

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(CUCBCSS—UG)

Physics/Applied Physics

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

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. Displacement current is given by the equation _____, if the electric field is E.
2. The average power per unit area transported by an electromagnetic wave is called its _____.
3. The phase difference between the current and the voltage across the resistance connected in series with inductance and capacitor in an a.c. circuit is _____.
4. The quality factor of an LCR circuit is given by _____.
5. The velocity of electromagnetic waves in a medium with permittivity ϵ and permeability μ is given by _____.

Write True or False :

6. Magnetic monopoles exist while electric monopole doesn't exist.
7. Electromagnetic wave is transverse and not longitudinal.
8. An ideal current source has infinite internal resistance.
9. A parallel resonant circuit is a rejector circuit.
10. In a purely capacitive circuit the power consumed is zero.

(10 × 1 = 10 marks)

Turn over

Section B

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

Each question carries 2 marks.

11. State and explain Faradays law.
12. Give the Maxwell's equations in linear medium.
13. Define figure of merit of a moving coil mirror galvanometer. What is its unit ?
14. Show graphically the relation between current and e.m.f having a pure inductance. Explain.
15. What is j operator? Give one of its applications to A.C. Circuits.
16. State Maximum Power Transfer theorem. Give one of its applications.
17. State Kirchoffs laws in Network theory.

(7 × 2 = 14 marks)

Section C

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

Each question carries 4 marks.

18. Find Neumann formula for Mutual induction.
19. Why Ampere Circuital law is to be modified ? How is it modified by Maxwell ?
20. What is radiation pressure due to electromagnetic field ? Find how it is related to intensity of the wave.
21. Plot the graph showing the relation between charge and time in (a) Critically damped ; and (b) Oscillatory discharge of a capacitor. Give the conditions in each case
22. An insulated wire has an iron core. An aluminium ring is slipped over the core so as to rest on the top of the coil. If an alternating current is passed through the coil show that the coil will repel the ring.
23. State Norton's theorem and explain it with an example.
24. Write down the real electric and magnetic field for a monochromatic plane wave of amplitude E_0 , frequency ω and phase angle zero that is travelling in the positive x direction and polarized in the z direction.

(5 × 4 = 20 marks)

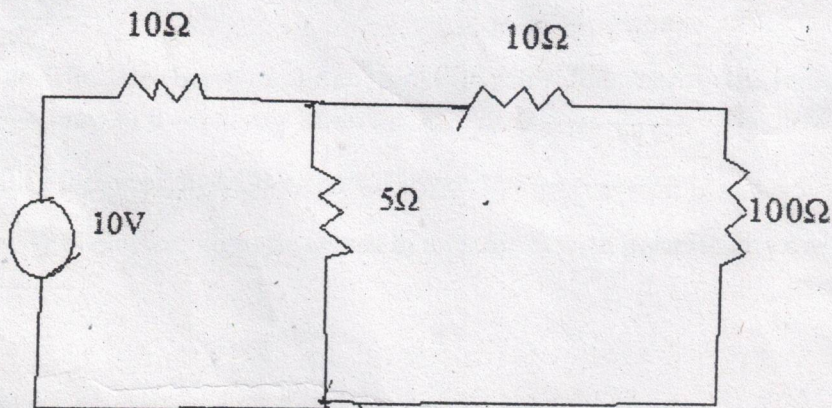
Section D

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

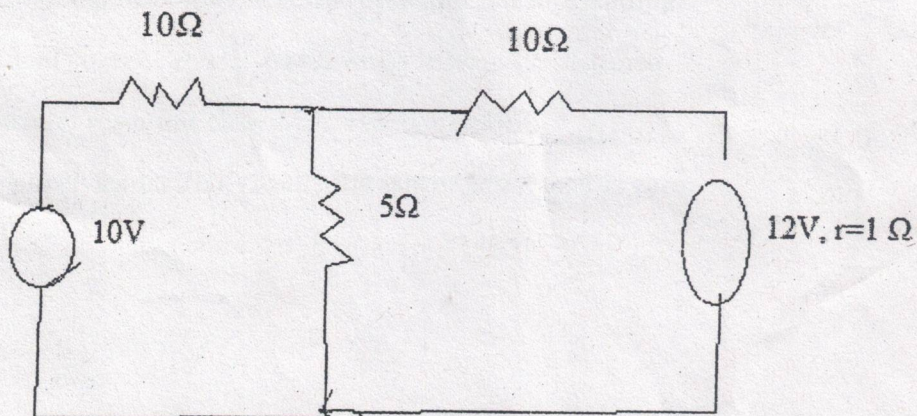
Answer any **four** questions.

Each question carries 4 marks.

25. A long coaxial cable has current I flowing down the surface of the inner cylinder of radius a , and back along the outer cylinder of radius b . Find the magnetic energy stored in section of length l .
26. Are the electric field and magnetic field continuous at a boundary between two different media? Find the relevant equations.
27. From Maxwell's equations find the wave equation for the Electric field in vacuum.
28. A capacitor $3\mu\text{F}$ is discharged through a resistance. The time taken for half the charge on the capacitor to leak is found to be 5 seconds. Compute the value of the resistance.
29. An a. c of 100 V and 50 hertz is applied across a series circuit having an inductance of 5 henry, a resistance of 100 ohm and a variable capacitance. At what value of capacitance will the current in the circuit be in phase with the applied voltage? Calculate the current in this condition.
30. Use Thevenin's theorem to find the current in load resistance of $100\ \Omega$ in the circuit given.



31. Use Superposition theorem to find current through the $5\ \Omega$ resistance.



(4 × 4 = 16 marks)

Turn over

Section E (Essays)

Answer in about two pages

Answer any two questions.

Each question carries 10 marks.

32. Explain how Maxwell's equations in vacuum are modified in Matter.
33. Find the boundary conditions for reflection and transmission of electromagnetic wave, when propagated through a string which is tied onto a second string.
34. Discuss the growth of current in an inductor in a circuit containing resistance connected to a cell of steady e.m.f. Also find the time constant of the circuit.
35. Describe the Raleigh's method to find the self inductance of a coil with the necessary diagram and theory.

(2 × 10 = 20 marks)