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P – 3840

Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, January 2023.

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. State Gauss' law.
2. Write down the dimensions of electric flux.
3. What is polarizability?
4. Why does the electric displacement vector be so important?
5. Give the differential and integral form of Gauss' law in magnetostatics.
6. State Ohm's law.
7. How do the energy density and momentum density of electromagnetic waves relate to Poynting vector?

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8. If a capacitor of 500nF is connected in series with a resistance of 50Ω , and 10V DC supply, find the time constant.
9. Express Q factor in terms of bandwidth.
10. What is power factor?

(10 × 1 = 10 Marks)

SECTION – B

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

11. List the fundamental properties of electric charge.
12. How do Poisson's and Laplace equations be connected?
13. Distinguish between polar and nonpolar molecules with an example.
14. What is Biot-Savart Law? Why is it so important?
15. Write down the Maxwell's equations in magnetostatics and name them.
16. What do you understand from the solenoidal nature of magnetic induction?
17. By the method of leakage only high resistance can be measured. Why?
18. Compare series and parallel resonant circuits.
19. A series LCR circuit as an acceptor circuit. Explain why?
20. What are the losses when a current passes through a resistance wire?
21. What is the important role of a discharging capacitor through an inductor and resistor in wireless telegraphy?
22. Prove that the velocity of electromagnetic wave in any medium depends on the permittivity and permeability.

(8 × 2 = 16 Marks)

SECTION – C

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

23. Two equal charges are separated by a distance of 0.5m. The electric force between the charges is $9\mu N$. Find the value of the charge. What will be the force if the charges are halved and the distance between them is doubled?
24. Show that the curl of an electrostatic field is zero.
25. An electric line of force is going from a dielectric of dielectric constant 4 to another with dielectric constant 3 making an angle of 60° with the boundary in the first dielectric. Find its direction in the second dielectric using the law of refraction of electrostatic lines of force.
26. A circular coil of wire of diameter 20cm have 100 turns. The coil is placed in a uniform magnetic field of 0.5T. The current through the coil is 2A. Determine the maximum torque on the coil.
27. A copper wire of diameter 2mm and length 40cm is arranged in the shape of a square. A magnetic field exists perpendicular to the plane of the square and it changes with a rate $-0.02T/s$. Determine the current induced in the frame. Given the resistivity of copper $1.7 \times 10^{-8} \Omega m$.
28. A $1\mu F$ capacitor is charged by a 100V battery. It is then discharged through a $2M\Omega$ resistor. Determine the value of the potential difference across the capacitor in a time of 5s. How much time will take to become the voltage across the capacitor to half its initial value?
29. If the refractive index of glass is 1.50, find its permittivity and the speed of light through it.
30. Write down Maxwell's equation in both differential and integral forms.
31. A battery of emf 100V is connected in series with an inductance of 500mH, a resistance of 500Ω and a capacitor of $0.5\mu F$. 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 **15** marks.

32. (a) Derive the expression for energy of a continuous charge distribution.
(b) Obtain the Gauss' law in dielectrics.
33. Discuss the properties of various types of magnetic materials.
34. Discuss the growth and decay of current through a circuit containing resistance and inductance. Plot the variations of current with various time constants. Find the expression for the time at which the growing current and decay current are equal.
35. Analyse the working of a circuit containing inductance with some resistance connected in parallel with a capacitor supplied with an ac voltage.

(2 × 15 = 30 Marks)