

D 140852

(Pages : 2)

Name.....

Reg. No.....

**FOURTH SEMESTER (CBCSS—U.G.) DEGREE EXAMINATION
APRIL 2026**

Physics/Applied Physics

PHY4B04/APH4B04—ELECTRODYNAMICS—II

(2019 Syllabus)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in this question paper have their usual meanings.***Section A (Short Answer Type)***Answer questions in two or three sentences, each correct answer carries a maximum of 2 marks.**All questions can be attended.*

1. Give Maxwell's modification of Ampere's law.
2. Define intensity of e.m.waves and how it is related to Poynting vector.
3. Define the r.m.s value of e.m.f and write how it is related to peak value of e.m.f.
4. What is an ideal constant voltage source ?
5. Write the boundary conditions for E, B, D and H, at a boundary between two different media.
6. Discuss the growth of current in a L-R circuit ?
7. Write down the characteristics of a dead beat moving coil galvanometer.
8. What you mean by Q-factor in a series resonant circuit.
9. Give the differential and integral form of Gauss' law in magnetostatics.
10. What is power factor ?
11. Write down the differential and integral forms of Faraday's law.
12. Compare series LCR resonant circuit and parallel LCR resonant circuit.

(Ceiling 20 marks)

Turn over

Section B (Paragraph / Problem Type)

All questions can be attended.

*Answer questions in a paragraph of about **half a page to one page**, each correct answer carries a maximum of 5 marks.*

13. Obtain the classical wave equation.
14. How can a voltage source be converted into equivalent current source and vice versa.
15. Find the potential inside and outside a spherical shell of radius R that carries a uniform surface charge. Set the reference point at infinity.
16. A capacitor of capacitance $0.5 \mu\text{F}$ and resistance 10 megaohm is charged to a potential difference of 10 V . Calculate the time constant and the maximum charge stored.
17. An LCR series circuit consists of an inductance 1 H , a capacitance $20 \mu\text{F}$ and a resistance 6Ω . Find the resonant frequency and Q -factor of the circuit.
18. Calculate the speed of electromagnetic waves in free space. The permeability and permittivity of free space are respectively $4\pi \times 10^{-7} \text{ H/m}$ and $8.857 \times 10^{-12} \text{ F/m}$.
19. State Lenz's law. Obtain the expression for energy stored in an inductor.

(Ceiling 30 marks)

Section C (Essay Type)

*(Essays - Answer in about **two pages**, any **one** question. Answer carries 10 marks)*

20. Describe with theory, the Anderson's method to determine self inductance of a coil.
21. Discuss the growth and decay of current through a circuit containing resistance and inductance. Plot the variations of current with various time constants. Find the expression for the time at which growing current and decay current are equal.

(1 × 10 = 10 mark)

D 120581

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Name.....

Reg. No.....

**FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2025**

Physics/Applied Physics

PHY4B04/APH4B04—ELECTRODYNAMICS—II

(2019—2023 Admissions)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in this question paper have their usual meanings.***Section A (Short Answer Type)***Answer questions in two or three sentences.**Each correct answer carries a maximum of 2 marks.**All question can be attended.*

1. How can the refractive index of a medium be obtained from basic electro-magnetic constants ?
2. Discuss the growth of current in a CR circuit ?
3. Compare series LCR resonant circuit and parallel LCR resonant circuit.
4. What is an ideal constant voltage source ?
5. Discuss Faraday's laws of electromagnetic induction.
6. Write down Poynting theorem.
7. What is meant by the logarithmic decrement in a moving coil galvanometer ?
8. State superposition theorem.
9. State Gauss' Law.
10. If a capacitor of 500 nF is connected in series with a resistance of 50Ω and 10 V d.c. supply, find the time constant.

Turn over

11. Explain polarization of electromagnetic waves.
12. Write the boundary conditions for E, B, D and H, at a boundary between two different media.
(Ceiling 20 marks)

Section B (Paragraph / Problem Type)

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

Each correct answer carries a maximum of 5 marks.

13. State Lenz's law. Obtain the expression for energy stored in an inductor.
14. Give a brief account of magnetic charge.
15. Describe with vector diagram, how the impedance of an LCR series circuit is expressed in terms of j -operator.
16. Find the electric field a distance z above the midpoint between two equal charges (q), a distance d apart.
17. A coil of self inductance 2.5 H is joined to the terminals of a 2 V battery through a resistance of 5Ω . Find the time constant of the circuit. What is the maximum current attained in the circuit?
18. Find the capacitive reactance of a $15 \mu\text{F}$ capacitor at 2000 Hz. Calculate the inductance required to produce series resonance with the capacitor at this frequency.
19. Draw and explain with circuit diagram, the decay of current in an L-R circuit.

(Ceiling 30 marks)

Section C (Essay Type)

(Essays - Answer in about two pages, any one question.

Answer carries 10 marks).

20. Define the charge sensitiveness of BG. With necessary theory, describe an experiment to determine the charge sensitiveness of BG using standard condenser and HMS.
21. (a) Derive an expression for the energy of a continuous charge distribution.
(b) Obtain Gauss' law in dielectrics.

(1 × 10 = 10 marks)

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Name.....

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**FOURTH SEMESTER (CBCSS-UG) DEGREE EXAMINATION
APRIL 2024**

Physics/Applied Physics

PHY4B04.APH4B04—ELECTRODYNAMICS – II

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in this question paper have their usual meanings***Section A - Short Answer type***Answer questions in two or three sentences,
each correct answer carries a maximum of 2 marks.**All questions can be attended.*

1. Write down the differential and integral forms of Faraday's law.
2. Explain polarization of electromagnetic waves.
3. What are the conditions for a moving coil galvanometer to be ballistic ?
4. Draw the circuit diagram for obtaining balance using Anderson's bridge.
5. State Thevenin's theorem.
6. Write down general wave equation. Give its solution.
7. Write down Maxwell's equations inside matter.
8. What is the power factor in inductor-resistor series circuit ?
9. Write down the dimensions of electric flux.
10. How do the energy density and momentum density of electromagnetic waves relate to Poyntings vector ?
11. Define the r.m.s value of e.m.f.
12. How can the refractive index of a medium be obtained from basic electro-magnetic constants ?

(Ceiling 20 marks)

Turn over

Section B – Paragraph Problem type

All questions can be attended.

Answer questions in a paragraph of about half a page to one page, each correct answer carries a maximum of 5 marks.

13. Draw and explain circuit diagram for decay of current in L-R circuit.
14. Explain mutual inductance and obtain Neumann's formula for the same.
15. Find the field outside a uniformly charged solid sphere of radius R and total charge q.
16. A coil having a resistance of $10\ \Omega$ and inductance 4 H is connected to a dc source of e.m.f. 100 V. How long does it take for the voltage across the resistance to attain a value of 50 V ?
17. A choke of 0.5 H, a capacitance of $15\ \mu\text{F}$ and a resistance of $100\ \Omega$ are connected in series across 200 V 50 Hz main. Find the current in the circuit.
18. Check whether the following function is a solution to the one dimensional wave equation.
 $Y = 2 \sin x \cos vt$.
19. Find the potential inside and outside a spherical shell of radius R that carries a uniform surface charge. Set the reference point at infinity.

(Ceiling 30 marks)

Section C – Essay type

Essays – Answer in about two pages.

*Any **one** question.*

The question carries 10 marks.

20. Explain how Maxwell modified Ampere's theorem. Derive Maxwell's equation in matter.
21. Briefly discuss electrostatic boundary conditions.

(1 × 10 = 10 marks)

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**FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2023**

Physics/Applied Physics

PHY 4B 04/APH 4B 04—ELECTRODYNAMICS—II

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

*The symbols used in question paper have their usual meanings***Section A (Short Answer Type)***Answer all questions in two or three sentences, each correct answer carries a maximum of 2 marks.*

1. Explain the Neumann formula in mutual inductance.
2. Write down the equation of continuity in electrodynamics. Explain the terms involved.
3. Show that the Maxwell's equations for E and B are symmetric in free space.
4. Explain the term polarization in the context of electromagnetic waves. Draw a suitable figure to indicate the polarization vector.
5. Write down wave equation for the electric field vector E in free space and explain the terms involved. What is the expression for the speed of the wave ?
6. Write down the boundary conditions for the electric field vector E at an interface separating two linear media of permittivities ϵ_1 and ϵ_2 and permeabilities μ_1 and μ_2 .
7. What are gauge transformations ?
8. Discuss the two different types of transient currents in circuits.
9. Give an expression for the DC transient current in an R-C series circuit. Explain the terms involved.
10. What are the differences between a ballistic galvanometer and an ordinary moving-coil galvanometer ?
11. What is Kirchoff's current law ?
12. What is maximum power transfer theorem ?

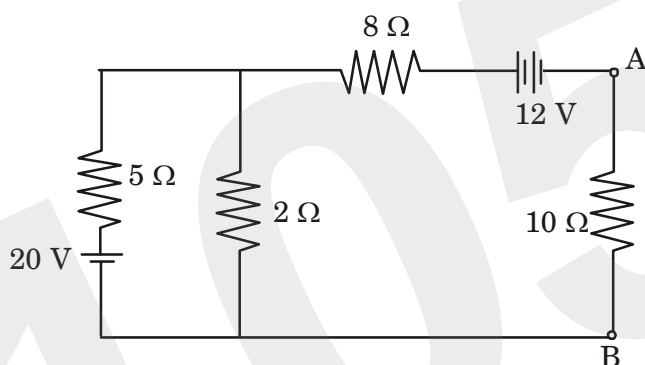
(Ceiling - 20)

Turn over

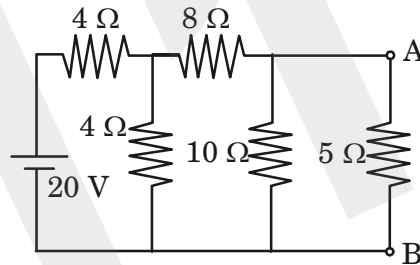
Section B (Paragraph/Problem Type)

Answer **all** questions in a paragraph of about **half a page to one page**, each correct answer carries a maximum of 5 marks

13. A long solenoid of radius a is driven by an alternating current so that the field inside is sinusoidal, given by $B(t) = B_0 \cos(\omega t) \hat{z}$. A circular loop of wire, of radius $a/2$ and resistance R , is placed inside the solenoid and co-axial with it. Determine the current induced in the loop as a function of time.
14. 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.
15. A coil of 10 H inductance and 5Ω resistance is connected in parallel with a 20Ω resistor across a 100 V d.c. supply, which is suddenly disconnected. Determine the voltage across the 20Ω resistor initially and after 0.3 s.
16. A large coil of inductance 1.405 H and resistance 40Ω is connected in series with a capacitor of $20 \mu\text{F}$. Determine the frequency at which the circuit resonates.
17. Give an expression for the power consumed in a series LCR circuit. Show that in a purely inductive or a purely capacitive circuit, the power consumed is zero.
18. Use Thevenin's theorem to determine the current through the 10Ω resistance of the following circuit :



19. Use Norton's theorem to determine the current through the $5\ \Omega$ resistance of the following circuit.



(Ceiling - 30)

Section C (Essay Type)

Answer in about two pages, any one question.

Answer carries 10 marks.

20. Explain Faraday's law and Ampere's law. Give the integral and differential forms of the laws. Discuss how Maxwell modified Ampere's law in the case of time varying electric fields.
21. Discuss the potential formulation of electrodynamics.

(1 × 10 = 10 marks)

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Name.....

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**FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2022**

Physics/Applied Physics

PHY4B04/APH4B04—ELECTRODYNAMICS—II

(2019 Admission onwards)

Time : Two Hours

Maximum : 60 Marks

Section A*Answer at least **eight** questions.**Each question carries 3 marks.**All questions can be attended.**Overall Ceiling 24.*

1. Explain Ohm's law. Discuss the terms involved.
2. What do you mean by the term displacement current ? Give an expression for the same.
3. Illustrate the symmetry of Maxwell's equations for E and B in the absence of the charge and current density terms.
4. What is Poynting vector ? Give an expression for the same.
5. Give the wave equation for the magnetic field vector B in free space and explain the terms involved. Write down the expression for the speed of the wave.
6. What do you mean by a monochromatic plane wave ? Give its general form.
7. Write down the boundary conditions for the magnetic field vector B at an interface separating two linear media of permittivities ϵ_1 and ϵ_2 and permeabilities μ_1 and μ_2 .
8. Distinguish between initiation and transition transient currents.
9. What do you mean by wattless current ?
10. Give Kirchhoff's mesh law.
11. What are the features of an ideal constant voltage source ?
12. What is reciprocity theorem ?

(8 × 3 = 24 marks)

Turn over

Section B

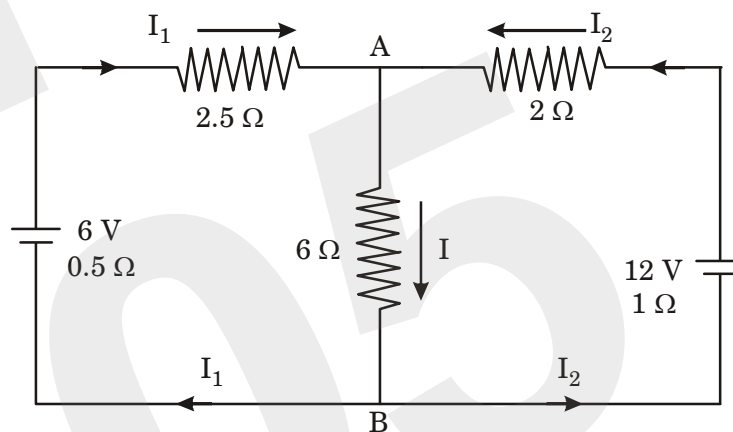
Answer at least **five** questions.

Each question carries 5 marks.

All questions can be attended.

Overall Ceiling 25.

13. Obtain an expression for the energy stored in a magnetic field due to a current.
14. Write down the integral forms of Maxwell's equations and explain the terms involved.
15. Prove that for a plane monochromatic wave, the Poynting vector is the energy density times the velocity of the wave.
16. Give the fundamental laws of geometrical optics considering the reflection and transmission of electromagnetic waves at a boundary separating two linear media.
17. A circuit consists of a non-inductive resistance of 50Ω , an inductance of 0.3 H and a resistance of 2Ω and a capacitor of $40 \mu\text{F}$ in series and is supplied with 200 V at 50 Hz . Find the impedance of the circuit.
18. An alternating voltage of 10 V at 100 Hz is applied to a choke of inductance 5 H and resistance 200Ω . Determine the power factor of the coil.
19. For the circuit shown below, find the currents flowing in all branches and the voltage across the 6Ω resistor using superposition theorem.



(5 × 5 = 25 marks)

Section C

*Answer any **one** question.*

The question carries 11 marks.

20. 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.
21. Explain the construction and working principle of a ballistic galvanometer. Obtain the relation connecting the charge flowing and the ballistic throw of the galvanometer.

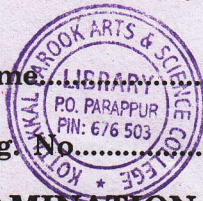
(1 × 11 = 11 marks)

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Name.....

Reg. No.....



**FOURTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
APRIL 2021**

Physics/Applied Physics

PHY 4B 04/APH 4B 04—ELECTRODYNAMICS—II

Time : Two Hours

Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

Answer at least eight questions.

Each question carries 3 marks.

All questions can be attended.

Overall Ceiling 24.

1. Explain Joule heating law.
2. Comment on the statement “nature abhors a change in flux”.
3. Illustrate the symmetry in Maxwell’s equations for E and B in free space.
4. Write down the general wave equation. Give its solution.
5. Draw a monochromatic plane wave travelling in the z direction indicating the E and B vectors.
6. Give expressions for the electric and magnetic field vectors E and B in terms of the potentials.
7. Show that the Coulomb gauge leads to Poisson’s equation.
8. List the origin of transient currents in circuits.
9. Write down an expression for the DC transient current in a series R-L circuit. Explain the terms involved.
10. Plot the growth and decay of DC transient currents in an RC series circuit.
11. Compare series and parallel resonant circuits.
12. Write down the Kirchhoff’s voltage law.

(8 × 3 = 24 marks)

Turn over

Section B (Paragraph/Problem Type)

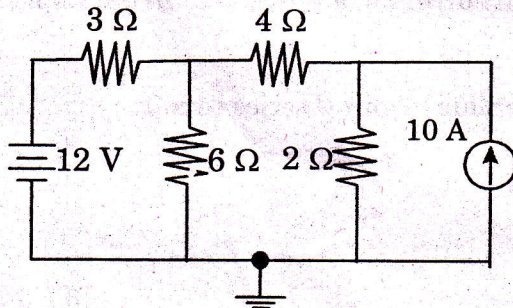
Answer at least five questions.

Each question carries 5 marks.

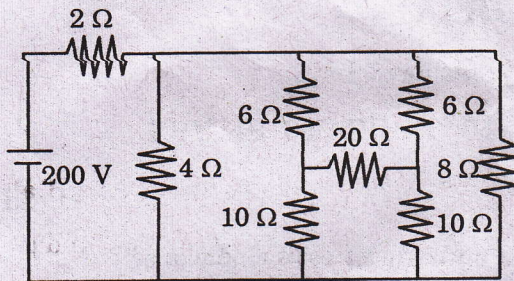
All questions can be attended.

Overall Ceiling 25.

13. Explain the boundary conditions for the electric and magnetic vectors E and B at an interface separating two linear media of permittivities ϵ_1 and ϵ_2 and permeabilities μ_1 and μ_2 .
14. Show that, for a plane monochromatic wave, the momentum density stored in the field is the energy density divided by the velocity of the wave.
15. A ballistic galvanometer has a free period of 10 seconds and gives a steady deflection of 200 divisions with a steady current of 0.1 milli-amperes. A charge of 121 micro-coulombs is instantaneously discharged through the galvanometer giving rise to a first maximum deflection of 100 divisions. Calculate the decrement of the resulting oscillations.
16. A coil having an inductance of 50 mH and resistance 10Ω is connected in series with a $25 \mu\text{F}$ capacitor across a 200 V AC supply. Determine : (i) The resonance frequency of the circuit ; (ii) Current flowing at resonance ; and (iii) Q-factor.
17. Obtain an expression for the power consumed in a series LCR circuit.
18. Use Thevenin's theorem to determine the current flowing through the 4Ω resistance of the following circuit.



19. Find the current through the $8\ \Omega$ resistor of the following circuit using Norton's theorem.



(5 × 5 = 25 marks)

Section C (Essay Type)

Answer any one question.

The question carries 11 marks.

20. Obtain Maxwell's equations in matter.
21. Obtain the wave equation for the electric and magnetic field vectors E and B in free space. Explain the term polarization and show that electromagnetic waves are transverse in behavior.

(1 × 11 = 11 marks)