D 30195 (Pages : 4) Name.....

Reg. No.....

FIFTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION NOVEMBER 2022

Physics/Applied Physics

PHY 5B 06/APY 5B 07—ELECTRODYNAMICS—II

(2017—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

The symbols used in the question paper have their usual meanings.

Section A

Answer in a word **or** *a phrase.*
Answer **all** *questions.*
Each question carries 1 *mark.*

1. Write down Ampere's law in integral form.
2. If μ_0 represents the permeability, E is the electric field and B is the magnetic field intensities, then the expression for poynting vector is ————.
3. If Q is the charge on the capacitor with capacitance C at any instant 't', then the potential difference across the capacitor is ———— in a series CR circuit.
4. The ratio of rms value of emf to the mean value of emf is called ————.
5. The condition at which an LCR series circuit allows maximum current to flow as the impendence is minimum is known as ————.

Write True *or* False :

6. Electromagnetic waves travel with the same speed irrespective of the nature of the medium.
7. The tangential component of E is continuous across the boundary between two media.
8. As the value of L/R in an LR series circuit increases, the time taken by the current to reach its maximum value also increases.
9. In a capacitative circuit, the instantaneous value of current is leading the emf by $\pi/2$ in phase.
10. Norton's theorem can be applied to networks with DC only

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in two* **or** *three sentences.*
Each question carries 2 *marks.*

11. State and explain Lenz's law in electromagnetic induction.
12. Write down maxwell's equations in free space.

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13. Explain polarization of electromagnetic waves.

14. Give an explanation for dead beat galvanometer. What are the conditions for a moving coil galvanometer to be dead beat ?

15. Give and expression for the growth of charge in a CR circuit. What are the terms involved ?

16. Define power factor in an LR series circuit and give an expression for the same.

17. State and explain Kirchoff s voltage law and current law.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions in paragraph of about* **half a page to one page.**

Each question carries 4 *marks.*

18. Obtain and expression for energy stored in a magnetic field in terms of magnetic field, B.

19. Explain how Ampere's law is modified by Maxwell to include time varying electric fields ?

20. Obtain an expression for electromagnetic wave equation in free space and hence prove EM in space travels with the velocity of light.

21. Derive an expression for the growth and decay of current in a circuit containing inductor and resistor.

22. Define J operator. Give three applications of J operator in AC circuits.

23. With suitable example, explain the solution of simultaneous equations using determinants.

24. State Thevenin's theorem. Give the different steps involved in thevenizing a given circuit network.

(5 × 4 = 20 marks)

Section D

Problems-Write all Relevant formulas, all important steps carry separate marks.

Answer any **four** *questions.*

Each question carries 4 *marks.*

25. A short solenoid of length L and radius a, with n_1 number of turns per unit length lies on the axis of a very long solenoid of radius b with n_2 turns per unit length. Current I flow in the short solenoid. What is the flux through the long solenoid ?

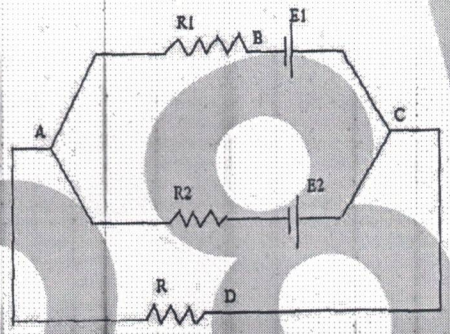
26. Find the energy stored in a solenoid of length 1, radius R, current I, N turns per unit length and having magnetic flux density, B.

27. The intensity of sunlight hitting the earth is about 1300 W/m^2. What is the pressure exerted if the sunlight strikes a perfect absorber ? Find the pressure exerted if sunlight strikes a perfect reflector ? Also find the fraction of atmospheric pressure related to it.

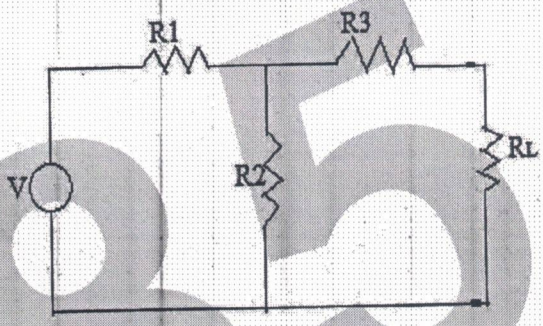
28. A capacitor is charged by a dc supply through a resistance of 2 megaohms. If it takes 1 second for the charge to reach ½ of its final value, what is the capacitance of the capacitor.

29. An alternating emf of 200 volt, 50 Hz is applied to a condenser in series with a 20 volt, 5 watt lamp. Find the capacity of the condenser.

30. Using superposition theorem find the current in the resistance R in the following figure. Given R_1 = 2.5 ohms, R_2 = 2 ohms, R = 6 ohms, E_1 = 6 V, E_2 = 12 V.



31. Apply Thevenin's theorem to find the current in load resistance of the circuit given, where R_1 = 8 ohms, R_2 = 4 ohms, R_3 = 6 ohms, R_L = 100 ohms, V = 24Volts.



(4 × 4 = 16 marks)

Turn over

Section E (Essays)

Answer in about **two pages.**
Answer any **two** *questions.*
Each question carries 10 *marks.*

32. Obtain the boundary conditions for E, B, D and H at a surface which carries charge density σ and current density K which separates two media using integral form of Maxwell's equations.

33. Obtain expressions for the average energy and momentum of an electromagnetic wave. What is the intensity of the wave and give an account for radiation pressure on a perfect absorber and reflector.

34. Using necessary theory, describe an experiment to determine the charge sensitiveness of BG using a standard condenser and HMS.

35. Explain the basic theory of AC bridges with circuit diagram. With necessary theory and diagram, explain how the self inductance of a coil can be measured using Rayleigh method.

(2 × 10 = 20 marks)