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1B3N22093

(Pages : 2)

Reg. No:.....

Name: .....

FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2022

BPH3B03 – Electrodynamics – I

(2019 Admission onwards)

Time: 2 hours

Max. Marks : 60

Section A- Short Answer Type

(Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks)

1. Write down Stoke's theorem, mention its use.
2. Discuss the principle of cyclotron motion.
3. What do you meant by volume bound current density?
4. Write down any four electrostatic properties of conductors.
5. Write down the expression for differential displacement vectors and differential volume element in cylindrical polar coordinates.
6. From differential form of Gauss's law obtain Laplace's equation.
7. Discuss Biot-Savart's law.
8. What are linear magnetic materials?
9. What is the relation between electric susceptibility and dielectric constant?
10. Discuss briefly about Dirac delta function.
11. Write down any four properties of paramagnetic materials.
12. Write down the relation between the Cartesian coordinates and spherical polar coordinates of a point in 3-D.

(Ceiling-20)

Section B- Paragraph/ Problem Type

(Answer all questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks)

13. A displacement vector $\vec{r}$ is defined by the distance between a fixed point (x', y', z') to the point (x, y, z). Find $\nabla(r^2)$ and $\nabla(\frac{1}{r})$, where r is the magnitude of $\vec{r}$.
14. Find the potential inside and outside a uniformly charged solid sphere whose radius is R and whose total charge is q. Use infinity as your reference point. Also sketch V(r).

15. Find the capacitance of a parallel plate capacitor. Obtain the expression for energy stored in a capacitor.
16. From the expression for the potential of a polarized object, discuss volume bound current density and surface bound current density.
17. A long straight wire, carrying uniform line charge 'λ', is surrounded by rubber insulation out to a radius 'a'. Find the electric displacement.
18. Using Biot-Savart's law, find the magnetic field a distance 's' from a long straight wire carrying a steady current 'I'.
19. Show that the effect of external magnetic field on atomic orbitals gives a qualitative description of diamagnetism.

(Ceiling- 30)

Section C- Essay Type

Answer any one question. Answer carries 10 marks

20. Starting from the expression for potential due to a point charge, show that electrostatic energy can be stored in the electric field.
21. (i) Discuss Ampere's law. From its integral form obtain the differential form.
    (ii) Obtain the magnetostatic boundary conditions.

(1x10= 10 Marks)

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FAROOK COLLEGE (AUTONOMOUS), KOZHIKODE

Third Semester B.Sc Degree Examination, November 2022

BPH3C03 – Mechanics, Relativity Waves & Oscillations

(2019 Admission onwards)

Time: 2 hours

Max. Marks : 60

Symbols used in this question paper have their usual meanings

SECTION A

(Answer *ALL* questions in 2 or 3 sentences. Each correct answer carries a maximum of 2 marks)

1. Distinguish between inertial and non-inertial frames of references.
2. What are Galilean transformations?
3. What are fictitious forces? Give examples.
4. What are conservative forces? Give two examples.
5. Define C-frame of reference. Why is it called a zero momentum frame?
6. State the postulates of special theory of relativity.
7. Write down the mass- energy relation , explaining the symbols. Give one example for conversion of energy into mass.
8. What is meant by 'time dilation' in relativity?
9. Write down the momentum-energy relation in relativity. Explain the symbols.
10. Mention the properties of electromagnetic waves.
11. Define phase velocity and group velocity.
12. Write down the Schrodinger equation. Define Hamiltonian.

(Ceiling- 20 marks)

SECTION B (Paragraph/ Problem)

(Answer *ALL* questions in a paragraph of about half a page to one page. Each correct answer carries a maximum of 5 marks)

13. Show that 'if a frame is an inertial frame, then all those frames, which are moving with constant velocity relative to the first frame, are also inertial.

14. If a force $(5\hat{\imath} - 3\hat{\jmath} + \hat{k})$ N acts on a particle during a displacement from a point A(20,15,0) m to point B(0,0,7) m , find the work done on the particle.

15. A rod is moving with velocity 0.6c with respect to the laboratory. If an observer sitting in the laboratory measures its length as 1 m, calculate its proper length.

16. Show that in the non relativistic limit, the Lorentz transformations reduce to Galilean transformations.

17. A particle describes simple harmonic vibrations in a line 4 cm long. Its velocity when passing through the centre of the line is 12 cm. Find the period.

18. The work function of aluminium is 4.2 eV. Calculate the kinetic energy of the fastest photoelectrons, the stopping potential and the cut off wavelength when light of wavelength 2000 A^0 falls on a clean aluminium surface.

19. An electron is confined to a box of length 10^{-9}m. Calculate the minimum uncertainty in velocity. Given mass of electron = 9.1×10^{-31} kg.

(Ceiling- 30 marks)

SECTION C (Essay)

(Answer anyone in about two pages. Each question carries 10 marks)

20. Explain the principle of a rocket. Derive an expression for the velocity of rocket at any instant.

21. Derive an expression for energy density of a plane progressive wave.

(1 x 10 = 10 marks)