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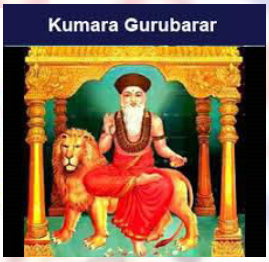

QUESTIONBANK

Title of the Paper

ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

Course: II B.Sc. PHYSICS

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CORE COURSE IV

ELECTRICITY, MAGNETISM AND ELECTROMAGNETISM

Objective:

This course provides an in depth coverage of behaviour of stationary electric charges, electricity, magnetism and how they are connected.

UNIT I

Electrostatics Coulomb's Law – Gauss's Law and its applications (Electric Field due to a uniformly charged sphere, hollow cylinder & solid cylinder)– Electric Potential – Potential at a point due to a uniformly charged conducting sphere – Principle of a capacitor– Capacity of a spherical and cylindrical capacitors – Energy stored in a charged capacitor–Loss of energy on sharing of charges between two capacitors.

UNIT II

Current Electricity Ampere's circuital law and its applications -Field along the axis of a circular coil and Solenoid–Theory of Ballistic Galvanometer –Figure of merit– Damping Correction– Kirchhoff's Laws of Electricity –Wheatstone's Bridge–Carey Foster's Bridge–Potentiometer– Calibration of Ammeter – Calibration of Voltmeter (Low range and High range) – Comparison of Resistances.

UNIT III

Electromagnetic Induction Laws of electromagnetic induction– Self and mutual induction– Self-inductance of a solenoid– Mutual inductance of a pair of solenoids– Coefficient of coupling– Experimental determination of self (Rayleigh's method) and mutual inductance– Growth and decay of current in a circuit containing L and R–Growth and decay of charge in a circuit containing C and R– Measurement of High resistance by leakage.

UNIT IV

AC Circuits Alternating EMF applied to series circuits containing LC, LR and CR– Alternating EMF applied to circuits containing L, C and R–Series and Parallel resonance circuits– Sharpness of resonance–Q factor– Comparison between Series and Parallel resonant circuits –Power in AC circuits (R, L-R, L-C-R only) – Power factor– Wattlesscurrent – Choke Coil – Transformer – Uses of Transformers – Skin Effect.

UNIT V

Magnetism Intensity of Magnetization– Magnetic Susceptibility– Magnetic Permeability – Types of magnetic materials– Properties of para, dia and ferromagnetic materials– Langevin's theory of dia and para magnetism– Weiss's theory of ferromagnetism – B-H curve–Energy loss due to magnetic hysteresis – Ballistic Galvanometer method for plotting B-H curve - Magnetic properties of iron and steel.

Books for Study:

1. BrijLal and N. Subrahmanyam, A Text Book of Electricity and Magnetism, RatanPrakasanMandir Educational & University Publishers, New Deihi,2000.

2. R. Murugeshan, Electricity and Magnetism, S. Chand & Company Pvt. Ltd., New Delhi – 2015

Books for Reference:

1. D. L. Sehgal, K. L. Chopra and N. K. Sehgal, Electricity and Magnetism, S. Chand & Sons. New Delhi. 1996.

UNIT - I
ELECTROSTATICS

CHOOSE THE CORRECT ANSWER

1. The force acting between two charges is.
    a. Directly proportional to the distance.
    b. Inversely proportional to the distance.
    c. Directly proportional to the square of the distance.
    d. Inversely proportional to the square of the distance.

2. If the distance between two charges is doubled the electrostatic force between the charges will be
    a. Four time more
    b. Four times less.
    c. Will increase two times.
    d. Will decrease two times.

3. the unit of charge is.
    a. Ohm
    b. Ampere
    c. Coulomb
    d. mho

4. When the distance between two equal charges is decreased to half and their magnitude of charge also decreased to half, the force between them.
    a. Remains unchanged
    b. Reduces to half
    c. Becomes double
    d. Becomes four times.

5. The work done on a unit positive charge in bringing it from infinity to any point is called.
    a. Intensity at that point.
    b. Electric potential at that point
    c. Electric potential at infinity
    d. Electric intensity at infinity.

6. The dimensions of potential are same as that of.
    a. Work
    b. Electric field per unit charge
    c. Work per unit charge
    d. Force per unit charge

7. Electric field lines and equipotential lines are.
    a. Always orthogonal.
    b. Orthogonal only when electric field is uniform
    c. Orthogonal only when potential does not change.
    d. None of the above is correct.
8. Electric field potential due to a point charge.
    a. Falls inversely proportional to the distance
    b. Falls inversely proportional to the square
    c. Falls inversely proportional to the square root of the distance.
    d. It does not change with distance.
9. 1microfarad is.
    a. 10^{-3} F
    b. 10^{-6}F
    c. 10^{-12}F
    d. 10^{-15}F

10. If the radius of the spherical conductor is doubled, the capacitance.
    a. Decrease by two time
    b. No change
    c. Increase
    d. Increase by four times.

ANSWERS:

1) d 2)b 3)c 4)a 5)b 6)c 7)a 8)a 9)b 10)b

TWO MARKS

11. Define the coulomb's law?
12. Define Gauss's law and it's applications?
13. What is Electric potential Energy?
14. Give Cavendish's proof of inverse square law in electrostatics.
15. State the electrical images.
16. Give the electrical energy in a crystal lattice.
17. What are lines of force?
18. What is electric filed soap bubble?
19. State and capacity of a conductor.
20. What are condensers?

FIVE MARKS

21. Define the terms 'potential' and equipotential surface'.
22. Explain the terms electrical intensity', 'electrical induction ' and electrical polarisatricon' for a medium.
23. Give, with necessary theory, an account of the Cavendish's method for the proof of 'Inverse square law' in electrostatics.

24. Define electric potential and electric field at a point.
25. Show theoretically that there in no electric field inside a hollow charged spherical conductor.
26. Define electric potentical and intensity at a point in an electric field and derive the intensity at any point (r,θ) due to an electric dipole.
27. State and prove Gauss's theorem in electrostatics.
28. Calculate the excess of pressure inside a charged soap bubble of radius r.
29. Find an expression for the mechanical force per unit area of the surface of a charged conductor.
30. State briefly what do you mean by electric image and its usefulness.

TEN MARKS

31. Derive an expression for the electric field due to a uniformly charged sphere.
32. Derive an expression for the electric field due to a uniformly charged hollow cylinder.
33. Derive an expression for the electric field due to a uniformly charged solid cylinder.
34. Define the potential at a point due to a uniformly charged conducting sphere.
35. Obtain the expression for the principle of a capacitor.
36. Obtain the expression for the capacity of a spherical.
37. Obtain the expression for the capacity of a cylindrical capacitors.
38. Derive an expression for the energy of a charged capacitor.
39. Explain the loss of energy on sharing of charges between two capacitors.
40. Derive an expression for the capacity of a parallel plate condenser.

UNIT - II
CURRENT ELECTRICITY

CHOOSE THE CORRECT ANSWER

1.The magnetic field intensity at a distance 'a' form a long linear conductor is.

a. Directly proportional to the current and distance 'a'.
b. Directly proportional to the current but inversely proportional to the distance 'a'
c. Inversely proportional to the current and distance a.
d. Inversely proportional to the distance 'a' Directly proportional to the distance 'a'.

2. Magnetic field intensity on the axis of a circular coil at a distance x away from the loop is.

a. Inversely proportional to x^3
b. Directly proportional to x^3
c. Inversely proportional to x^2
d. Directly proportional to x^2

3. The ratio the magnetic field inside a solenoid at an axial point well inside and at an axial end point is

a. 2
b. $\frac{1}{2}$
c. 1
d. $\frac{3}{2}$

4. Two wires carrying same current in the same direction placed 1 an apart will experience.

a. Repulsive force.
b. No force.
c. Attractive force.
d. None of the above.

5. While using a wheatstone's bridge.

a. Both the keys should be pressed.
b. Battery key should be pressed first
c. Galvanometer key should be pressed first
d. Any key may be pressed.

6. The device which is used to measure current and voltage is

a. Voltmeter
b. Ammeter
c. Potentiometer
d. Flux meter

7. In the case of a moving coil galvanometer the deflection is

a. Non-linearly proportional the current
b. Directly proportional to the current
c. Inversely proportional to the current
d. None of the above

8. In fleming's left hand rule the thumb gives the direction of

a. Current
b. Field
c. Motion of conductor
d. All the above

9. An ammeter is

a. An ordinary galvanometer
b. A galvanometer with a high resistance
c. A low resistance galvanometer
d. None of the above

10. The coil of a ballistic galvanometer is wound over a frame of
    a. Copper
    b. Bamboo
    c. Any material
    d. Manganin

ANSWERS:

1)b 2)a 3)a 4)c 5)b 6)c 7)b 8)c 9)c 10)b

TWO MARKS

11. Define oersted's experiment.
12. What is maxwell's cork screw rule?
13. Give the right hand rule.
14. What is ampere's swimming rule?
15. Define laplace law.
16. Define ampere's law.
17. Give the fleming's left hand rule.
18. State biot-savart's law.
19. What is displacement current?
20. Define sine galvanometer.

FIVE MARKS

21. Deduce an expression for the field due to a current flowing in a straight conductor of infinite length.
22. Show that the magnetic intensity at a point distant a from a wire carrying current.
23. Discuss the equivalence of a magnetic shell and a circuit carrying current.
24. Calculate the field at a point on the axis of a plane circular shell.
25. Derive an expression for the magnetic field due to the current in a circular coil, at any point on its axis.
26. Find the position of the point where the variation of the field is uniform along the axis.
27. Establish the formula for the intensity of the magnetic field at a point.
28. Find the expression for the intensity of the magnetic field at apoint on the axis of a circular coil.
29. Obtain an expression for the intensity of the magnetic field inside a long solenoid.
30. Obtain an expression for the magnetic intensity at a point on the axis of a circular coil carrying a current.

TEN MARKS

31. Explain the field along the axis of a circular coil.
32. Explain the field along the axis of a solenoid.
33. Discuss the theory of Ballistic galvanometer.
34. Briefly explain figure of merit, Damping correction.

35. Explain the Kirchhoff's laws of electricity.
36. Briefly explain wheat stone's bridge.
37. Discuss the carey foster's bridge.
38. Derive an expression for the potentiometer calibration of Ammeter.
39. Derive an expression for the potentiometer calibration of voltmeter(low range).
40. Derive an expression for the potentiometer calibration of voltmeter(High range).

UNIT - III
ELECTROMAGNETIC INDUCTION

CHOOSE THE CORRECT ANSWER

1.Electromagnetic effect was discovered by.
   a. Oersted
   b. Faraday
   c. Ampere
   d. Lenz.

2. The direction of induced e.m.f in a circuit is given by.
   a. Lenz Low
   b. Faraday law
   c. Fleming's left hand rule
   d. Swimming rule

3. Henry is equal to.
   a. Weber / ampere
   b. Ampere / Weber
   c. Volt / ampere
   d. Ampere / volt

4. The induced e.m.f in a conductor is.
   a. Inversely proportional to the rate of change of flux.
   b. Directly proportional to the rate of change of flux.
   c. Directly proportional to the total flux.
   d. Inversely proportional to the total flux.

5. In Fleming's right hand rule the fore finger represents.
   a. Direction of magnetic field
   b. Motion of conductor.
   c. Direction of induced current
   d. May be any.

6. The unit of self inductance is.
    a. Ohm
    b. Ampere
    c. mho
    d. Henry
7. The maximum value of coefficient of coupling is.
    a. 0
    b. 1
    c. 2
    d. Infinity
8. Eddy currents are observed by.
    a. Oersted
    b. Faraday
    c. Ampere
    d. Foucault
9. Eddy currents are used in.
    a. Speedometers
    b. Induction motor
    c. Induction furnace
    d. In all the above.
10. Eddy current is also called as.
    a. Primary current
    b. Secondary current
    c. Foucault current
    d. Ionisation current.

ANSWERS:

1)b 2)a 3)c 4)b 5)a 6)d 7)b 8)d 9)d 10)c

TWO MARKS

11. State and Faraday's law of Electro – magnetic induction.
12. What is lenz's law?
13. Define naumann's law.
14. Give the total charge through the circuit.
15. Define self – Induction.
16. Give the units of self - Inductance.
17. What is non – inductive coils?
18. What is varying currents?
19. Define charging of a condenser.
20. Give the nature of the discharge.

FIVE MARKS

21. A charged condenser discharges through a circuit containing an inductance and resistance.
22. Give the theory of oscillatory discharge of a condenser through an inductance and a resistance.
23. Define and explain mutual inductance between two circuits. Describe a method to measure.
24. Discuss the discharge of a condenser in a purely resistive circuit and explain how the result.
25. Obtain expressions for the growth and decay of the charge of a condenser through a resistance.
26. Find the conditions under which the discharge of the condenser is oscillatory.
27. Define a). coefficient of self – inductance and b). coefficient of mutual inductance.
28. Describe with theory an experimental method to determine the self – inductance of a coin.
29. What is self – inductance? Calculate the self – Inductance of a long solenoid of length L, total number of turns N and radius r.
30. Describe a method of measuring the self – inductance of a coil.

TEN MARKS

31. Briefly explain self – induction and mutual induction.
32. Discuss the self – inductance of a solenoid.
33. Discuss the mutual inductance of a pair of solenoids.
34. Briefly explain coefficient of coupling.
35. Describe experimental determination of self (Rayleigh'smethod) and mutual inductance.
36. Explain the Growth of current in a circuit containing L.
37. Explain the Growth of current in a circuit containing R.
38. Discuss the decay of current in a circuit containing L.
39.Discuss the decay of current in a circuit containing R.
40. Briefly explain growth and decay of charge in a circuit containing C and R.

UNIT - IV
AC CIRCUITS

CHOOSE THE CORRECT ANSWER

1.Form factor is the ratio of.
   a. r.m.s to average.
   b. Average tor.m.s.
   c. r.m.s to maximum.
   d. Average of maximum.

2. In an a.c circuit having R and L in series.
   a. Voltage Leads the current.
   b. Current leads the voltage.
   c. Voltage and current are in phase.
   d. None of the above.

3. The unit of impedence is.
   a. mho
   b. Ohm
   c. Ampere
   d. Volt

4. power in an a.c circuit when voltage and current are in phase.
   a. EI
   b. EI Sinθ
   c. EI cosθ
   d. zero

5. Impedence is composed of.
   a. Resistance and capacitance.
   b. Resistance and inductance.
   c. Resistance and reactance.
   d. Reactance and inductance or capacitance.

6. Power in a capacitive circuit is.
   a. EI
   b. EI Sinθ
   c. EI Cosθ
   d. Zero.

7. Power factor is the ratio between.
   a. Resistance / Impedence
   b. Impedence / Resistance
   c. Volt / ampere
   d. None of the above

8. In series resonance circuit, the current at resonance is.
    a. Minimum
    b. Maximum
    c. Zero
    d. Maximum or minimum
9. The frequency of the resonant circuit is.
    a. $2\pi\sqrt{LC}$
    b. 2π/Lc
    c. $\frac{1}{2\pi\sqrt{LC}}$
    d. $\frac{1}{2\pi \mathrm{LC}}$
10. Quality factor Q of a coil is.
    a. $\frac{\omega L}{R}$
    b. ωLR
    c. $\frac{R}{\omega \mathrm{L}}$
    d. $\frac{1}{\omega \mathrm{LR}}$

ANSWERS:

1)a 2)a 3)b 4)a 5)c 6)d 7)a 8)b 9)c 10)a

TWO MARKS

11. What is measurement of AC?
12. State and principle of AC Instruments.
13. What is Resistance?
14. What isInductance?
15. What is capacitance?.
16. Give the choke coil.
17. Define series circuits.
18. Define parallel circuits.
19. Write short notes on complex numbers.
20. What is Q – Quality factor?

FIVE MARKS

21. As alternating EMF is applied to the ends of a coil having a resistance R and self – inductance L
22. Explain fully what you understand by a choke coil.
23. Distinguish between the true mean value, peak value and root mean square volume of alternating current.
24. Give an expression for the average power in an AC circuit consisting a resistance and an inductance.

25. Derive expressions for the EMF and current in an AC circuit containing resistance and inductance.
26. An alternating EMF is applied to a circuit having capacitance resistance in series.
27. Derive an expression for the impedance and the current in the circuit.
28. Explain the terms reactance, impedance and power factor.
29. Describe how you would determine the power factor of a load in an AC circuit.
30. What do you understand by R.M.S value of an alternating E.M.F?

TEN MARKS

31. Explain the Alternating EMF applied to series circuits containing LC.
32. Explain the Alternating EMF applied to series circuits containing LR.
33.Explain the Alternating EMF applied to series circuits containing CR.
34. Discuss the Alternating EMF applied to circuits containing L.
35.Discuss the Alternating EMF applied to circuits containing C.
36. Discuss the Alternating EMF applied to circuits containing R.
37. Obtain an expression for the series resonance circuits.
38. Obtain an expression for the parallel resonance circuits.
39. Explain the comparison between series and parallel resonant circuits.
40. Briefly explain the power in AC circuits (R, L-R, L- C –R).

UNIT - V
MAGNETISM

CHOOSE THE CORRECT ANSWER

1.Themagnetic susceptibility K is given by the relation.

a. K = $\frac{I}{H}$
b. K = $\frac{H}{I}$
c. K = $\frac{B}{H}$
d. K = $\frac{H}{B}$

2. The absolute permeability $\mu_a$is given by the relation.

a. $\mu_a = \frac{I}{H}$
b. $\mu_a = \frac{H}{I}$
c. $\mu_a = \frac{B}{H}$
d. $\mu_a = \frac{H}{B}$

3. Magnetic potential at a point is.
    a. Work done in moving a unit north pole from infinity to that point.
    b. The force experienced by a unit north pole .
    c. Work done in moving a unit south pole from infinity to that point.
    d. None of the above.
4. The magnetic potential at a point due to an isolated pole is.
    a. Directly proportional to r.
    b. Inversely proportional to r.
    c. Directly proportional to r^2
    d. Inversely proportional to r^2.
5. Magnetic potential to a dipole is zero at.
    a. Axial point.
    b. Equatorial point.
    c. At an angle60^0
    d. None of the above.
6. Materials that are repelled away from the region of strong magnetic field are called.
    a. Paramagnetic.
    b. Diamagnetic.
    c. Ferromagnetic.
    d. None of the above.
7. When a substance is placed in a magnetic field, its ability to get magnetized depends upon.
    a. Permeability.
    b. Susceptivity
    c. Magnetic Viscosity.
    d. None of the above.
8. Platinum has permeability greater than unity and a small positive value of susceptibility, it must be.
    a. Paramagnetic.
    b. Diamagnetic.
    c. Ferromagnetic
    d. None.

9. Diamagnetic substance are attracted by magnetic field. The attraction is.
    a. Very strong
    b. Weak
    c. Zero
    d. Negative.

10. For a magnetic substance the hysteresis loss perunit volume is equal to.
    a. Area of I –H loop.
    b. Times the area of the I –H loop.
    c. $\frac{1}{4\pi}$times the area of the I – H loop.
    d. None of the above.

ANSWERS:

1)a 2)c 3)a 4)b 5)b 6)b 7)b 8)a 9)d 10)a

TWO MARKS

11.Define the magnetic field.
12. Define the magnetic intensity.
13. Define intensity of magnetization.
14. Define absolute permeability of a medium.
15. Define the magnetic potential.
16. What is magnetic shell?
17. Define the strength of a magnetic shell.
18. Define the intensity of magnetic shell.
19. What are the classifications of magnetic material.
20. What is called as residual magnetism or retentivity.

FIVE MARKS

21. Give three examples for a) Diamagnetic b) paramagnetic and c) Ferro magnetic substances.
22. Derive an expression for the potential at any point due to a magnetic shell.
23. Find the relation between H, I and B.
24. Derive an expression for the magnetic potential at a point due to a single isolated pole.
25. Derive a relation between magnetic potential and intensity.
26. What is hysteresis? Show that the loss of energy is equal to the area of hystereses loop.
27. Explain clearly what do you understand by dia, para and ferro magnetism?
28. Describe the coercive force or coercivity force.
29. Define magnetic induction and magnetic susceptibility.
30. Describe the magnetometer method of tracing the hystereses curve of a sample of iron in the form of a long thin rod.

TEN MARKS

31. Derive an expression for the magnetic susceptibility.
32. Derive an expression for the magnetic permeability.
33. Briefly explain Types of magnetic materials.
34. Describe the properties of para, dia and ferromagnetic materials.
35. Discuss the langevin's theory of dia and para magnetism.
36. Deduce an expression for the weiss's theory of ferromagnetism.

37. Briefly explain B – H curve.
38. Discuss the energy loss due to magnetic hysteresis.
39. Describe an experiment for the determination of Ballistic galvanometer method for plotting B-H curve.
40. Briefly explain magnetic properties of iron and steel.