n=1000$) carries a current $I=100\text{mA}$ is filled with a linear material of susceptibility 2.0×10^{-4} . What is the magnetic field (\mathbf{B}) inside the Solenoid?
30. Calculate the magnitude of electric displacement \mathbf{D} and polarisation \mathbf{P} in a dielectric material having dielectric constant 5.25 placed in an electric field of $\mathbf{E} = 2000 \text{ V/m}$.
31. a) Three charges ($q = 2\text{C}$) are situated at the corners of a square of side $a = 10\text{cm}$ as shown in figure. How much work does it take to bring in another charge, $+q$ from far away and place it in the fourth corner?

b) How much work does it take to assemble the whole configuration of four charges?



(4x4 = 16 marks)

SECTION E

(Answer in about two pages)

Answer any TWO questions: Each question carries 10 marks.

With necessary theory obtain electrostatic and magnetostatic boundary conditions.

- a) Derive the expression showing the effect of magnetic field on atomic orbitals.
- b) Derive the relation connecting magnetic susceptibility and relative permeability.
- a) Obtain the expression for the electric field due to a polarized object.
- b) Obtain the integral form of Gauss's law in presence of dielectrics.
- a) State and Explain Biot – Savart's law.
- b) Find the magnetic field a distance ' s ' from a long straight wire carrying a steady current, I .

(2x10 = 20 marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
 Fourth Semester B.Sc Degree Examination, March 2018
 PH4C04 – Electricity, Magnetism & Nuclear Physics
 (2016 Admission onwards)

Max. Time: 3 hours

Max. Marks: 64

Part A**Answer all questions(Each question carries one mark)**

1. When a dielectric is placed between the plates of a capacitor the electric field between the plates -----
 a)increases b)decreases c)becomes zero d)Remains unchanged
2. A potentiometer is an ideal instrument for measuring emf because
 a)It has a long wire b)It does not disturb the pd it measures
 c)It has a sensitive galvanometer d)None of the above
3. A uniform electric field of magnitude 100 N/C exists in space along the X direction. The flux of this field through a plane square area of sides 10 cm placed in the Y-Z plane is
 a)10 b)1 c)110 d)0
4. Permanent magnets are made from ----- substances
5. Horizontal and vertical components of earths field are equal at a place where
 a)Dip = 0 b)Dip = 45° c)Declination = 0 d)Total intensity = 0
6. The most stable nucleus is -----
7. The field bound by quarks is -----
8. The energy equivalent to 1 atomic mass unit = ----- MeV
9. The spin of photon is -----
10. The relation between half life and mean life is ----- (10 x 1 = 10 Marks)

Part B**Answer all questions(Each question carries two marks)**

11. Define electrostatic potential at a point.
12. What is a dielectric?
13. Why are manganin wires preferred for the manufacture of standard resistances.
14. Distinguish between paramagnets and ferromagnets.
15. What are the limitations of a linear accelerator?
16. Distinguish between fermions and bosons.
17. What are dark matters?

(7 x 2= 14 Marks)

Part C

Answer any three questions(Each question carries four marks)

18. Explain electrostatic shielding. Mention one practical application
19. What is a deflection magnetometer? Explain its principle.
20. Write a short note on nuclear waste disposal.
21. Explain the method of determining the resistance of a wire using potentiometer.
22. Explain the theory of Origin of Universe.

(3 x 4 = 12 Marks)

Part D

Answer any three questions(Each question carries four marks)

23. Three charges of $1nC$, $2nC$ & $3nC$ are placed at the corners of an equilateral triangle of side $1m$. Calculate the potential at a point equidistant from the three corners of the triangle.
24. A copper wire of length $10m$ has a resistance of $2 \Omega/m$ at $20^{\circ}C$. If the temperature coefficient of resistance is $3.79 \times 10^{-4}/^{\circ}C$ calculate the resistance at $50^{\circ}C$.
25. Calculate the drift velocity of free electrons in Copper. Given current density = $480 A/cm^2$. Avogadro number = $6 \times 10^{23}/mole$. Density of copper = $9 g/cc$ and its atomic weight = $64 g/mol$ Assume that there is one free electron per atom of copper.
26. If 10% of a radioactive element decays in 5 days calculate the amount of the element left after 20 days.
27. A cyclotron used to produce a beam of protons has a magnetic field of flux density $1.8 Wb/m^2$ and the extreme useful radius is $0.20m$. Assuming the specific charge of proton to be $9.58 \times 10^7 C/Kg$ obtain values of a) energy of the protons b) wavelength of the electromagnetic waves produced by the oscillator. $M = 1.67 \times 10^{-27} Kg$.

(3 x 4 = 12 Marks)

Part E

Answer any two questions(Each question carries eight marks)

28. Explain the principle and working of a Carey Fosters bridge. Describe an experiment to determine resistance of a wire using Carey Fosters bridge.
29. Describe with theory how will you compare the magnetic moments of two magnets using Searles vibration magnetometer.
30. What are particle accelerators? Explain the theory and working of a linear accelerator. What are its limitations.
31. Discuss in detail the classification of elementary particles.

(2 x 8=16 Marks)