D 50606 (Pages : 3) Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2018

(CUCBCSS—UG)

Physics/Applied Physics

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

Time : Three Hours Maximum : 80 Marks

Symbols used in this question paper have their usual meanings.

Section A

Answer in a word **or** *phrase.*

Answer **all** *questions. Each question carries* 1 *mark.*

1. Define Poynting vector.
2. Write down the Faraday's law of electromagnetic induction in integral form.
3. If the r.m.s. value of voltage of a source is 100 volts, its peak value of voltage will be ————.
4. If I_0 is the maximum value of current in an LR circuit connected to a cell of steady e.m.f. E, then write down the expression for the instantaneous current in the circuit at time t.
5. An ideal current source is that voltage source whose internal resistance is ————.

Questions 6 *to* 10. *Write True* **or** *False.*

6. For a moving coil galvanometer to be ballistic the moment of inertia of the moving system should be large.
7. At very low frequencies a series RC circuit behaves like a purely capacitive circuit.
8. Efficiency of power transfer when maximum transfer of power occurs is 100%.
9. Parallel components of H are continuous at a boundary between two different media.
10. For a monochromatic plane electromagnetic wave, the electric and magnetic contributions are equal.

(10 × 1 = 10 marks)

Section B

Answer in two **or** *three sentences.*

Answer **all** *questions. Each question carries* 2 *marks.*

11. What do you mean by polarization of a wave ? How the polarization vector n is related to the plane of vibration ?
12. Differentiate between conduction current and Displacement current.

Turn over

13. Define intensity and radiation pressure of an electromagnetic wave.

14. An e.m.f. $E = E_0 e^{j\omega t}$ is applied across a series LCR circuit. Derive the expression for average power. What do you mean by wattless current ?

15. Write the physical context of the statement $\nabla . B = 0$?

16. An inductance L, capacitance C and resistance R is connected in series to a cell of e.m.f. E and the capacitor is allowed to charge. Obtain the relation between L, C and R for the circuit to be damped oscillatory. Also find the frequency of oscillation in the circuit.

17. State and explain Kirchhoff's voltage law and current law.

(7 × 2 = 14 marks)

Section C

Answer in **a paragraph** *of about* **half a page to one page**.
Answer any **five** *questions. Each question carries 4 marks.*

18. Obtain an expression for the energy stored per unit volume in the magnetic field of an inductor, when a steady current i_0 is established in it.

19. State Ampere's law in magnetostatics. Show that Ampere's law fails for non-steady currents.

20. Describe how the constant K of a Ballistic Galvanometer can be determined using Hilbert's Magnetic Standard.

21. Give the different steps involved in Nortonizing a circuit network.

22. Derive an expression for the velocity of propagation of a plane electromagnetic wave in a medium of permeability μ and permittivity ϵ.

23. Obtain an expression for the growth and decay of charge in a capacitor through a resistance.

24. Explain how given voltage source with a series resistance can be converted into an equivalent current source with a parallel resistance.

(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. Find the induced e.m.f. in a 50 cm rod moving with a velocity of 2 m/s perpendicular to a field of 2×10^{-4} Wb/m^2.

26. A circuit contains resistance 200 Ω and inductance at 50 henry connected in series to an e.m.f. 100 volt. If the source is switched Off, what will be the current at the end of a) one fourth of a second ; and b) half a second.

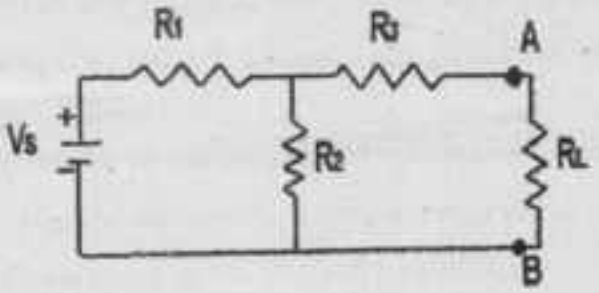
27. An a.c. supply of frequency 10000 and 110 V is connected across a circuit containing a resistance of 10 ohm, an inductance of 1 mH and a capacitor of 1 μF. find the value of the current. What must be the value of the capacitance in order that the current may be maximum ?

28. A solenoid has a length of 1 m. The number of turns per metre is 5×10^4 and diameter is 0.05 m. Find the magnetic flux when a current 2 A flows through it. Also calculate the self inductance of the coil.

29. Show that the standing wave $f(x, t) = A \sin(kx) \cos(kvt)$ satisfies the classical wave equation.

30. An e.m.f. 200 V at 50 Hz is applied to a circuit containing an inductance of 100 mH and a resistance 25 ohm in series. Calculate the magnitude and phase of the current.

31. Find the current through the load resistor R_L using Thevinin's theorem, if $V_S = 10$ V, $R_1 = R_3 = 10\ \Omega$, $R_2 = 5\ \Omega$ and $R_L = 100\ \Omega$.



(4 × 4 = 16 marks)

Section E

Essays. Answer in about **two pages.**

Answer any **two** *questions. Each question carries* 10 *marks.*

32. Derive the transmission and reflection coefficients for a plane wave of frequency ω, travelling in the *z* direction and polarized in the *x* direction falling at the interface of two linear media at *normal incidence.*

33. Explain self induction and mutual induction. Derive an expression for the force of repulsion between a coil carrying A.C. and a neighboring conductor ?

34. With necessary theory explain how the self inductance of a coil can be measured using Anderson's bridge.

35. Explain the *j* operator method in studying a.c. circuits. Discuss the theory of LR circuit when an alternating current is applied to it. Obtain expressions for the current and impedance of the circuit.

(2 × 10 = 20 marks)