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# Third Semester B.Sc. Degree Examination, February 2024 First Degree Programme under CBCSS

## **Physics**

#### Core Course I

**PY 1341 : ELECTRODYNAMICS** 

(2018 Admission Onwards)

Time: 3 Hours

Max. Marks: 80

#### SECTION - A

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

- 1. State Coulomb's Law.
- 2. Define equipotential surface.
- 3. Write down the integral version of Amperes law.
- 4. Write the expression for magnetic field in terms of vector potential.
- 5. Define magnetic torque.
- 6. State ohms law with the equation in terms of electric field.
- 7. Write Maxwells equation.
- 8. Write an expression for classical wave equation.
- 9. Write an expression for pointing vector.
- 10. Draw the series LCR (acceptor) circuit.

 $(10 \times 1 = 10 \text{ Marks})$ 

#### SECTION - B

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

- Prove that curl of electric field is zero.
- Derive Poisson's equation and give the condition for which Poisson's equation reduces to Laplace's equation.
- Derive an expression for Gauss's law in the presence of dielectrics.
- 14. Give an account on induced dipoles and define atomic polarizability.
- 15. State Biot-Savart Law. Give the expression for magnetic field of a steady line current.
- 16. Deduce Ampere's Circuital Law.
- 17. Prove  $\nabla \cdot A = 0$ ?
- 18. Deduce the intensity of the electromagnetic wave using the Poynting vector.
- 19. Deduce the wave equations for E and B.
- 20. Define the time constant of an LR circuit in which current is decaying.
- 21. What is meant by Q factor?
- 22. Distinguish between acceptor and rejector circuits.

 $(8 \times 2 = 16 \text{ Marks})$ 

## SECTION - C

Answer any **six** questions. Each question carries **4** marks.

- 23. Three equal point charges 'q' are placed at the vertices of an equilateral triangle of side 'a'. Find the net force acting on any one charge due to others?
- 24. A long straight wire, carrying uniform line charge  $\lambda$ , is surrounded by rubber insulation out to a radius a. Find the electric displacement.
- 25. Using Ampere's law, find the magnetic field at a distance S from a long straight wire carrying a steady current I?
- 26. Deduce an expression for magnetic field inside a solenoid.

- 27. Discuss energy and momentum of electromagnetic waves.
- Discuss the properties of electromagnetic waves in conductors and obtain the modified wave equation for E and B.
- 29. What is the resonant frequency of a circuit containing a coil of inductance 0.20 henry and capacitance 0.002  $\mu F$ ?
- 30. An alternating emf 220 volts. 50 cps is applied to a circuit containing an inductance of 0.2H and a resistance I5ohms in series. Calculate (a) the current (b) phase lag (c) p.d.across the resistance and inductance.
- 31. Find the value of the current through an inductance of 0.5H when an alternating emf of 220 volts at 50cps is applied to it.

 $(6 \times 4 = 24 \text{ Marks})$ 

## SECTION - D

Answer any two questions. Each question carries 15 marks.

- 32. Derive an expression to find the work done to move a charge from infinity to a point at a specific distance. Also, deduce the energy of a point charge distribution.
- 33. Explain and derive an expression for the field inside a dielectric.
- 34. Explain and derive integral form of Faraday's law. Also, write a note on induced electric field.
- 35. Discuss the problem of charging of a capacitor in an LCR series circuit.

  (2  $\times$  15 = 3)

 $(2 \times 15 = 30 \text{ Marks})$