C 21306 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
APRIL 2022

Physics/Applied Physics

PHY 4B 04/APY 4B 04—ELECTRODYNAMICS—I

(2014—2018 Admissions)

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*
Answer in a word **or** *phrase.*

1. Write the relationship between electric displacement vector and electric field vector.
2. State Faraday's law of electromagnetic induction. Explain the symbols used.
3. State Coulomb's law in electrostatics.
4. What is the nature of force between two parallel conductors carrying currents ?
5. State Gauss's law for magnetic fields.

State whether the statement is True *or* False

6. For static charge, the curl of E is zero.
7. Below the Curie temperature, a ferromagnetic material would become paramagnetic.
8. H_2O is an example of a polar molecule.
9. For paramagnetic materials, the susceptibility is negative and small.
10. $\nabla^2 V = -\rho/\epsilon_0$ is called Poisson's equation.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in two* **or** *three sentences.*
Each question carries 2 *marks.*

11. Write down the expression for the work done to assemble a collection of point charges.
12. Write Ampere's law in differential and integral form.

Turn over

13. Derive the relation between electric field and electric potential.
14. Differentiate between susceptibility and permeability.
15. State ampere's force law.
16. Draw a diagram to show the variation of electric field of a charged metallic sphere with distance.
17. Explain scalar potential and vector potential.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions.*
Each question carries 4 *marks.*

18. Derive the equation $E = -\nabla V$
19. Derive the relation connecting dielectric constant and electric susceptibility.
20. Show that the energy of a magnetic dipole in a magnetic field B is given by $U = -m.B$
21. Derive an expression for the potential of a localized charge distribution.
22. State and explain Gauss's law in the presence of dielectrics.
23. Compare magnetostatics and electrostatics.
24. Explain the magnetostatic boundary conditions.

(5 × 4 = 20 marks)

Section D

Answer any **four** *questions.*
Each question carries 4 *marks*

25. The electric field in some region of space is found to be $E = kr^3 \hat{\mathbf{r}}$ in spherical coordinates, where k is some constant and $\hat{\mathbf{r}}$ is the unit vector. Find the charge density.
26. A conductor 4m. in length lies along the y axis with a current of 10A in the $\hat{y}$ direction. Find the force on the conductor if the field in the region is B = 0.05 tesla in the x direction.
27. A charge 1×10^{-6} C is at the centre of a cubical Gaussian surface of 0.5 mm. edge. What is the electric flux for this surface ?
28. Find the magnetic induction at the centre of a square loop of wire of side '*a*' carrying a current I.

29. A metallic sphere of radius 10 cm. has a surface charge density of 10 nC/m^2. Calculate the energy stored in the system.

30. An all metal aeroplane dives down vertically at 300 km/s where $B_H = 0.4 \times 10^{-4}$T. If the wing span is 30 m, what will be the resulting potential difference between the tips ?

31. A current distribution gives rise to the magnetic vector potential $\mathbf{A} = x^2y\ \hat{x} + y^2x\ \hat{y} - 4xyz\ \hat{z}$. Calculate **B** at (– 1, 2, 5).

(4 × 4 = 16 marks)

Section E

Answer any **two** *questions.*

Each question carries 10 *marks.*

32. Obtain the Gauss's law in differential form. Using Gauss's law, find the electric field inside and outside a spherical shell of radius R that carries a uniform surface charge density σ.

33. (a) State and explain Biot Savart's law.

(b) Derive an expression for the magnetic field due to a circular loop of current at a point on the axis of the coil.

34. (a) Explain atomic polarizability and polarisation vector.

(b) Derive the expression for the torque experienced by a polar molecule (dipole) in a non-uniform field.

35. (a) Derive the expression showing the effect of magnetic field on atomic orbit.

(b) Derive the relation connecting magnetic susceptibility and permeability.

(2 × 10 = 20 marks)

C 2226 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION
APRIL 2021

Physics/Applied Physics

PHY 4B 04/APY 4B 04—ELECTRODYNAMICS—I

Time : Three Hours Maximum : 80 Marks

Section A

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

Answer **all** *questions ; each question carries* 1 *mark.*

1. VXB = _____.
2. The Curl of vector field is _____.
3. A particle is released from rest in to a region in which E is perpendicular B. The particle will undergo _____ motion.
4. The electric field inside a charged spherical shell is_____.
5. For paramagnetic material, the value of χ is_____.

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

6. Electrostatic energy obeys superposition principle.
7. No work is done in moving a charge from one point to another point on the surface of a conductor.
8. Continuity equation gives the local conservation of charges.
9. Surface current density is the current per unit area.
10. Polarization is the dipole moment per unit volume.

(10 × 1 = 10 marks)

Section B

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

Answer **all** *questions.*

Each question carries 2 *marks.*

11. Show that electricfield is the negative gradient of potential
12. State first uniqueness theorem.

Turn over

13. Show that the energy of an ideal dipole in an electric field is-**p.E.**

14. What is a polarizability tensor ?

15. Find the expression relating dielectric constant and electric susceptibility.

16. What is a linear magnetic material ?

17. State Ampere's law in magnetostatics.

(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. Derive the boundary conditions for electric displacement D.

19. Differentiate between paramagnetism and diamagnetism.

20. What do you mean by method of images ? Explain.

21. Find the electric field due to an infinite plane carrying a uniform surface charge σ and comment on the result.

22. Find the work needed to form an assembly of four point charges.

23. Show that the normal derivative of vector potential is discontinuous across a boundary.

24. What is the effect of magnetic field on atomic orbits ?

(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 capacitance per unit length of two coaxial metal cylindrical tube of radii '*a*' and '*b*'.

26. A spherical conductor of radius '*a*' carries a charge Q. It is surrounded by a linear dielectric material of susceptibility χ_e, out to radius '*b*'. Find the energy of this configuration.

27. Find the electric field due to a uniformly polarized sphere ?

28. At the interface between two linear dielectrics the electric field lines bend. Show that $\frac{\tan\theta_2}{\tan\theta_1} = \frac{\varepsilon_2}{\varepsilon_1}$, where θ_1 and θ_2 are the angle made by the electric field of the two media with the normal. There is no free charge at the boundary.

29. A long copper rod of radius R carries a uniformly distributed free current I. Find auxiliary field **H** inside and outside the rod.

30. Find the vector potential of an infinite solenoid with '*n*' turns per unit length, radius R and current I.

31. Find the capacitance of a parallel plate capacitor containing two dielectrics with $K_1 = 1.5$ and $K_2 = 3.5$, each occupying one half of the space between the plates with interface parallel to the plates. Given area of the plates equal to 2 m^2 and distance between the plates is equal to 10^{-3} m.

(4 × 4 = 16 marks)

Section E (Essays)

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

32. State Biot-Savart law. Find the magnetic field due to a circular coil carrying a current I.

33. State and prove Gauss's law in electrostatics. Find the electric field due to a uniformly charged solid sphere. Represent the variation of electric field with distance graphically.

34. What do you mean by ferromagnetism ? Explain the hysteresis curve.

35. What are dielectrics ? Find the expression for force experienced by a dielectric system placed between the plates of a parallel plate capacitor.

(2 × 10 = 20 marks)

C 80923 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER (CUCBCSS—UG) DEGREE EXAMINATION APRIL 2020

Physics/Applied Physics

PHY 4B 04/APY 4B 04—ELECTRODYNAMICS—I

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions.*
Each question carries 1 *mark.*
Answer in a word **or** *phrase.*

1. State Gauss's law in differential form. Explain the symbols used.
2. Give the relation between vector potential and magnetic field.
3. If the electrostatic potential in a region is represented as $V = 2x + 3y - z$, obtain the expression for electric field strength.
4. Write down the wave equation in one dimension.
5. What are equipotential surfaces ?

State whether the statement is True *or* False :

6. If the electric field is zero at a point, the electric potential is necessarily zero at that point.
7. The number of electric field lines penetrating normal to a surface is called electric flux.
8. Above the Curie temperature, a ferromagnetic material would become paramagnetic.
9. CO_2 is an example of non polar molecule.
10. In the interior of a dielectric kept in a uniform field, the net charge is zero.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions in two* **or** *three sentences.*
Each question carries 2 *marks.*

11. Show that electrostatic energy does not obey superposition principle.
12. Define one ampere current using the expression for the force acting per unit length of long parallel current carrying conductors.
13. Find the vector potential of an infinite solenoid with n turns per unit length, radius R and current I.
14. Is dielectric an insulator ? Explain.

Turn over

15. What is meant by dielectric breakdown ?

16. Distinguish between permeability and permittivity.

17. Write the relation connecting M, B and H.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions.*
Each question carries 4 *marks*

18. Explain scalar potential and vector potential.

19. Derive the expression for the capacitance of two concentric metal shells with radii α and β.

20. Explain cyclotron motion and cyclotron frequency.

21. Explain electrostatic boundary conditions.

22. Derive the Poisson's equation and Laplace's equation.

23. Derive an expression for the energy of a point charge distribution.

24. Write Ampere's law in differential and integral form.

(5 × 4 = 20 marks)

Section D

Answer any **four** *questions.*
Each question carries 4 *marks*

25. A metallic sphere of radius 10 cm. has a surface charge density of 10 nC/m^2. Calculate the energy stored in the system.

26. A current distribution gives rise to the magnetic vector potential $A = x^2y\ \hat{x} + y^2x\ \hat{y} - 4\ xyz\ \hat{z}$. Calculate B at (– 1, 2, 5).

27. A 50 cm. long solenoid having 500 turns and radius 2 cm. is wound on an iron core of relative permeability 800. What will be the average e.m.f. induced in the solenoid if the current in it changes from 0 to 2A in 0.05 *s* ?

28. Two point charges – 4 μC and 5 μC are located at (2, – 1, 3) and (0, 4, – 2). Find the potential at (1, 0, 1) assuming zero potential at infinity.

29. A capacitor is constructed from two conductive metal plates 30 cm. × 50 cm. which are spaced 6 mm. apart from each other, and uses dry air as its only dielectric material. Calculate the capacitance of the capacitor.

30. The electric field in some region of space is found to be $E = kr^3 \hat{r}$ in spherical Co-ordinates, where k is some constant and $\hat{r}$ is the unit vector. Find the charge density.

31. In an electric field, the potential at any point is given by $V = 5x^2 - 3y^2 + 2z^2$ volts. Find the expression for electric field intensity at a point (2,3,1). Also find its magnitude.

(4 × 4 = 16 marks)

Section E

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

32. Show that the potential due to a polarized dielectric is the same as that produced by a volume charge density and surface charge density.

33. Use Gauss's law to find the electric field:

    (a) Outside a uniformly charged solid sphere of radius R and total charge q.

    (b) At a distance from an infinite plane of uniform surface charge density.

34. Explain the following types of magnetic materials : (a) Paramagnets ; (b) Diamagnets ; and (c) Ferromagnets.

35. (a) State and explain Biot Savart's law.

    (b) Derive an expression for the magnetic field due to a circular loop of current at a point on the axis of the coil.

(2 × 10 = 20 marks)

C 61217 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2019

(CUCBCSS—UG)

Physics/Applied Physics

PHY 4B 04/APY 4B 04—ELECTRODYNAMICS—I

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in a word* **or** *phrase.*
Each question carries 1 *mark.*

1. Electric field inside a charged conductor is ————.
2. Electric lines of force penetrating normal to unit area of a surface is ————.
3. Torque acting on an electric dipole kept in a uniform field is ————.
4. The integral form of Ampere's law is ————.
5. The relation connecting the magnetic vector potential A and the current density J is given by ————.

State whether the statement is true *or* false :

6. Atomic polarizability, $\alpha = 4\pi\varepsilon_0 a^2$.
7. Hydrogen is an example of a non polar molecule.
8. For diamagnetic substances, susceptibility is independent of temperature.
9. Line integral of static electric field around a closed path is zero.
10. S.I. unit of electric field is V/m.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Write each answer in two **or** *three sentences.*
Each question carries 2 *marks.*

11. Explain Maxwell's equations of electrostatics.
12. Explain electrostatic boundary conditions.
13. No two electric lines of force intersect each other. Why ?

Turn over

14. What is electric displacement ?
15. Define Ampere's force law.
16. Define Gauss's law of magneto statics.
17. Explain current density.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions.*
Each question carries 4 *marks.*

18. Derive the expression for the capacitance of a parallel plate capacitor.
19. Derive the expression for electrostatic energy density.
20. Explain polarizability tensor.
21. What is magnetic vector potential ? Why is it called so ?
22. Explain Laplace equation in two dimensions.
23. State and prove Gauss's law in the presence of dielectric.
24. Explain dielectric strength.

(5 × 4 = 20 marks)

Section D

Answer any **four** *questions.*
Each question carries 4 *marks.*

25. Calculate the potential at points 10 cm. and 40 cm. from a point charge of 2.23×10^{-10} C. Calculate the potential difference between these two points.
26. An oil drop of mass 5×10^{-12} gm. is held stationary under the electric field applied between the two horizontal plates. Calculate the electric field if the drop carries 8 excess electrons.
27. Dielectric constant of a medium is 5. Calculate the electric susceptibility. Calculate the electric displacement and polarization for applied electric field of strength 10^6 V/m.
28. Two long parallel wires separated by 3 cm in air carries a current of 100 A. Find the force on 1 m length of a wire.
29. An electron enters a magnetic field of flux density 3T with a velocity of 2×10^7 m/s at an angle of 30° with the field. Calculate the magnitude of force on the electron.

30. Prove that magnetic torque, $\tau = m \times B$

31. An iron rod of volume $10^{-6}m^3$ is placed inside a solenoid of 1000 turns/m carrying a current of 3A. Find the magnetic moment of iron bar if the relative permeability of iron is 1000.

(4 × 4 = 16 marks)

Section E

Answer any **two** *questions.*

Each question carries 10 *marks.*

32. State and prove Gauss's law. Derive Laplace and Poisson's equation.

33. (a) What are the three electric vectors ? Explain each.

(a) Explain electric susceptibility, permittivity and derive the relation connecting them.

34. (a) Define electric potential and potential difference.

(b) Show that electric field is the gradient of scalar potential.

35. (a) State Biot Savart law.

(b) Derive an expression for the magnetic field due to a current carrying conductor at a point near to it.

(2 × 10 = 20 marks)

D 41960 (Pages : 2) Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2018

(CUCBCSS—UG)

Physics

PHY 4B 04/APY 4B04—ELECTRODYNAMICS—I

Time : Three Hours Maximum : 80 Marks

I. Answer *all* questions, each question carries 1 mark (in a word *or* phrase) :

1 Give an example of a physical quantity to be quantized.

2 For a given potential difference does a capacitor store more or less charge with a dielectric than it does without a dielectric ?

3 What is force on surface charge ?

4 Can two different equipotential surface intersect ?

5 What is Laplace equation ?

6 What is bound charge ?

7 Is there any difference between dielectric constant and dielectric strength ?

8 Write down the expression for magnetic field of toroidal coil.

9 What is the use of magnetic vector potential ?

10 Why electrostatic potential is a scalar ?

(10 × 1 = 10 marks)

II. Answer *all* questions, each question carries 2 marks (Answer in two *or* three sentences) :

11 Electric charge is quantized. What does this statement mean ?

12 A dipole in a uniform electric field experiences no net force. Is this statement true or false ? Give the reason for your answer.

13 State two properties of electric field.

14 State mean value theorem.

15 State the properties of solutions of Laplace's equation.

16 What is bound currents ?

17 Discuss magnetic field inside matter.

(7 × 2 = 14 marks)

III. Answer any *five* questions, each question carries 4 marks (Answer in *a paragraph*) :

18 Derive the expression for capacitance of a parallel plate capacitor with partially filled dielectric.

19 Briefly discuss the method of images.

Turn over

20 Obtain Clausius-Mosotti formula.

21 Show that $\nabla . B = 0$.

22 Give a brief account of comparison of Magneto statics and electrostatics.

23 Use Biot-Savart law to find the magnetic field inside and outside an infinitely long current carrying solenoid.

24 Explain magneto static boundary condition.

(5 × 4 = 20 marks)

IV. Answer any *four* questions, each question carries 4 marks :

25 An electron with a velocity of 2.4×10^6 m/s flies into a uniform electric field of intensity 135 Vm^{-1}. It moves along a field line until it comes to a halt. Calculate the distance travelled by the electron within the field.

26 Three charges + $1.5q$ + $1.5q$ and – $3q$ are placed at the vertices of an equilateral triangle of side b. Find the dipole moment of the charge distribution.

27 Dielectric constant of a gas at NTP is 1.000074. Calculate dipole moment of each atom of the gas when it is held in an external field of 3×104 Vm^{-1}

28 A wire shaped to regular hexagon of side 2 cm. carries a current of 2 amperes. Find the magnetic induction at the centre of the hexagon.

29 Derive an expression for the gyro magnetic ratio.

30 In the Rowland ring 2.0 amp current is passing through the winding of number of turns per unit length 10- turns /cm. Magnetic Induction measured is 1.0 weber/$m.^2$ Calculate (a) H, (b) M.

31 A toroidal winding of N turns surrounding a ferromagnetic specimen in which a narrow gap of width d has been cut. Calculate the value of magnetic field both in the gap and in the material.

(4 × 4 = 16 marks)

V. Answer any *two* questions, each question carries 10 marks :

32 Derive .an expression for the potential at a point due to a uniformly charged spherical shell.

33 Obtain Laplace's equation in two and three dimensions. Explain the properties of the solutions. State mean value and maximum value theorem.

34 Explain the terms polarization and displacement. Derive the relation connecting them. Derive an expression for potential of polarized objects.

35 Discuss in detail the Ampere's law in Magnetized materials. Derive an expression for the magnetic field at any point inside and outside of a long copper rod of radius R carries a uniformly distributed current I.

(2 × 10 = 20 marks)

C 3295

(Pages : 3)

Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2017

(CUCBCSS—UG)

Physics/Applied Physics

PHY 4B 04/APY 4B 04—ELECTRODYNAMICS—I

Time : Three Hours

Maximum : 80 Marks

Section A

Answer **all** *questions in a word* **or** *phrase.*
Each question carries 1 *mark.*

1. The number of electric field lines penetrating normal to a surface is called _____.
2. For static charge, curl of E is _____.
3. The induced electric dipole moment per unit volume is called _____.
4. Maxwell introduced the concept of _____ current.
5. Above curie point temperature, a ferromagnetic material would become _____.

State whether the statement is True *or* False (6-10) :

6. CO_2 is an example of non-polar molecule.
7. For Ferromagnetic material susceptibility is negative and small.
8. In the interior of a dielectric kept in a uniform field, the net charge is zero.
9. $\nabla^2 V = -\rho/\varepsilon_0$ is called Poisson's equation.
10. S.I unit of magnetic moment is Am.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Write each answer in two **or** *three sentences.*
Each carries 2 *marks.*

11. State curie's law.
12. What is meant by dielectric breakdown ?
13. Distinguish between permeability and permittivity.

Turn over

14. State ampere's force law.

15. What is magnitude vector potential ?

16. Write the relation connecting M, B, and H.

17. Draw a diagram to show the variation of electric field of a charged metallic sphere with distance.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions ; each carries* 4 *marks.*

18. Derive the expression for the capacitance of two concentric metal shells with radii a and b.

19. Derive the equation, $\mathbf{E} = -\nabla V$.

20. State first and second law of uniqueness theorem.

21. Explain cyclotron motion and cyclotron frequency.

22. Derivethe relation connecting dielectric constant and electric susceptibility.

23. Derive Ampere's law.

24. Explain electrostatic boundary conditions.

(5 × 4 = 20 marks)

Section D

Answer any **four** *questions.*
Each answer carries 4 *marks.*

25. Show that the energy of a magnetic dipole in a magnetic field B is given by $U = -m \cdot B$.

26. Four grams of gold is beaten into a thin leaf of area 1 m^2. A small piece is cut-off from this and placed upon a conductor. Calculate the charge density required by the conductor, so that the piece of gold is jut lifted up.

27. A parallel plate capacitor consists of two square plates of sides 4 cm, separated by 1 cm. A sulphur slab of thickness 5 mm is placed on the lower plate. Calculate the capacitance of the capacitor. Dielectric constant of sulphur is 4.

28. The horizontal component of magnetic flux density of earth's magnetic field (B) at a place is 0.40×10^{-4}T. What is the horizontal component of magnetic intensity (H) ?

29. An electron with energy 20 KeV enters a uniform magnetic field of 0.02 T. Find the cyclotron frequency and radius of the circle it will describe. ($m_e = 9.1 \times 10^{-31}$Kg, $q = 1.6 \times 10^{-19}$ C).

30. Calculate the magnitude of **D** (electronic displacement) and **P** (polarization) in a dielectric material in which E = 0.20 MV/m and electric susceptibility is 4.25.

31. What is the magnetic field at a point on the axis of a long solenoid of length 3 m, 600 turns, when a current of 2 A flows through it.

(4 × 4 = 16 marks)

Section E

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

32. Use Gauss's law to find the electric field :

    (a) Outside a uniformly charged solid sphere of radius R and total charge q.

    (b) At a distance from an infinite plane of uniform surface charge density.

33. (a) State and explain Biot Savart's law.

    (b) Derive an expression for the magnetic field due to a circular loop of current at a point on axis of the coil.

34. (a) Derive the expression showing the effect of magnetic field on atomic orbit.

    (b) Derive the relation connecting magnetic susceptibility and permeability.

35. (a) Explain atomic polarizability and polarization vector.

    (b) Derive the expression for the torque experienced by a polar molecule (dipole) in a non-uniform field

(2 × 10 = 20 marks)

C 25600

(Pages : 3)

Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE (SUPPLEMENTARY) EXAMINATION, APRIL 2017

(UG—CCSS)

Physics

PH 4B 07—ELECTRODYNAMICS—I

Time : Three Hours

Maximum : 30 Weightage

Section A

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

1. A and B are two spherical conductors of the same external size. A is a solid and B is hollow. Both are charged to the same potential. Then charge on A and B are connected by the relation :

   (a) $q_A > q_B$.

   (b) $q_A < q_B$.

   (c) $q_A = q_B$.

   (d) None of the above.

2. The potential gradient at which the dielectric of a condenser just gets pearced is called _____.

3. No current flows between the charged bodies connected together when they here the same :

   (a) Capacitance.

   (b) Charge.

   (c) Resistance.

   (d) Potential.

4. Eight small drops, each of radius 'r' and having same charge 'q' are combined to form a big drops. The ratio between the potentials of the bigger drop to smaller drop is :

   (a) 8 : 1.

   (b) 4 : 1.

   (c) 2 : 1.

   (d) 1 : 8.

5. If the dielectric constant and strength be denoted by k and x respectively, then the material suitable for use as a dielectric in a capacitor must have :

   (a) High k and x.

   (b) High k and low x.

   (c) Low k and x.

   (d) Low k and high x.

6. The electric potential at the surface of an atomic nucleus ($z = 50$) of radius 9.0×10^{-13} cm. is :

   (a) 80 volt.

   (b) 8×10^6 volt.

   (c) 9 volt.

   (d) 9×10^5 volt.

Turn over

7. A particle has charge + q and particle B has charge + $4q$ with each of them having the same mass m, when allowed to fall from rest through the same electrical potential differences, the ratio of their speed is :

   (a) 2 : 1. (b) 1 : 2.

   (c) 1 : 4. (d) 4 : 1.

8. A charge q is moving with a velocity v parallel to a magnetic field B. Force on the charge due to magnetic field is :

   (a) $q v B$. (b) $\frac{qB}{v}$.

   (c) Zero. (d) $\frac{Bv}{q}$.

9. A small current loop has a magnetic field B_1 at a point on its axis and B_2 at a point at the same distance in its plane. Then :

   (a) $B_1 = B_2$. (b) $B_1 = 2B_2$.

   (c) $B_2 = 2B_1$. (d) $B_2 = B_1 / \sqrt{2}$.

10. If an electron describes half a revolution in a circle of radius 'r' in a magnetic field B, the energy required by it is ————.

11. Form of energy stored in an inductor is ————.

12. The direction of propagation of e.m. wave is given by the direction of :

   (a) Vector $\bar{E}$. (b) Vector $\bar{H}$.

   (c) Vector $(\bar{E} \times \bar{B})$. (d) None of the above.

(12 × ¼ = 3 weightage)

Section B

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

13. Explain Coulomb's law in vector form.

14. Discuss the proportion of divergence of a vector.

15. Explain the properties of induced charge.

16. Explain the mean value and maximum value theorem.
17. Write down the expression for induced surface charge and give its significance.
18. State and explain Ampere's Circuital Theorem.
19. State and explain Biot and Savart law.
20. Give a short note on magnetic vector potential.
21. Discuss Gauss's law in presence of dielectric.

(9 × 1 = 9 weightage)

Section C

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

22. Applying Gauss's law derive an expression for the electric intensity due to an infinite sheet of charge.
23. Derive and discuss the force on surface charge.
24. Explain Uniqueness theorems and give its significance.
25. What do you mean by Bond charges and give its significance ?
26. Distinguish between polarizability and susceptibility.
27. Derive an expression for the orbital magnetic moment of electron and hence obtain an expression for gyromagnetic ratio.
28. Show that for a charged particle moving with a velocity $\bar{V}$, the magnetic potential is given by $\bar{A} = \frac{\bar{V}}{C^2} V$, where V is the electrostatic potential.

(5 × 2 = 10 weightage)

Section D

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

29. What are linear dielectrics ? Derive and discuss the boundary condition for $\bar{D}$.
30. Obtain the Laplace's equation in two and three dimensions. Explain the properties of solutions.
31. Discuss the properties of dia, para and ferro-magnetic materials. Obtain the relation $B = \mu_0 [H + M]$.

(2 × 4 = 8 weightage)

C 3965 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2016

(CUCBCSS—UG)

Core Course—Physics

PHY 4B 04/APY 4B 04—ELECTRODYNAMICS–I

Time : Three Hours Maximum : 80 Marks

Section A

Answer **all** *questions in a word* **or** *phrase.*
Each question carries 1 *mark.*

1. Potential energy of a system of two charges, U = ————.
2. Electric potential is ———— across any boundary.
3. Intensity of magnetic field at the center of a current carrying circular coil, B = ————.
4. Laplace equation in two dimension is ————.
5. ———— is the S.I. unit of magnetic field strength.

State whether the statement is True *or* False :

6. Dipole moment is a vector quantity.
7. Permeability of diamagnetic substance is always greater than unity.
8. Permanent magnetic material must have high coercivity.
9. Area is a vector quantity.
10. If the centre of gravity of the positive nuclei and the electron cloud coincide, the molecule is called polar molecule.

(10 × 1 = 10 marks)

Section B

Answer **all** *questions.*
Write each answer in two **or** *three sentences.*
Each question carries 2 *marks.*

11. During lightening, we are safe inside a car. Why ?
12. Why electrostatic force is considered as a conservative force ?
13. What's the working principle of a cyclotron ?
14. State the Gauss's theorem in magnetostatics.

Turn over

15- Magnetic field that exist in vaum and induced magnetism is called magnetizing field. A region around the magnet with material when termed magnetic aid

15. Explain magnetizing field and magnetic field.

16. Can a system have magnetic moment even if its net charge is zero ? Explain.

17. Explain electrostatic pressure.
charge exerts on the surface of a conductor as the magnitude of the force per unit area.

(7 × 2 = 14 marks)

Section C

Answer any **five** *questions.*
Each question carries 4 *marks.*

18. Explain Maxwell's equations of electrostatics.

19. How is atomic polarizability and polarization related ?
relative tendency of charge distribution.

20. Explain bound charge. external electric fueld that is applied to dielectric material, causes a displacement of bound.

21. Derive Poisson's equation.

22. Derive the expression for the energy of a charged capacitor.

23. Explain hysteresis. Value of.

24. Distinguish between para, dia and ferromagnetic materials.

(5 × 4 = 20 marks)

Section D

Answer any **four** *questions.*
Each question carries 4 *marks.*

25. A dielectric slab of thickness 0.75 cm and dielectric constant 4 is placed between the plates of a parallel plate capacitor of area 0.02 m^2 and separation 2 cm. Calculate the change in capacitance on the introduction of a dielectric.

What would be the change if the slab were conducting ?

26. Three point charges, each of +250 μC are placed at the three corners of an equilateral triangle. Calculate the resulting electric potential at the center of the triangle, which is at a distance of 18 cm from each corner.

27. The electron in a hydrogen atom circles around the proton with a speed of 2×10^6 m/s in an orbit of radius 5.3×10^{-11} m. Calculate :

(a) The equivalent current.

(b) Magnetic field strength produced at the proton.

28. An iron rod of 0.2 cm^2 area of cross-section is subjected to a magnetizing field of 1200 Am^{-1}. If the susceptibility of iron is 599, calculate :

    (a) Permeability.

    (b) Magnetic flux produced.

29. A horizontal overhead power line carries a current of 60 A from south to north. Calculate the magnitude and direction of magnetic field due to the current at a point 2.5 m above the line.

30. Derive the expression of torque experienced by a dipole in a non-uniform electric field.

31. Current passing through a solenoid is 2 A. What is the magnetizing field (H) if it is 2 m long and contains 400 turns. Find intensity of magnetic field (B) in free space.

(4 × 4 = 16 marks)

Section E

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

32. Discuss electrostatics boundary conditions and first and second uniqueness theorem.

33. (a) State Ampere's law.

    (b) Derive the expression for the magnetic field due to :

    (i) Solenoid.

    (ii) Toroid.

34. (a) State and prove Gauss's law in the presence of dielectric.

    (b) What are the three electric vectors ? Derive the relation connecting them.

35. Derive the expression for :

    (a) The energy of a continuous charge distribution.

    (b) Electrostatic energy density.

(2 × 10 = 20 marks)

C 5130 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE (SUPPLEMENTARY/IMPROVEMENT) EXAMINATION, MAY 2016

Core Course—Physics

PH 4B 07—ELECTRODYNAMICS—I

Time : Three Hours Maximum : 30 Weightage

The symbols used in this question paper have their usual meanings.

Section A

I. Objective type questions. Each question carries a weightage of ¼.

Choose the correct alternative from the given list :

1 div Curl **E** = _____.

(a) Zero. (b) ∇^2 B.

(c) Infinity. (d) None above.

2 The Displacement vector **D** =

(a) ε_0 **E** + **P**. (b) $\varepsilon_0 \chi_e$ **E**.

(c) $\varepsilon_0 \partial \mathbf{E}/\partial t$. (d) $1 + \chi_e$.

3 **V.B** = 0 implies.

(a) **B** is always zero. (b) **B** is a constant.

(c) **B** is irrotational. (d) **B** is solenoidal.

4 The magnetic susceptibility of a diamagnetic material is :

(a) Zero. (b) Less than zero.

(c) Greater than zero. (d) Complex.

Fill in the blanks :

5 The value of permittivity of air is _____.

6 The general solution of one dimensional Laplace's equation is a _____.

7 The equation connecting Polarization and susceptibility is _____.

8 The field outside a current carrying solenoid is _____.

Turn over

Give very brief answers :

9 Write down the expression for flux of a vector.

10 Give differential form of Ampere's law.

11 Name the force experienced by a moving charge due to a magnetic field.

12 Give an example for a ferromagnetic material.

(12 × ¼ = 3 weightage)

Section B

II. Answer all *nine* questions. Each question carries a weightage of 1 :

13 What is a Gaussian surface ?

14 Show that electric potential obeys superposition principle.

15 State 2nd Uniqueness theorem.

16 Define a linear Dielectric. Give an example.

17 What are the boundary conditions for **D**.

18 When a bar magnet is broken into 2 equal parts each part becomes a new magnet. Explain it on the basis of vanishing divergence of B.

19 What is Physical significance of the equation $\nabla x\mathbf{E} = 0$.

20 Define magnetization .What is its unit ?

21 How is Magnetic susceptibility related to permeability ? (9 × 1 = 9 weightage)

Section C

III. Answer any *five* questions. Each question carries a weightage of 2 :

22 Find the electric field due to a uniformly charged solid cylinder both inside and outside the Cylinder.

23 Derive the equation for the capacitance of a Spherical capacitor.

24 A point charge q is situated at a distance r from the centre of a grounded conducting sphere of radius R. Find the potential inside and outside the sphere using the method of images

25 Find the minimum kinetic energy of a proton which would encircle the earth along the equator. Assume the radius of earth = 6,400 km and $B_H = 4 \times 10^{-5}$ Tesla. Mp = 1.7×10^{-27}kg.

26 Find the magnetic flux density of a square wire loop of side 10 cm, carrying 1 Amp at its centre

27 Explain how the concept of vector potential is introduced in magnetostatics. What is its advantage ?

28 Derive the equation of field due to a magnetised object.

(5 × 2 = 10 weightage)

Section D

IV. Answer any *two* questions. Each question carries a weightage of 4 :

29 Derivean expression for energy of a charged capacitor. Show that the dielectric in between the plates of a parallel plate capacitor experiences a force and derive an equation for it.

30 Definethe terms 'boundary condition'. Derive boundary conditions in magneto statics and compare them with electrostatic boundary conditions.

31 Derive Clausius-Mossotti equation.

(2 × 4 = 8 weightage)

C 1814

(Pages : 3)

Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION
APRIL/MAY 2015

(UG-CCSS)

Core Course—Physics

PH 4B 07—ELECTRODYNAMICS—I

Time : Three Hours

Maximum : 30 Weightage

Section A

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

1. In a charged bubble the mechanical force due to charge is counter balanced by :

   (a) Force of gravity.
   (b) Viscosity.
   (c) Surface tension.
   (d) None of the above.

2. The electric field inside a perfectly conducting media is :

   (a) α.
   (b) °.
   (c) 120π.
   (d) None of the above

3. The dimension of potentials are same as that of :

   (a) Work.
   (b) Electric field per unit charge.
   (c) Work per unit charge.
   (d) Force per unit charge.

4. In free space Poisson's equation is :

   (a) $\nabla^2 V = 8.85 \times 10^{-12} e$
   (b) $\nabla^2 V = 0$.
   (c) $\nabla^2 V = \alpha$.
   (d) None of these.

5. The unit of $\vec{D}$ is :

   (a) V/m^2.
   (b) $Coul/m^2$.
   (c) V/m.
   (d) Q/m.

6. The unit of polarisation is $\vec{p}$ is :

   (a) Same as that of $\vec{E}$.
   (b) Same as that of $\vec{D}$.
   (c) Same as that of charge.
   (d) None of the above.

Turn over

7. For steady state continuity equation is :

(a) $\nabla \cdot J = 0$.

(b) $\nabla \cdot J = -\frac{\partial e}{\partial t}$.

(c) $\nabla \cdot J = 0$.

(d) $\nabla \cdot J = \frac{\partial e}{\partial t}$.

8. $\nabla \cdot B = 0$ is based on :

(a) Continuity equation.

(b) Faradays law.

(c) Gauss's law.

(d) Ohm's law.

9. If two conductors carry current in opposite direction, they will experience a force of :

(a) Attraction.

(b) Repulsion.

(c) No force.

(d) None of the above.

10. The ratio of intensity of magneticfield at the centre of a very long solenoid to that at the extreme end is :

(a) 2.

(b) ½.

(c) 4.

(d) ¼.

11. The idea of displacement current is due to :

(a) Ampere.

(b) Faraday.

(c) Gauss.

(d) Maxwell.

12. The source of H is :

(a) Q.

(b) M.

(c) I.

(d) B.

(12 × ¼ = 3 weightage)

Section B

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

13. Define electron volt.

14. What are the importance of Poisson's equation ?

15. What are polar and non-polar molecules ?

16. Write down the relation between electric susceptibility and atomic polarisability.
17. What do you mean by dielectric strength ?
18. State and explain Ampere's circuital law.
19. Discuss the importance of the equation $\nabla \cdot B = 0$.
20. Obtain an expression for energy density in a magnetic field.
21. Write short note on Poynting Vector.

(9 × 1 = 9 weightage)

Section C

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

22. Obtain the expression for Laplace equation and bring out its importance.
23. What do you mean by electrostatic boundary conditions ?
24. Discuss the applications of method of images.
25. Obtain the relation between three electric vectors.
26. Obtain the relation between suscephability and polarisability.
27. With suitable example discuss any *one* application of Amperes law to find the field.
28. Distinguish between linear and non-linear media. Write down the expression for torques and force on magnetic dipole.

(5 × 2 = 10 weightage)

Section D

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

29. With necessary theory obtain electrostatic boundary conditions. Discuss about work and energy in electrostatics.
30. What do you mean by polarizability tensor ? Obtain an expression for torque acting on a dipole in a uniform electric field.
31. Derive an expression for the magnetic field due to an infinitely long straight conducted and hence find the field at the centre of a square loop of side 'a' carrying current I.

(2 × 4 = 8 weightage)

C 62043 (Pages : 3) Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, MAY 2014

(U.G.—CCSS)

Physics—Core Course

PH4 B07—ELECTRODYNAMICS—I

Time : Three Hours Maximum : 30 Weightage

Section A

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

1. The magnitude of electric field E in the annular region of a charged cylindrical capacitor is :
   (a) Same though out.
   (b) Higher nearer the outer cylinder than the inner cylinder.
   (c) Varies $1/r$ where r is distance from the centre.
   (d) Varies $1/r^2$.

2. The energy density of a capacitor is given by :
   (a) $\frac{1}{2}\varepsilon_0 E^2$. (b) $\frac{1}{2}\varepsilon_0 B^2$.
   (c) $\frac{1}{2}\varepsilon_0 E$. (d) None of the above.

3. The displacement current arises due to :
   (a) Positive charges only.
   (b) Negative charges only.
   (c) Both positive and negative charge.
   (d) Time varying electric field.

4. Mathematical expression for Poisson's equation is ————.

5. Tesla equals to :
   (a) Nam. (b) Nam^{-1}.
   (c) $NA^{-1}m^{-1}$. (d) None of the above.

Turn over

6. Two parallel wires each of 50 cm. length are placed 1 m. apart. Each wire is carrying a current of 2 A in the same direction. The force between the two wires is :

   (a) Attractive. (b) Repulsive.

   (c) Sometime (a) and sometime (b). (d) None of the above.

7. Laplace's equations is given by ———.

8. The ferromagnetic property can be explained on the basis of formation of ———.

9. Circular loop A has radius R and current I and another B has twice the current and radius as that of A then the ratio of magnetic field at the centre of these loop is :

   (a) 1. (b) 2.

   (c) 3. (d) 4.

10. The magnetic field at a point on the axis of a long solenoid of length 2m total number of turns 500 when a current of 2 A flows though it is

    (a) 3.24×10^{-4} T. (b) 6.28×10^{-4} T.

    (c) 13.24×10^{-4} T. (d) 5.24×10^{-4} T.

11. The magnetic field at the centre of the cube of edge of length a is ———.

12. A magnet of moment M is rotated through 360° in a magnetic field B , the work done will be :

    (a) MB. (b) 2MB.

    (c) MB/2. (d) None of the above.

(12 × ¼ = 3 weightage)

Section B

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

13. State Coulomb's law.

14. Obtain an expression for the charge required to produce equilibrium in an electrified soap bubble.

15. State mean value and maximum value theorem

16. Derive an expression for the energy of a charged condenser.

17. Show that $\Delta \cdot A = 0$

18. State and explain Amperes law.

19. Define magnetic vector potential.

20. Define susceptibility.

21. What is Lorentz force ?

(9 × 1 = 9 weightage

Section C

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

22. Applying Gauss's law for deriving an expression for the electric intensity due to an infinite sheet of charge..

23. The energy of a charged capacitor is 0.2 J . If its capacitance is 2 μF, calculate :

    (i) The charge on the capacitor ; and

    (ii) The potential difference between the plates.

24. Define electrical images with a neat diagram.

25. State and explain second uniqueness theorem

26. An atom consist of a point nucleus of charge q surrounded by a uniformly charged spherical cloud $(-q)$ of radius a. Find the atomic polarizability of such an atom.

27. Explain the physical interpretation of bound charge.

28. Discuss about the comparison of magetostatics and electrostatics.

(5 × 2 = 10 weightage)

Section D

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

29. List and explain the basic properties of conductors and insulators. Discuss the properties of equipotential surfaces.

30. Obtain the Laplace's equation in one, two and three dimension. Explain its properties of the solution.

31. State Biot Savart law. Derive an expression for the magnetic field due to a current carrying conductor at a point near it.

(2 × 4 = 8 weightage)

C 41425

(Pages : 3)

Name.....

Reg. No.....

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH 2013

(CCSS)

Physics

PH 4B 07—ELECTRODYNAMICS—I

Time : Three Hours

Maximum : 30 Weightage

Section A

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

1. A hollow metal sphere of radius 5 cm is charged such that the potential on its surface 10 V. The potential at the centre of the sphere is :

   (a) Zero.
   (b) 10 V.
   (c) 15 V.
   (d) 20 V.

2. A soap bubble is given a positive charge. Its radius will :

   (a) Increase.
   (b) Decrease.
   (c) Remain unchanged.
   (d) Oscillate.

3. When a dielectric of dielectric constant K is introduced between the plates of a parallel plate capacitor, the field at a point between the plates :

   (a) Increases.
   (b) Remains the same.
   (c) Becomes K times E.
   (d) None of the above.

4. An infinite number of capacitors each of capacitors C, 2C, 4C, 8C, 16C, ... are connected in series. The equivalent capacitance of the system is :

   (a) C.
   (b) C/2.
   (c) 2c.
   (d) infinite.

5. The displacement current arises due to :

   (a) Positive charges only.
   (b) Negative charges only.
   (c) Both positive and negative charges.
   (d) Time varying electric field.

Turn over

6. The mathematical expression for Laplace's equation is _____.

7. A long, straight wire is carrying a current of 2 A. The magnetic filed at a point distant 10 cm from the wire is :

   (a) 4×10^{-6} G. (b) 4×10^{-7} G.

   (c) 4×10^{-2} G. (d) None of the above.

8. Two parallel wires each of 50 cm length are placed 1 m apart. Each wire is carrying a current of 2 A in the same direction. The force between the two wires is :

   (a) Attractive. (b) Repulsive.

   (c) Sometime (a) and sometime (b). (d) None of the above.

9. Most of the substance show which of the magnetic property :

   (a) Diamagnetism. (b) Paramagnetic.

   (c) Non-magnetic. (d) Ferromagnetic.

10. The magnetic materials having negative magnetic susceptibility are :

    (a) Paramagnetic. (b) Diamagnetic.

    (c) Ferromagnetic. (d) Ferromagnetic.

11. Which among the following is a unit less quantity :

    (a) Permeability. (b) Magnetic flux.

    (c) Susceptibility. (d) Pole strength.

12. The magnetic field at a point on the axis of a long solenoid of length 2m total number of turns 500 when a current of 2 A flows though it is :

    (a) 3.24×10^{-4} T. (b) 6.28×10^{-4} T.

    (c) 13.24×10^{-4} T. (d) 5.24×10^{-4} T.

(12 × ¼ = 3 weightage)

Section B

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

13. State Coulomb theorem.

14. Define Volt.

15. What are induced charges ? Explain with example.

16. What are dielectrics ? Give example.

17. State Gauss's law in presence of dielectric.

18. Show that $\nabla \times B = \mu_0 J$.

19. Define magnetic vector potential.

20. Define susceptibility.

21. Distinguish between linear and nonlinear media.

(9 × 1 = 9 weightage)

Section C

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

22. Obtain the differential form of Gauss's law.

23. A point charge 10^{-7} is situated at the centre of a cube of 1m side. Calculate the electric flux though its surface.

24. Derive Poisson's equation and obtain Laplace's equation.

25. Two parallel conducting planes in free space are at $y = 0$ and $y = 2$ cm, and the zero voltage reference is at $y = 1$ cm. Calculate the conductor voltages, if the electric displacement between the conductors is 253j nc/m^2.

26. A dielectric cube of side a centered at the origin, carries a frozen-in-polarization P = kr where k is a constant. Find all the bound charges and check they add up to zero.

27. Find the magnetic field of an infinite uniform surface current K = Kx flowing over the *xy*-plane.

28. Discuss about the comparison of magnetostatics and electrostatics.

(5 × 2 = 10 weightage)

Section D

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

29. Derive an expression for the electric intensity due to a uniformly charged ring at a point on its axis and hence find the electric intensity at the centre of the ring.

30. State Ampere's law. Express the law in differential form and obtain an expression for the divergence and curl of B.

31. With suitable example classify the properties of Diamagnets, Paramagnets and Ferromagnets.

(2 × 4 = 8 weightage)

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 ?

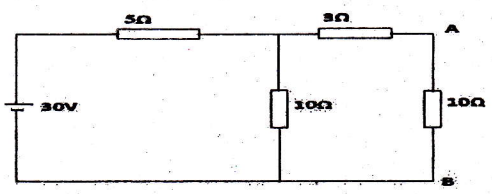
26. Find the self inductance per unit length of a long solenoid of radius R and *n* turns per unit length, carrying a current I.

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)