D 50208 **(Pages : 3)** **Name.....**

Reg. No.....

FIFTH SEMESTER (CUCBCSS–UG) DEGREE EXAMINATION
NOVEMBER 2023

Physics/Applied Physics

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

(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. Magnetic field can be produced by a current or by a changing ————.
2. The average power per unit area transported by an electromagnetic wave is called its ————.
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. Higher the quality factor of the circuit, then the impedance of the circuit is ————.
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. If the value of L/R in an LR series circuit increases, the time taken by the current to reach its maximum value decreases.
9. In pure inductive circuits, the current is lagging behind 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 Faraday's law in electromagnetic induction
12. Write down maxwell's equations in free space.

Turn over

13. Explain polarization of electromagnetic waves.
14. Give an explanation for ballistic galvanometer. What are the conditions for a moving coil galvanometer to be ballistic?
15. Give and expression for the instantaneous current in a series LR 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 maximum power transfer theorem.

(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. Explain briefly about magnetic charge.
19. Obtain an expression for the energy stored in a magnetic field in terms of current.
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. What are the basic steps for converting a voltage source with a series resistance into an equivalent current source with a parallel resistance ?
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.*

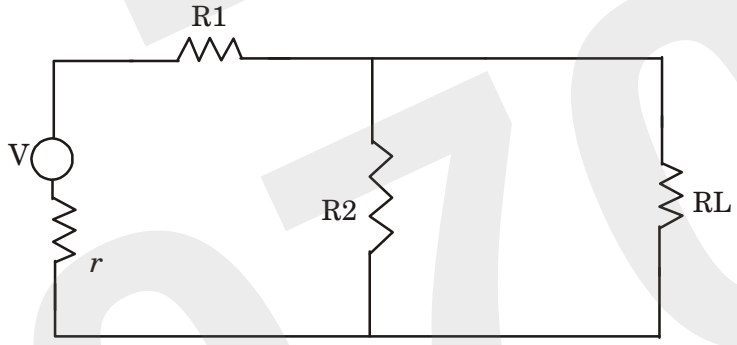
25. Write down Neumann's formula for mutual induction. Explain its importance.
26. Find the magnetic flux through a solenoid of length l with number of turns per unit length N and radius R carrying a current I. Also calculate self inductance per unit length of the coil.
27. The intensity of sunlight 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 1second 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. An alternating voltage of 100 V at a frequency of 25 Hz is applied to a circuit consisting a resistance 1.5Ω and an inductance of 0.01 Henry in series. a) find the current flowing b) phase difference between emf and current c) potential drop across resistor and inductor.

31. Apply Thevenin's theorem to find the current through the load resistance, $RL = 15\Omega$ in the following network. Given $R_1 = 3\Omega$, $R_2 = 12\Omega$, V = 24 Volts with an internal resistance $r = 1\Omega$.



(4 × 4 = 16 marks)

Section E

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

32. Derive the Maxwell's equations inside a polarized matter.

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. Obtain expressions for resultant emf, impedance and power factor of an LCR series circuit when an alternating current is flowing through it. Explain the resonance in LCR series circuit.

(2 × 10 = 20 marks)