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.*

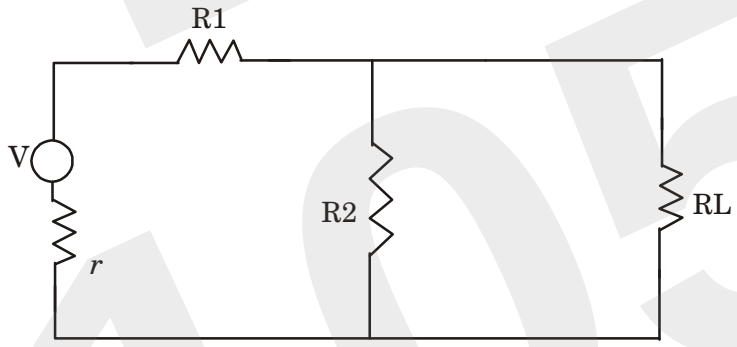
25. Write down Neumann's formula for mutual induction. Explain its importance.
26. Find the magnetic flux through a solenoid of length l with number of turns per unit length N and radius R carrying a current I. Also calculate self inductance per unit length of the coil.
27. The intensity of sunlight 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)

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.

Turn over

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 ?

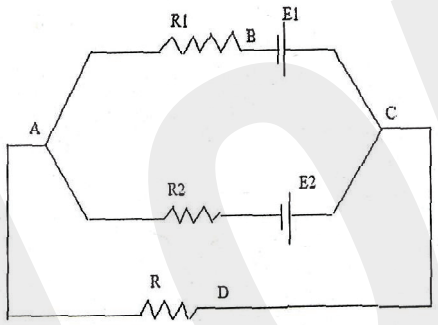
26. Find the energy stored in a solenoid of length 1, radius R, current I, N turns per unit length and having magnetic flux density, B.

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.

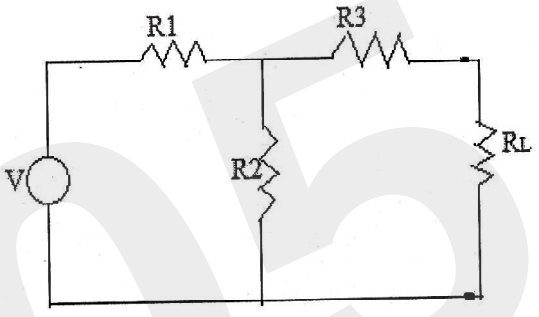
28. A capacitor is charged by a dc supply through a resistance of 2 megaohms. If it takes 1 second for the charge to reach ½ of its final value, what is the capacitance of the capacitor.

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)

D 10243 **(Pages : 4)** **Name.....**

Reg. No.....

FIFTH SEMESTER B.A./B.Sc. DEGREE EXAMINATION, NOVEMBER 2021

(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. 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. The smaller is the time constant CR, the ———— is the discharge of the capacitor in a series CR circuit.
4. The ratio of r.m.s. value of current to the mean value of current is called ————.
5. Higher the quality factor of a circuit, ———— is its bandwidth.

Write True *or* False :

6. Electromagnetic waves travel with the speed of light in vacuum.
7. The tangential component of H 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 e.m.f. by $\pi/2$ in phase.
10. Thevenin's theorem can be applied to networks with DC only.

(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 Faraday's law in electromagnetic induction.

12. Write down the importance of displacement current in Maxwell's equations.

13. Define Poynting vector and give an expression for the same.

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. Draw the basic circuit of an AC bridge and write down the condition to balance it.

17. State and explain maximum power transfer theorem.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions in* **a 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. Show that the energy flux density transported by the field is given by $\frac{1}{\mu_0} E \times B$.

21. Obtain an expression for the growth and decay of charge in a capacitor through a resistor.

22. Obtain equations for r.m.s. value of e.m.f. and current in an AC circuit.

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 Norton's theorem. Give the different steps involved in Nortanizing 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.

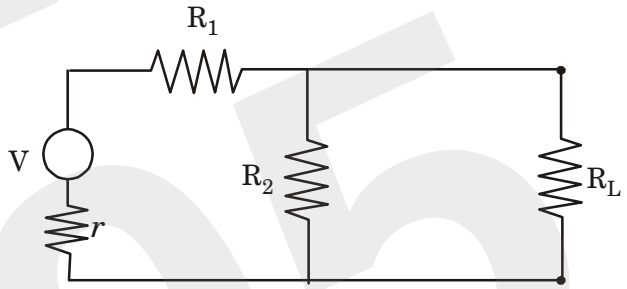
27. Find the energy stored in a long coaxial cable of length 'l' carries a current 'I' flowing down the surface of the inner cylinder of radius 'a' and back along the outer cylinder of radius 'b'.

28. Write down the boundary conditions for the electric and magnetic vectors E and B at an interface separating two linear dielectrics of permittivities ε_1 and ε_2 and permeabilities μ_1 and μ_2.

29. A capacitor of 0.2 μF is first charged and discharged through a resistance of 10 megaohms. Find the time, the potential takes to fall to ¼ of its original value.

30. An alternating voltage of 100 V at a frequency of 25 Hz is applied to a circuit consisting a resistance 1.5 Ω and an inductance of 0.01 Henry in series : (a) Find the current flowing ; (b) Phase difference between e.m.f. and current ; and (c) Potential drop across resistor and inductor.

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



(4 × 4 = 16 marks)

Turn over

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. Find expressions for the transmission and reflection coefficients when a plane polarized monochromatic wave of angular frequency ω passes normally through the boundary between two linear dielectrics.

34. Discuss the growth of current in a circuit containing an inductance L and a resistance R connected in series with a cell of steady e.m.f. Explain the time constant of the circuit.

35. Obtain expressions for resultant e.m.f., impedence 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)

D 90243 (Pages : 4) Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2020

(CUCBCSS—UG)

Physics/Applied Physics

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

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*

Each question carries 1 *mark.*

1. Write down the three dimensional wave equation in Cartesian co-ordinates.
2. If the unit *Henry* can be expressed as $\Omega^x S^y$, then what are the values of x and y.
3. An LR circuit has inductance L and resistance R. Its time constant, t = _____.
4. State Kirchoff's current law.
5. A series LCR circuit given by $\frac{d^2Q}{dt^2} + 2b\frac{dQ}{dt} + k^2Q = 0$; becomes critically damped if _____.

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

6. When a current is passed through a coil, suspended freely in a magnetic field, it experiences a force in a direction given by Fleming's left hand rule.
7. To determine the polarity of the voltage drop across a resistor, it is necessary to know the direction of current through the resistor.
8. In an electromagnetic wave, the phase difference between electric and magnetic field vectors E and B is π.
9. Ampere-turns is also a unit of Inductance.
10. Intensity of electromagnetic wave is the average power per unit area transported by an electromagnetic wave.

(10 × 1 = 10 marks)

Turn over

Section B

Answer at least **six** *questions.*
Each question carries 2 *marks.*
All questions can be attended.
Overall Ceiling 12.

11. What is the physical context of the statement $\nabla \cdot B = 0$?
12. Write the wave equations governing electromagnetic field vectors E and B in free space.
13. Define mutual inductance and coupling co-efficient
14. Derive the expression for instantaneous charge during the growth of charge in an R-C circuit.
15. Explain ideal voltage source and ideal current source.
16. What are the conditions for a moving coil galvanometer to be dead beat ? How can it be constructed ?
17. A series resonant circuit is referred as an acceptor circuit, while a parallel resonant circuit is referred as a rejector circuit. Explain.

(6 × 2 = 12 marks)

Section C

Answer at least **four** *questions.*
Each question carries 5 *marks.*
All questions can be attended.
Overall Ceiling 20.

18. Explain how Maxwell modified Ampere's law. Comment on the concept of displacement current.
19. What is the principle behind the working of a moving coil galvanometer ? Explain.
20. Derive the boundary conditions for E, B, D and H at a boundary between two different media.
21. Explain how high resistance can be measured by leakage method.
22. State and explain superposition theorem.
23. Explain the use of operator j in study of A.C. circuits.
24. Obtain the expression for the 'resistance' of a capacitor and 'resistance' of an inductor using the analysis of an a.c. circuit containing pure capacitance and pure inductance separately.

(4 × 5 = 20 marks)

Section D

Answer at least **three** *questions.*
Each question carries 6 *marks.*
All questions can be attended.
Overall Ceiling 18.

25. A 500 turn coil with a cross-sectional area of 9 cm^2 is removed in perpendicular direction from a field of 4 T magnetic field in 0.125 s. What is the e.m.f. induced in the coil ?

26. Prove that, for $\omega = kc$;

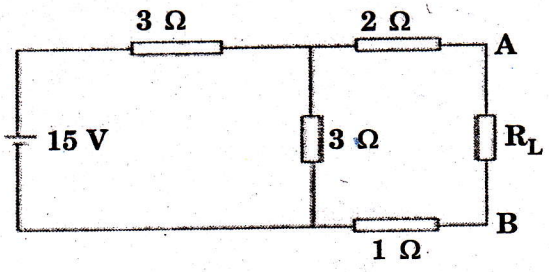
$$E_y(x,t) = E_0 \cos(kx - \omega t)$$

satisfy the one dimensional wave equation.

27. A fully charged condenser of capacity 1 μF is discharged through a resistance of 2 megaohm (a) Calculate the time taken by charge to fall 36.8% of its initial value ; and (b) How long will it take for the charge to fall to half of its initial value.

28. A laser beam has a power of 25 GW and diameter of 2 mm. Calculate the peak value of E andB.

29. In the network shown below, find the value of R_L such that maximum possible power will be transferred to R_L. Find also the value of the maximum power and the power supplied by source under these conditions.



30. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which R = 3 ohm, L = 25.48 mH and C =796 μF. Find (a) The impedance of the circuit ; (b) the phase difference between the voltage across the source and the current ; and (c) the power dissipated in the circuit.

31. A 60 cycle ac circuit has a resistor of resistance 2 ohm and inductor of inductance 10 mH. (a) What is the power factor ? (b) What capacitance if connected in the circuit will make the power factor unity ?

(3 × 6 = 18 marks)

Turn over

Section E

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

32. Describe the behavior of series LCR circuit when an e.m.f. $E = E_0 e^{j\omega t}$ is applied across it. Draw the phasor diagram showing current and voltages. Discuss the phenomenon of resonance.

33. Explain how the self inductance of a coil can be determined using Anderson's bridge.

34. What are monochromatic plane waves ? Explain Poynting vector and derive the expression for average value of energy(u), intensity(I), Poynting vector(S), momemtum(p) and radiation pressure(R) of monochromatic plane waves.

35. State and explain Faraday's laws of electromagnetic induction. Derive an expression for the energy stored in the magnetic field.

(2 × 10 = 20 marks)

D 70333 (Pages : 4) Name.....

Reg. No.....

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)

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)

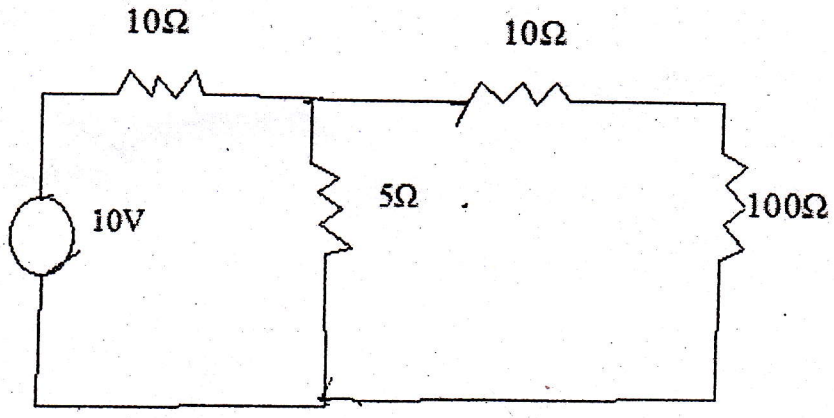
Section D

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

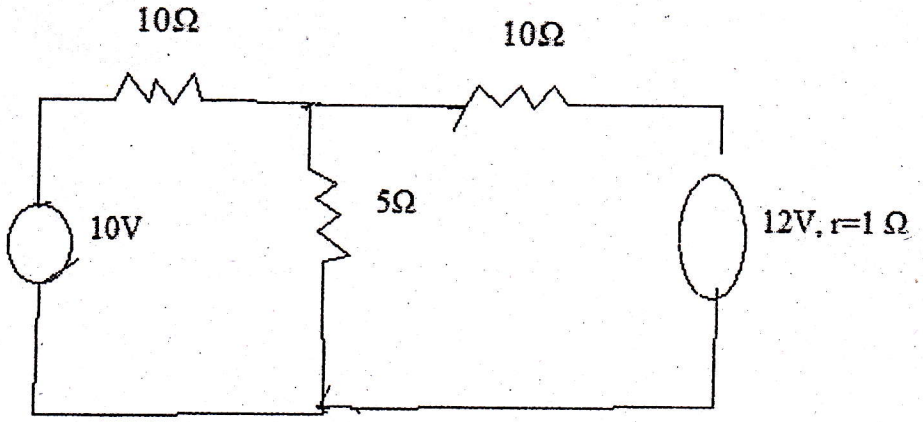
Answer any **four** *questions.*

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 3μF 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 Ω in the circuit given.



31. Use Superposition theorem to find current through the 5Ω 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)

D 5J606 (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. $E = E_0 e^{jwt}$ 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.

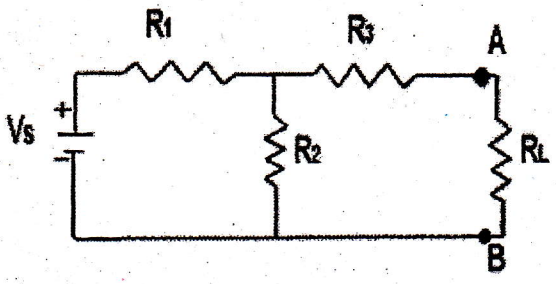
27. An a.c. supply of frequency 10000 and 110 V is connected across a circuit containing a resistance of 10 ohm, an inductance of 1 mH and a capacitor of 1 μF. find the value of the current. What must be the value of the capacitance in order that the current may be maximum ?

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 $f(z, t) = A \sin(kz) \cos(kvt)$ 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)

Reg

C 30312 (Pages : 4) Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2017

(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. In an LCR circuit if $\frac{1}{LC} < \frac{R^2}{4L^2}$, the circuit will be ———.
2. Write down the Neumann formula for mutual inductance.
3. How is Poynting vector (S) related to energy density (u) of electromagnetic waves ?
4. State the expression for instantaneous charge during the growth of charge in an R-C circuit.
5. State Kirchoffs voltage law.

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

6. $\Delta XB = -\mu_0 J + \mu_0 \in_0 \frac{\partial E}{\partial t}$ Maxwell's fourth equation in electromagnetism.
7. A capacitor can store magnetic energy in an electromagnetic field.
8. In an a.c. circuit containing pure inductance only, the current lags behind the e.m.f. by a phase $\frac{\pi}{2}$.
9. Greater the time constant of an LR circuit, the more rapidly does the current die away.
10. An ideal current source has an infinite internal resistance.

(10 × 1 = 10 marks)

Turn over

Section B

(Answer in Two **or** *three sentences).*
Answer **all** *questions.*
Each question carries 2 marks.

11. Discuss Faraday's laws of electromagnetic induction.
12. What is radiation pressure ? Write the relation connecting intensity and radiation pressure of an electromagnetic wave.
13. What are the boundary conditions for E, B, D and H at a boundary between two different media ?
14. Compare series LCR resonant circuit and parallel LCR resonant circuit.
15. Draw the circuit diagram for obtaining dc balance of Anderson's Bridge and obtain the dc balance condition.
16. What are the conditions for a moving coil galvanometer to be ballistic?
17. State and explain maximum power transfer theorem.

(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. State Lenz law. Obtain the expression for energy stored in an inductor.
19. Derive an expression for the velocity of propagation of a plane electromagnetic wave in a linear medium of permeability μ and permittivity ϵ.
20. Give the different steps involved in Thevenizing a circuit network.
21. Draw and explain circuit diagram for decay of current in LR circuit.
22. Obtain the classical wave equation.
23. Explain the condition for resonance in a series LCR circuit ? What is meant by sharpness of resonance ?
24. Derive an expression for the torque on a current loop placed in a uniform magnetic field.

(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 square wire loop of side 10 cm is perpendicular to a magnetic field of 4×10^{-3} T.
    (a) What is the magnetic flux through the loop ?
    (b) If the field drops to zero in 0.1 *s*, what average *e.m.f.* induced in the circuit during this time ?

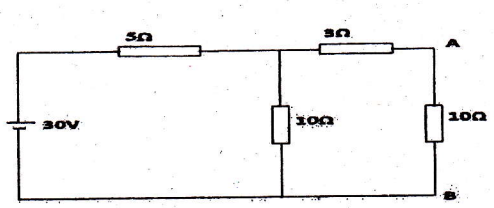
26. Find the self inductance per unit length of a long solenoid of radius R and *n* turns per unit length, carrying a current I.

27. The time averaged magnitude of the Poynting vector of sun's electromagnetic radiation received at the upper surface of the earth's atmosphere, (S) = 1.35 × 103 W/m^2. Assuming that the waves are plane sinusoidal, what are the magnitudes of the electric and magnetic fields (Use $\varepsilon_0 = 8.85 \times 10^{-12}$ F/m.)

28. If the charge on a capacitor of capacitance 2 microfarad in leaking through a high resistance of 100 mega ohms is reduced to half its maximum value, calculate the time of leakage.

29. An alternating potential of 100 volt 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 the capacitance will the current in the circuit be in phase with the applied voltage ? Calculate the current in this condition. What will be the potential difference across the resistance, inductance and capacitance at that time ?

30. Use Norton's theorem to find the current across the load resistance 10 ohm in the following circuit :—



31. A capacitor of 5 μF is first charged and then discharged through a resistance of 0.1 mega ohm. What is the time in which the potential will decrease to 36.8 % of its initial value ?

(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 modified Ampere's law. Derive Maxwell's equation in matter.

33. An alternating e.m.f. is applied to (a) A pure-resistance ; (b) A pure inductance ; and (c) A pure capacitance. Investigate the phase relationship of the alternating current with the e.m.f. in each case. Explain the term 'resistance' as referred to a capacitor and an inductor.

34. A plane electromagnetic wave is incident *normally* at the boundary of two non-conducting media. Discuss the phenomenon of reflection and refraction.

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

(2 × 10 = 20 marks)

D 11168

(Pages : 4)

Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2016

(CUCBCSS—UG)

Physics/Applied Physics

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

Time : Three Hours

Maximum : 80 Marks

The symbols used in this 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. If μ_0 represents the permeability and ε_0 represents the permittivity of free space, the velocity of electromagnetic waves in free space is given by ———.
3. The larger the ratio, R/L, the ——— is the decay of current in a series LR circuit.
4. In a purely inductive circuit, the power consumed is ———.
5. Lower the Q-factor of a circuit, ——— is its bandwidth.

Write True *or* False :

6. A conducting loop favours to maintain a constant flux through it.
7. The wave vector k points in a direction perpendicular to the direction of propagation and its magnitude is the wave number.
8. Charge in a capacitor takes infinite time to decay to zero.
9. When a.c. flows through an inductance, the back e.m.f. lags behind the current by $\pi/2$.
10. An ideal constant current source has zero resistance.

(10 × 1 = 10 marks)

Section B

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

Answer **all** *questions.*

Each question carries 2 *marks.*

11. What is Faraday's law ? Write its differential form.
12. Write down the general wave equation. Give its solution.

Turn over

13. What is Poynting vector ? Give an expression for the same.

14. Give an expression for the instantaneous current in a series LR circuit. What are the terms involved ?

15. Show graphically the relation between e.m.f. and current in an AC circuit containing a pure inductance.

16. What do you mean by the Q-factor of a series resonant circuit ?

17. Write Kirchhoff s laws in network theory.

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

19. A plane electromagnetic wave of angular frequency ω, wave vector k_1, traveling in the z direction represented by $E_I(z,t) = E_{0I}\, e^{i(k_1 z - \omega t)}\, \hat{x}$ and $B_I(z,t) = \frac{1}{v_1} E_{0I}\, e^{i(k_1 z - \omega t)}\, \hat{y}$ enters at normal incidence from one linear medium to another. Write expressions for the electric and magnetic vectors for the reflected and transmitted waves. Assume that in the second medium, the wave vector and velocity are given by k_2 and v_2, respectively.

20. Show that the radiation pressure caused by an electromagnetic wave is equal to the ratio of the intensity of the electromagnetic wave and the velocity of light.

21. Show graphically the decay of charge in a series LCR circuit corresponding to over-damped, critically-damped and damped-oscillatory cases.

22. Compare a series and a parallel LCR resonant circuit.

23. What are the basic steps for converting a voltage source to a current source ?

24. State :

    (i) Thevenin's theorem ; and

    (ii) Superposition theorem.

(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 the boundary conditions for the electric and magnetic vectors E and B at an interface separating two linear dielectrics of permittivities ε_1 and ε_2 and permeabilities μ_1 and μ_2.

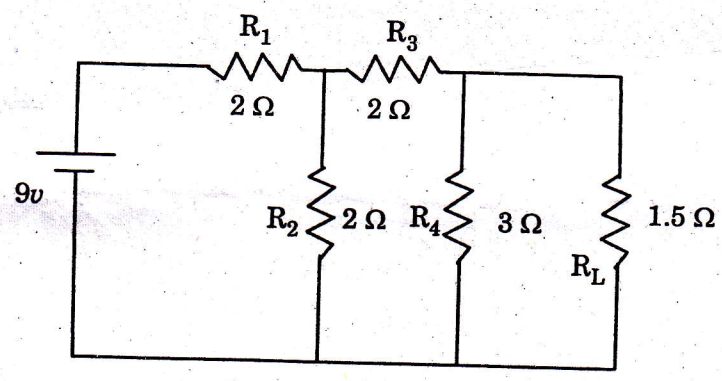
26. Write down Neumann formula for mutual induction. Discuss its importance.

27. For a plane monochromatic wave, show that the momentum density stored in the field is the energy density divided by the velocity of the wave.

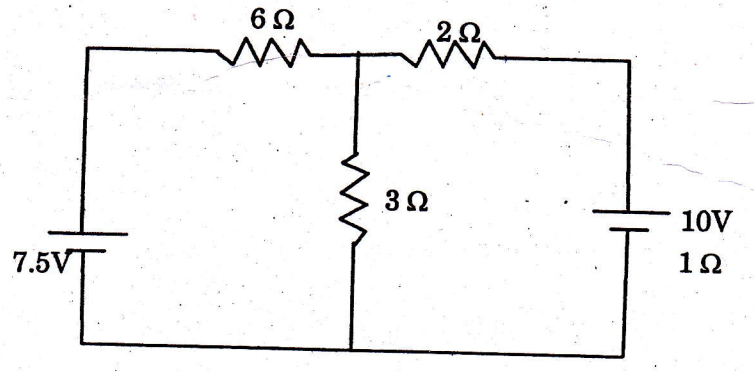
28. A capacitor is charged by a DC supply through a resistance of 2 MΩ. If it takes 0.5 sec for the discharge to reach three quarters of its final value, what is the capacitance of the capacitor ?

29. What is the resonance frequency of a circuit containing a coil of inductance 2.5 H and a capacitor of capacity 40 μF.

30. Find the current through the 1.5 Ω resistance in the following circuit using Thevenin's theorem :



31. Find the current through the 3 Ω resistor of the following network using superposition theorem :



(4 × 4 = 16 marks)

Section E

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

32. Discuss the terms electric and magnetic polarization. What is the relation between the microscopic and macroscopic fields, if the medium is linear ? Obtain Maxwell's equations in matter.

33. Obtain the wave equation for the E and B vectors in free space. Using a plane wave solution show that the electromagnetic waves are transverse in nature and the E and B vectors are in phase and mutually perpendicular.

34. Discuss the growth of current in a circuit containing an inductance L and a resistance R connected in series with a cell of steady e.m.f. E. Explain the term time constant of the circuit.

35. Discuss the measurement of an inductance using Anderson bridge.

(2 × 10 = 20 marks)

D 11559 (Pages : 4) Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT) EXAMINATION, NOVEMBER 2016

(UG—CCSS)

Physics

PH 5B 09—ELECTRODYNAMICS—II

(2013 Admissions)

Time : Three Hours Maximum : 30 Weightage

I. Objective questions (Answer *all* questions) :

1 An inductor stores energy in :

(a) Its electric field. (b) Its magnetic field.

(c) Its electric and magnetic fields. (d) Its coil.

2 The Poynting vector is :

(a) $\frac{\mu_0}{E \times B}$. (b) $\frac{\mu_0}{E \cdot B}$.

(c) $\frac{E \cdot B}{\mu_0}$. (d) $\frac{E \times B}{\mu_0}$.

3 The speed of electromagnetic waves in free space is given by :

(a) $\mu_0 \varepsilon_0$. (b) $\sqrt{\mu_0 \varepsilon_0}$.

(c) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$. (d) $\frac{1}{\mu_0 \varepsilon_0}$.

4. The relation between the vectors electric field intensity E, electric flux density D and polarization P is :

(a) $D = \varepsilon_0 E + P$. (b) $E = \varepsilon_0 D + P$.

(c) $E = \varepsilon_0 P + D$. (d) $E = \varepsilon_0 P - D$.

5 The power factor of a series resonant circuit is :

(a) 1. (b) – 1.

(c) 0. (d) Infinity.

Turn over

6 In an a.c. circuit with voltage V and current I, the power developed is :

(a) VI.

(b) $\frac{VI}{2}$.

(c) $\frac{VI}{\sqrt{2}}$.

(d) Depends on the phase relation between V and I.

7 Assuming L, C, R representing inductance, capacitance and resistance, respectively, the quantity which has the dimension of frequency is :

(a) RC. (b) $\frac{1}{RC}$.

(c) $\frac{RL}{C}$. (d) $\frac{C}{RL}$.

8 Kirchhoff's voltage law is concerned with :

(a) IR drops only. (b) Battery EMFs only.

(c) Junction voltages only. (d) Both (a) and (b).

State whether the following statements are True *or* False :

9 Self inductance of a coil depends on its geometry.

10 During one time constant, the current through a series LR circuit rises to 37 % of its final steady value.

11 An ideal constant voltage source has zero resistance.

12 Higher the resistance of a resonant circuit, better is its selectivity.

(12 × ¼ = 3 weightage)

II. Short answer questions (Answer *all* questions) :

13 Explain Lenz's law in electromagnetic induction.

14 Discuss the necessity of the term displacement current in Maxwell's equations.

15 What do you mean by intensity of electromagnetic waves ?

16 Define the terms phase and phase constant of a sinusoidal wave.

17 What do you mean by a plane wave and write down the equation for a plane wave.

18 Draw graphs representing over-damped, critically-damped and damped-oscillatory cases of the growth of charge in a series LCR circuit.

19 Discuss the term reactance of an a.c. circuit.

20 Draw the basic circuit of an a.c. bridge and write down the condition for balance.

21 Using *j*-operator, write down the voltage-current relationship in a purely inductive and a series LC circuit.

(9 × 1 = 9 weightage)

III. Short essay questions (Answer any *five* questions) :

22 Write down the Maxwell's equations and explain the terms involved.

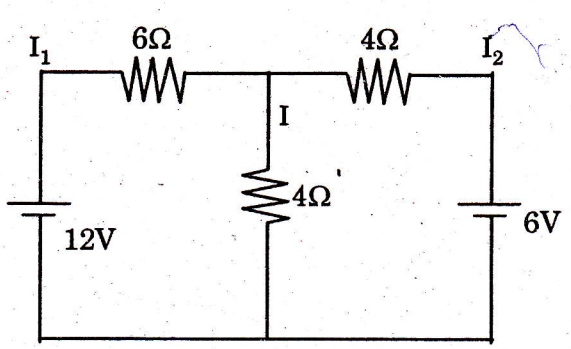
23 Write down the boundary conditions satisfied by electromagnetic fields at the interface between two media of different permeabilities and permittivities.

24 Write down the expression for energy density and momentum density of an electromagnetic wave.

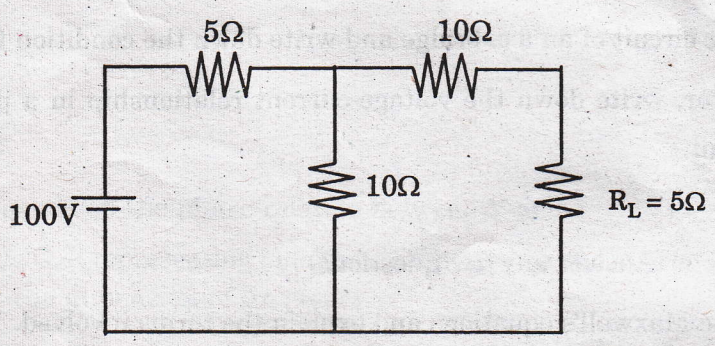
25 A series combination having R = 1 MΩ and C = 0.02 μF is connected to a d.c. voltage source of 100 V. Determine (i) The time constant of the circuit ; (ii) Capacitor voltage after 0.02 second ; and (iii) Capacitor voltage after 0.04 second.

26 A pure resistance of 50 Ω is in series with a capacitance of 100 μF. The combination is connected to a 100 V, 50 Hz supply. Determine the (i) Impedance ; (ii) Power factor ; (iii) Voltage across resistance ; and (iv) Voltage across capacitance.

27 Using superposition theorem, calculate the current in each branch of the following network :—



28 In the following figure, determine the current through the load resistance 5 Ω using Norton's theorem.



(5 × 2 = 10 weightage)

IV. Essay questions (Answer any *two* questions) :

29 Obtain the wave equation for the electric and magnetic field vectors E and B in free space. Discuss the term polarization and prove that electromagnetic waves are transverse in nature.

30 What is the working principle of a ballistic galvanometer ? Obtain an expression relating the charge flowing through a ballistic galvanometer and the corresponding deflection.

31 Obtain the relation between voltage and current in a series LCR circuit. Discuss the resonance of the circuit.

(2 × 4 = 8 weightage)

D 90919 (Pages : 4) Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2015

(U.G.—CCSS)

Core Course—Physics

PH 5B 09—ELECTRODYNAMICS—II

(2013 Admissions)

Time : Three Hours Maximum : 30 Weightage

I. Objective questions (Answer *all* questions) :

1 Which among the following is a wrong statement ?

(a) Electromagnetic waves are produced by accelerating charges.

(b) Electromagnetic waves are transverse in nature.

(c) Electromagnetic waves travel with the same speed irrespective of the nature of the medium.

(d) Electromagnetic waves travel with the velocity of light in vacuum.

2 The Poynting vector is given by :

(a) $\frac{\mu_0}{E \times B}$. (b) $\frac{\mu_0}{E \cdot B}$.

(c) $\frac{E \cdot B}{\mu_0}$. (d) $\frac{E \times B}{\mu_0}$.

3 In free space, electromagnetic waves propagate at a speed of :

(a) $\mu_0 \varepsilon_0$. (b) $\sqrt{\mu_0 \varepsilon_0}$.

(c) $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$. (d) $\frac{1}{\mu_0 \varepsilon_0}$.

4 The relation between the vectors magnetic field intensity H, magnetic flux density B and magnetization M is :

(a) $B = \mu_0 (H + M)$. (b) $H = \mu_0 (B + M)$.

(c) $M = \mu_0 (H + B)$. (d) $B = \mu_0 (H \times M)$.

Turn over

5 The power factor of a circuit is unity. Then the impedance of the circuit is :

(a) Inductive.

(b) Capacitive.

(c) Resistive.

(d) Partially inductive and partially capacitive

6 In an a.c. circuit with voltage V and current I, the power developed is :

(a) VI.

(b) $\frac{VI}{2}$.

(c) $\frac{VI}{\sqrt{2}}$.

(d) Depends on the phase relation between V and I.

7 Assuming L, C, R representing inductance, capacitance and resistance, respectively, the quantity which has the dimension of frequency is :

(a) RC. (b) $\frac{1}{RC}$.

(c) $\frac{RL}{C}$. (d) $\frac{C}{RL}$.

8 Superposition theorem is based on the concept of :

(a) Linearity. (b) Duality.

(c) Reciprocity. (d) Multiplicity.

State whether the following statements are TRUE *or* FALSE :

9 Magnetic monopoles do not exist.

10 In a series LR circuit, as the value of L/R decreases, it takes a longer time for the current to reach its maximum value.

11 An ideal constant current source has infinite resistance.

12 Lower the Q-actor of a circuit, narrower is its bandwidth.

(12 × ¼ = 3 weightage)

II. Short answer questions (Answer *all* questions) :

13 Explain Lenz's law in electromagnetic induction.

14 Discuss the necessity of the term displacement current in Maxwell's equations.

15 What do you mean by intensity of electromagnetic waves ?

16 Define the terms phase and phase constant of a sinusoidal wave.

17 What do you mean by a plane wave and write down the equation for a plane wave.

18 Show graphically the decay of charge in a series LCR circuit corresponding to over-damped, critically-damped and damped oscillatory cases.

19 What do you mean by wattles current ?

20 Draw the basic circuit of an a.c. bridge and write down the condition for balance.

21 Write down the voltage-current relationship in a purely capacitive and a series RC circuit using *j*-operator.

(9 × 1 = 9 weightage)

III. Short essay questions (Answer any *five* questions) :

22 Obtain an expression for the energy stored in a magnetic field due to the establishment of current.

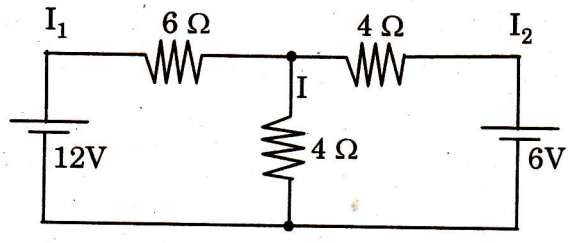
23 Comment on the symmetry of Maxwell's equations in free space.

24 Write down the expression for energy density and momentum density of an electromagnetic wave and explain the terms used.

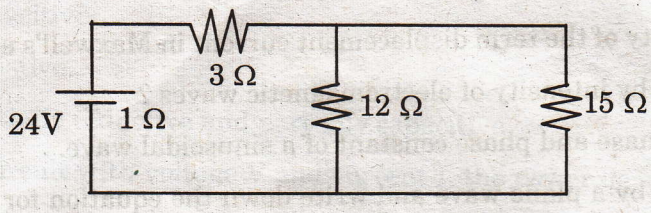
25 A coil having R = 120 Ω and L = 24 H is connected to a 12 V battery. Determine (i) the time constant of the circuit (ii) current after 0.2 second ; and (iii) current after 1 second.

26 A pure resistance of 50 Ω is in series with a pure capacitance of 100 μF. The combination is connected to a 100 V, 50 Hz supply. Determine the (i) impedance ; (ii) power factor ; (iii) voltage across resistance ; and (iv) voltage across capacitance.

27 Using superposition theorem, calculate the current in each branch of the following network :—



28 Using Thevenin's theorem, find the current through the 15 Ω resistance in the following figure :—



(5 × 2 = 10 weightage)

IV. Essay questions (Answer any *two* questions)

29 Obtain the wave equation for the electric and magnetic field vectors E and B in free space. Discuss the term polarization and prove that electromagnetic waves are transverse in nature.

30 What is the working principle of a ballistic galvanometer ? Obtain an expression relating the charge flowing through a ballistic galvanometer and the corresponding deflection.

31 Discuss the resonance of a parallel resonant circuit. Compare resonance in series and parallel resonant circuits.

(2 × 4 = 8 weightage)

EDG

D 70947 (Pages 3) Name.....

Reg. No.....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2014

(UG–CCSS)

Core Course

Physics/Applied Physics

PH 5B 09/AP 5B 11—ELECTRODYNAMICS II

Time : Three Hours Maximum : 30 Weightage

Part A

Answer **all** *questions.*
Each question carries ¼ weightage.

1. The law of electromagnetic induction has been used in the construction of :
   (a) Electro generator. (b) Galvanometer.
   (c) Ammeter. (d) Electric motor.
2. An inductor may store energy in :
   (a) Electric field (b) Its coils.
   (c) magnetic field (d) Both electric and magnetic fields
3. The displacement current is related to the _____.
4. $1/\sqrt{\mu E}$ has the dimensions of_____
5. Inductive reactance $L\omega$ of a coil is expressed as _____.
   (a) Ampere. (b) Ohm.
   (c) mho. (d) Heber.
6. In an LCR circuit the inductance and capacitance are doubled, then the resonant frequency of the circuit :
   (a) Decreases to half. (b) Is doubled.
   (c) Increases 4 fold. (d) Increases 8 fold.
7. The displacement current flows in the dielectric of a capacitor when the p.d across the plates :
   (a) Increases with time. (b) Decreases with time.
   (c) Neither increases nor decreases. (d) Increases and decreases with time.
8. Electromagnetic waves :
   (a) are polarized. (b) are not polarized.
   (c) are longitudinal. (d) longitudinal and non polarized.

Turn over

9. The current through a coil of wire when connected to a 200V, 50HZ supply is 2A. If the power consumed is 200W/ the power factor is

   (a) 2. (b) 1.

   (c) 0.5. (d) zero.

10. The self inductance of a coil is measured using :

   (a) Wheatstone's bridge. (b) Anderson bridge.

   (c) Metre bridge. (d) Potentiometer.

11. While applying Kirchoff 's laws/the assumed direction of current flow is :

   (a) clockwise. (b) anti-clockwise.

   (c) either clockwise *or* left to right. (d) None of the above.

12. Superposition theorem can be applied only to circuit having ———— elements.

   (a) Linear bilateral. (b) Non linear.

   (c) Passive. (d) Resistive.

(12 × ¼ = 3 weightage)

Part B

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

13. State Faraday's law of electromagnetic induction.
14. Give Maxwell's modification of ampere's law.
15. Give Maxwell's equation for a region of finite conductivity.
16. What is Phase velocity of an electromagnetic wave ?
17. Define inductive reactance and capacitance reactance.
18. What is a BG ? How are eddy currents reduced in BG ?
19. What are the characteristics of an AC sine wave?
20. State and explain Kirchoff 's current law.
21. What is an ideal constant current source ?

(9 × 1 = 9 weightage)

Part C

Answer any **five** *questions.*
Each question carries 2 *weightage.*

22. Derive an expression for the energy stored in an inductance. Calculate the energy of an inductor having an inductance of 60 mH when a current of 2A flows through it.
23. In a plane electromagnetic wave the electric field oscillates sinusoidally at a frequency of 20mhz and amplitude 48V/m. What is the wavelength of the wave ? What is the amplitude of the oscillating magnetic field ?

24. State and prove Poynting's theorem.

25. An alternating current is represented by I = 141.4 sin 628t. Calculate : (a) its frequency ; (b) rms value ; (c) average value.

26. A sinusoidal voltage V(t) = 200 sin 1000t is applied across a pure inductance of 0.02H. Determine : (a) the current $i(t)$; (b) Instant power ; (c) average power consumed.

27. An electric lamp marked 100 volts DC consumes a current of 10 amps. It is connected to a 200 Volt 50 cycles 1 sec AC mains. Calculate the inductance of the choke.

28. State and prove the maximum power transfer theorem.

(5 × 2 = 10 weightage)

Part D

Answer any **two** *questions.*
Each question carries 4 *weightage.*

29. Derive Maxwell's equations in an isotropic dielectric medium.

30. Describe the experimental method to determine the change sensitiveness of BG using a standard condenser and Hibbert's magnetic standard.

31. Derive an expression for the e.m.f. and impedance of an AC series resonant circuit.

(2 × 4 = 8 weightage)