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Reg. No. : .....

Name : .....

Third Semester B.Sc. Degree Examination, March 2022

First Degree Programme under CBCSS

Physics

Core Course

PY 1341 — ELECTRODYNAMICS

(2018 Admission)

Time : 3 Hours Max. Marks : 80

SECTION – A

Answer **all** questions in **one** or **two** sentences. Each question carries **1** mark.

1. What are the applicable Conditions of Gauss' law?
2. A point charge is moved in an electrostatics field. What path must be followed for a maximum rate of expenditure of energy?
3. Write down the boundary conditions at a surface separating two dielectric media.
4. How does a crystal get polarized?
5. What will happen to a diamagnetic substance when placed in a non-uniform magnetic field?
6. State Faraday's law.
7. What is Poynting vector?
8. If a coil has an inductance of 500mH and a resistance of 50Ω, find the time constant.
9. Draw the Curves showing the growth of charge of a capacitor through inductance and resistance in series with dc Source.
10. What is the importance of form factor?

(10 × 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **eight** questions, not exceeding a paragraph. Each question carries **2** marks.

11. State and explain Coulomb's law.

12. List the properties of electric field lines.

13. Explain dielectric breakdown.

14. Does a static magnetic field can change the kinetic energy of a moving charge? Explain.

15. Write down the Maxwell's equations in electrostatics and name them.

16. Explain the concept of displacement current.

17. Why are Maxwell's equations important?

18. Find the expression for the time at which the growing current and decay current are equal.

19. Why does the parallel LCR circuit be known as rejector circuit?

20. What is wattless Current? How is it obtained?

21. In a stationary medium, what are the constituent currents responsible for the total current? Explain.

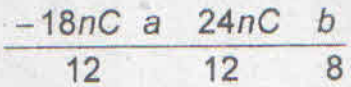
22. If an electric field of an electromagnetic wave in free space is represented by $E = E_0 \sin(\omega t - kx) j$, find B and H.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Two charges of magnitude 24nC and -18nC are placed 24 cm apart as shown. Find the potential difference V_{ab} between the two points.



24. Prove Gauss' law using Coulomb's law.

25. Show that $D = \varepsilon_0 E + P$.

26. A square coil of side 2cm carries a current 0.5A. Calculate the magnetic induction at the center of the coil.

27. Derive the wave equations for E and B from Maxwell's equations.

28. A solenoid of resistance 10Ω and self-inductance 500mH is connected to a battery' of 100V and negligible resistance. After how long will the current in it rise to 1A.

29. A coil of 10Ω resistance and 10mH inductance is connected in series with a condenser of $1\,\mu F$ and an ac supply of 100V at 50Hz. Calculate the impedance of the circuit. What should be the operating frequency to obtain resonance?

30. A series LCR circuit with the following components L = 50mH C = $10\,\mu F$, and R = 50Ω is connected to ac source with Voltage 20V and frequency 50Hz. Calculate the average power dissipated and power factor.

31. A battery of emf 50V is connected in series with an inductance of 50mH, a resistance of 50Ω and a capacitor of $5\,\mu F$. Find the frequency of the oscillatory current, logarithmic decrement and the final capacitor charge.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Each question carries **12** marks.

32. (a) Derive the expression for energy of a point charge distribution.

    (b) Obtain Poisson's equation in electrostatics from Gauss' law.

33. (a) State and prove Ampere's circuit law. Obtain its differential form.

    (b) Derive the expression for magnetic vector potential due to a current loop.

34. Discuss the growth and decay of charge through a circuit containing a resistance and capacitor. Explain how this theory can be applied to the measurement of high resistance.

35. Analyse the discharge of a capacitor through a circuit containing inductance with some resistance.

(2 × 15 = 30 Marks)