Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, January 2023

First Degree Programme under CBCSS

Physics

Core Course – I

PY 1341 — ELECTRODYNAMICS

(2019 Admission onwards)

Time : 3 Hours   Max. Marks : 80

SECTION – A

Answer **all** questions. **Each** carries **1** mark.

1. State Coulomb's Law.

2. What you mean by electric flux?

3. For plane symmetry, the Gaussian surface is ————

4. What are dielectrics?

5. Explain Polarization.

6. $A \times (B \times C) =$

7. Is current vector or scalar?

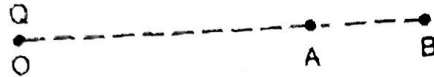8. Give the integral form of Faraday's law.

9. What is the required condition for resonant frequency?

10. Current per unit area perpendicular to flow is called?

(10 × 1 = 10 Marks)

SECTION – B

Answer any **eight** questions, **Each** carries **2** marks

11. A point charge Q is placed at point O as shown in the figure. Is the potential difference $(V_A - V_B)$ positive, negative or zero, if Q is positive?

12. Two charges 5µC and -5µC are placed at points A and B 2cm apart. Depict an equipotential surface of the system.

13. What are the properties of electric filed lines?

14. Derive Laplace's equation.

15. "Magnetic force do no work". Justify the statement.

16. Give Stokes's theorem. What is its geometrical interpretation?

17. Define the term' potential energy' of charge 'q' at a distance V in an external electric field.

18. Illustrate hysteresis loop.

19. What do you mean by electric displacement?

20. Briefly explain electromotive force.

21. Give Maxwell's equations.

22. What do you mean by impedance?

23. Define quality factor (Q).

24. What is the significance of cosΦ in a series LCR circuit?

25. Differentiate between acceptor circuit and rejecter circuit.

26. Why we take rms values in case of ac current and voltages?

$(8 \times 2 = 16$ Marks$)$

SECTION – C

Answer any **six** questions, not exceeding a paragraph. **Each** carries **4** marks.

27. Find the electric filed at a distance z above the midpoint of a straight-line segment of length 2L, which carries a uniform line charge λ.

28. A long cylinder carries a charge density that is proportional to the distance from the axis ρ = ks for some constant k. Find the electric filed inside this cylinder.

29. Using Ampere's circuital law, obtain an expression for the magnetic field along the axis of a current carrying solenoid of length l and having N number of turns.

30. Find the electric field produced by a uniformly polarized sphere of radius R.

31. Using Biot – Savarts law, Find the magnetic field at a distances from a long straight wire carrying steady current I.

32. Compare Magnetostatics and Electrostatics with suitable mathematical support.

33. How can you express Ohm's law in terms of current density and electric field? A cylindrical resistor of cross-sectional area A and length L is made from material of conductivity σ. If potential difference is V. What is the current flow?

34. How will you measure high resistance by the method of leakage of charge of a capacitor?

35. Check that the following functions obey wave equation or not.

    (a) $f(z,t) = Ae^{-b(bz^2 - vt)^1}$

    (b) $f(z,t) = A\sin[b(z-vt)]^1$

36. Derive the expression for magnetic vector potential.

37. A dc voltage of 80V is switched on to a circuit containing resistance of 5Ω in series with an inductance of 20H. Calculate the rate of growth of current at the instant when current is 6A.

38. A resistor of 200 Ω and a capacitor of 15.0 μF are connected in series to a 220 V. 50 Hz ac source.

    (a) Calculate the current in the circuit

    (b) Calculate the voltage (rms) across the resistor and the capacitor.

    (6 × 4 = 24 Marks)

SECTION – D

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

39. Briefly discuss electrostatic boundary conditions.

40. What do you mean by magnetic field? How Biot – Savart law is useful in determining the magnetic field at a point? Derive the expression for divergence and curl of B.

41. What you mean by motional emf? With a neat diagram, prove flux rule for motional emf.

42. What you mean by electromagnetic waves? Explain its properties. Also derive the one-dimensional wave equation and solve for it.

43. What are bound charges? Obtain the expression for surface and volume charge density. Also explain the physical interpretation of bound charges.

44. Briefly explain Growth and decay of current in CR circuit.

    (2 × 15 = 30 Marks)