

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE
Fourth Semester B.Sc Physics Degree Examination, March 2017
PH4C04 – Electricity, Magnetism & Nuclear Physics
(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 64

PART A (One Word)**Answer all questions. Each question carries one mark**

1. Electric field inside conductor is -----
2. A charge q is situated at the centre of a cube. The electric flux through one of the face of the cube is----
3. The unit of resistivity is -----
4. The temperature at which a conductor becomes superconductor is called -----
5. For paramagnetic substance , the susceptibility is-----
6. The angle of dip at the magnetic pole is -----
7. Solar energy arises chiefly due to-----
8. Large hadron collider is situated at-----
9. The size of nucleus is of the order of-----
10. Charge of strange quark is-----

(10 x 1=10 Marks)**PART B(Short Answer Questions)****Answer all questions. Each question carries two marks**

11. What are super conductors? Give one example.
12. Two electric field lines never intersect. Why?
13. What is Meissener effect?
14. Define electric potential at a point. What is its unit?
15. Distinguish between primary and secondary cosmic rays.
16. Define mass defect and binding energy.
17. What are the magnetic elements of earth?

(7 x 2=14 Marks)

PART C(Paragraph Questions)

Answer any three questions. Each question carries four marks

18. What is the principle of potentiometer?
19. Explain the phenomenon of cosmic ray showers.
20. Derive the expression for the capacitance of a parallel plate capacitor.
21. Distinguish between diamagnetic, paramagnetic, and ferromagnetic materials.
22. Explain the stability of nucleus in terms of proton and neutron numbers.

(3 x 4=12 Marks)

PART D(Problems)

Answer any three questions. Each question carries four marks

23. Find binding energy per nucleon in ${}_{26}^{56}\text{Fe}$, Mass of Hydrogen=1.00783u, mass of neutron =1.008665u and atomic mass of ${}_{26}^{56}\text{Fe}$ =55.9349u $1\text{u}=931.49\text{ Mev}$
24. The half-life of a radioactive sample is 4 days. What fraction of 1gm sample will remain after 20 days
25. If the horizontal component of earth's field is $0.36 \times 10^{-4}\text{T}$ and angle of dip 40° at certain place. What is the total intensity of earth's field there?
26. A parallel plate capacitor is maintained at a certain potential difference. When a 3mm thick dielectric slab is introduced between the plates, the distance between the plates is increased by 2.4mm to keep the potential difference the same. Find the dielectric constant of the slab.
27. The resistance of a wire is 5Ω at ice point and 5.23Ω at steam point. Find the temperature at which resistance is 5.795Ω

(3 x 4=12 Marks)

PART E (Essays)

Answer any two questions. Each question carries eight marks

28. State and prove Gauss's law. Apply this law to find electric field due to a uniform plane sheet of charge.
29. Explain the working of a linear accelerator and obtain the maximum energy from it.
30. What is the theory of Searle's vibration magnetometer? How it can be used to determine the magnetic moment of magnet.
31. Explain Classification of the elementary particles with the associated quantum numbers. Give examples.

(2 x 8 =16 marks)

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Fourth Semester B.Sc Physics Degree Examination, March 2017

PH4B04 – Electrodynamics I

(2015 Admission onwards)

Max. Time: 3 hours

Max. Marks: 80

Section A

(Answer all questions; each question carries 1 mark)

Questions 1 to 5: Answer in a word or Phrase

1. The electric field inside a good conductor is _____
2. The volume bound charge density within a uniformly polarized material is _____
3. The general solution for Laplace's equation in spherical polar coordinates where V depends only on r will be _____
4. Nature of force between two long current carrying straight metallic wire is _____
5. The expression for material-independent magnetic field at a distance r from a current carrying long conductor is _____.

Questions 6 to 10: Write True or False

6. Mechanical force of a charged bubble is counter balanced by viscosity.
7. The unit of polarization is same as that of electric displacement.
8. The ratio of intensity magnetic field at the centre of a very long solenoid to that at the end of the solenoid is 2.
9. Magnetic vector potential is discontinues across any boundary.
10. For a steady current flow inducing magnetization M , $\nabla \cdot \nabla \times M$ cannot be zero.

(10 × 1=10 Marks)

Section B

(Answer in Two or three sentences)

Answer all questions. Each question carries 2 marks.

11. Write the advantages of potential formulation in electrostatics.
12. Write the electrostatics boundary conditions regarding \bar{D} and V .
13. Get the relation between electric susceptibility and dielectric constant of a linear dielectric medium.
14. Comment on first uniqueness theorem.
15. How $\nabla \cdot \bar{B}$ leads to conclusion that magnetic monopoles cannot exist.
16. Derive cyclotron formula.
17. Explain the magnetic saturation of a ferromagnetic material based on competing magnetic domains?

(7 × 2=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. Using Gauss's law find the electric field inside and outside a spherical shell of radius R , which carries uniform charge density σ .
19. Based on the solution to Laplace's equation in three dimensions prove that value of potential at a point is the average value of V over a spherical surface of radius R centered at P .
20. Describe polar and non polar dielectric materials.
21. A sphere of linear dielectric material is placed in a uniform electric field E_0 . Find the new field inside the sphere.
22. Derive the mathematical statement of local charge conservation.
23. Compare magnetostatics and electrostatics.
24. Obtain the relation between magnetic susceptibility and permeability of a medium.

(5 × 4=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. Three point charges each of $100\mu\text{C}$ are placed at the three corners of a square of side 10 cm. Find the total potential energy of the system, when a fourth charge of same magnitude is brought to the last corner of the square.
26. Find the capacitance of two concentric spherical metallic shells, with inner radius a and outer radius b .
27. Derive the law of refraction for electric line of force.
28. A dielectric slab of thickness 4 mm and dielectric constant 6 is placed between two oppositely charged plates. If a potential difference of 200 volt is applied between the plates, calculate the (i) polarization in the dielectric (ii) electric displacement and (iii) bound charges inside the dielectric.
29. Find the vector potential of an infinite solenoid with N turns per unit length, radius R and current I .
30. An electron beam passes undeviated normal to a crossed electric and magnetic field of magnitudes 4×10^4 V/m and 6×10^{-3} tesla. Find the velocity of electron leaving out undeviated from the crossed fields and also find the radius of electron path when the electric field is switched off.
31. Calculate the intensity of magnetization inside a metal rod if a magnetizing field results in a magnetic field of 3×10^{-4} weber/m² induced in vacuum and a magnetic field of 1.5×10^{-3} weber/m² induced in the material of the rod. (4 × 4=16 Marks)

SECTION E

(Essays - Answer in about two pages)

Answer any two questions. Each question carries 10 marks

32. Obtain the electrostatic boundary conditions and a relation between electric field and potential.
33. Derive Clausius-Mossotti formula connecting polarizability and dielectric constant.
34. Derive an expression for the magnetic field due to an infinitely long straight conductor and then find magnetic field at the centre of a square loop of side s , carrying current I .
35. Discuss the motion of electric charges in cyclotron and derive expressions for cyclotron frequency and maximum energy acquired by charge from cyclotron.

(2 × 10=20 Marks)