AS PER NEW PATTERN 2023-2024

PUC II YEAR
PHYSICS

COLLECTION OF DIFFERENT DISTRICT

MID TERM EXAMINATION 2023-2024

QUESTION PAPERS

By :

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- ಅರ್ಪಣೆ -

ವಿವಿಧ ಜಿಲ್ಲೆಯ ವಿದ್ಯಾರ್ಥಿಗಳು ಅವರ ಜಿಲ್ಲೆಯಲ್ಲಿ ಪರೀಕ್ಷೆಗಳು ಮುಗಿದ ತಕ್ಷಣ, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆಗಳನ್ನ photo ಅಥವಾ pdf ಮಾಡಿ ನನಗೆ ಕಳುಹಿಸುತಿದ್ದರು, ಅವೆಲ್ಲವುಗಳನ್ನ ಒಂದೇ ಕಡೆ Collect ಮಾಡಿಕೊಂಡು ನಾನು ನಿಮಗೆ ಈ **QUESTION PAPER MATERIAL** ನ ತಲುಪಿಸುತ್ತಿದ್ದೇನೆ, ಆದಕಾರಣ ಈ **COLLECTION OF DIFFERENT DISTRICT QUESTION PAPERS MATERIAL** ನ ನಾನು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅರ್ಪಿಸುತ್ತಿದ್ದೇನೆ.

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DEPUTY DIRECTOR OF PRE-UNIVERSITY EDN, BAGALKOTE &

BAGALKOT DIST. P. U. COLLEGE'S PRINCIPALS MAHAMANDAL, BAGALKOT.

PUC IInd Year Mid Term Examination - Oct. 2023

Time : 3.15 hours **Sub : PHYSICS (33)** Marks : 70

General instructions:

1. All parts are compulsory
2. For Part-A questions, first written answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to numerical problems without detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four given options for ALL of the following questions: **15 × 1 = 15**

1. The property which differentiates the two kinds of charges is called
   (a) polarity (b) conservation (c) induction (d) quantization
2. If $\vec{F}_{12}$ is the force on charge q_1 by q_2 and $\vec{F}_{21}$ is the force on charge q_2 by q_1, then
   (a) $\vec{F}_{12} = \vec{F}_{21}$ (b) $\vec{F}_{12} = -\vec{F}_{21}$ (c) $\vec{F}_{12} = 2\,\vec{F}_{21}$ (d) $\vec{F}_{12} = -2\,\vec{F}_{21}$
3. The electric potential due to charged conducting sphere of radius R will be maximum
   (a) on the surface of a conducting sphere (b) at a distance 2R from the centre
   (c) at a distance $\frac{3R}{2}$ from the centre (d) at infinite distance from the centre
4. The maximum electric field that a dielectric medium can withstand without dielectric breakdown is called as
   (a) permittivity (b) dielectric constant (c) dielectric strength (d) electric susceptibility
5. SI unit of current density is
   (a) ampere (b) Am^{-1} (c) Am^{-2} (d) Am^{-3}
6. The path described by a charged particle is helical when it enters the magnetic field at an angle (θ)
   (a) $0^0 < \theta < 90^0$ (b) $\theta = 0^0$ (c) $\theta = 90^0$ (d) $\theta = 180^0$
7. The relation between magnetic permeability(μ_r) and magnetic susceptibility (χ) is
   (a) $\mu_r = 1 + \chi$ (b) $\chi = 1 + \mu_r$ (c) $\mu_r \chi = 1$ (d) $\mu_r = 1 - \chi$
8. The net magnetic flux through any closed surface is
   (a) positive (b) negative (c) zero (d) depends on the nature of the surface
9. The magnetic potential energy of a magnetic dipole in a uniform magnetic field is
   (a) $U_m = -(\vec{m} \cdot \vec{B})$ (b) $U_m = +(\vec{m} \cdot \vec{B})$ (c) $U_m = -(\vec{m} \times \vec{B})$ (d) $U_m = -(\vec{m} \times \vec{B})$
10. To induce emf in a coil, the magnetic flux linking with coil
    (a) must increase (b) must decrease (c) can either increase or decrease (d) must remain constant
11. The mutual inductance of pair solenoids depends on
    (a) separation between solenoids (b) their relative orientation (c) both (a) & (b) (d) neither (a) nor (b)
12. In a AC circuit, the current and voltage are in phase. The circuit contains which of the following?
    (a) only resistor (b) only inductor (c) only capacitor (d) both resistor and capacitor
13. The relation between peak value of current (i_m) and rms value of current (i) is
    (a) $i = \frac{i_m}{\sqrt{2}}$ (b) $i = i_m\sqrt{2}$ (c) $i = 2i_m$ (d) $i = \frac{i_m}{2}$
14. The electromagnetic waves with shortest wavelength is
    (a) X-ray (b) Gamma ray (c) visible wave (d) UV wave
15. Which of the following types of electromagnetic radiation travels at greatest speed in vacuum?
    (a) X-ray (b) Gamma ray (c) visible wave (d) All of these travel at the same speed

II. Fill in the blanks by choosing appropriate answer in the bracket for ALL the following questions: 5 × 1 = 5

(deceases, magnetization, parallel, vacuum, zero)

16. The electrostatic force between two charges is maximum in ---------- Vacuum
17. The work done to move a charge on an equipotential surface is ---------- Zero
18. The resistance of a semiconductor ---------- when its temperature is increased. Decrease
19. The galvanometer is converted into ammeter by connecting a low resistance in ---------- parallel
20. ---------- is defined as the net magnetic moment per unit volume. magnetisation

PART- B

III. Answer any FIVE of the following questions: **5 × 2 = 10**

21. Write any two properties of electric charges.
22. The work done in bringing a point charge of $3mC$ from infinity to appoint is 0.06 J. Calculate the electric potential at that point.
23. Mention any two limitations of Ohm's law.

24. Define mobility. Mention its SI unit.
25. State and explain Ampere's circuital law.
26. What is a solenoid? Write an expression for magnetic field at a point inside a solenoid.
27. What are hard ferromagnetic materials? Give an example.
28. How can be magnetic flux linked with a coil changed?
29. What is displacement current? Write the expression for displacement current.

PART-C

IV. Answer any FIVE of the following questions: **5 × 3 = 15**

30. Derive the expression for electric force on a point charge due to multiple point charges.
31. Obtain the relation between electric field and electric potential due to point charge.
32. Draw graphs showing the variation of resistivity with absolute temperature for (a) copper (b) nichrome metals and (c) semiconductor.
33. Draw labeled Wheatstone's bridge and hence write the balancing condition in terms of resistances.
34. Give the expression for force acting on a charge moving in magnetic field and explain the symbols. When does the force become maximum?
35. State and explain Biot-Savart's law.
36. A galvanometer having a coil of resistance of 12 ohm gives full scale deflection for a current of 4mA. How can it be converted into a voltmeter of range 0 to 24V?
37. Write three differences between diamagnetic and paramagnetic materials.
38. Explain briefly Faraday and Henry coil and magnet experiment to demonstrate the phenomenon of EMI.

PART-D

V. Answer any THREE of the following questions: **3 × 5 = 15**

39. What is an electric field line? Write the four general properties of electric field lines.
40. What is equivalent capacitor? Obtain the expression for the equivalent capacitance of two capacitors connected in parallel.
41. Derive an expression for equivalent emf and equivalent internal resistance when two cells of different emf's and internal resistances are connected in series.
42. Deduce the force between two parallel current carrying conductors. Hence define ampere.
43. (i) State and explain Faraday's law of electromagnetic induction. (2)
    (ii) Derive the expression for motional emf induced in a conductor moving in a uniform magnetic field. (3)
44. (i) What is a transformer? (1)
    (ii) Explain the construction and working of a transformer. (4)

VI. Answer any TWO of the following questions: **2 × 5 = 10**

45. Two point charges $q_A = 3\mu C$ *and* $q_B = -3\mu C$ are located 20cm apart in vacuum. (a) What is the electric field at the midpoint O of the line AB joining the two charges? (b) If a negative test charge of magnitude $1.5 \times 10^{-9} C$ is placed at this point, what is the force experienced by the test charge?

46. ABCD is a square of side 4cm. Charges of +2nC, -2nC and +3nC are placed at corners A, B and C respectively. Calculate the work done in transferring a charge of +4nC from D to the centre of the square.

47. A wire having length 2.0 m, diameter 1.0 mm and resistivity 1.963 x 10^{-8} Ω m is connected in series with a battery of emf 3V and internal resistance 1 Ω. Calculate the resistance of the wire and current in the circuit.

48. A circuit has a 50 Ω resistor, 0.3H inductor and a capacitor of 40 μF, all are connected in series with a 220V, 50Hz ac supply. Calculate (i) inductive reactance (ii) capacitive reactance (iii) impedance (iv) rms value of current and (v) phase difference between voltage and current.

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SECOND PUC MID-TERM EXAM OCTOBER - 2023

Code : 33 | Subject : **PHYSICS** | Duration : 3 Hrs 15 Min.

Date : | Max. Marks : 70

General Instructions :

i) All parts are compulsory.
ii) Only the first written answers will be considered for Part-A
iii) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
iv) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART - A

I. Pick the correct option among the four given options for ALL the following questions. **15 x 1 = 15**

1) The law, governing the force between charges is known as
a) Ampere's law b) Ohm's law c) Faraday's law d) Coloumb's law

2) The unit of permittivity of free space ε_0 is
a) coloumb / newton metre
b) newton - metre^2 / coulomb^2
c) coloumb^2 / newton metre^2
d) coloumb^2 / (newton - metre)^2

3) When the distance between the charged particles is halved, the force between them becomes
a) One-fourth b) Half c) Double d) Four-times

4) Electric Potential is a
a) Vector b) Scalar c) Neither Scalar nor Vector d) Both

5) The flux through any closed surface is $\left[\frac{1}{\varepsilon_0}\right]$ times the total charge enclosed in it is known as
a) Ampere's law b) Gauss Law c) Ohm's Law d) None of them.

6) Three capacitors of capacitance 3μF are connected in the circuit. Then their maximum and minimum capacitances will be
a) 9μF, 1μF b) 8μF, 2μF c) 9μF, 0μF d) 3μF, 2μF

7) The magnitude of drift velocity per unit electric field is
a) mobility b) drift velocity c) relaxation time d) resistivity

8) When length and area of cross section both are doubled, then its resistance
a) Will become half
b) Will be doubled
c) Will remain same
d) Will become four times.

(P.T.O.)

9) Graphical representation of Ohm's law is
a) Parabola b) Hyperbola c) Straight line d) None of them.

10) Kirchhoff's first law i.e. $\Sigma I = 0$ at a junction is based on the law of conservation of
a) Charge b) Energy c) Momentum d) Angular Momentum.

11) S I unit of magnetic field is
a) tesla b) newton c) ohm d) ampere

12) Galvanometer is converted into voltmeter by connecting
a) high resistance in series with galvanometer
b) low resistance is series with galvanometer
c) high resistance in parallel with galvanometer.
d) low resistance in parallel with galvanometer.

13) The nature of the force between two infinite length parallel wires carrying currents in the same direction is
a) attractive b) repulsive c) attractive and repulsive d) None

14) The ability of a Ferro magnetic material to hold the residual magnetism is called
a) Retentivity b) Coercivity c) Declination d) None

15) The Lenz's law is the consequence of law of conservation of
a) mass b) energy c) charge d) momentum

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions. **5 x 1 = 5**

(Conductance, Lorentz force, Zero, Infinity, Dip)

16) Electric field inside a charged spherical shell is _____.

17) _____ is the value of dielectric constant for perfect conductor.

18) Reciprocal of resistance is _____

19) Force experienced by a moving charged particle in a region containing both electric and magnetic field is called _____.

20) The angle made by the magnetic needle with horizontal drawn in the magnetic meridian is _____

PART - B

III. Answer any FIVE of the following questions. **5 x 2 = 10**

21) Mention any two properties of electric charges.

22) Obtain the relation between the electric field and electric potential.

23) Write any two limitations of Ohm's law.

24) Define the term current density. Write its SI unit.

25) Write the expression for the magnitude of force on a moving charge in a uniform magnetic field. Explain the terms.

26) Express Biot-Savart's law in vector form and explain the terms.

27) What are Para magnetic materials and write any one property ?

28) What is meant by motional emf. Write the expression for it ?

29) Define magnetic flux. Write its SI unit.

PART - C

IV. Answer any FIVE of the following questions. **5 x 3 = 15**

30) Obtain the expression for electric intensity due to a point charge.

31) Derive the expression for the torque on a dipole placed in a uniform electric field.

32) Derive the expression for electric potential energy of a system of two point charges in the absence of electric field.

33) Derive the expression for capacitance of a parallel plate capacitor.

34) Derive the expression $\vec{J} = \sigma\vec{E}$

35) State and explain Ampere's circuital law.

36) Mention the factors on which the magnetic field at a point inside a solenoid depend.

37) a) Define the term Magnetic Intensity. [1]

b) Explain why magnetic field lines do not intersect each other. [2]

38) The current through a coil of self inductance 5 mH changes at rate of $10mAs^{-1}$. Calculate the induced emf in the coil.

PART – D

V. Answer any THREE of the following questions. **3 x 5 = 15**

39) Derive the expression for electric field at a point on the equitorial line of an electric dipole.

40) Derive the expression for electric potential at a point due to a point charge.

41) a) What is Wheat Stone's bridge. [1]

b) Derive the expression for balancing condition of a Wheat Stone's Bridge. [4]

42) Derive the expression for the effective emf and effective internal resistances of two cells connected in parallel.

43) Derive the expression for the magnetic intensity at a point on the axis of a circular coil carrying current.

44) a) What is Hysteresis curve ? [1]

b) Discuss Magnetic Hysteresis. [4]

PART – E

VI. Answer any TWO of the following questions. **2 x 5 = 10**

45) Two equal charges repel each other with a force of 4×10^{-5}N. When they are 0.03m apart in air, find the charges. What will be the force if the distance between them is doubled ?

46) Charges of 10nC, – 20nC, 30nC and 20nC are placed at the corners A, B, C and D of a square ABCD of side 1m. Find the net potential at the intersection of the diagonals.

47) Two cells of emf 2v and 4v and internal resistances 1 Ω and 2 Ω respectively are connected in parallel. So as to send the current in the same direction through an external resistance of 10 Ω. Find the potential difference across 10 Ω resistor.

48) A milli ammeter of resistance 0.5 Ω gives full scale deflection for a current of 5mA. How do you convert it into an ammeter to read 0 to 0.5A and voltmeter to read 0 to 50V.

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II PUC MID-TERM EXAMINATION, OCTOBER - 2023

Time : 3 Hrs. 15 Mins. **SUBJECT : PHYSICS (33)** **Max Marks : 70**

General Instructions :

1) **All parts are compulsory.**
2) **Only the first written answer will be considered for the Part-A questions.**
3) **Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.**
4) **Direct answers to the numerical problems without detailed solutions will not carry any marks.**

PART - A

I Pick the correct option among the four given options for all the following questions: **15x1=15**

1) If the distance between two charged particles is doubled then force between them
   a) remains the same b) is doubled c) is halved d) be one fourth

2) If θ is the angle between Electric field $\vec{E}$ and area Δs, then electric flux $\Delta\phi$ is
   a) $\Delta\phi = EAS$ b) $\Delta\phi = \frac{E\cos\theta}{\Delta s}$ c) $\Delta\phi = \Delta s\cos\theta$ d) $\Delta\phi = EAS\cos\theta$

3) When one electron is taken towards another electron then the potential energy of the system
   a) decreases b) increases
   c) remains unchanged d) decreases and finally becomes zero

4) A component of the circuit used to store electric potential energy
   a) Resistor b) capacitor c) semiconductor d) ammeter

5) The relation connecting potential difference (V), strength of the current (I) and resistance of the conductor is
   a) I = VR b) I = V/R c) I = R/V d) $R = \frac{I}{V}$

6) The relaxation time in conductors
   a) increases with the increase of temperature
   b) decreases with the increase of temperature
   c) it is independent of temperature
   d) increases linearly up to critical temperature and then decreases exponentially

7) In a Wheatsone's bridge if the battery and galvanometer are interchanged then the deflection in galvanometer will
   a) not change b) change in previous direction
   c) change in opposite direction d) none of these

8) Magnetic force is zero when
   a) a porton moves at right angles to a uniform magnetic field
   b) an α-particle enters a uniform magnetic field at an angle 45°
   c) an electron moves parallel to uniform magnetic field
   d) a proton enters a uniform magnetic field at angle 30°

9) The resistance of an ideal voltmeter is
   a) infinity b) very less c) very large d) zero

10) The magnetic dipole moment associated with a current loop is
   a) $\vec{m} = nIA$ b) $\vec{m} = nI^2\vec{A}^2$ c) $\vec{m} = \frac{n\vec{A}}{I}$ d) $\vec{m} = \frac{nI\vec{A}}{V}$

11) Lenz's law of electromagnetic induction is based on
   a) Law of conservation of momentum b) Law of conservation of energy
   c) Law of conservation of mass d) Law of conservation of momentum and energy

(P.T.O.)

12) Unit of self inductance is

a) Am^{-1} b) Am^{-2} c) H d) Wbm^2

13) If I_m is amplitude value of current then rms value of current I_{rms} is

a) $I_{rms} = \frac{2I_m}{\pi}$ b) $I_{rms} = \frac{I_m}{\sqrt{2}}$ c) $I_{rms} = \sqrt{2}i_m$ d) $I_{rms} = \frac{I_m}{2}$

14) The average value of power dissipated in a resistor is

a) $\bar{P} = I_m^2 R$ b) $\bar{P} = V_m^2 R$ c) $\bar{P} = \frac{1}{2} V_m^2 R$ d) $\bar{I} = \frac{1}{2} I_m^2 R$

15) The wave length of visible light is in the range

a) 1nm to 400 nm b) 400 nm to 700 nm c) 700 nm to 1 mm d) 1nm to 10^{-3} nm

II Fill in the blanks by choosing appropriate answer given in the brackets, for all the questions: **5x1=5**

(Distance, mobility, displacement current, coulomb's law, mutual induction)

16) The mutual electric force between two charge is given by _____.

17) The potential due to a dipole depends on _____.

18) The magnitude of the drift velocity per unit electric field _____.

19) Transformer is based on the principle of _____.

20) The current due to changing electric field is called _____.

PART - B

III Answer any FIVE of the following questions: **5x2=10**

21) Define dipole moment. Mention its expression.

22) Show that $E = \frac{-dv}{dx}$

23) Give two dependent factors on which resistance of a conductor depends.

24) Define internal resistance, and emf of a cell.

25) Give the expression for Lorentz force acting on a moving electric charge in a combined electric and magnetic field.

26) State and explain ampere circuital law.

27) State Gauss law in magnetism. Write its mathematical form.

28) The magnetic flux linked with a coil changes from 12×10^{-3} wb to 6×10^{-3} wb in 0.01 second calculate the induced emf in the coil.

29) Write any two sources of energy losses in transformer.

PART - C

IV Answer any FIVE of the following questions: **5x3=15**

30) Mention the three types of continuous charge distribution.

31) Obtain an expression for the potential energy of a dipole in a uniform electric field.

32) Derive an expression for the capacitance of a parallel plate capacitor.

33) Arrive at the equation $J = \sigma E$. Where the symbols have usual meaning.

34) State and explain Kirchhoff's voltage law.

35) How to convert galvanometer into ammeter ? Explain.

36) Write the differences between diamagnetic and paramagnetic materials.

37) Derive an expression for motional emf.

38) What are infrared waves ? Give any two uses of IR - waves.

PART - D

V Answer any THREE of the following questions: **3x5=15**

39) Derive an expression for Electric field due to a dipole along the axial point.

40) Derive an expression for the capacitance of a parallel plate capacitor with dielectric.

41) Derive an expression for balanced condition for wheat stones network.

42) To derive an expression for force acting between two straight conductor and hence define one ampere.

43) What is an AC generator ? Derive the expression for the alternating emf induced in a coil rotating with uniform speed in a uniform magnetic field.

44) Show that the voltage in an inductor leads the current by $\pi/2$ rad for a pure inductor connected across ac source.

VI Answer any TWO of the following questions: **2x5=10**

45) Two point charges $+10\,\mu C$ and $-15\,\mu C$ are placed at the vertices A and B of a right angle Δ^{le} ABC. Such that AB = 0.05 m, BC = 0.12 m. Calculate the resultant field intensity at the point 'C'. If $+100\,\mu C$ of charge is placed at C, then the what force will be experienced by the point charge at C ?

46) A battery of emf 10V and internal resistance $3\,\Omega$ is connected to a resistor. If the current in the circuit is 0.5 A. What is the resistance of the resistor ? What is the terminal voltage of battery when the circuit is closed?

47) An α - particle of mass 6.65×10^{-27} kg is travelling at right angles to a magnetic field with a speed of $6\times10^{5}\,ms^{-1}$ the strength of the magnetic field is 0.2 T. Calculate the force on the α - particle and its acceleration.

48) A 100 pF capacitor in series with a $40\,\Omega$ resistance is connected to a 110 V 60Hz supply
a) What is the maximum current in the circuit ?
b) What is the time lag between current maximum and voltage maximum ?

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II PUC Mid Term Examination - Oct. 2023

Time : 3.15 hours Sub : PHYSICS (33) Marks : 70

General Instructions :

1 All parts are compulsory .
2. For part-A question, first written -answer will be consider for awarding marks.
3. Answer without relevlant diagarm / figure/ circuit wherever necessary will not carry any marks.
4. Direct answer to numerical problems without detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four given options for ALL of the following questions : 1 5 x 1 =15

1. the apparatus used to detect electric charge on a body is
   (A) Laser (B) electroscope (C) metal detector (D) Vande graff genertor
2. Force per unit charge is called
   (A) electric flux (B) electric potential (C) electric current (D) eletric field
3. Which of the following is an example for polar molecule
   (A) O_2 molecule (B) N_2 molecule (C) H_2O molecule (D) H_2 molecule
4. Which of the following satement is /are correct for equipotential surface?
   I. The electic potential at all points on an equipotential surface is same
   II. Equipotential surface never intersect ~~ecah other~~ each other.
   III. Work done in moving a charge from one point to other on an equipotential sufarce is Zero.
   (A) I only (B) II only (C) I asnd II (D) I, II and III
5. The ratio of drift velocity per unit electric field is
   (A) mobility (B) relaxation time (C) current density (D) conductivity
6. Constantan wire is used for making standard resistance because it has
   (A) high melting piont (B) law specific resistance
   (C) high specific resistance (D) negligible temperature cofficient of resistance.
7. To convert a galvanometer into avoltmeter one should connect a
   (A) high resistance is series with galvanometer (B) low resistance in series with galvanometer
   (C) high resistance in parallel with galvanometer (D) low resistance in parallel with galvanometer
8. The magentic moment per unit volume is numerical equal to
   (A) magnetic intensity (B) magnetisation (C) susceptibility (D) permeability.
9. Torque acting on a magnetic dipole of magnetiic moment m placed in unfirom magnetic field B is
   (A) $\vec{C} = -\vec{m} \cdot \vec{B}$ (B) $\vec{C} = \vec{M} \cdot \vec{B}$ (C) $\vec{C} = \vec{B} \times \vec{M}$ (D) $\vec{C} = \vec{B} \cdot \vec{M}$
10. Identify the wrong statement among the following option about magnetic field lines.
    (A) they form closed loops
    (B) they tandent draw to the magnetic field line at any piont gives the direction of magenetic feild at that point
    (C) they can intersect each other
    (D) Outside a magnet they move from north pole to south pole.
11. Which of the following gives the polarity of the induced emfs ?
    (A) Biot savart law (B) Lenz's law (C) ampere's circuital law (D) Fleming's right hand rule
12. The principle behind the working of ac generator is;
    (A) electromagnetic indution (B) eddy currents (C) hysteresis (D) torque on a current loop
13. The expression for rms value of ac voltage is
    (A) $V = \frac{Vm}{\sqrt{2}}$ (B) $V = Vm\sqrt{2}$ (C) $V = \frac{N\overline{Z}}{Vm}$ (D) $V = 2Vm$
14. Which of the following material is used as core of a transfomer.
    (A) copper (B) soft iron (C) molybdrnum (D) bismuth
15. Out of the following options which one can be used to produce a propagating electromagnetic wave?
    (A) a chargeless particle (B) an acccelerating charge
    (C) a charge moving at constant velocity (D) a stationary charge

II. Fill in the balabs by choosing appropriate answer given in the bracket for all the following question : Sol= 5

(Electric potential , electric flux, Zero, Circular , displacement , straight line)

16. Number of electric field lines passing normally through a given area is called .....
17. ..... is the work done to move a unit positive charge from (Infinity), to a given piont.
18. When a charged partivle enters perpendicular to the external unifron magnetic field, it follows ..... path.
19. The net magnrtic flux through aclosed surface is .....
20. The current arising due to time varying electric flux is ..... current.

PART-B

III. Answer any FIVE of the following questions **5x2=10**

21. Write coulomb's law in vector form and explain the terms.
22. Name any two factors on which capacitance of a parallel plate capacitor depends.
23. Write the limitations of Ohm's law.
24. Define reistivity of material of a conductor give its S.I unit.
25. State and explain Amperei circuital law.
26. Define magnetic intensity .Give its S.I Unit .
27. Give the Expression for mutual inductance induced between two co axial solenoids and explain the terms.
28. Current in a circuit falls from 5.0A to O.OA in O.1s. if an average emf of 200v induced give an estimate of the self inductance of the circuit.
29. Mention any two uses of UV - Waves.

IV. Answer any FIVE of the following questions : **5x3=15**

30. Write any three properties of electric field lines.
31. Derive the relation between electric potential and electric feild.
32. Plot the graph of variation of resistivity with temperature bfor (i) Copper (ii) Nichrome and (iii) Semiconductor.
33. Derive $\vec{J} = \sigma E$ Using Ohm's law where the symbols have their usual meanings
34. State and explain Biot-savart' law.
35. Obtain the expression for radius of circular path described by a charged particle in a uniform magnetic field.
36. Distinguish betwwen diamagnetic and paramagnetic materials.
37. Describe coil and magnet experiment of faraday and henry to demonstrate electromagnetic induction phenomena
38. Derive an expression for motional emf induced across the ends of a conducting rod moving perpendicular to uniform magnetic field

PART-D

V. Answer any THREE of the following questions **3x5=15**

39. (a) State Gauss law in electrostatics .
    (b) USing Gausss law derive the expression for the electric field due to an infinitely long straight Umiformly charged wire.
40. (a) What is effective capacitance ?
    (b) Derive an expression for effective capacitance of two capacitors in series .
41. Obtain the expression electic potential due to apoint charge.
42. DEduce the condition for balance of wheat stone's network using kirchhaff's law.
43. Derive the expression for magnetic field at a piont on the axis of a circular current loop.
44. Derive the expression for impedance and hence the current of a series L C R circuit connnrted to ac supply. Also draw phasor diagram .

VI. Answer any two of the following question **2x5=10**

45. *ABC is an equilateral* triangle of side 0.1m Charges of 4nc and -8nc are placed the corners Aand B respectively Calculate the resultant electic field intensity at the corner C .
46. Two cells rated as 10v ,2 Ω and 8v,1 Ω are connected in parallel to send current in the same direction across a 6 Ω resistor. Find the P. d across 6 Ω resistor.
47. Two straight parallel conductors of 2m length are 0.2m apartin air find the magnitude of the force acting on the conductors if a current of 3A flows through each of them .Also find force per unit length of the conductor.
48. Calculate the resonant frequency and Q- factor (Quality factor) of a series LCR circuit containing a pure inductor of inductance 4H , capacitor of Capacitance 27 μF resistor of resistance 8.4 Ω.

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Rohan Nath-C

C

SECOND PUC MID-TERM EXAMINATION – OCTOBER 2023
Sub: PHYSICS (33)

Time: 3 Hrs. 15 Min. **Total Marks: 70**

General Instructions:

(i) All parts are compulsory.

(ii) Only the first written answers will be considered for Part A.

(iii) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.

(iv) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART – A

Pick the correct answer among the four given options for ALL the following questions. $15 \times 1 = 15$

1. The value of electric permittivity of free space

   (a) $9\times10^{9}\,NC^{2}M^{-2}$ (b) $8.85\times10^{-12}\,Nm^{2}/c^{2}$ sec

   (c) $8.85\times10^{-12}\,c^{2}/Nm^{2}$ (d) $9\times10^{9}\,\frac{Nm^{2}}{c^{2}}$

2. S.I. unit of electric flux is _____

   (a) NC^{-2} (b) NC^{-1} (c) $NC^{-1}m^{2}$ (d) Nm^{2}

3. The ratio of 1 joule to 1 coulomb is

   (a) 1 volt (b) 1 ampere (c) 1 farad (d) electric potential energy

4. Which of the following is the SI unit of capacitance

   (a) Coulomb (C) (b) farad (F) (c) volt (V) (d) tesla (T)

5. Average time between the 2 successive collision is called

   (a) relaxation time (b) conductivity (c) current density (d) mobility

6. Kirchoff's junction rule signifies the law of conservation of

   (a) charge (b) energy (c) mass (d) momentum

7. The magnetic force on neutral particle moving in external uniform magnetic field

   (a) zero (b) Bqv (c) Bqv sin θ (d) qE

8. Two parallel wires carrying current in opposite direction, the force between them is

   (a) attractive (b) repulsive

   (c) neither attractive nor repulsive (d) none of the above

9. Magnetic susceptibility of paramagnetic material is

   (a) small and positive (b) small and negative

(c) large and positive (d) none of these

10. Correct statement of EMI is

(a) electric current is generated by varying electric field

(b) electric current is generated by varying magnetic field

(c) electric current is generated by varying charge

(d) none of the above

11. Choke coil works on the principle of

(a) Transient current (b) self induction

(c) mutual induction (d) wattles current

12. Which of the following is independent of the frequency of applied AC

(a) resistance (b) Inductive reactance

(c) capacitive reactance (d) impedance

13. The average value of AC over a complete cycle is

(a) 1 (b) zero (c) 180 (d) 90

14. Velocity of electromagnetic waves in free space

(a) $3\times10^{8}\,ms^{-1}$ (b) $3\times10^{-8}\,ms^{-1}$ (c) $3\times10^{8}\,kms^{-1}$ (d) $3\times10^{-8}\,ksm^{-1}$

15. The ray used in photosynthesis

(a) x-rays (b) uv rays (c) IR – rays (d) visible rays

II. Fill in the blanks by choosing appropriate answer given in the brackets for all the following questions. (Capacitor, moving charges, Lenz's law, Gamma rays, electroscope) $5 \times 1 = 5$

16. _____ is an apparatus used to detect charge on a body.

17. _____ is used to store electric charges.

18. Magnetic field is produced by_____

19. The direction of induced emf during electromagnetic induction is given by_____

20. _____ electromagnetic waves has smallest wave length.

PART – B

III. Answer any FIVE of the following questions: $5 \times 2 = 10$

21. State and explain coulomb's law.

22. Mention the expression for potential energy of system of two point charges and explain the terms.

23. Calculate the potential at a point 'P' due to a charge of 4×10^{-9} C located 0.09 m away.

24. State and explain Ampere's circuital law.

25. Write any two differences between diamagnetic substances and paramagnetic substance.

26. Mention the expression for magnetic flux and write its SI unit.

27. Draw a graph of voltage and current are in same phase, when AC voltage applied to a pure resistor.

28. Write any two sources of energy losses in a transformer.

29. Write any two properties of electromagnetic waves .

PART – C

IV. Answer any FIVE of the following questions: **5 × 3 = 15**

30. Mention three properties of electric charges.

31. Derive the relation between electric field and electric potential due to point charges.

32. Derive the expression for equivalent capacitance of 2 capacitor connected in series.

33. Mention any three limitations of Ohm's law.

34. Find the drift velocity of electron in a copper wire of cross-section area $5\times10^{-8}\,m^2$ if the current through the wire is 1 mA. Given free electron density of copper 8×10^{28} electrons / m^3.

35. What is an ammeter? Explain how galvanometer can be converted into ammeter.

36. Mention any three properties of magnetic field lines.

37. Define the following terms:

    (a) Magnetisation

    (b) Magnetic intensity

    (c) Magnetic permeability

38. Deduce the expression for emf induced across the ends of the conducting rod moving in a perpendicular magnetic field.

PART – D

V. Answer any THREE of the following questions: **3 × 5 = 15**

39. Derive the expression for electric field at a point just outside a charged thin spherical shell using gauss's law.

40. Two cells of different emf's and different internal resistances are connected in series. Obtain the expression for equivalent emf and equivalent internal resistance of the combination.

41. Derive the expression for current interms of drift velocity of free electrons.

42. Deduce the condition for balance of wheat-stone bridge using Kirchoff's rules.

43. Derive the expression for radius of circular path and angular frequency of charged particle moving perpendicular to uniform magnetic field.

44. Derive the expression for instantaneous emf in a coil rotating in a uniform magnetic field.

PART – E

VI. Answer any TWO of the following: **2 × 5 = 10**

45. ABC is an equilateral triangle of side 0.03 m charges of + 5 nC, + 3nC and – 5nC are placed at the corners A, B and C respectively. Find the resultant force on a charge placed at B.

46. 100 mg mass of nichrome metal is drawn into a wire of area of cross section 0.05 mm^2. Calculate the resistance of this wire. Given density of nichrome is $8.4\times10^{3}\ kgm^{-3}$ and resistivity of the material is $1.2\times10^{-6}\ \Omega-m$.

47. A circular coil of 20 turns of mean radius 0.06 m carries a current of 1 A. Calculate magnetic field at

    (i) the centre of the coil

    (ii) A point on the axis 0.08 m from its centre (Given $\mu_0 = 4\pi\times10^{-7}\ TmA^{-1}$].

48. A resistor of resistance 100 Ω, a coil of inductance 0.2 H and a capacitor of capacitance 20 μF are connected in series across an AC source of 200 V, 50 Hz calculate,

    (i) Impedance of the circuit.

    (ii) Current through the circuit.

* * * * *

DHARWAD DIST. P U COLLEGES PRINCIPAL'S ASSOCIATION, DHARWAD

P.U.C. IInd YEAR MID - TERM EXAMINATION SEPT/OCT-2023 Max. Marks : 70

Date : 07 - 10 -2023 Subject : **PHYSICS (33)** Time : 3 Hts. 15 Min.

Instructions : a) All parts are compulsory.
b) For Part-A questions, first written answer will be considered for awarding marks.
c) Answer without relevant diagram/figure/circuit wherever necessary will not carry any marks.
d) Direct answers to the numerical Problems without detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four given options for ALL of the following question: 15x1 =15

1) If electric field is uniform, then the electric field lines are.
A) divergent B) convergent C) circular D) parallel

2) Net charge of a dipole is.
A) 2q B) zero C) +q D) -q

3) Electric field inside a spherical charged conducting shell.
A) is same as on the surface B) varies inversely as the distance
C) is zero D) varies inversely as square of the distance

4) On the equatorial plane of an electric dipole.
A) $V = 0$ and $E \neq 0$ B) $V \neq 0$ and $E = 0$
C) $V = 0$ and $E = 0$ D) $V \neq 0$ and $E \neq 0$

5) Energy stored in a capacitor of capacitance C charged to potential Q is given by.
A) $U = \frac{1}{2}CV^2$ B) $U = \frac{1}{2}QV$ C) $U = \frac{Q^2}{2C}$ D) All of the above

6) The rate of flow of electric charge through any cross-section of a conductor is know as .....
A) Electric flux B) Electric potential C) Electric current D) Electric field

7) The resistivity of a wire.
A) increases with the length of the wire B) decreases with the area of cross-section
C) decreases with the length and increases with the cross-seciton of wire
D) None of the above

8) Current density is a ..... .
A) scalar quantity B) vector quantity C) dimensionless quantity D) none of these

9) A charged particle enters a uniform magnetic field at an arbitrary angle with the field direction will follow.
A) linear path B) helical path C) elliptical path D) circular path

10) In a circular coil of radius r, the magnetic field at the centre is proportional to.
A) r^2 B) r C) $1/r$ D) $1/r^2$

11) At a place an electric field and a magnetic field are in downward direction. There an electron moves in downward direction. Hence this electron will.
A) bend towards its left B) bend to toward its right
C) gain velocity D) lose velocity

12) Identify the wrong statement among the following options about magnetic field lines.
A) They form closed loops
B) The tangent drawn to the magnetic field line at a point gives the direction of magnetic field at that point.
C) They can intersect each other
D) Outside a magnet, they go from north pole to south pole

13) The measure of the number of magnetic field lines passing through given surface normally is.
A) magnetic flux B) magnetic intensity C) magnetic induction D) magnetization

14) The net magnetic flux through any closed surface is zero is in accordance with
A) Gauss's law in magnetism B) Gauss's law in electrostatics
C) Ampere's circuital law D) Biot-Savart's law

15) S.I. unit of mututal inductance of pair of coils is
A) henry B) ohm C) farad D) ohm-metre

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following question (zero, -1, mobility, charge, energy, electroscope) 5x1=5

16) The instrument is used to detect the charge is ..... .

17) The work done in moving a change over a closed path in electric field is ..... .
18) The magnitude of the drift velocity per unit electric field is ..... .
19) The magnetic susceptibility of a superconductor is ..... .
20) Lenz's law is in accordance with law of conservation of ..... .

PART-B

III. Answer any FIVE of the following questions. 5x2=10

21) State and explain Coulomb's law in electrostatics.
22) Draw equipotential surfaces for (a) positive charge and (b) a uniform field.
23) What are polar molecules? Give an example.
24) Mention the limitations of Ohm's law.
25) When does the force on a conductor carrying current in a magnetic field (a) minimum and (ii) maximum?
26) State and explain Ampere's circuital law.
27) Define magnetization of a magnetic material. Mention its SI unit.
28) Write any two properties of paramagnetic substances,
29) The current in the coil of inductance 6 mH changes from 3 A to 2.5 A in 0.01 second. Calculate the induced emf.

PART-C

IV. Answer any FIVE of the following questions : 5x3=15

30) Write the fundamental properties of electric charge.
31) Obtain the expression for the torque acting on an electric dipole in a uniform electric field.
32) Show that the electric field at a point is equal to the negative potential gradient at that point
33) Arrive at $\vec{J} = \sigma \vec{E}$, where the symbols have their usual meaning.
34) Show the variation of resistivity of (a) a metallic conductor, (b) an alloy and (c) a semiconductor graphically.
35) A solenoid has 2500 turns per meter. If it carries a current of 8 A, estimate the magnitude of the magnetic field inside the solenoid near its center. Given $\mu_0 = 4\pi \times 10^{-7}\, Hm^{-1}$.
36) With a circuit diagram explain how a galvanometer is converted into an ammeter.
37) Mention three distinguish properties between diamagnetic and ferromagnetic materials.
38) Explain briefly the coil and magnet experiment to demonstrate electromagnetic induction

PART-D

V. Answer any THREE of the following questions: 3x5=15

39) Derive an expression for the electric field at a point due to a uniformly charged, infinitely long, thin conducting wire using Gauss's law.
40) Obtain an expression for the potential energy of a system three point charges in the absence of external electric field.
41) a) Define relaxation time and drift velocity of free electrons. 2
    b) Drive an expression for drift velocity of free electrons in a conductor. 3
42) Arrive at the balancing condition for Wheatstone bridge, using Kirchhoff's laws.
43) Obtain the expression for the force between two long straight parallel conductors carrying currents and hence define ampere.
44) a) What is AC generator? 1
    b) Derive an expression for instantaneous emf in an AC generator 4

VI. Answer any TWO of the following questions: 2x5=10

45) Three charges each equal to +4 nC are placed at the three corners of a square of side 2 cm. Find the electric field at the fourth corner.
46) Three capacitors each of capacitance 9 pF are connected in series. (a) What is the total capacitance of the combination? (b) What is the potential difference across each capacitor if the combination is connected to a 120V Supply ?
47) Two identical cells either in series or in parallel combination, gives the same current of 0.5 A through external resistance of 4Ω. Find emf and internal resistance of each cell.
48) A square coil of side 10 cm consists of 20 turns and carries a current of 12 A. The coil is suspended vertically and the normal to the plane of the coil makes an angle of 30^0 with the direction of a uniform horizontal magnetic field of magnitude 0.80 T. What is the magnitude of torque experienced by the coil?

Department of Pre-University Education

Code No. KT

DISTRICT P.U.COLLEGE PRINCIPALS' ASSOCIATION (R)

Date : 13-10-2023

PUC II-Year Midterm Examination 2023-24

Time : 9-30 to 12-45 p.m.]

Subject : PHYSICS (33)

[Max. Marks : 70

Instructions : *1) All parts are compulsory.*
2) Part-A questions first written answer will be considered for awarding marks.
3) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART-A

Q. I. Pick the correct option among the four given options for ALL of the following questions. **15×1=15**

1) A glass rod is rubbed with silk cloth. The charge acquired by glass rod is _____
   a) negative b) positive c) zero d) positive on one end and negative on the opposite end.

2) Potential energy of an electric dipole in uniform electric field is maximum when angle between E and P is equal to
   a) 180° b) 90° c) 45° d) 0°

3) The resistivity of a metallic conductor _____ with decrease in temperature.
   a) increases b) decreases
   c) first increases and then decreases d) first decreases and then increases.

4) The Lorentz force is the force on a charged particle moving in a region containing _____.
   a) only electric field b) only magnetic field
   c) both electric and magnetic fields d) only crossed electric and magnetic fields.

5) Mobility of charge carrier in a conductor is defined as
   a) Electric field / Magnitude of drift velocity b) Magnitude of drift velocity / Electric field
   c) Electric field X Magnitude of drift velocity d) None of these

6) A straight conductor of length '*l*' is moving with a velocity 'v' in the direction of uniform magnetic field of strength 'B". The magnitude of emf induced between the ends of the conductor is
   a) *Blv* b) 1 c) 0 d) 2*Blv*

7) The Mutual Inductance between the two coils depends upon.
   a) the medium between the coils only b) the separation between the coils only
   c) both the medium and separation d) neither the medium nor the separation

8) The Lenz's Law follows from the principle of conservation of
   a) mass b) charge c) momentum d) energy

9) The electromagnetic waves with lowest frequency among the following are :
   a) gamma rays b) UV rays c) microwaves d) radio waves

10) Electromagnetic waves are
   a) transverse in natur b) longitudinal in nature
   c) may be longitudinal or transverse d) none of the above

11) The magnitude of electric dipole moment vector of an electric dipole is given by the general expression (with symbols having usual meanings)
   a) p=aq b) $p=2aq^2$ c) p=2aq d) $p=2a^2q$

2) For large distance from short dipole, the electric field due to it depends on the distance from it as
   a) $1/(\text{distance})^2$ b) $1/(\text{distance})^3$ c) $(\text{distance})^2$ d) $(\text{distance})^3$

) An example for polar molecule is
   a) Oxygen molecule (O_2) b) Nitrogen Molecule (N_2)
   c) Hydrogen molecule (H_2) d) Water molecule

Electric potential 'V' due to an electric dipole is related to the distance '*r*' of the observation point as
a) $V \propto r$ b) $V \propto r^{-1}$ c) $V \propto r^2$ d) $V \propto r^3$

n an AC circuit containing only Inductor
) The current leads the Voltage by 90° b) The current lags the Voltage by 90°
The current leads the Voltage by 180° d) The current and Voltage are in phase

Q. II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: (magnetization, insulating, net charge, generator, increase) **5×1 = 5**

16) A convenient way to increase the current sensitivity of a galvanometer is to ___ the number of turns of the coil.
17) The outward electric flux through a closed surface is equal to $1/\epsilon_0$ times _____ charge enclosed.
18) The device used to convert mechanical energy into electrical energy is called a _____
19) _____ is defined as the net magnetic moment / unit volume.
20) Charging by friction is greatly preferred for _____ materials.

PART–B

Q. III. Answer any FIVE of the following questions. **5 × 2 =10**

21) Mention any two basic properties of electric charges.
22) The amount of work done in bringing a point charge of 3 mC from infinity to a point P is 0.06 J. Find the electric potential at the point P.
23) What is Drift Velocity. Mention the expression for Drift Velocity.
24) How does the resistance of (1) good conductor, (2) semiconductor vary with increase in temperature ?
25) What is Lorentz force? Write the expression representing this force.
26) State and explain Lenz's law in electromagnetic induction.
27) Write any two differences between inductive reactance and capacitive reactance.
28) What is displacement current ? Give expression for the same.
29) Give any two uses of radio waves.

PART–C

Q. IV. Answer any FIVE of the following questions. **5 × 3 =15**

30) State and explain Coulomb's law. Define '1 coulomb'.
31) Obtain the expression for potential energy of an electric dipole placed in a uniform electric field.
32) Mention three limitations of Ohm's law.
33) Derive $I=neAv_d$ where the symbols have their usual meaning.
34) Derive the expression for the magnetic field due to a straight infinite current carrying wire using Ampere's circuit law.
35) Explain briefly Faraday's Coil and Magnet experiment to demonstrate electromagnetic induction.
36) Define the terms:(1) Magnetization of a magnetic material 2) Magnetic intensity & 3) Magnetic susceptibility.
37) Arrive at the expression for motional emf induced by considering Lorentz force acting on free charge carriers of a conductor.
38) Obtain an expression for radius of circular path traced by a charge when it enters perpendicular to a uniform magnetic field.

PART–D

V. Answer any THREE of the following questions. **3 × 5 =15**

39) Using Gauss law derive the expression for the electric field due to an infinitely long straight uniformly charged wire.
40) Derive the expression for capacitance of a parallel plate capacitor with air as dielectric.
41) Obtain the condition for balance of Wheatstone bridge using Kirchhoff's rules.
42) Derive an expression for the magnetic field at a point on the axis of a circular current loop.
43) Derive the expression for impedance and hence the current of an RLC series circuit connected to an AC using phasor diagram.
44) Describe the construction and working of AC generator with a labelled diagram and hence arrive at the expression for the instantaneous value of emf induced in it.

I. Answer any TWO of the following questions. **2 × 5 =10**

45) Charges +2nC, +4nC, and +8nC are placed at the corners ABC respectively of a square of side 0.2m. Calculate the work done to transfer a charge of +2nC from the corner D to the center of the square.
46) Three capacitors of capacitance 2pF, 3pF, 4pF are connected in parallel. What is the total capacitance of the combination? Determine charge on each capacitor if the combination is connected to a 100V supply.
47) Two cells of EMF 2V and 4V internal resistance 1Ω and 2Ω respectively are connected in parallel across 10Ω resistor, such that they tend to send current through resistor in same direction. calculate potential difference across 10Ω resistor.
48) A 50Ω resistor, 0.5H inductor and 200μF capacitor are connected in series with 220V and 50Hz source. Find the impedance of the circuit and hence the current.

JH

DISTRICT LEVEL II PUC MID-TERM EXAM, OCTOBER : 2023

Time: 3 Hrs. 15 Mins. **Sub: PHYSICS (33)** **Max. Marks:** 70

General Instructions:

1. All parts are compulsory.
2. Part – A questions have to be answered in the first two pages of the answer booklet. For Part – A questions, first written answer will be considered for awarding marks.
3. Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART – A

I. **Pick the correct option among the four given options for ALL of the following questions:** **15 × 1 = 15**

1. The ratio of charge per unit length
   (A) Volume charge density (B) Linear charge density
   (C) Surface charge density (D) None of the above

2. The force between two charges is 200N. If the distance between the charge is doubled the force will be
   (A) 200 N (B) 100 N (C) 50 N (D) 400 N

3. The potential in the equatorial plane of a dipole is
   (A) $V = -\frac{1}{4\pi\varepsilon_0}\frac{P}{r^2}$ (B) $V = +\frac{1}{4\pi\varepsilon_0}\frac{P}{r^3}$
   (C) zero (D) $V = \pm\frac{1}{4\pi\varepsilon_0}\frac{q}{r}$

4. An example for polar molecule is
   (A) Oxygen molecule (B) Nitrogen molecule
   (C) Hydrogen molecule (D) Water molecule

5. Drift velocity per unit electric field is called
   (A) Mobility (B) Resistivity (C) Conductivity (D) Current density

6. Resistance of a conducting wire depends on
   (A) Length (B) Area of cross-section
   (C) Temperature (D) All of the above

7. The correct expression for Lorentz force is
   (A) $q\vec{E} + \left(\vec{B} \times \vec{v}\right)$ (B) $q\vec{E}$
   (C) $q\left[\vec{E}(r) + \left(\vec{v} \times \vec{B}(r)\right)\right]$ (D) $q\left(\vec{v} \times \vec{B}(r)\right)$

8. Path followed by the charged particle perpendicular to magnetic field is
   (A) Helical (B) Circle (C) Ellipse (D) Straight line

9. The current sensitivity of the moving coil galvanometer can be increased by decreasing
   (A) the magnetic field (B) the number of turns of the coil
   (C) the area of loop (D) the restoring torque per unit deflection

10. The long parallel wires carrying currents in opposite direction
    (A) Repel each other (B) Attract each other
    (C) Neither attract nor repel (D) None of the above

11. Choose the ferromagnetic material out of the following
    (A) Iron (B) Lead (C) Copper (D) Aluminium

12. The expression representing the Gauss's law in magnetism is

(A) $\sum_{all} \vec{B}.\overrightarrow{\Delta S} = 0$ (B) $\sum_{all} \vec{B} \times \overrightarrow{\Delta S} = 0$

(C) $\sum_{all} \vec{B}.\overrightarrow{\Delta S} = 1$ (D) $\sum_{all} \vec{B} \times \overrightarrow{\Delta S} = \mu_0 I$

13. The relation between susceptibility and magnetic permeability

(A) $\mu_r = (1-\chi)$ (B) $\mu_r = \mu_0(1+\chi)$

(C) $\mu_r = (1+\chi)$ (D) None of the above

14. Self – inductance plays the role of

(A) Impedance (B) Inertia

(C) Mutual inductance (D) None of the above

15. The magnetic flux through a square surface of area A placed with its plane parallel to a uniform magnetic field of strength B is

(A) BA (B) $-BA$ (C) Zero (D) BA/2

II. **Fill in the blanks choosing appropriate answers given in the bracket for ALL the following questions:** **5 × 1 = 5**

(Potential difference, Conductance, Electric field, Coulomb meter, Tesla, Induced emf)

16. The SI unit of dipole moment _____.

17. Work done in moving a unit positive charge against the electric field from one point to another is _____.

18. The reciprocal of resistance is _____.

19. The SI unit of magnetic field is _____.

20. The rate of change of magnetic flux through the circuit is equal to _____.

PART – B

III. **Answer any FIVE of the following questions:** **5 × 2 = 10**

21. State and explain Coulomb's law in electrostatics.

22. On what factors does the capacitance of parallel plate air capacitor depends.

23. Represent graphically the variation of resistivity with absolute scale of temperature of copper and semiconductor.

24. Mention the expression for magnetic force on a current carrying conductor in a magnetic field. Explain the symbols.

25. How to increase the magnetic field at a point inside a air cored solenoid.

26. Write any two properties of magnetic field lines.

27. Define magnetization of a magnetic material. Mention its SI unit.

28. Current in a circuit falls from 8A to 0A in 0.2 sec. If an average emf of 200V is induced. Estimate the self-inductance of the circuit.

29. State Lenz's law and write its significance.

PART – C

IV. **Answer any FIVE of the following questions:** **5 × 3 = 15**

30. Write the three basic properties of electric charge.
31. Obtain the expression for torque acting on an electric dipole placed in an uniform electric field.
32. Derive the expression for the potential energy of a system of three point charges in the absence of external electric field.
33. Obtain the expression for effective capacitance of two capacitors when connected in series.
34. Write the three limitations of Ohm's law.
35. A Nichrome wire of resistance 5Ω connected in series with a battery of emf 3V and internal resistance 0.5Ω. Calculate the current in the circuit.
36. Using Ampere's circuital law obtain the expression for magnetic field strength due to a straight current carrying wire.
37. Distinguish between diamagnetic and paramagnetic materials.
38. Describe the coil and bar magnet experiment to demonstrate the phenomenon of electromagnetic induction.

PART – D

V. **Answer any THREE of the following questions:** **3 × 5 =15**

39. State Gauss's law in electrostatics. Derive an expression for electric field due to an uniformly charged infinite plane sheet using Gauss law.
40. (a) Draw equipotential surface for (I) A positive point charge (II) An uniform electric field. [2M]
    (b) Deduce the relation between electric field and electric potential. [3M]
41. Derive an expression for equivalent emf and equivalent internal resistance when two different cells are connected in parallel.
42. (a) Define drift velocity and relaxation time. [2M]
    (b) Derive the expression for drift velocity of free electrons in a conductor interms of relaxation time. [3M]
43. Derive the expression for magnetic field at a point on the axis of a circular ring carrying current using Biot-Savart's law.
44. On what principle AC generator works? Derive an expression for instantaneous induced emf in an ac generator.

VI. **Answer any <u>TWO</u> of the following questions:** **2 × 5 = 10**

45. Two point charges of +4nC and +9nC are placed at the vertices of an equilateral triangle ABC of side 1cm. Find the magnitude and direction of the resultant electric field at C.

46. Two charges – 6μC and +5μC are located 10cm apart in air. At what points on the line joining the two charges the electric potential is zero? Take the potential at infinity to be zero.

47. The four arms of a Wheatstone bridge have the following resistances: AB = 100Ω, BC = 10Ω, CD = 5Ω and DA = 60Ω. A galvanometer of 50Ω resistance is connected across BD. Calculate the current through the galvanometer, when a potential difference of 10V is maintained across AC.

48. A galvanometer of resistance 120Ω requires a current of 0.6mA for full scale deflection. How do you convert it into (a) An ammeter of range 0 – 30mA (b) A voltmeter of range 0 – 3V?

GOVERNMENT OF KARNATAKA

DEPUTY DIRECTOR, DEPT. OF SCHOOL EDUCATION (PRE-UNIVERSITY)

PUC-II YEAR MIDTERM EXAMINATION-2023

Time : 3 Hours 15 Minutes | SUBJECT : **PHYSICS (33)** | MARKS 70

Instructions : 1) All parts are compulsory.
2) For Part-A questions, first written answer will be considered for awarding marks.
3) Answers without relevant diagram/ figure/ circuit diagram wherever necessary will not carry any marks.
4) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four options. **15X1=15**

1) When a body is connected to Earth, electrons from the Earth flow into the body. This means the body is
A) Uncharged B) charged positively C) charged negatively D) insulator

2) Electric potential of a electric dipole at a distance r is proportional to
A) $\frac{1}{r}$ B) $\frac{1}{r^2}$ C) $\frac{1}{r^3}$ D) $\frac{1}{r^4}$

3) Torque acting on electric dipole placed in uniform electric field is
A) $\vec{\tau} = \vec{P}.\vec{E}$ B) $\vec{\tau} = \vec{E}.\vec{P}$ C) $\vec{\tau} = \vec{P} \times \vec{E}$ D) $\vec{\tau} = \vec{E} \times \vec{P}$

4) Workdone by an external force in brining a unit positive charge from infinity to a point is
A) Equal to the electrostatic potential at that point
B) Equal to the negative of workdone by electrostatic forces
C) Both (A) and (B) D) Neither (A) and (B)

5) As the charge on the capacitor increases, its capacity
A) Increases B) decreases
C) increases upto certain state and then remain constant D) remain same

6) the dielectric constant of a metal is
A) Zero B) infinite C) finite D) unpredictable

7) Resistivity of a conductor depends on
A) Length B) area of cross section
C) volume D) temperature

8) According to Kirchhoff's law the sum of product of current an resistance as well as emfs in a closed loop is
A) Greater than zero B) zero
C) less than zero D) determined by the emf

9) the resistance of an ideal ammeter is
A) Infinite B) very high C) small D) zero

10) When the charged particle move in a combined magnetic and electric field then the force acting is ?
A) Centripetal force B) centrifugal force
C) Lorentz force D) orbital force

11) SI unit of magnetic field is
A) Dyne B) ohm C) tesla D) volt

12) the electric potential inside a conducting sphere is
A) zero B) Increase from centre to surface
C) Remains constant from centre to surface D) decrease from centre to surface

13) Permanent magnet has the capacity to attract
A) all the substance B) some substance
C) only ferro magnetic substances D) none of the above

14) Magnetic flux through a coil is directly proportional to
A) number of turns B) area
C) magnetic field D) all the above

15) Relation between mean value and peak value of sinusoidal ac is
A) $\frac{I_m}{I_0} = \frac{\pi}{2}$ B) $\frac{I_m}{I_0} = \frac{2}{\pi}$ C) $\frac{I_m}{I_0} = \frac{1}{\sqrt{2}}$ D) $\frac{I_m}{I_0} = \sqrt{2}$

II. Fill in the blanks by choosing appropriate answers : 5X1=5
(current, electric field, magnetic intensity, electrostatic shielding, straight path)

16) Force per unit charge is known as .....

17) The process in which a region is made free from any electric field is .....

18) When cells are connected in series same ..... flows through each cell.

19) The path of a charged particle moving along the uniform electric field is .....

20) Ration of magnetic induction to the permeability of the material placed in magnetising field is .....

PART-B

III. Answer ANY FIVE of the following questions. 5X2=10

21) Write any two properties of electric field lines.

22) Write an expression for electric flux through a surface and explain the terms.

23) What are polar and non-polar molecules ?

24) Write any two factors on which capacitance of a parallel plate capacitor depends.

25) Define : 1) mobility of free electrons ii) relaxation time

26) Mention any two limitations of ohm's law.

27) Obtain an expression for radius of circular path described by a charge in a uniform magnetic field.

28) Write any two differences between ammeter and voltmeter.

29) State Faraday's law of electromagnetic induction. Mention an expression for induced emf in the circuit.

PART-C

IV. Answer ANY FIVE of the following questions. 5X3=15

30) State and explain Coulomb's law.

31) Obtain the relation $E = -\frac{dv}{dx}$

32) Derive an expression for equivalent capacitance of two capacitors connected in parallel.

33) Derive an expression for drift velocity of free electrons in a conductor.

34) A battery of emf 10V an internal resistance 3Ω is connected to a resistor. If current in the circuit is 0.5A, what is the resistance of the resistor.

35) Derive an expression for magnitude of magnetic field at a point around a long straight conductor using ampere's circuital law.

36) Explain with circuit diagram, how to convert galvanometer into ammeter ?

37) Write any three properties of diamagnetic materials.

38) Derive an expression for motional emf.

PART-D

V. Answer ANY THREE of the following questions : 3X5=15

39) Obtain an expression for electric field due to a uniformly charged thin spherical shell when the point is outside the conductor.

40) Derive an expression for electric field at a point on equatorial line of electric dipole.

41) Derive an expression for electric potential at a point due to isolated point charge.

42) Assuming the expression for drift velocity, derive an expression for conductivity of the conductor.

43) Obtain the balancing condition for the wheatstone bridge.

44) Derive an expression for magnetic field at a point on the axis of a circular loop.

VI. Answer ANY TWO of the following questions. 2X5=10

45) Two point charges 4μC and −16μC are separated through a distance 1 m in air, calculate the resultant electric intensity at the mid-point between these two charges.

46) A parallel plate capacitor with air between the plates, each plate has an area of $6\times10^{-3}m^2$. The distance between the plates is 3mm. Calculate the capacitance of the capacitor. If this capacitor is connected to 100V supply, what is the charge stored in the capacitor ?

47) The number density of free electrons in copper conductor is $8.5\times10^{28}m^{-3}$. How long does an electron take to drift from one end of a wire 3.0m long to its other end ? The area of cross section of the wire is $2.0\times10^{-6}m^2$ and it is carrying a current of 3.0A.

48) Two straight long parallel conductors separated by 0.06m carry current of 2A and 3A in opposite direction. Find the magnitude of the force per unit length and also nature of the force. If distance between the conductors is doubled, what is the new force per unit length between them ?

K

SECOND PUC MID-TERM EXAMINATION – OCTOBER 2023

Sub: PHYSICS (33)

Time: 3 Hrs. 15 Min. **Total Marks: 70**

General Instructions:

(i) All parts are compulsory.

(ii) Only the first written answers will be considered for Part A.

(iii) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.

(iv) Direct answers to the numerical problems without detailed solutions will not carry any marks.

PART – A

Picks the correct option among the four given options for ALL the following questions. 15 × 1 = 15

1. The force between two point charges when the distance between them is doubled

(a) Force reduced to $\frac{1}{4}^{th}$ of initial value (b) force gets doubled

(c) force remains same (d) Force reduced to $\frac{3}{4}^{th}$ of initial value

2. The angle between electric field and dipole moment at any point on the axes line of electric dipole is

(a) $\theta = 0°$ (b) $\theta = 90°$ (c) $\theta = 45°$ (d) $\theta = 30°$

3. The field inside the cavity of a conductor is always zero. This is known as

(a) electroplating (b) electricity (c) electric charge (d) electrostatic shielding

4. An example for non-polar molecule

(a) water (b) HCl (c) oxygen (d) none

5. The example for non-ohmic divice is

(a) copper wire (b) carbon resistance (c) diode (d) Tungston wire

6. For which of the following the resistance decreases on increasing the temperature

(a) copper (b) tungsten (c) Germanium (d) Aluminium

7. A Galvanometer can be converted into an ammeter by connecting

(a) Low resistance in series (b) High resistance in parallel

(c) Low resistance in parallel (d) High resistance in series

8. Tesla is the unit of

(a) electric flux (b) Magnetic flux

(c) electric filed (d) magnetic filed

9. The magnetic lines of force inside a bar magnet

(a) Are from South-pole to north pole of magnet

(b) Are from north – pole to South pole of magnet

(c) Do not exist

(d) Depend upon the area of cross-section of the bar magnet.

10. Temperature above which a ferromagnetic substance becomes paramagnetic is called

(a) critical temperature (b) Boyle's temperature

(c) Debye's temperature (d) curie temperature

11. Lenz's law is consequence of the law of conservation of

(a) charge (b) momentum (c) mass (d) energy

12. A transformer is based on the principle of

(a) mutual inductance (b) self inductance

(c) Ampere's law (d) Lenz's law

13. Current in the circuit is wattles. If

(a) Inductance in the circuit is zero (b) Resistance in the circuit is zero

(c) Current is alternating (d) Resistance and inductance both are zero

14. We can reduce eddy currents in the core of transformer

(a) by increasing the number of turns in secondary coil

(b) by taking laminated core

(c) by making step-down transformer

(d) by using a weak ac at high potential

15. Current due to varying electric field is called

(a) conduction current (b) displacement current

(c) both (a) and (b) (d) none of these

II. Fill in the blanks by choosing appropriate answer given in the brackets for all the following questions. [$\sqrt{2}$, energy, gold leaf electroscope, zero, 180°, more than 1) **5 × 1 = 5**

16. _____ is an apparatus used to detect charge on a body.

17. Work done in an equipotential surface is _____

18. Kirchhoff's second law is based on the law of conservation of _____

19. Magnetic permeability of para magnets substance is _____

20. The ratio of peak value and r.m.s value of an ac is _____

PART – B

III. Answer any FIVE of the following questions: **5 × 2 = 10**

21. Mention two properties of electric charge.

22. What is an equipotential surface? Give one example.

23. State and explain Ohm's law.

24. Mention an expression for drift velocity in terms of relaxation time. Explain the terms.

25. What is Lorentz force? Write an expression for it.

24) Mention 4 properties of magnetic field lines.

26. Define (a) retentivity and (b) coexivity.

27. Mention an expression for self inductance of a solenoid and explain thermodynamics symbols.

28. Define Q – factor of resonant circuit. Define resonance and derive the expression for reson frequen LCR circ

29. Give any two uses of UV waves.

PART – C

IV. Answer any FIVE of the following questions: **5 × 3 = 15**

30. Derive an expression for torque on an electric dipole placed in uniform electric field.

31. Mention three properties of electric field lines.

32. Derive $\vec{E} = -\frac{dv}{dx}$.

33. Obtain the relation between current density and conductivity.

34. Mention the factors on which the resistance of Metalic conductor depends upon.

35. Distinguish between ammeter and voltmeter.

36. Mention three properties of diamagnetic materials.

37. Derive an expression for energy stored in an inductor.

38. Explain the construction and working of transformer.

PART – D

V. Answer any THREE of the following questions: **3 × 5 = 15**

39. Derive an expression for the electric field at a point on the equatorial line of an electric dipole.

40. Derive an expression for capacitance of parallel plate capacitor without dielectric medium.

41. Two cells of different emf's and different internal resistances are connected in parallel. Obtain the expression for equivalent emf and equivalent internal resistance of the combination.

41) Derive the expression for drift velocity in terms of current

42. Derive an expression for force between two straight parallel conductors carrying current in same direction, and hence define ampere.

43. (a) Define magnetization. Magnetic intensity and magnetic susceptibility.

(b) State and explain Gauss's law in magnetism.

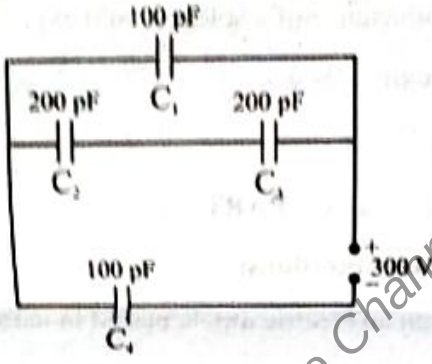
44. Derive an expression for resultant voltage, Impedance current and phase angle in series LCR circuit using phasor diagram.

PART - E

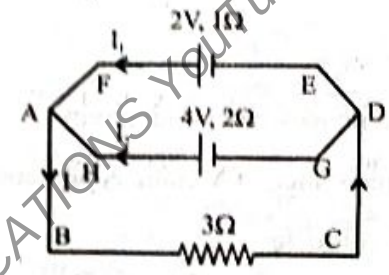
VI. Answer any TWO of the following: **2 × 5 = 10**

45. Find the point on the line joining the two charges + 14 nC and + 4 nC, where the resultant field is zero. Distance between the charges is 1.2 m.

46. Obtain the equivalent capacitance of the network in figure. For a 300 V supply, determine the charges and voltage across each capacitor.



47. Find the currents in the circuit and also power dissipated in 3Ω resistor in the circuit shown below:



48. A coil of inductance 0.6 H and resistance 200 Ω is connected to a 240 V, 50 Hz ac supply.

(a) What is maximum current in the coil?

(b) What is the time long between the voltage, maximum and the current maximum?

* * * * *

MD

II P.U.C. MID-TERM EXAMINATION -2023

II

Time : 3.15 hours **PHYSICS - 33** **Max. Marks : 70**

General Instructions:

1) All parts are compulsory.
2) Only the first written answer will be considered for Part A.
3) Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.
4) Direct answer to the numerical problems without detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four given options for ALL of the following questions. **15×1=15**

1. The SI unit of electric charge is
   a) volt b) coulomb c) joule d) newton
2. An electric dipole is kept in a uniform electric field. It experiences.
   a) a force and a torque b) a force but no torque c) A torque but no force d) neither a force nor a torque
3. 1 volt = _____
   a) 1 coulomb b) 1 newton / 1 columb c) 1 joile / 1 columb d) 1 newton / 1 metre
4. An example for polar molecule is _____
   a) oxygen molecule b) nitrogen molecule c) water molecule d) hydrogen molecule
5. The rate of flow of electric charge through any cross - section of a conductor is known as _____
   a) Electric flux b) Electric potential c) Electric current d) Electric field
6. Ohm's law is not applicable to
   a) semiconductors b) super conductors c) vaccum tubes d) all of these
7. The magnetic field strength at point. P distance r from a long straight wire carrying current I
   a) $\frac{\mu_o I}{2r}$ b) $\frac{\mu_o I}{2\pi r}$ c) $\frac{\mu_o I}{4\pi r}$ d) $\frac{\mu_o I}{\pi r}$
8. A charged particle enters in a magnetic field perpendicular to the magnetic lines of force. The path of the particle is _____
   a) straight line b) circular c) ellipse d) spiral
9. The magnetic dipole moment of a magnetic dipole is given by the formula
   a) M mx2l b) M = m+2l c) $M = \frac{m}{2l}$ d) M = m-2l
10. The ratio of magnetization to magnetic intensity is called _____
    a) Relative permeability b) absolute permeability
    c) magnetic susceptibility d) Retentivity
11. Significance of Lenz's law is _____
    a) law of conservation of charge b) law of conservation of energy
    c) law of conservation of momentum d) None of the above
12. When a magnet is moved with its N-pole towards a closed coil, the nearer end of the coil acts as_____
    a) N-pole b) S-pole c) Positive Charge d) negative charge
13. Frequency of DC source is _____
    a) 50Hz b)O c) ∞ d) 220Hz
14. Power factor in a purely resistive ac circuit is _____
    a) One b) infinity c) zero d) $1/\sqrt{2}$
15. Electromagnetic waves are _____
    a) transverse waves b) longitudinal waves c) mechanical waves d) one dimensional waves

(P.T.O.)

II. Fill in the blanks by choosing appropriate answer given in the brackets for all the following questions. **5×1=5**

(Electrostatic shielding, 6.25×10^{18}, infinite, time varying electric field, $\mu_r > 1$)

16. The number of electrons in one coulomb of charge will be _____
17. The electric field inside the cavity of a charged conductor is zero, this is known as _____
18. The resistance of an ideal voltmeter is _____
19. For paramagnetic substances _____
20. Displacement current is due to _____

PART-B

III. Answer any FIVE of the following questions. **5×2=10**

21. Sketch the electric field lines of two equal and opposite point charges.
22. What is an equipotential surface? Give one example.
23. State and explain Ohm's law.
24. Define the terms relaxation time, mobility of free electron.
25. Write the expression for the magnitude of force on a moving charge in a uniform magnetic field. Explain the terms.
26. What are diamagnetic materials? Give one example.
27. Mention an expression for self inductance of a solenoid and explain the symbols.
28. State and explain Faraday's law of electromagnetic induction.
29. Mention the any two uses of gamma rays.

PART-C

IV. Answer any FIVE of the following questions. **5×3=15**

30. Mention any three properties of electric charges.
31. Obtain the relation between electric field and electric potential.
32. Derive an expression for drift velocity of free electrons in a conductor.
33. Show that graphically the variation resistivity of a
    (i) metallic conductor (ii) semi conductor
34. State and explain Biot-Savart's law.
35. Mention any three properties of Magnetic field lines.
36. Explain briefly the coil and magnet experiment to demonstrate electromagnetic induction.
37. Derive an expression for energy stored in an inductor.
38. What is the power consumed in (1) purely resistive circuit, (2) purely inductive circuit and (3) purely capacitive circuit.

PART-D

V. Answer any THREE of the following questions. **3×5=15**

39. Derive an expression for the electric field at a point outside a charged spherical shell using Gauss's law.
40. Derive an expression for electric potential due to an isolated point charge.

1. Deduce the condition for balance of a Wheatstone's bridge using Kirchhoff's rules.
2. Derive an expression for the force between two straight parallel current carrying wires and hence define ampere.
3. (i) What is an AC generator?
   (ii) Derive an expression for the instantaneous emf induced in a coil rotating in a uniform magnetic field.
4. (i) What is wattless current?
   (ii) What is the principle of transformer?
   (ii) Mention any three losses in a transformer

I. Answer any TWO of the following questions. **2×5=10**

45. Find the point on the line joining the two charges +12nc and +3nc where the resultant electric field is zero. Distance between the charges is 1.2 m

46. A negligibly small current is passed through a wire of length 15m and uniform cross - section 6.0×10^{-7} m^2 and its resistance is measured to be 5.0Ω. What is the resistivity of the material at the temperature of the experiment?

47. A galvanometer of resistance 50Ω requires a current of 2mA for full scale deflection. How do you convert it into (a) an ammeter of range 0-3A and (b) a voltmeter of range of 0-5v?

48. A series LCR circuit is connected to 220V ac source of variable frequency. The inductance of the coil is 5H, capacitance of the capacitor is 5μF resistance is 40Ω. At resonance, calculate (a) the resonant frequency (b) current in the circuit and (c) the inductive reactance

RN

II PUC MIDTERM EXAMINATION, OCTOBER - 2023

II

Time : 3:15 Hours | **PHYSICS - 33** | Max. Marks : 70

General Instructions:-

i) All parts are compulsory.
ii) For Part-A questions, first written answer will be considered for awarding marks.
iii) Answers without relevant diagram/figure/circuit wherever necessary will not carry any marks.
iv) Direct answers to numerical problems without detailed solutions will not carry any marks.

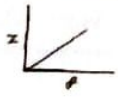
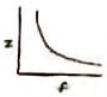
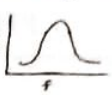
PART - A

I Pick the correct option among the four given options for ALL of the following questions: **15×1=15**

1) The net charge of an elecric dipole is
   a) q b) 2q c) $^{q}/_{2}$ d) zero
2) Electric potential is
   a) Scalar & dimensionless quantity b) Vector & dimensionless quantity
   c) Scalar & dimensional quantity d) Vector & dimensional quantity
3) Which one of the following is a Polar molecule
   a) H_2 b) O_2 c) H_2O d) N_2
4) The electric field inside the cavity of a charged conductor is zero, this is known as
   a) Charging b) grounding c) Electrostatic shielding d) Electrostatic induction
5) The magnitude of the drift velocity per unit electric field is
   a) Mobility b) drift velocity c) Relaxation time d) Resistivity
6) A moving charge produces
   a) Only Electric field b) Only magnetic field
   c) Both Electric and magnetic field d) Neither electric field nor magnetic field
7) The path described by a charged particle is helix, when it enters the magnetic field at an angle q
   a) q = 0° b) q = 90° c) 0° < q 90° d) q = 180°
8) If the number of turns of the coil is doubled, then voltage sensitivity of the galvanometer will be.
   a) doubled d) unchanged c) halved d) four times
9) Gauss's law for magnetism is
   a) $\Sigma\vec{B}.\overrightarrow{\Delta S} = 0$ b) $\Sigma\vec{B}.\overrightarrow{\Delta S} = \mu_o I$ c) $\Sigma\vec{B}.\overrightarrow{\Delta S} = \frac{1}{4\pi\varepsilon_o}$ d) $\Sigma\vec{B}.\overrightarrow{\Delta S} = \frac{\mu_o I}{4\pi}$
10) The relation connecting between magnetic susceptibility (x) and relative permiability is
   a) x = μr + 1 b) μr x = 1 c) x = μr - 1 d) μr x - 1
11) S.I. Unit of magnetic dipole moment is
   a) Am b) Am^2 c) Am^{-1} d) Am^{-2}
12) Identify the statement which is correct.
   a) Only an emf is induced when the flux linked with a closed circuit changes.
   b) Only current is induced when the flux linked with a closed circuit changes.
   c) both emf and current is induced when the flux linked with a closed circuit changes.
   d) both emf and current is induced when the flux linked with a open circuit changes.
13) Lenz's law is a direct consequence of law of
   a) Conservation of momentum b) conservation of charge c) conservation of energy d) conservation of emf
14) A self inductance stores energy in the form of
   a) magnetic energy b) electric energy
   c) Magnetic energy and electric energy d) both Kinetic and Potential energy

(P.T.O.)

15) In a series LCR circuit, variation of impedance (z) with applied frequency (f) is

a)  b)  c)  d) 

II Fill in the blanks by choosing the appropriate. answer given in the brackets for ALL the following questions:- 5×1=5

(∞, non-conducting, Zero, Henry, Meissner effect)

16) Dielectrics are _____ substance.

17) The resistance of ideal Voltmeter is _____

18) The phenomenon of perfect diamagnetism in superconductors is called _____

19) Inductance is measured in _____

20) The sum of the instantaneous value of current over one complete cycle is _____

PART - B

III Answer any FIVE of the following questions. 5×2=10

21) Write Coulomb's law in vector notation and explain the terms.

22) How much of work is done in carrying a proton between two points of a potential difference 10V?

23) A parallel plate capacitor with air between the plates has a capacitance 'C'. What will be the capacitance if
   i) distance b/w the plates is doubled.
   ii) the space b/w the plates is filled with a substance of dielectric constant 3.

24) Graphically represent the variation of resistivity as function of temperature in case of
   i) Copper ii) semiconductor

25) Write any two limitations of ohm's law.

26) What is Lorentz force? Write the expression for it.

27) What is the nature of force b/w two parallel conductors carrying currents in
   i) same direction ii) opposite direction

28) Define magnetic Intensity. Write its SI Unit.

29) What is an alternating current. Write any one advantage of ac over dc.

PART -C

IV Answer any FIVE of the following questions. 5×3=15

30) Write any three properties of Electric field lines.

31) Mention the expression for electric flux through a surface, when is it maximum and minimum.

32) Derive the expression for effective capacitance of two capacitors. Connected in series.

33) Show that the Electric field at any point is equal to negative potential gradient at that point.

34) Derive the relation $\vec{J} = \sigma\vec{E}$, with terms have usual meaning.

35) Explain with circuit diagram, how to convert galvanometer into Ammeter.

36) Mention any three properties of ferromagnetic materials.

37) A conductor of length 3m moving in a uniform magnetic field of strength 10T. covers a distance of 70m in 5 second with director perpendicular to magnetic field. Calculate the emf induced in it.

38) Show that current and voltage are in phase with each other in case of pure resistor.

PART - D

V Answer any THREE of following questions:- **3×5=15**

39) i) define electric dipole moment. Write its S.I. unit.
ii) Obtain the expression for the torque acting on an electric dipole placed in an uniform electric field.

40) Derive an expression for Electric potential due to an isolated point charge.

41) Deduce the condition for balance of a wheatstone's bridge using Kirchhoff's rules.

42) State Ampere's circuital law and hence derive an expression for magnitude of magnetic field at a point around a straight conductor.

43) Derive an expression for the magnetic field at a point along the axis of the circular conductor carrying current.

44) i) What is an AC generator? On what principle does it works.
ii) Derive the expression for instantaneous emf induced in an AC generator.

VI Answer any TWO of following questions. **2×5=10**

45) Three charges each equal to +4nC are placed at the three comers of a square of side 2cm find the electric field at the fourth corner.

46) The number density of free electrons in a copper conductor is estimated to be 8.5×10^{28} m^{-3}. How long does an electron take to drift from one end of wire 3.0 m long to its other end. The area of cross-section of wire is $2.0\times10^{-5}m^2$ and is carrying a current 3.0A.

47) Two cells of Emf 2V & 4V and internal resistance 1Ω and 2Ω respectively are connected in prallel so as to send current in same direction through an external resistance of 10Ω.
Find the potential difference across 10Ω resistance.

48) A source of alternating emf of 220V - 50Hz is connected in series with a resistance of 200Ω an inductance of 100mH and a capacitance 30μF. Does the current leads or lags the voltage and by what angle.

GOVERNMENT OF KARNATAKA

DEPUTY DIRECTOR, DEPT. OF SCHOOL EDUCATION (PRE-UNIVERSITY)

PUC-II YEAR MIDTERM EXAMINATION-2023

Time : 3 Hours 15 Minutes | SUBJECT : PHYSICS (33) | MARKS :70

Instructions : 1) All parts are compulsory.
2) For Part-A questions, first written answer will be considered for awarding marks.
2) Answers without relevant diagram/ figure/ circuit wherever necessary will not carry any marks.
4) Direct answers to the Numerical problems without writing the relevant formula and detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four given options for ALL of the following questions : 15X1=15

1) According to Quantisation of charge, the total charge in a system is
A) $Q=\pm\frac{n}{e}$ B) $Q=\pm ne$ C) $Q=\pm(n+e)$ D) $Q=\pm n^e$

2) The force experienced by a unit positive charge placed at a point is called
A) Electric field B) Electric force C) Lorentz force D) Electric Potential

3) The symmetry of equipotential surface for a uniform electric field is
A) Circular B) Spherical C) Plane D) Cylindrical

4) An example for non polar dielectric is
A) Water B) Ammonia C) Sodium chloride D) Hydrogen molecule

5) The resistance of a conductor does not depend on
A) Pressure B) Temperature C) Length of conductor D) Area of conductor

6) The power loss in transmission cables can be reduced by
A) Using thick cables B) Sending high voltages from generating stations
C) both (a) and (b) D) None of the above

7) The path traced by a proton moving perpendicular to the magnetic field is
A) Helix B) Ellipse C) Straight line D) Circle

8) The relationship between speed of light, permittivity of free space and permeability of free space is
A) $\epsilon_0=\frac{1}{\sqrt{c\mu_0}}$ B) $c=\frac{1}{\sqrt{\epsilon_0\mu_0}}$ C) $\mu_0=\frac{1}{\sqrt{c\epsilon_0}}$ D) $c=\sqrt{\epsilon_0\mu_0}$

9) For which of the following angle, the magnetic flux is large
A) 60° B) 45° C) 90° D) 30°

10) The Gauss law in magnetism states that, the net magnetic flux thought a surface is a always
A) $\frac{q}{\epsilon_0}$ B) zero C) $q\epsilon_0$ D) $q+\epsilon_0$

11) The Lenz's law is regarded as a consequence of conservation of
A) Momentum B) Mass C) Energy D) Charge

12) The expression for instantaneous value of induced emf in an AC generator is
A) $\epsilon=\epsilon_0 tan\omega t$ B) $\epsilon=\epsilon_0 sec\omega t$ C) $\epsilon=\epsilon_0 cot\omega t$ D) $\epsilon=\epsilon_0 sin\omega t$

13) The current which does not require any power for its maintenance in a circuit is called
A) Displacement current B) Electric current
C) Wattless current D) Induced current

14) The source of electromagnetic wave is
A) Static charges B) Accelerated charges
C) charges moving with constant velocity D) Steady current

15) Which of the following wave is used in night vision cameras
A) Radio waves B) Infra red waves C) Micro waves D) x-rays

II. Fill in the blanks by choosing appropriate answer given in the brackets for all the following questions : 5X1=5

(Electrical inertial, $\varepsilon=-N\frac{d\phi_B}{dt}$, $\oint\vec{B}.\vec{dl}=\mu_0 I_{net}$, visible light, $B=\mu_0 nI$)

16) According Ampere's circuital law .....
17) The expression for magnetic field of a solenoid is .....
18) According to Faraday's law of electromagnetic induction .....
19) The self inductance of a coil is also called .....
20) ..... wave has a wavelength range of 400 nm to 750 nm

PART-B

III. Answer ANY FIVE of the following questions. **5X2=10**

21) State Coulomb's law and write Coulomb's law in vector form.

22) State and explain Gauss law in electrostatics.

23) Three capacitors each of capacitance 9 pF are combined in parallel. Calculate the equivalent capacitance.

24) A 12 pF capacitor is connected to a 50V battery. How much electrostatic energy is stored in the capacitor ?

25) Mention the expression for torque on a rectangular current loop placed in a uniform magnetic field and hence explain the terms.

26) Define the terms : a) Magnetisation and b) Magnetic intensity

27) What is mutual induction ? Mention the expression for mutual inductance of two long co axial solenoids.

28) Draw the phasor diagram for a pure inductive circuit and hence write the phase relationship between current and voltage in pure inductive circuit.

29) Write any two uses of x-rays.

PART-C

IV. Answer ANY FIVE of the following questions. **5X3=15**

30) Mention the basic properties of electric charges.

31) Write any three properties of electric field lines.

32) Derive an expression for effective capacitance when two capacitors are connected in series.

33) Derive an expression for drift velocity of electrons.

34) Explain the conversion of a galvanometer to ammeter.

35) Derive an expression for magnetic field of an infinite wire carrying current.

36) Write any three differences between diamagnetic and ferromagnetic materials.

37) Derive an expression for motional emf.

38) Derive an expression for energy stored in an inductor.

PART-D

V. Answer ANY THREE of the following questions : **3X5=15**

39) What is electrostatic potential ? Derive an expression for electrostatic potential due to a point charge.

40) Derive an expression for capacitance of a parallel plate capacitor.

41) With a neat diagram obtain the balancing condition of Wheatstone bridge.

42) a) Define emf of a cell and internal resistance of a cell. (2)
b) Obtain an expression for equivalent emf and internal resistance when two cells are connected in series. (3)

43) Derive an expression for force between two parallel conductors carrying current and hence define ampere.

44) a) What is impedance of a LCR circuit. (1)
b) Obtain the expression for impedance of a series LCR circuit using the phasor diagram. (4)

VI. Answer ANY TWO of the following questions. **2X5=10**

45) Two point charges $q_A = 3\mu C$ and $q_B = -3\mu C$ are located 20cm apart in vacuum.
a) What is the electric field at the midpoint O of the line joining the two charges ?
b) If a negative test charge of magnitude 1.5nC is placed at this point, what is the force experienced by the test charge ?

46) An electric dipole with charges $\pm 2\mu C$ are separated by a distance 2mm. Find the electric dipole moment. If the dipole is aligned at angle of 30° with the direction of a uniform electric field of magnitude $5 \times 10^4 NC^{-1}$ then calculate the magnitude of the torque acting on the dipole.

47) A heating element using nichrome connected to a 230V supply draws an initial current of 3.2A which settles after few seconds to a steady value of 2.8A. What is the steady temperature of the heating element if the room temperature is 27°C ? Temperature coefficient of nichrome averaged over the temperature range involved is $1.70 \times 10^{-4}\ ^0C^{-1}$.

48) A battery of emf 10 V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance of the resistor ? What is the terminal voltage of the battery when the circuit is closed ?

DEPARTMENT OF SCHOOL EDUCATION (PUC)
SECOND PUC MIDTERM EXAMINATION–OCTOBER-2023
II PUC - PHYSICS (33)

Time: 3 hours 15 min. **Max Marks: 70**

General Instructions:

1. *All parts are compulsory.*
2. *For Part – A questions, first written-answer will be considered for awarding marks.*
3. *Answers without relevant diagram / figure / circuit wherever necessary will not carry any marks.*
4. *Direct answers to the numerical problems without detailed solutions will not carry any marks.*

PART – A

I. Pick the correct option among the four given options for ALL of the following questions: **15 × 1 = 15**

1. **The value of electric permittivity of free space is**
   (a) $9x10^9 NC^2/m^2$ (b) $8.85x10^{-12} Nm^2/C^2$
   (c) $8.85X10^{-12} c^2/Nm^2$ (d) $9X10^9 C^2/Nm^2$

2. **When does the torque acting on the electric dipole is maximum**
   (a). $\theta=0^0$ (b). $\theta=30^0$ (c). $\theta=60^0$ (d) $\theta=90^0$

3. **The work done to move a charge from one point to another in an equipotential surface is**
   (a). zero (b). 1J (c). 2J (d). 3J

4. **The value of the potential(V) at a point 'P' due to a charge of $4x10^{-9}$ C located 9cm away from it is**
   (a). 100V (b). 200V (c). 300V (d). 400V

5. **Capacitance of a parallel plate capacitor does not depend on:**
   (a). Shape of the plates (b). Size of the plates
   (c). Dielectric constant between the plates (d). Charge on the plates

6. **The relation between resistance and resistivity is**
   (a). $R=\rho L/A$ (b). $\rho=RL/A$ (c). $R=A/\rho L$ (d). $\rho=A/RL$

7. **The SI unit of mobility of free electron is**
   (a). Vs/m^2 (b). m^2/Vs (c). $m^2 V/s$ (d). $V/m^2 s$

8. The expression $\mathbf{F}=q[\mathbf{E}+(\mathbf{v}x\mathbf{B})]$ is named as(bold letter indicates vector)
   (a). Coulomb force (b). Magnetic force (c).Lorentz force (d). None of the above

9. **The magnetic susceptibility of a paramagnetic material is**
   (a). Small and positive (b) Small and negative (c) Large and positive (d) None of these

10. **The diamagnetic substance is brought near a strong magnet, then it is**
    (a) Attracted by a magnet
    (b) Repelled by a magnet
    (c) Repelled by north pole & attracted by south pole
    (d) Repelled by north pole & attracted by south pole

11. The net magnetic flux through any closed surface is always zero is the statement of.

(a). Lorentz's law (b). Lentz's law

(c). Gauss's law in magnetism (d).Gauss's law in electrostatic.

12. The south pole of a magnet is brought near a circular conducting ring. The direction of the induced current in the circular ring will be

(a).Clockwise (b). Anticlockwise

(c). Towards north (d).Towards south

13. The law which gives the polarity of induced emf in electromagnetic induction is.

(a). Gauss' law in magnetism. (b). Ampere's circuital law.

(c). Faraday law. (d). Lenz'slaw.

14. The phenomenon of induction of emf and hence current in the secondary coil due to the variation of current in the primary coil is called

(a). Self induction. (b) Mutual induction.

(c) Solenoid. (d) emf of the coil

15. The amount of opposition on the flow of current by the series LCR circuit is known as,

(a). Period (b). Inductive reactance.

(c). Capacitive reactance (d). Impedance

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL the following questions: **5 × 1 = 5**

(charge, high, mechanical, store, towards)

16. The direction of electric field is_____ the negative charge.
17. Capacitors are used to _____ the electrical energy.
18. Kirchhoff's junction rule signifies the law of conservation of _____.
19. A galvanometer can be converted into a voltmeter by connecting suitable ____ resistance in series with resistance of the galvanometer.
20. The device used to convert _____ energy into electrical energy is called AC generator.

PART – B

III. Answer any FIVE of the following questions: **5 × 2 = 10**

21. State and explain Gauss's law in electrostatics.
22. A 15pF capacitor is connected to a 50V battery. How much electrostatic energy is stored in the capacitor
23. State Kirchhoff's two laws for electrical network.
24. What is moving coil galvanometer? State the principle of the moving coil galvanometer.
25. State and explain Gauss's law in magnetism.
26. Mention any two properties of magnetic field lines.
27. What is magnetization? Mention its SI unit.
28. Give any two differences between inductive reactances and capacitive reactances.
29. If the peak value of ac current is 4.24 A, what is its root mean square value?

PART – C

IV. Answer any FIVE of the following questions: $5 \times 3 = 15$

30. Mention any three properties of electric field lines.
31. Obtain the relation between electric field and electric potential.
32. Derive an expression for electric potential energy due to a dipole placed in a uniform electric field.
33. Show that $\sigma = ne^2\tau/m$.
34. Draw a labeled Wheatstone's bridge and hence mention the balanced conditions of it.
35. How would you convert galvanometer into an ammeter? Explain..
36. Distinguish between paramagnetic and ferromagnetic substances.
37. Derive an expression for self induction of inductor.
38. Deduce an expression for motional (induced) emf when a conducting rod moving in a perpendicular magnetic field.

PART - D

V. Answer any THREE of the following questions: $3 \times 5 = 15$

39. Derive the expression for the electric field at a point outside and inside a uniformly charged spherical shell.
40. Obtain an expression for electric potential due to an isolated point charge.
41. Find the expression for the equivalent emf's and internal resistances of two cells of different emf's and different internal resistances are connected in parallel.

VI. Answer any THREE of the following questions: $3 \times 5 = 15$

42. With proper diagram, write the principle, construction and working theory of Moving coil galvanometer.
43. Explain the construction and working of an AC generator.
44. Derive an expression for the instantaneous current in an AC circuit with a pure capacitor. (draw neat circuit and phasor diagram).

VII. Answer any TWO of the following questions: $2 \times 5 = 10$

45. Two point charges $q_A = 3\mu C$ & $q_B = -3\mu C$ are located 20cm apart in vacuum.
    (a) What is electric field at the midpoint O of the line AB joining the two charges?
    (b) If a negative charge of magnitude $1.5 \times 10^{-9} C$ is placed at this point, what is the force experienced by the test charge?
46. A battery of emf 10V and internal resistance 3Ω are connected to a resistor. If the current in the circuit is 0.5A, what is the resistance of the resistor? What is the terminal voltage of the battery when the circuit is closed?
47. A galvanometer coil has a resistance of 12Ω and the meter shows full scale deflection of 3mA. How can the galvanometer be converted into (a) an ammeter of range 0 to 6A & (b) a voltmeter of range 0 to 18V?
48. A pure inductor of 25mH is connected to a source of 220V and 50Hz. Find the inductive reactance, rms value of current and peak value of current in the circuit.

TUMAKURU DISTRICT P.U. COLLEGES PRINCIPALS' ASSOCIATION (R.)

MID TERM EXAMINATION - **2023**

Subject Code : **33** Total No. of ques: **48**

Time : **3-15 hours** **II PUC - PHYSICS** Max Marks : **70**

1] All parts are compulsory.
2] Answers without relevant diagram/figure/ circuit wherever necessary will not carry any marks.
3] Direct answers to the numerical problems without detailed solutions will not carry any marks.
4] For Part-A questions ,first written answer will be considered for awarding marks.

PART-A

I. Pick the correct option among the four given options for ALL of the following questions: **15x1=15**

1. A glass rod is rubbed with silk cloth. The charge acquired by glass rod is _____.
   a]negative b] positive c] zero
   d] positive on one end and negative on the opposite end
2. For large distances from a short dipole, the electric field due to it depends on the distance from it as:
   (a) 1/distance^2 (b) 1/distance^3 (c)(distance)^3 (d) (distance)^3
3. Potential due to a charge at its own location is_____
   (a) zero (b) $k\frac{q}{r}$ (c) $k\frac{q}{r^2}$ (D) not defined
4. Which of the following molecule has permanent dipole moment?
   (a) O_2 (b) H_2 (c) Cl_2 (d) H_2O
5. Magnitude of drift velocity per unit electric field is called_____
   (a) resistivity (b) conductivity (c) mobility (d)free electron density
6. Resistivity of metallic conductor _____ with increase in temperature.
   (a) increases (b) decreases (c) first decreases and then increases (d) will not vary
7. Which of the following relation represent Ampere circuital law?
   (a) $\oint\vec{B}.\vec{dA}=0$ (b) $\oint\vec{B}.\vec{dl}=0$ (c) $\oint\vec{E}.\vec{dA}=\frac{q}{\varepsilon_0}$ (d) $\oint\vec{E}.\vec{dl}=\frac{d\phi_B}{dt}$
8. The magnetic potential energy of the magnetic needle placed in uniform magnetic field is give by_____
   (a) $U_m = -mB\sin\theta$ (b) $U_m = -mB\cos\theta$ (c) $U_m = -m^2B\sin\theta$ (d) $U_m = -mB^2\cos\theta$
9. Which of the following is true for a ferromagnetic material?
   (a) $\mu > \mu_0$ (b) $\mu < \mu_0$ (c) $\mu = \mu_0$ (d) $\mu >>> \mu_0$
10. Which of the following is dimensionless quantity?
    (a) magnetic permeability (b) magnetic susceptibility
    (c) magnetic intensity (d) magnetic flux density
11. The SI unit of magnetic flux is:_____
    (a) Wb m^{-1} (b) T m^{-2} (c) weber (d) Wb m^{-2}
12. The device which converts mechanical energy into electrical energy is
    (a) generator (b) cell (c) photo cell (d) motor
13. The laminated core is used in a transformer to reduce energy loss due to _____
    (a) flux leakage (b) resistance of the windings (c) eddy currents (d) hysteresis
14. The average power dissipated in an ac circuit is maximum if the ac source is connected :
    (a) only to pure resistor (b) only to pure inductor
    (c) only to pure capacitor (d) to a series combination of capacitor and inductor
15. The electromagnetic waves with highest frequency among the following are :
    (a) gamma rays (b) UV rays (c) microwaves (d) radio waves

II. Fill in the blanks by choosing the appropriate answer from these given in the brackets:
(zero, Lorentz force; displacement current, electric dipole, magnetisation, Coulomb force)**5x1=5**

16. _____ is a system of two equal and opposite charge separated by small distance.
17. Work done in moving a charge on an equipotential surface is _____.
18. The net force on a charge moving in presence of both electric and magnetic fields is called_____
19. _____is defined as magnetic moment per unit volume of a sample.
20. Current due to time varying electric field is called _____.

P.T.O.

PART-B

III. Answer any FIVE of the following questions: **5x2=10**

21. State and explain Coulomb's law in electrostatics.
22. A parallel plate capacitor of capacitance 4×10^{-6}F is charged by connecting it to a 100 V supply. Calculate the electrostatic energy stored in the capacitor.
23. Write the expression for current density. Mention its SI unit.
24. How is resistance of a conductor related to its i) length and ii) area of cross section.
25. Define i) current sensitivity and ii) voltage sensitivity of a galvanometer.
26. Differentiate between paramagnetic and diamagnetic materials.
27. Mention any two factors on which self inductance of a long solenoid depends.
28. State Lenz's law. What is its significance?
29. Give any two uses of X-rays.

PART-C

IV. Answer any FIVE of the following. **5x3=15**

30. Mention the three basic properties of charges.
31. Show that $E = \frac{dV}{dr}$
32. Derive the expression for electric current in terms of drift velocity.
33. Mention three limitations of Ohm's law.
34. Write the expression for magnitude of force acting on a charged particle moving in magnetic field. What will be the force on a charged particle moving i) parallel and ii) perpendicular to a uniform magnetic field?
35. Explain with circuit diagram how a moving coil galvanometer is converted into an ammeter.
36. List the properties of magnetic field lines.
37. Derive the expression for motional emf in a straight conductor moving perpendicular to a uniform magnetic field.
38. Current in a circuit falls from 5.0 A to 0.0 A in 0.1 s. If an average emf of 200 V induced, give an estimate of the self-inductance of the circuit.

PART-D

V. Answer any THREE of the following questions: **3x5=15**

39. i) State Gauss' law in electrostatics. (1)
    ii) Using Gauss' law derive an expression for electric field at a point outside a uniformly charged thin spherical shell. (4)
40. i) Define electric potential at a point. (1)
    ii) Derive an expression for electric potential at a point due to a point charge. (4)
41. Obtain an expression for effective capacitance of two capacitors connected in series.
42. Obtain the condition for balance of Wheatstone bridge using Kirchhoff's rules.
43. Derive an expression for the magnetic field at a point on the axis of a circular current loop.
44. Derive an expression for current through a pure inductor connected to an ac source and hence show that voltage leads current by $\frac{\pi}{2}$

PART-E

VI. Answer any TWO of the following questions: **2x5=10**

45. Two point charges qA= 5μ C and qB = - 5μ C are located at the points A and B which are 0.2m apart in vacuum.
    a) What is the electric field at the midpoint 'O' of the line AB joining the two charges?
    b) A negative test charge of magnitude 2×10^{-9} C is placed at the point 'O'. What is the force experienced by the test charge?
46. At room temperature (27.0 °C) the resistance of a heating element is 100Ω. What is the temperature of the element if the resistance is found to be 117Ω? Given that the temperature coefficient of the material of the resistor is 1.70×10^{-4} °C^{-1}. Also find the resistance at 0°C.
47. Two long and parallel straight wires A and B carrying currents of 8.0 A and 5.0 A in the same direction are separated by a distance of 4.0 cm. Find force per unit length on each conductor. Also estimate the force on a 10 cm section of wire A.
48. A sinusoidal voltage of rms value 283 V and frequency 50 Hz is applied to a series LCR circuit in which R = 3μ and C=796 μ F and L=25.48 mH. Calculate: a) Impedance of the circuit and b) resonance frequency of the circuit.

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UKDPUCPA

II PUC MID-TERM EXAMINATION - 2023

PHYSICS (33)

Time 3.00 Hrs. 15 Min **Max Marks 70**

General instructions :

1. All parts are compulsory.
2. Part-A questions must be answered in the first two pages of the answer booklet. For part-A questions first written answer will be considered for awarding marks.
3. Answers without diagram/figure/circuit whwrever necessary will not carry any marks.
4. Direct answers to the numerical problems without detailed solution will not carry any marks.

PART-A

I. Pick the correct option among the given four options for ALL the following questions: **15x1=15**

1) When two bodies are rubbed against each other, they acquire
   A. Equal and similar charges B. Equal and opposite charges
   C. Unequal and similar charges D. Unequal and opposite charges
2) Magnitude of electric field outside a uniformly charged spherical shell varies with distance r from the centre as
   A. $E \alpha r^{-2}$ B. $E \alpha r^{-1}$ C. $E \alpha r$ D. $E \alpha r^{2}$
3) Electrostatic potential on the equatorial plane of a dipole is
   A. Positive B. Zero C. Maximum D. Negative
4) A nonpolar molecule among the following molecules is
   A. SO_2 B. HCl C. N_2 D. H_2O
5) If a dielctric substance is introduced between the plates of a Capacitor, the energy of the capacitor will
   A. Increase B .Remain unchanged C. Decrease D .become zero
6) Two copper wires have the ratio of lengths 1:2 and ratio of cross sectional areas 2:1. Ratio of their resistivities is
   A. 2:1 B. 1:1 C. 2:1 D. 1:4
7) Which of the following expression does not represent electric power?
   A. P=VI B. $P=V^2/R$ C. P=IR D. $P=I^2R$
8) SI unit of mobility is
   A. ms^2V^{-1} B. $m^2 s^{-1} V^{-1}$ C. $m^{-1}s^2V^{-1}$ D. m^2sV^{-1}
9) Pick the correct statement
   A. Plane mirror produces only real images
   B. Convex mirror produces both real and virtual images
   C. Convex mirror produces only real images
   D. Concave mirror produces both real and virtual images.
10) Effective power of two thin lenses in contact having powers 2D And -5D is
   A. 7D B. -10D C. -3D D. 0.4D
11) A small ink dot on a paper is seen through a glass slab of thickness 6cm and refractive index 1.5. Dot appears to be shifted by
   A. 1cm B. 2cm C. 3cm D. 1.33cm
12) A plane wave front passes through a convex lens. The shape of emergingwavefront is
   A. Plane B. Diverging spherical
   C. Converging spherical D. Cylindrical
13) Which of the following phenomena confirms that light waves are transverse
   A.Interference B. Diffraction C. Refraction D. Polarisation
14) The energy gap in conductors,semiconductors and insulators are respectively E_1, E_2 and E_3 respectively. The relation among them is
   A. $E_1=E_2=E_3$ B. $E_1>E_2>E_3$ C. $E_1<E_2<E_3$ D. $E_1<E_2>E_3$
15) The purpose of doping in semiconductors is to
   A. Increasethe conductivity B. Increasethe strength of material
   C.Increase the resistivity D. Make resistivity independent of temperature

II. Fill in the blanks by choosing appropriate answer given in the brackets for all the following questions.(vector quantity, linear charge density ,energy,parallel,negative) **5x1=5**

16) Charge per unit length of a wire is called_____.
17) Capacitance can be increased by connecting capacitors in _____.
18) Current density is a _____.
19) Focal length of concave lens is_____.

20) Interference and diffraction are consistent with law of conservation of_____.

PART-B

III.Answer any FIVE of the following questions: 5x2=10

21) What are the factors on which the electric field at a point due to a point charge depends?
22) When is torque on an electric dipole maximum and minimum?
23) Define temperature coefficient of resistivity and write its SI unit.
24) State Kirchoff's rules for electric circuits.
25) Draw a neat labelled ray diagram for the image formation by a compound microscope.
26) Mention the conditions for constructive interference in terms of path difference and phase difference.
27) Write two uses of a polaroid.
28) Draw the energy band diagrams of intrinsic semiconductor at temperature T=0K and T>0K.
29) Distinguish between forward biasing and reverse biasing of a p-n junction.

PART-C

IV. Answer any FIVE of the following questions: 5x3=15

30) Obtain the expression for force on a point charge due to multiple charges.
31) Derive the expression for potential energy of two point charges in the absence of external electric field
32) Establish the relation between electric field and electric potential.
33) Write any three electrostatic properties of a conductor.
34) Define relaxation time of conduction electrons. Explain variation of resistivity of copper with temperature using relaxation time.
35) Derive the expression for current drawn from a cell connected to an external resistor.
36) What is critical angle? Show that $\sin i_c = 1/n$
37) Anunpolarised light of intensity I_0 passes through two polarisers whose pass axes are at 30^0 with each other. Find the intensity of light coming out of 2^{nd} polariser.
38) Differentiate between n-type and p-type semi conductors.

PART-D

V. Answer ANY three of the following questions: 3x5=15

39) State Gauss's law in electrostatics and hence obtain the expression for electric field due to a uniformly charged plane sheet.
40) Define electrostatic potential at a point. Arrive at an expression for electric potential at a point due to a point charge.
41) Obtain the expressions for effective emf and effectiveinternal resistance of two cells connected in parallel.
42) Derive the relation connecting n, u, v and R for refraction through a spherical surface where the terms have usual meanings.
43) Explain Huygen's principle and prove law of refraction using it.
44) i) What is a half wave rectifier? 1
ii) Draw the circuit diagram and the input- output waveforms of a half wave rectifier. 2
iii) Explain working of a half wave rectifier. 2

VI. Answer any Two of the following questions. 2x5=10

45) Two point charges +10iC and -10iC are placed $5x10^{-3}$m apart. Determine the electric field at
i) a point on the axis of dipole 0.1m away from its centre on the side of positive charge.
ii) a point on the equatorial plane at same distance($5x10^{-3}$m) from the centre.
46) Three capacitors of capacitances 2nF, 5nF and 10nF are connected in series to a 100V supply.
Find i) effective capacitance of the combination.
ii) Charge on each capacitor
iii) Potential difference across each.
47) Double convex lens is to be made from glass of refractive Index1.55 with both faces of the same radius of curvature. What is the radius of curvature required if the focal length is to be 20cm? What will be the focal length of the same lens in water?
(refractive index of air-water=1.33)
48) In Young's double slit experiment lights of two wavelengths 650nm,520nm are used. The slits are $0.2x10^{-3}$m apart and the screen is at $80x10^{-2}$m away from the slits.
i)Find the distance between 2^{nd} bright fringes on both sides of central maximum for 650nm wavelength.
ii)Find the least distance from the central maximum where the bright fringes due to both the wavelengths coincide.

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GOVERNMENT OF KARNATAKA

DEPUTY DIRECTOR, DEPT. OF SCHOOL EDUCATION (PRE-UNIVERSITY)

PUC-II YEAR MIDTERM EXAMINATION-2023

Time : 3 Hours 15 Minutes | SUBJECT : PHYSICS (33) | MARKS : 70

Instructions : 1) All parts are compulsory.
2) For Part-A questions, first written answer will be considered for awarding marks.
3) Answers without relevant diagram/ figure/ circuit wherever necessary will not carry any marks.
4) Direct answers to the Numerical problems without detailed solutions will not carry any marks.

PART-A

I. Pick the correct option among the four options for ALL of the following questions : 15X1=15

1) The scientist who named charges as positive and negative was
A) coulomb B) Benjamin Franklin C) Gauss D) Ohm

2) An electric dipole placed in a uniform electric field experiences
A) Only force B) only Torque
C) both force and Torque D) Neither force nor Torque

3) The electric potential due to an electric dipole falls off, at large distance (along axis) as
A) $\frac{1}{r}$ B) $\frac{1}{r^2}$ C) $\frac{1}{r^3}$ D) r

4) When a dielectric is inserted fully between the plates of a capacitor, its capacitance ..... from its vacuum value ?
A) Remains same B) Decreases C) Increases D) None of these

5) In equation $\vec{j} = \sigma \vec{E}$ σ is
A) Resistivity B) mobility C) permittivity D) conductivity

6) The resistivity of a speciman increases with increase in temperature. The speciman is
A) semiconductor B) conductor C) Insulator D) None of these

7) Kirchhoff's loop rule is according to law of conservation of
A) momentum B) Energy
C) charge D) Angular momentum

8) The Lorentz force is the force on a charged particle moving in a region containing .....
A) only electric field B) only magnetic field
C) Both electric and magnetic fields D) only crossed electric and magnetic fields

9) Galvanometer can be converted in voltmeter by connecting
A) high resistance in series B) high resistance in parallel
C) low resistance in series D) low resistance in parallel

10) The magnetic field lines of a magnet form
A) Always open loops B) Always closed loops
C) Some times open and some other times closed D) None of these

11) The 'net magnetic flux through any closed surface is zero'. This is
A) Gauss law of electrostatics B) Gauss law of magnetism
C) Ampere's circuital law D) None of these

12) The equivalent quantity of mass in electricity is
A) current B) charge C) potential D) Self-Inductance

13) A long straight conductor carries an electric current. The direction of the magnetic field near it is.
A) Parallel to the plane containing conductor and point
B) anti-parallel to the current
C) parallel to the current
D) perpendicular to the plan containing conductor and point

14) Substances which have strong tendency to move from a region of weak magnetic field to strong magnetic field are called
A) Diamagnetic substances B) Paramagnetic substances
C) Ferromagnetic substances D) None of these

15) The phenomenon in which emf is induced in one coil due to change of current in neighbouring coil is called
A) Self-Inductance B) Mutual Inductance
C) Both (A) and (B) D) None of these

(P.T.O)

II. Fill in the blanks by choosing appropriate answer given in the brackets for all the following questions : 5X1=5
(Biot-Savart's law, Faraday's law of Induction, Insulators, Metals, Gold-leaf electroscope)

16) A device used to detect charge on a body is called .....
17) Dielectrics are .....
18) Ohm's law is applicable to .....
19) The magnitude of magnetic field due to small element of carrying element is given by .....
20) The magnitude of induced emf due to rate to change magnetic flux linked with a coil is given by.....

PART-B

III. Answer ANY FIVE of the following questions. 5X2=10

21) Mention any two basic properties of electric charges.
22) What is an equipotential surface ? Give one example for it.
23) State and explain ohm's law.
24) Define mobility of charge carries and write its SI unit.
25) What is current density ? Mention its direction.
26) Two cells of emf 1.5 V and 3V and internal resistances 1Ω and 2Ω are connected in parallel. Calculate equivalent emf.
27) Write the expression for magnetic force on a current carrying conductor placed in a magnetic field and explain the terms.
28) When does the force acting on a charged particle moving in magnetic field is
i) maximum and ii) minimum
29) Define magnetisation and magnetic intensity.

PART-C

IV. Answer ANY FIVE of the following questions. 5X3=15

30) Write three properties of electric field lines.
31) State and explain coulomb's law. Define 1 coulomb.
32) Obtain the expression for potential energy of an electric dipole placed in a uniform electric field.
33) Derive the expression for capacitance of a parallel plate capacitor with air as dielectric.
34) Mention any three factors on which resistance of a conductor depends.
35) Arrive at the expression for drift velocity, $V_d = \frac{eE\tau}{m}$
36) How would you convert a galvanometer into an ammeter ? Explain.
37) Derive the expression for motional emf induced in a straight conductor moving perpendicular to a uniform magnetic field.
38) Current in a coil falls from 5.0A to 0.0A in 0.1s. If an average emf of 200V is induced then calculate the self-Inductance of the coil.

PART-D

V. Answer ANY THREE of the following questions : 3X5=15

39) Derive the expression for electric field at a point on the equatorial plane of an electric dipole.
40) Derive the expression for electric potential at a point due to a point charge.
41) Obtain the condition for balance of wheatstone bridge using kirchhoff's rules.
42) Derive the expression for magnetic field at a point on the axis of a circular current loop.
43) Distinguish between diamagnetic and paramagnetic materials.
44) a) What is AC Generator ?
b) On which principle AC Generator works ?
c) Derive the expression for emf induced in AC Generator.

VI. Answer ANY TWO of the following questions. 2X5=10

45) Two point charges q_A=3μC and q_B=a3μC are located 20 cm apart in vacuum.
a) What is the electric field at the midpoint 'O' of the line AB joining the two charges ?
b) If a negative test charge of magnitude 1.5×10^{-9}C is placed at this point, what is the force experienced by the test charge ?
46) ABCD is a square of side 2m. Point charges of 50μC, 100μC and −50μC are placed at corners A, B, C respectively. Calculate the work done in transferring a charge of 0.5C from D to the point of intersection of diagonals.
47) The number density of free electrons in copper is found to be $8.5\times10^{28}m^{-3}$. A copper wire of length 3.0m and area of cross-section 2.0mm^2 is carrying a current of 3.0A. Calculate the drift velocity of electrons. How long does an electron take to drift from one end of wire to its other end ?
48) A circular coil of wire consisting of 100 turns, each of radius 8.0cm carries a current of 0.4A in anticlock wise direction to a observer. What is the magnitude and direction of magnetic field at the centre of the coil ?

Govt. Of Karnataka

Deputy Director of School Education & Literacy (PU College), Yadagiri

SECOND YEAR PUC MID TERM EXAMINATION OCTOBER-2023

TIME : 3.15 Hours | PHYSICS (33) | Max Marks : 70

General Instructions :

1. All parts are compulsory.
2. For Part - A questions, first written answer will be considered for awarding marks.
3. Answers without relevant diagram/figure / circuit wherever necessary will not carry any marks
4. Direct answer to the numerical problems without detailed solutions will not carry any marks.

PART - A

I. Pick the correct option among the four given options for ALL of the following questions **15 X 1 =15**

1) The dielectric constant of a metal is
   a) 1 b) ∞ c) 0 d) None of These
2) The S.I unit of electric flux is
   a) Weber b) Newton Per coulomb c) volt meter d) Joule per coulomb
3) Electric Potential at a point due to a point charge 'q' depends on Distance as.
   a) Distance b) $(Distance)^2$ c) 1/ distance d) $1/(distance)^2$
4) The Electric field inside a cavity present in a Conductor is always
   a) positive b) Negative c) zero d) Greater Them E
5) Kirchoff's Junction Rule signifies the Law of Conservation of
   a) Energy b) momentum c) charge d) mass
6) Current Per unit area is called
   a) Relaxation time b) conductivity c) current density d) mobility
7) A charge 'q' is moving in magnetic field Then The magnetic force does not depend upon
   a) charge b) mass c) velocity d) magnetic field
8) A magnetic field can be produced by
   a) a moving charge b) Static charge c) neutral Particle d) All of These
9) The S.I. unit of magnetic pole strength is
   a) ampere $metre^{-1}$ b) ampere metre c) ampere $metre^2$ a) ampere $metre^{-2}$
10) Susceptibility is Positive and large for
    a) Paramagnetic b) Ferromagnetic c) Diamagnetic d) None of the above
11) The significance of Lenz's Law is
    a) Law of conservation of Energy b) Law of conservation of mass
    c) Law of conservation of charge d) None of the above
12) Self Induction Plays The role of
    a) Inertia b) Impedance c) Mutual Inductance d) None of The above
13) When frequency of A.C. is doubled. The impdence of an L.C.R. circuted
    a) Is doubled b) Increase c) Decreases d) is halved
14) The power of dissipation in a pure capacitive circuit is
    a) Zero b) 180^0 c) 6^0 d) 90^0
15) Which of the following is not an electromagnetic wave
    a) X-rays b) r-rays c) F-rays d) Heat rays

II. Fill in the blanks by choosing appropriate answer given in the brackets for ALL of the following questions: **5x1=5**

[Tesla, Electromagnetic, Induction, zero, Condectivity, Induction]

16. A body can be changed by the method of.....
17. The reciprocal of resistivity is.....
18 S.I. Unit of Magnatic filed is.....
19. The principle A.C. generater is.....
20 The phase difference between current and voltege in resistor is.....

PART - B

III. Answer any five of the following questions. **5 x2 = 10**

21) State and Explain coulomb's Law of Electrostatic
22) What are polar and Non polar molecules
23) State and Explain Ohm's Law.
24) State and Explain Lorentz's Force
25) State and Explain Biot-Savert Law
26) Draw The Pattern of magnetic field lines of force of a Bar magnet.
27) State and Explain Faraday's Law of Electro magnetic Induction.
28) Write any Two sources of Energy loss of Transformer.
29) Write any Two uses of X-rays.

PART - C

IV. Answer any Five of the following questions **(5x3=15)**

30) Write The Basic properties of Electric charges,
31) Obtain expression for Electric potential due to a Point charge.
32) Obtain Expression for Drift velocity
33) Obtain Expression for Equivalent E.m.f & internal Resistance when Two cell's are Connected in series.
34) Obtain Expression for magnetic force on a current carrying
35) Write any Three Properties of Diamagnetic Substance
36) Explain magnet-coil Experiment with a Neat Diagram.
37) Expain How current lag's behind the voltage when A.C. Voltage applied across an Inductor
38) Write any Three Properties of Electromagnetic waves.

PART – D

V. Answer any Three of the following questions. **3 x 5 = 15**

39) Derive an Expression for Electric field at a point on axis of Dipole.
40) Derive an Expression for Capacitance of a parallel Plate Capacitor.
41) Obtain Expression for Balanced condition of Wheatstone Bridge network by using Kirchoff's Laws.
42) Derive an Expression for magnetic field at a Point on axis of Circular coil carrying current.
43) What is Mutual Induction? obtain expression for it.
44) obtain Expression for Impedance and current When A.C. Voltage Applied across LCR in series.

VI Answer any TWO of the following questions: **2x5=10**

45) Two Point Charges $q_A = 3$ MC and $q_B = -3$MC are located 20cm apart. in vaccume
    a) What is the Electric field at The mid point of 'O' of the line joining Two Charges
    b) If a -ve charge of magnitude $1.5X10^{-9}$ C is placed at the point, what is force experienced by the Test charge.
46) Two charges $5x10^{-8}$ C & and $-3x10^{-8}$ C are located 16 cm apart. At what Point on the line joining The Two Charges is The Electric potential is zero.
47) A Battery of Emf 10 V. and internal resistance 3Ω is connected to a resistor. If current in Circuit is 0.5 A. What is the resistance of Resistor? What is the Terminal P.d. of the Battery when Circuit is closed.
48) A light bulb is rated 100 w. for a 220V. supply find
    a) Resistance of Bulb
    b) Peak voltage of source
    c) The Rms current Through the bulb.

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22416

II P.U.C. MID TERM EXAMINATION - OCTOBER - 2023

Subject: Physics

Date: 03.10.2023 **Max. Marks: 70**

Time: 09:30am **Duration: 180 Min**

General Instructions:

(i) All parts are compulsory

(ii) For Part – A questions, first written – answer will be considered for awarding marks.

(iii) Answers without relevant diagram/figure /circuit wherever necessary will not carry any marks.

(iv) Direct answers to Numerical problems without detailed solutions will not carry any marks.

PART - A

I. Pick the correct option among the four options for ALL of the following questions: **15 × 1 = 15**

1. The electric field at a point on equatorial line of a dipole and direction of the dipole moment
   (a) will be parallel (b) will be in opposite direction
   (c) will be perpendicular (d) are not related
2. An electric dipole is kept in a non-uniform electric field. It experiences
   (a) a force and a torque (b) a force but not a torque
   (c) a torque but no force (d) neither a force nor a torque
3. The maximum electric field that a dielectric medium can withstand without break-down is called its
   (a) permittivity (b) dielectric constant
   (c) electric susceptibility (d) dielectric strength
4. When air in a capacitor is replaced by a medium of dielectric constant K, the capacity
   (a) decreases K times (b) increases K times
   (c) becomes $\frac{1}{K^2}$ times (d) remains constant
5. Drift velocity of electrons is due to
   (a) motion of conduction electrons due to random collisions
   (b) motion of conduction electrons due to electric field E.
   (c) repulsion to the conduction electrons due to inner electrons of ions.
   (d) collision of conduction electrons with each other.
6. Emf of a cell is
   (a) the maximum potential difference between the terminals of a cell when no current is drawn from the cell.
   (b) the force required to push the electrons in the circuit.
   (c) the potential difference between the positive and negative terminal of a cell in a closed circuit.
   (d) less than terminal potential difference of the cell.

7. A charged particle moves through a magnetic field in a direction perpendicular to it. Then the
   (a) velocity remains unchanged
   (b) speed of the particle remains unchanged
   (c) direction of the particle remains unchanged
   (d) acceleration remains unchanged
8. Magnetic field inside a solenoid is
   (a) directly proportional to its length
   (b) directly proportional to current
   (c) inversely proportional to total number of turns
   (d) inversely proportional to current
9. The magnetic lines of force inside a bar magnet
   (a) are from N-pole to S-pole of magnet
   (b) do not exist
   (c) depend upon the area of cross section of bar magnet
   (d) are from S-pole to N-pole of magnet
10. Susceptibility is positive and large for a
   (a) paramagnetic substance (b) ferromagnetic substance
   (c) diamagnetic substance (d) non magnetic substance
11. Lenz's Law is a consequence of law of conservation of
   (a) charge (b) momentum
   (c) angular momentum (d) energy
12. Henry is the S.I. unit of
   (a) resistance (b) electromotive force
   (c) inductance (d) current
13. The square root of the product of inductance and capacitance has the dimension of
   (a) Length (b) Mass
   (c) Time (d) No dimension
14. At resonant frequency the current in series LCR circuit is
   (a) maximum (b) minimum
   (c) zero (d) infinity
15. Electric current due to time varying electric field is called
   (a) drift current (b) conduction current
   (c) displacement current (d) diffusion current

II. Fill in the blanks by choosing appropriate answer give in the brackets for ALL the following questions: **5 × 1 = 5**

(magnetic field lines, area of cross-section, length, magnetic field, electric potential)

16. Joule/coulomb is the SI unit of_____
17. Resistance of a conductor is inversely proportional to its_____
18. The magnitude of force on a current carrying wire kept in uniform magnetic field is directly proportional to its _____
19. _____ never cross each other
20. An inductor stores energy in its _____

PART – B

III. Answer any FIVE of the following questions: **5 × 2 = 10**

21. State and explain Coulomb's law in electrostatics.
22. Mention the factors on which the capacity of parallel plate capacitors depends.
23. Define a) terminal potential of a cell b) Internal resistance of a cell
24. What is Ohmic device? Give an example.
25. State and explain Ampere's circuital law.
26. Mention the properties of magnetic field lines.
27. Write any two factors on which the Self-inductance of a coil depends.
28. What is a transformer? Mention its principle of working.
29. Give any two applications of microwaves.

PART – C

IV. Answer any FIVE of the following questions: **5 × 3 = 15**

30. Derive an expression for torque acting on a dipole in a uniform electric field.
31. Obtain the relation between electric field and electric potential due to a point charge.
32. Derive the relation $\vec{J} = \sigma\vec{E}$.
33. Write any three limitations of Ohm's law.
34. State and explain Biot – Savart's law and write its mathematical expression in vector form.
35. Derive the expression for magnetic field at a point due to a long straight current carrying conductor using Ampere's circuital law.
36. Mention three distinguishing properties of diamagnetic and paramagnetic materials.
37. Derive the expression for motional emf induced in a conductor moving in a uniform magnetic field.
38. Show that voltage and current are in phase with each other when AC is applied to a pure resistor.

PART – D

V. Answer any THREE of the following questions: **3 × 5 = 15**

39. Derive the expression for electric field at a point on the axis of an electric dipole.
40. Derive the expression for electric potential at a point due to a point charge.
41. Obtain the expression for capacity of a parallel plate capacitor with air as medium.
42. Derive the expression for balanced condition of the Wheatstone's network.
43. Obtain the expression for force between two parallel current carrying conductors. Hence define one ampere.
44. What is AC generator? With the help of a labeled diagram, derive an expression for instantaneous induced emf in an AC generator.

VI. Answer any TWO of the following questions: **2 × 5 = 10**

45. Two point charges 3 μC and -3μC are located 20 cm apart in vacuum. (a) Find the electric field at the midpoint of the line joining the two charges. (b) If a negative test charge of magnitude 1.5 nC is placed at this point, what is the force experienced by the test charge?
46. Two cells of emf 2 V and 4 V and internal resistance 1 Ω and 2 Ω respectively are connected in parallel so as to send the current in the same direction through an external resistance of 10 Ω. Find the potential difference across 10 Ω resistor.
47. A wire of length 0.26 m is bent to form a circular loop. If 2 A of current is flowing through this loop, calculate the magnetic field due to this loop at a point which is at a distance of 0.15 m from its centre on its axis.
48. An inductor 200 mH, a capacitor of capacitance 500 μF and a resistor of resistance 10 Ω are connected in series to a 100 V variable frequency AC source. Calculate (a) frequency at which at which the power factor of the circuit is unity (b) impedance (c) current at this frequency.

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USHARANI KATARI PU SCIENCE AND COMMERCE COLLEGE – GUTTALA

CLASS: PU-II YEAR **PRE MIDTERM QUESTION PAPER (2023)** **SUB: PHYSICS**

Max Marks: 70M

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PART A

I. PICK THE CORRECT OPTION AMONG THE FOUR OPTIONS FOR ALL OF THE FOLLOWING QUESTIONS: **15 X 1 = 15**

1. "Two point charges $q1$ and $q2$ separated by certain distance attracts each other". Then
   A) $q1>0$ and $q2>0$ B) $q1>0$ and $q2<0$ C) $q1>0$ and $q2=0$ D) $q1=0$ and $q2<0$
2. Electric dipole placed in non-uniform field experiences
   A) torque only B) both torque and net force C) net force only D) neither torque nor net force
3. Electric potential due to electric dipole at a point
   A) directly proportional to distance B) inversely proportional to distance
   C) directly proportional to the square of the distance D) inversely proportional to the square of the distance
4. If n capacitors each of capacitance C are connected in series, then effective capacitance Cs is
   A) Cn B) nC C) nC D) Cn
5. The magnitude of the drift velocity increases, if the temperature
   A) remains same B) decreases C) increases D) none of these
6. Internal resistance of the cell does not depend on
   A) distance between electrodes B) nature of the electrolyte C) temperature D) mass of the cell
7. 'tesla' is the unit of
   A) electric field B) electric potential C) magnetic flux D) magnetic field
8. Torque on the current loop in the presence of magnetic field becomes maximum, if
   A) loop is parallel to the field. B) loop is perpendicular to the field.
   C) loop makes an angle of 45° with the field. D) both A and B
9. The net magnetic flux through any closed surface is
   A) zero B) $\mu 0$ C) $\mu 0 I$ D) $q\varepsilon 0$
10. For diamagnetic material relative permeability is
    A) $\mu r \gg 1$ B) $0 \leq \mu r < 1$ C) $1 < \mu r < 1x10-4$ D) $-1 \leq \mu r < 0$
11. Magnetic flux can be changed by changing
    A) electric charge B) electric potential C) electric dipole moment D) magnetic field
12. The SI unit of magnetic pole strength is
    A) ampere metre^{-1} (B) ampere metre (C) ampere metre^{2} (D) ampere metre^{-2}
13. Nickel is a
    A) diamagnetic (B) paramagnetic (C) ferromagnetic (D) None of these
14. In stable equilibrium, the potential energy of a magnetic dipole in uniform magnetic filed is $U = -MB$. The amount of work done required to rotate the magnetic dipole through 180° is
    (A) $-MB$ (B) 0 (C) $+MB$ (D) +2MB
15. The law which gives the polarity of induced emf in electromagnetic induction is.
    A) Gauss' law in magnetism. (B) ampere's circuital law (C)faraday law (D) Lenz's law

II. FILL IN THE BLANKS BY CHOOSING APPROPRIATE ANSWER GIVEN IN THE BRACKETS FOR ALL THE FOLLOWING QUESTIONS: **5 × 1 = 5**

(zero, *insulator, perpendicular, conductor, a moving charge, away*)

16. The direction of electric field is from the positive charge.
17. The example for non-ohmic resistance is _____
18. A magnetic field can be produced by _____
19. The net magnetic flux through a closed surface is _____
20. In electromagnetic wave, electric field and magnetic field are _____

PART - B

III. ANSWER ANY FIVE OF THE FOLLOWING QUESTIONS **5x2 = 10**

21. Mention any two basic properties of electric charges,
22. A capacitor of capacitance is charged by 150 V supply. Calculate the amount of charge stored in the capacitor
23. Define the terms node and loop in an electrical network

24. Write an expression for resistivity of the material of the conductor and explain the terms.
25. What is Lorentz's force? Write an expression for it.
26. State and explain Gauss law in magnetism.
27. Define mutual inductance. Write the SI unit of mutual inductance.
28. What is an AC generator? Give the principle of AC generator.
29. State laws of electromagnetic induction

PART - C

IV. ANSWER ANY FIVE OF THE FOLLOWING QUESTIONS **5x3 = 15**

30. Explain Coulomb's law in vector form
31. Derive an expression for potential energy of a system of two charges in absence of external electric filed.
32. Derive an expression for drift velocity of free electron in a conductor.
33. An electric bulb marked 40 W, 200 V is used in a circuit of supply voltage of 100 V. what will be its power?
34. Mention the expression for force experienced by a charged particle moving in uniform magnetic field. Explain. When the force does become maximum and minimum?
35. Derive an expression for torque on a rectangular current loop placed in a uniform magnetic field with its plane parallel to the magnetic field.
36. Write any three differences between dia and ferro magnetic materials.
37. Derive an expression for instantaneous induced emf in an A C generator.
38. State and explain Lenz's law.

PART - D

V. ANSWER ANY THREE OF THE FOLLOWING QUESTIONS **3x5=15**

39. (a) State Gauss law. (1)
    (b) Derive an expression for electric field at a point due to infinitely long uniformly charged straight conductor using Gauss law. (4)
40. (a) What is a capacitor? (1)
    (b) On what factors the capacitance of a parallel plate capacitor depends on? (2)
    (c) Write an expression for energy stored in a capacitor and explain the terms (2)
41. Define electric potential due to a point charge and arrive an expression for electric potential at a point due to a point charge.
42. Derive an expression for equivalent emf and equivalent internal resistance of two cells in parallel.
43. Derive an expression for force between two infinitely long current carrying wires and hence define one ampere.
44. Derive the expression for magnetic field along the access of current caring circular loop.

VI. ANSWER ANY TWO OF THE FOLLOWING QUESTIONS **2x5=10**

45. A uniformly charged conducting sphere of 240 cm diameter has a surface charge density of 80 μCm^{-2}.
    (a) Find the charge on the sphere?
    (b) What is the total electric flux leaving the surface of the sphere?
46. Two cells of emf 2 V & 4 V and internal resistance 1 Ω & 2 Ω respectively are connected in parallel, so as to send current in same direction through an external resistance of 10 Ω. Find the potential difference across 10 resistor.
47. What is the radius of path of an electron moving at a speed of $3x107\ ms^{-1}$ in a magnetic field of $6x10^{-4}$ T perpendicular to it? Also find its frequency. Take mass of the electron, $m = 9x10^{-31}$ kg, charge of the electron, $q = 1.6x10^{-19}$ C.
48. The number density of free electron in a copper conductor is estimated as $8.5x10^{28}/m^3$. How long does an electron take to drift from one end to the other end of a copper wire of length 3.0 m? The area of cross-section of the wire is $2.0x10^{-6}\ m^2$ and it carry a current of 3.0 A.

Second PUC Mid-Term Examination, October - 2023

Subject : **PHYSICS (33)**

Time : 3 Hrs 15 Min. Max. Marks : 70

General instructions:

1. All parts are compulsory.
2. For Part - A questions, first written answer will be considered for awarding marks.
3. Answers without relevant diagram / figure/ circuit wherever necessary will not carry any marks.
4. Direct answers to numerical problems without detailed solutions will not carry any marks.

PART - A

I. Pick the correct option among the four given options for ALL of the following questions. 15 x 1 = 15

1. A glass rod is rubbed with silk , then glass rod
   (A) gains electrons from silk (B) gives electrons to silk
   (C) gains protons from silk (D) gives protons to silk
2. When 10^{19} electrons are added to a neutral metal plate, the charge on it is
   (A) -1.6 C (B) +1.6 C (C) 10^{+19} C (D) 10^{-19} C
3. Electric potential at a point due to a short dipole varies with distance as
   (A) distance (B) $(\text{distance})^2$ (C) $(\text{distance})^{-1}$ (D) $(\text{distance})^{-2}$
4. An example for polar molecule is a molecule of
   (A) oxygen (B) hydrogen (C) nitrogen (D) water
5. When a number of unequal capacitors are connected in parallel, which quantity remains same every time for all capacitors ?
   (A) capacitance (B) charge (C) potential difference (D) dielectric constant
6. Average time between two successive collisions of a free electron in a conductor is called
   (A) relaxation time (B) conductivity (C) mobility (D) drift velocity
7. Resistance of a conductor depends on
   (A) length (B) temperature (C) area of cross section (D) all of these
8. Which of the following is a vector quantity ?
   (A) electric current (B) electric current density (C) electric power (D) wattless current
9. On increasing the temperature of a conductor, its resistance increases because
   (A) relaxation time decreases (B) mass of electrons increases
   (C) electron density decreases (D) none of the above
10. A magnetic field can be produced by
    (A) a moving charge (B) a stationary charge (C) a moving neutron (D) all the above
11. The S.I. unit of magnetic susceptibility is
    (A) Wb A^{-1} (B) Wb A^{-1} m^{-1} (C) Hm (D) No units
12. Iron is a
    (A) diamagnetic (B) paramagnetic (C) ferromagnetic (D) none of the above
13. A bar magnet kept in a uniform magnetic field experience
    (A) a torque but not a force (B) a force but not a torque
    (C) both A and B (D) neither A nor B

14. The significance of Lenz's law is
(A) law of conservation of energy (B) law of conservation of mass
(C) law of conservation of charge (D) none of the above

15. To induce an emf in a coil, the linking magnetic flux
(A) must decrease (B) can either increase or decrease
(C) must remain constant (D) must increase

II Fill in the blanks by choosing appropriate answer given in the bracket for ALL of the following questions. 5 x 1 = 5

(mobility, Galvanometer, Dielectrics , increase, Coulomb's,)

16. ..... law agrees with the Newton's third law.
17. ..... are non-conducting substances.
18. The magnitude of drift velocity per unit electric field is .....
19. ..... is a device which detects electric current.
20. A convenient way to increase the current sensitivity of a galvanometer is to ..... the number of turns of the coil.

PART – B

III Answer any FIVE of the following questions : 5 x 2 = 10

21. State and explain Coulomb's law in electrostatics.
22. Write the expression for potential energy stored in a system of two point charges
(i) in the absence (ii) in the presence of an electric field.
23. What is an equipotential surface? Give one example for it.
24. State Kirchhoff's loop rule and mention its significance.
25. When will be the force acting on a charged particle moving in the uniform magnetic field
(i) maximum (ii) minimum ?
26. Define magnetisation and magnetic susceptibility.
27. Draw the magnetic field lines due to a current carrying finite solenoid.
28. State and explain Gauss's law in magnetism.
29. Give the expression for motional emf and explain the terms.

PART – C

IV Answer any FIVE of the following questions : 5 x 3 = 15

30. Mention any three properties of electric field lines.
31. Derive the expression for energy stored in a capacitor.
32. An electric dipole with dipole moment 4×10^{-9} Cm is aligned with the direction of a uniform electric field 5×10^{4} NC^{-1}. Calculate the magnitude of the torque acting on the dipole.
33. Mention three limitations of Ohm's law.
34. Derive $\vec{j} = \sigma \vec{E}$ with terms having usual meaning.
35. Using Ampere's circuital law, arrive at the expression for magnetic field due to a straight infinite current carrying wire.

36. Write three distinguishing properties between diamagnetic and paramagnetic materials.

37. How would you convert a galvanometer into an ammeter? Explain with a diagram.

38. Describe Faraday and Henry coil and magnet experiment to demonstrate the phenomenon of electromagnetic induction.

PART – D

V Answer any THREE of the following questions : **3 x 5 = 15**

39. Derive the expression for electric field at a point on the equatorial line of an electric dipole.

40. Obtain an expression for capacitance of a parallel plate capacitor with air as dielectric. Write the expression for capacitance of a parallel plate capacitor when a dielectric medium of dielectric constant K is introduced between its plates.

41. Two cells of emfs E_1 and E_2 having internal resistances r_1 and r_2 respectively are connected in parallel such that they send current in the same direction. Derive an expression for equivalent emf and equivalent internal resistance of the combination.

42. Using Kirchhoff's rules, obtain the expression for the balancing condition of Wheatstone bridge.

43. Derive the expression for the force between two straight parallel conductors carrying currents. Hence define ampere.

44. Derive an expression for sinusoidal emf when a rectangular coil is rotated in a uniform magnetic field.

VI Answer any TWO of the following questions. **2 x 5 = 10**

45. A spherical shell of a metal has a radius of 0.25 m and carries a charge of 0.2μC. Calculate the electric field at a point

(i) inside the shell (ii) just outside the shell (iii) 3.0 m from the centre of the shell.

46. ABCD is a square of side 2m. Point charges 5nC, 10nC and -5nC are placed at the corners A, B and C respectively. Calculate the work done in moving a charge of 2 μC from D to the point of intersection of the diagonals.

47. A battery of emf 10 V and internal resistance 3Ω is connected to a resistor. If the current in the circuit is 0.5 A, what is the resistance voltage of the resistor?

terminal voltage of the circuit

48. A circular coil of 20 turns of mean radius 0.06 m caries a current of 1 A. Calculate the magnetic field at

(i) the centre of the coil.

(ii) a point on the axis distant 0.08 m from its centre. Given : $\mu_0 = 4\pi \times 10^{-7}\ TmA^{-1}$

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