

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
 Fourth Semester B.Sc Degree Examination, March /April 2019
 BPHY4B04 – Electrodynamics I
 (2017 Admission onwards)

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 expression relating polarisation (\mathbf{P}) and electric field (\mathbf{E}) for a linear dielectric?
2. What is the trajectory of a charged particle moving in a crossed electric and magnetic fields?
3. Write down the relation between polarisation and electric field for a linear dielectric material.
4. What is the electric field between two infinite plane sheets separated by air carrying equal surface charge density ($+\sigma$)?
5. Write down the differential form of Gauss's law.

Questions 6 to 10: Write True or False

6. Electric potential inside a hollow spherical shell is zero.
7. Surface current density is the current per unit area in a direction perpendicular to the flow.
8. Divergence of magnetostatic field intensity is zero leads to the fact that magnetic monopoles do not exist.
9. The energy of a magnetic dipole (\mathbf{m}) in a magnetic field (\mathbf{B}) is $U = -\mathbf{m} \cdot \mathbf{B}$
10. When an electric dipole is placed in a uniform electric field in which dipole moment is perpendicular 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 electric potential? What is the advantage of potential formulation?
12. What is Lorentz force law?
13. What is atomic polarizability?
14. Define electric flux.
15. What is magnetic susceptibility?
16. State and explain second uniqueness theorem.
17. Define Curie temperature.

(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. What are ferromagnets? Explain hysteresis in a ferromagnetic material.
19. Explain cyclotron motion and cyclotron frequency.
20. Using Biot – Savart's law, obtain the curl and divergence of magnetic field (\mathbf{B}).
21. State and prove first and second uniqueness theorem.
22. Obtain Gauss's law in presence of dielectrics.
23. Discuss any four electrostatic properties of a conductor.
24. What do you mean by capacitance? Obtain the expression for the energy of a parallel plate capacitor.

(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. Using Gauss's law find the electric field intensity inside a long solid cylinder carries a charge density that is proportional to the distance from the axis; $\rho = k s$, for some constant 'k'. 's' is the distance from the axis to the point.
26. A long straight wire carries a current of 3 A. An electron at a distance of 10cm from it travels parallel to the wire in a direction opposite to the current at a speed of $5 \times 10^4 \text{ ms}^{-1}$. Calculate the force experienced by the electron in the magnetic field of the current.
27. A point charge $q = +2 \text{ C}$ is held at a distance (0,0,10cm) above an infinite grounded conducting surface in the XY plane. What is the induced surface charge on the conducting plane?
28. An electric current is distributed in wire of circular cross section with radius ' $a = 2 \text{ cm}$ '. If the current density varies as $\mathbf{J} = 3 \mathbf{r}$, Where \mathbf{r} is the distance from the axis. Find the total current in the wire.
29. A capacitor of capacitance $C_1 = 3 \mu\text{F}$ is charged to a potential of $V_0 = 6 \text{ V}$, using a battery. The charging battery is then removed and the capacitor C_1 is connected to an uncharged capacitor of capacitance $C_2 = 7 \mu\text{F}$.
 - a) What is the common potential difference of the new arrangement?
 - b) What is the difference in energy of the capacitor before and after sharing the charges?
30. Calculate the dielectric constant and electric susceptibility of a material having a polarisation of $3.76 \times 10^{-8} \text{ Cm}^{-2}$ when a field of 1000V/m is applied.
31. Calculate the work needed to assemble four point charges each of +2C at the corners of a square of side 2cm.

(4 x 4 = 16 marks)

SECTION E

(Answer in about two pages)

Answer any TWO questions: Each question carries 10 marks.

2. a) With necessary theory obtain electrostatic boundary condition for electric field and electric potential.
- b) Show that electric field is negative gradient of potential.
3. a) Derive the expression showing the effect of magnetic field on atomic orbitals.
- b) Derive the relation connecting magnetic susceptibility and relative permeability.
4. a) Obtain the torque experienced by a polar molecule placed in an uniform electric field and in an non-uniform electric field.
- b) Obtain the expression for the electric field due to a polarized object.
5. a) State and explain Ampere's circuital theorem. Obtain its differential form.
- b) Using Ampere's circuital theorem obtain the magnetic field intensity inside a long solenoid.

(2x10 = 20 marks)

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Reg. No:.....

Name:

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
 Fourth Semester B.Sc Degree Examination, March /April 2019
 BPHY4C04 – Electricity, Magnetism & Nuclear Physics
 (2017 Admission onwards)

Time: 3 hours

Max. Marks: 64

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

The non existence of magnetic monopoles is explained by ----- law

The trajectory of a charged particle in a uniform electric field is -----

Name a material having zero temperature coefficient of resistance.

The drift velocity of electrons in a conductor is of the order of -----

Best material for permanent magnets is -----

In a nuclear reactor control rods are used for -----

The principle of Carey Fosters Bridge is that of -----

Cosmic rays were discovered by -----

The exchange particle in the electromagnetic force is -----

Particles which are made up of three quarks are known as -----

(10 x 1 =10 Marks)**Part B****Answer all questions(Each question carries two marks)**

What are equipotential surfaces. Mention one property.

Define dielectrics.

Explain BCS theory of superconductivity.

Distinguish between primary and secondary cosmic rays.

How an electromagnet differ from a permanent magnet?

Explain the concept of colour in quark theory.

What are the two inferences drawn from the binding energy per nucleon curve.

(7 x 2= 14 Marks)

Part C

Answer any three questions(Each question carries four marks)

18. What is a Carey Foster's bridge? Explain its principle.
19. What are superconductors? Mention any four applications of superconductors.
20. Define the three elements of earth's magnetic field.
21. Explain the working of a semiconductor detector.
22. Explain latitude effect.

(3 x 4 = 12 Marks)

Part D

Answer any three questions(Each question carries four marks)

23. Two capacitors $4\mu\text{F}$ and $6\mu\text{F}$ charged to a potential of 20V and 24V respectively are connected in parallel. Find their common potential and loss of energy.
24. Calculate the drift velocity of free electrons in Copper. Given current density = 480 A/cm^2 . Avogadro number = $6 \times 10^{23}/\text{mole}$. Density of copper = 9 g/cc and its atomic weight = 64g/mol . Assume that there is one free electron per atom of copper.
25. A potentiometer wire of length 10m and resistance 1Ω is connected in series with a resistance 10Ω and a cell of emf E . The balancing length for 2V pd is 8m . Calculate the emf of the battery in auxiliary circuit.
26. The horizontal and vertical components of earth's magnetic field at a place are $3 \times 10^{-4}\text{ Wb/m}^2$ and $4 \times 10^{-4}\text{ Wb/m}^2$ respectively. Calculate angle of dip and total intensity of earth's field.
27. Calculate mass defect, binding energy and binding energy per nucleon for ${}_{6}\text{C}^{12}$ nucleus. Nuclear mass of ${}_{6}\text{C}^{12} = 12.0\text{ amu}$, mass of hydrogen nucleus = 1.007825 amu and mass of neutron is 1.008665 amu .

(3 x 4 = 12 Marks)

Part E

Answer any two questions(Each question carries eight marks)

28. What is the principle of Searle's vibration magnetometer? How it can be used to determine magnetic moment of a magnet?
29. What is the principle of potentiometer? With neat diagram and detailed theory explain how resistance of a wire is determined using potentiometer.
30. What are radiation detectors? Explain the working of any two radiation detectors.
31. Write a note on quarks, colour and flavor and define Higgs boson.

(2 x 8 = 16 Marks)