Reg. No. : ....

Name : ....

Third Semester B.Sc. Degree Examination, March 2022

First Degree Programme under CBCSS

Physics

Core Course

PY 1341 : ELECTRODYNAMICS

(2019 & 2020 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. The electromagnetic waves are ——————— in nature

2. The relation connecting Electric field E and the potential V is ———————

3. Give an example for polar molecule.

4. Two parallel conductors separated by a distance d carries same current I in opposite direction. What is the force per unit length acting on the conductor.

5. The Ferromagnetic property can be explained on the basis of formation of —————————

6. In free space, Poisson's equation is ———————

7. The time constant in a LR circuit is ———————

8. The phase difference between current and voltage at resonance in a series LCR circuit is ――――――

9. The index of refraction of the material whose dielectric constant ε_r ――――――

10. A monochromatic plane electromagnetic wave traveling in vacuum in z direction. What are the corresponding electric field and magnetic field vector.

(10 × 1 = 10 Marks)

SECTION – B

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

11. Write down two fundamental equations of electrostatic field. Write its integral form.

12. Is electrostatic force is conservative or not. Explain.

13. Sketch the electric field lines due to

    (a) point charge

    (b) dipole

14. State Gauss's theorem in magneto statics.

15. Define power factor.

16. What is displacement current. How its differed from conduction current.

17. Define magnetic vector potential. How it is related to magnetic flux.

18. What is Poynting vector. Give an expression for the same.

19. What is meant by electro motive force?

20. Discuss the necessity of the term displacement current in Maxwell's equation.

21. Comment on the statement Maxwell's equations beg for magnetic charge to exist.

22. Explain Ampere's circuital theorem.

23. Explain Biot-Savart law.

24. State and explain Gauss's law in the presence of dielectric.

25. Show that electrostatic energy did not hold superposition principle.

26. Sketch the variation of electric field and potential due to a spherical shell of radius R having uniform surface charge density (both inside and outside).

(8 × 2 = 16 Marks)

SECTION – C

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

27. A long straight wire. carrying uniform line charge λ, is surrounded by rubber insulation out to a radius a. Find electric displacement.

28. A LCR circuit is critically damped with L = 2 mH and R = 100Ω. Find the value of capacitance C. For what values of C the circuit will be oscillatory.

29. What do you mean by intensity of electromagnetic wave. Give an expression for the same.

30. A circular cross-section conductor of radius 1.5 mm carries a current $i_c = 5.5 \sin 10^{10} t (\mu A)$. What is the amplitude of displacement current density if $\sigma = 35 \times 10^6 \, S/m$ and $\varepsilon_r = 1$. At what frequency conduction current will be equal to the displacement current.

31. Briefly explain how magnetic materials are classified.

32. Briefly explain physical interpretation of bound changes.

33. An inductor of inductance 100 mH is connected in series with a resistance 1 $k\Omega$, a variable capacitance and an ac source 2 kHz. What should be the value of the capacitance so that maximum current may drawn to the circuit.

34. Calculate electric potential due to a dipole.

35. Check whether is possible or impossible electric field or not
$$\vec{E} = k(xy\hat{x} + 2yz\hat{y} + 3xz\hat{z})$$

36. Obtain expression for potential energy of system of charges.

37. The magnetic susceptibility of a linear medium is 948×10^{-9}. Calculate permeability and relative permeability. If it is subjected to a uniform field 1 T find M and B.

38. A long copper rod of radius R carries a uniformly distributed free current I. find H inside and outside the rod.

(6 × 4 = 24 Marks)

SECTION – D

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

39. With necessary theory obtain electrostatic boundary conditions. Discuss work and energy in electrostatics. Derive expression for the energy of continuous charge distribution.

40. Explain briefly atomic polarizability and polarizability tensor. Derive an expression for torque acting a dipole placed in a uniform field. What will happen if field is non uniform.

41. State and explain Ampere's circuital theorem. Obtain its differential form. Using Ampere's law find magnetic field inside (a) Solenoid (b) Toroid

42. Write down Maxwell's equations in free space. Hence show that electric filed and magnetic fields can propagate in such a space as wave. Obtain the expression for velocity of electromagnetic wave in terms of μ and ε.

43. With necessary theory compare and contrast series and parallel LCR circuit.

44. Explain decay of charge through a CR circuit. Sketch the growth and decay curve and hence explain time constant of a CR circuit. Explain how high resistance is measured using CR circuit.

(2 × 15 = 30 Marks)

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