Karnataka Board

Mid-Term Question Paper

2024-25

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II PUC MID-TERM EXAMINATION, OCT./NOV. - 2024

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

General Instructions :

1) **All parts A to D 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 relevant formula and 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) Which of the following statements about the properties of electric charge is incorrect.
   a) Charge is conserved
   b) Charge is additive in nature
   c) Like charges attract and unlike charges repel
   d) Charge is quantised

2) Match the physical quantities in the I-column with their units in II column. Identify the correct match

I Column	II Column
(i) electric field	A) $NC^{-1}m^{-2}$
(ii) electric flux	B) N
(iii) Electrostatic force	C) NC^{-1}

   a) i-B, ii-C, iii-A b) i-A, ii-B, iii-C c) i-C, ii-A, iii-B d) i-B, ii-A, iii-C

3) Shape of equipotential surface in uniform electric field will be
   a) Spherical normal to electric field
   b) Random
   c) Circular normal to electric field
   d) Equidistant planes normal to electric field

4) Two conducting spheres A and B of radii 'a' and 'b' respectively are at the same potential. The ratio of surface charge densities of A and B is

   a) $\frac{b}{a}$ b) $\frac{a}{b}$ c) $\frac{a^2}{b^2}$ d) $\frac{b^2}{a^2}$

5) Statement I : The average thermal velocity of the electrons in a conductor is zero.
   Statement II : Directions of motion of electrons are randomly oriented
   a) both I and II are true and II is correct explanation of I
   b) both I and II are true and II is not correct explanation of I
   c) I is true but II is false
   d) both I and II are false

6) In case of insulators as the temperature decreases its resistivity
   a) decreases b) increases c) becomes zero d) remains constant

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

8) The torque τ on a current loop of magnetic moment 'm' placed in a magnetic field 'B' is
   a) $\vec{\tau} = \vec{m} \times \vec{B}$ b) $\vec{\tau} = \vec{B} \times \vec{m}$ c) $\vec{\tau} = \vec{m} \cdot \vec{B}$ d) $\vec{\tau} = I(\vec{m} \times \vec{B})$

9) When an electric current is passed through a solenoid, it behaves as a/an
   a) capacitor b) bar magnet c) resistor d) insulator

10) The magnetic susceptibility of an ideal diamagnetic substance is
   a) + 1 b) 0 c) −1 d) ∞

(P.T.O.)

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11) The direction of the induced emf is given by
a) Fleming's left hand rule b) Fleming's right hand rule c) Biot Savart law d) Lenz's Law

12) Weber is the unit of
a) Magnetic flux b) Magnetic flux density c) capacitance d) electric conductance

13) The peak voltage of an ac source is equal to
a) $1/\sqrt{2}$ times the rms value of the source b) the value of voltage supplied to the circuit
c) the rms value of the ac source d) $\sqrt{2}$ times the rms value of the ac source

14) Transformer is used to
a) convert ac to dc b) convert dc to ac
d) obtain desired ac voltage d) obtain desired dc voltage

15) Arrange the following electromagnetic waves in the increasing order of their wavelength
i) x-rays ii) Radio waves iii) Gamma rays iv) visible rays
a) iii, i, iv, ii b) ii, iv, i, iii c) iv, i, iii, ii d) i, ii, iii, iv

II Fill in the blanks by choosing appropriate answer given in the brackets, for ALL of the following questions: 5x1=5
(zero, remains constant, perpendicular, magnetic intensity, opposite, Magnetisation)

16) On reducing voltage across a capacitor, its capacitance _____.

17) The direction of current density is _____ to the direction of drift velocity of free electrons in conductor.

18) The resistance of an ideal ammeter is _____.

19) _____ is net magnetic moment per unit volume.

20) In electromagnetic wave, electric and magnetic fields are _____ to each other.

PART-B

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

21) When does the torque acting on an electric dipole in an uniform electric field is
a) maximum and b) minimum

22) Calculate electrostatic potential energy by a positive charge of $10\,\mu C$ placed at a point where electric potential is 2V.

23) Define current sensitivity of the galvanometer, How it can be increased ?

24) Mention any two properties of magnetic field lines.

25) State Ampere's circuital law.

26) What is electrical resonance ? Give the expression for resonant frequency in an AC circuit of LCR in series.

27) Write the expression for displacement current and explain the terms.

28) Write any two applications of microwaves.

PART-C

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

29) Obtain an expression for the potential energy of system of two point charges in the absence of electric field.

30) Write the expression for electrical resistivity of the conductor in terms of resistance of the conductor. Explain the terms. Write SI unit of resistivity.

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31) State Kirchhoff's junction rule and loop rule. Which rule of Kirchhof signifies conservation of energy.

32) State and explain Biot-Savart law. Write its vector form.

33) A circular copper coil of radius 6.284 cm has 20 turns. If a current of 2A is passed through this, find the magnitude of magnetic moment of the coil.

34) Give any three differences between diamagnetic and paramagnetic substances.

35) Obtain an expression for the motional emf in a rod moving in a magnetic field.

36) Mention any three factors affecting energy loss in transformer.

PART-D

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

37) Derive an expression for the electric field at a point due to an infinitely long thin uniformly charged straight wire using Gauss Law.

38) a) Derive an expression for the effective capacitance of two capacitors connected in series.
b) Mention any two characteristics of equipotential surface.

39) Derive an expression for effective emf and effective internal resistance of two different cells connected in parallel.

40) Arrive at an expression for the force between two parallel conductors carrying current and hence define ampere.

41) a) State and explain Lenz law of electromagnetic induction.
b) What is AC generator ? Mention its principle.

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

42) Two point charges +5C and -10C are placed at the vertices B and C respectively of an equilateral triangle ABC of side 10 cm. Calculate the magnitude and direction of resultant electric field at the vertex A due to these two charges.

43) In a circular parallel plate capacitor, radius of each plate is 5 cm and they are separated by a distance of 2mm. Calculate the capacitance and energy stored when it is charged by connecting the battery of 200 V. $\left[\text{Given } \epsilon_0 = 8.854 \times 10^{-12}\,\text{Fm}^{-1}\right]$

44) A copper wire has a resistance of $10\,\Omega$ and an area of cross section 1 mm^2. A potential difference of 10V exists across the wire. Calculate the drift velocity of the electrons if the number density of copper is 8×10^{28} electrons per cubic metre.

45) A resistor of $100\,\Omega$, a pure inductor of L = 0.5H and a capacitor are in series in a circuit containing an ac source of 200 V, 50 Hz. In the circuit, current is ahead of voltage by 30°. Find the value of the capacitance.

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