

Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, October 2019

First Degree Programme under CBCSS

Physics

Core Course I

PY 1341 – ELECTRODYNAMICS

(2018 Admission)

Time : 3 Hours

Max. Marks : 80

PART – A

Answer **all** the questions. Answer should not exceed **2** sentences. Each question carries **1** mark.

1. Define polarization.
2. State Coulomb's law.
3. What is magnetic vector potential?
4. What is Q-factor in AC circuit?
5. What is meant by electrostatic shielding?
6. What is a choke coil?
7. What is meant by electromagnetic induction?
8. What are RL circuits used for?

9. What is the significance of Laplace equation?
10. Give the equation for torque about the center of a "perfect" dipole of infinitesimal length.

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. Answer should not exceed **one** small paragraph. Each question carries **2** marks.

11. Why magnetic forces cannot do work?
12. Discuss the properties of linear dielectric.
13. Obtain an expression for the potential of a localized charge distribution.
14. Discuss the applications of Ampere's circuital law.
15. Explain Ampere's circuital theorem. Use the theorem to find the magnetic field of a very long solenoid consisting of n closely wound turns per unit length on a cylinder of radius R and carrying a steady current I .
16. Discuss motional emf.
17. What is the advantage of the potential formulation?
18. What is electric potential? Show that electric potential is the line integral of the electric field.
19. Define equipotential surfaces. Give its important properties.
20. Obtain Laplace equation.
21. Define electric displacement. Obtain an expression for electric displacement.
22. Explain Biot-Savart Law.

(8 × 2 = 16 Marks)

PART – C

Answer any six questions. Each question carries 4 marks.

23. A capacitor of capacitance $0.1 \mu\text{F}$ is first charged and then discharged through resistance of 10 mega ohm. Find the time, the potential will take to fall to half its original value.
24. In an experiment to determine high resistance by leakage, a capacitor of $0.2 \mu\text{F}$ is used. It is fully charged and discharged through a B.G. The observed kick was 12 cm on the scale. The capacitor was fully charged again and allowed to leak through R for 2 sec. The remaining charge in C gave a kick of 6 cm on the same scale when discharged through the B.G. Calculate R.
25. Find the vector potential of an infinite solenoid with n turns per unit length, radius R , and current I .
26. A $0.5 \mu\text{F}$ capacitor is discharged through a resistance of 10 mega ohm. Find the time taken for half the charge on the capacitor to escape.
27. Calculate the polarisation vector of the material which has 100 dipoles per unit volume in a volume of 2 units.
28. A current I is uniformly distributed over a wire of circular cross section, with a radius a . Find the volume current density J . Suppose the current density in the wire is proportional to the distance from the axis, $J = kr$ (for some constant k). Find the total current in the wire.
29. A spherical charge distribution having volume charge density $A\varepsilon_0 e^{-br}(1-br)/r^2$ what is the electric field E on the surface of the sphere?
30. A circuit consists of a non-inductive resistance of 50 ohms, an inductance of 0.3 henry, and a resistance of 2 ohms and a capacitor of 40 micro-farad in series and is supplied with 200 volts at 50 Hz. Find the impedance, the current, lag or lead, and the Power in the circuit.
31. A long straight wire, carrying uniform line charge λ , is surrounded by rubber insulation out to a radius a . Find the electric displacement.

(6 × 4 = 24 Marks)

PART – D

Answer **any two** questions. Each question carries **15** marks.

32. Derive an expression for energy of a charged capacitor. Show that the dielectric in between the plates of a parallel plate capacitor experiences a force and derive an equation for it.
33. Explain the electrostatic properties of a conductor. Derive an expression for force on surface of a charged conductor.
34. (a) State and explain Ampere's law.
(b) Derive the expression for the magnetic field due to
 - (i) solenoid
 - (ii) toroid.
35. With necessary theory obtain electrostatic boundary conditions. Discuss about work and energy in electrostatics.

(2 × 15 = 30 Marks)