Bhavan's Tripura Vidyamandir
1st Terminal Examination: (2024-2025)

Class:- 12   **Subject:- Physics**

Time:- 3 Hours   Total :- 70 Marks

Name of the student :   Roll: Stream:

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General instructions:

(1) There are 33 questions in all. All questions are compulsory

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E. All the sections are compulsory.

(3) Section A contains twelve MCQ & four Assertion-reason question of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of 4 marks each, section E contains three long questions of five marks each.

(4) There is no overall choice. However, an internal choice has been provided in section B, C, D. You have to attempt only one of the choices in such questions.

(5) Use of calculators is not allowed.

SECTION-A

1) What does a electric dipole experience when it kept in a non-uniform electric field?
      a) only force   b) only torque
      c) force and torque   d) neither force nor torque

2) How is the electric field at the surface of a charge conductor related to the surface charge density?
      a) Proportional to each other   b) independent
      c) exponential   d) no relation

3) In a parallel combination of n cells , we obtain
      a) More voltage   b) more current
      c) less voltage   d) less current

4) Magnetic lines of force due to a bar magnet do not intersect because
      a) The lines has similar charge hence repel each other
      b) Intersecting point show two direction which is not possible.
      c) The lines always diverge from same point.
      d) None of this

5) An infinite line of charge has a linear charge density of 10-7 C/m. What will be the magnitude of the force acting on an alpha particle placed at a distance of 4 cm from the line of charge?
      a) 14.4×10^{-15} N   b) 7.2×10^{-15} N
      c) 4.5×10^{4} N   d) 9×10^{4} N

A circular coil is placed near a straight conductor as shown below. When the current in the straight conductor increases, the current in the coil is

Coil

I (increasing)
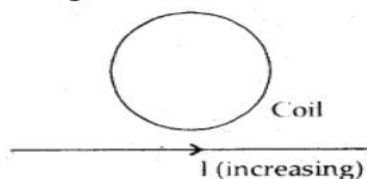
(a) clockwise
(b) anticlockwise
(c) normal to the plane oi coil
(d) None of them.

7) What happen to the inductive reactance when the frequency of the AC supply is increased?

a) Increases   b) Decreases   c) Remain the same   d) first increase then decreases

8) An AC ammeter connected in series in a AC circuit reads 5A, the pick value of current is

a) 5A   b) $5\sqrt{2}$ A   c) $5/\sqrt{5}$ A   d) $2\sqrt{5}$

9) The magnetic field due to current carrying conductor at a point is directly proportional to

a) Resistance of the conductor   b) thickness of the conductor

c) Current in the wire   d) distance from the wire.

10) The magnetic dipole moment of a current carrying coil does not depend on.

a) Number of turn of the coil   b) cross section area

c) current in the coil   d) Nature of the coil.

11) The phase different between voltage and current in an A.C circuit having resistor only.

a) Zero   b) п   c) п/2   d) 2п

12) Which is the factor that internal resistance does not depend on?

a) Distance between the electrodes

b) Temperature of the electrolyte

c) Nature of electrode and electrolyte

d) Area of the electrode, immersed in the electrolyte

Question number (13-16) these questions consist of two statements- Assertion (A) and Reason(R). Answer the question selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false

(d) A is false but R is true

13) **Assertion** (A) : In a simple battery circuit, the point of the lowest potential is positive terminal of the battery.

Reason (R) : The current flows towards the point of the higher potential, as it does in such a circuit from the negative to the positive terminal.

14) ASSERTION (A) Two concentric charge shells are given. The potential difference between the shell depends on charge of inner shell

REASON (R) Potential due to charge of outer shell remains same at every point inside the sphere.

15) Assertion (A)**:** In series LCR resonance circuit, the impedance is equal to the ohmic resistance.

Reason(R): At resonance, the inductive reactance exceeds the capacitive reactance.

16) ASSERTION (A) The energy of a charge particles moving in a uniform magnetic field remain constant.

REASON(R) work done by magnetic field on the charge is zero

SECTION-B

17) What is the geometrical shape of equipotential surface due to isolated charge? Draw a diagram for isolated +ve charge.

18) In which orientation, a dipole placed in a uniform electric field is in

a) stable, equilibrium

b) Unstable equilibrium

19) Why is electrostatic potential constant throughout the volume of the conductor and has the same value (as inside) on its surface

20) The electric current flowing in a wire in the direction B to A is decreasing. What is the direction of induced current in the metallic loop kept above the wire as shown in figure?

A ←———————— B
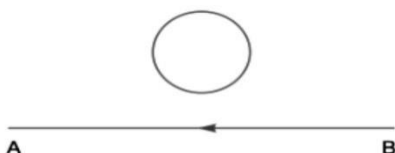
21) Two copper wires, P and Q of the same area of cross-section are joined in parallel. The combination of wires is connected across a battery of potential difference V. If the length of the wires, P and Q are in the ratio 1:2, find the ratio of drift velocities of electrons in wires P and Q. Or Two electric bulbs A and B are marked 220v, 40 W. and 220V, 60W respectively. Which one of the two bulbs has more resistance? (Show by calculation

Section - C

22) State the underlying principle of working of a moving coil galvanometer. Write two reasons why a galvanometer cannot be used as such to measure the current in a given circuit. Name any two factors on which the current sensitivity of a galvanometer depends.   (1+1+1+)

23) State lenz law, explain how it explain conservation of energy.

24) The peak voltage of a ac supply is 300V, find the rms voltage. If the rms current is found to be 10A, find the peak value of the alternating current?

25) Depict the magnetic field lines due to two straight long parallel conductors carrying current L_1 and L_2 in the same direction. Hence deduce an expression for the force per unit length acting on one of the conductor due to other.

26)   i) Define mutual inductance?
       ii) A pair of adjacent coils has a mutual inductance of 2.5H. if the current in one coil changes from 0 to 10A in 0.2s. what is the change of flux linkage with the coil?

27) Power P is to be delivered to a device via transmission cables having resistance Rc. If V is the voltage across R and I is the current through it; find the power wasted and how it can be reduced.

28) Define electric dipole moment? Find the torque produced by a dipole if it kept in uniform electric field.

OR

A circular ring of diameter 0.2 m is placed in a uniform magnetic field of 0.4 T. The ring is rotated about its diameter at a frequency of 60 Hz. (a) If the ring has 50 turns, then what is the maximum induced emf in the ring? (b) State one condition under which the induced emf in the circular ring will be zero?

Section-D

29) Read the following paragraph and answer the questions that follow.
Concept of field lines was introduced by Michael Faraday as an aid in visualizing electric and magnetic fields. Electric line of force is an imaginary straight or curved path along which a unit positive charge tends to move in an electric field. Properties of lines of forces observed by the scientist such as: Lines of force start from positive charge and terminate at negative charge, Lines of force never intersect, the tangent to a line of force at any point gives the direction of the electric field E at that point, the number of lines per unit area, through a plane at right angles to the lines, is proportional to the magnitude of E. This means that, where the lines of force are close together, E is large and where they are far apart, E is small. Each unit positive charge gives rise to 1/ ε_0 lines of force in free space. Hence number of lines of force originating from a point charge q is N = q/ε_0 in free space.

1) Choose correct statement regarding electric lines of force:
       (a) Emerges from (-ve) charge and meet at (+ve) charge.
       (2) Electric field in a region is strong when the electric lines of force at that region is closely spaced.
       (c) Just as it is shown for a point system in the same way it represents for a solid sphere.
       (d) has a physical nature.

3) Two electric field lines due to a point charge:
       (a) Never intersect   (b) May intersect near the charge
       (c) Always intersect at 2 points   (d) None of these

4) The tangent at any point on the electric field line gives;
    a) The direction of magnetic field at this point.
    b) The direction of electric field at this point.
    c) The direction of acceleration due to gravity.
    d) all of the above.

30) The parallel plate capacitor consists of two parallel metal plates X and Y each of area A, separated by a distance d, having a surface charge density σ as shown in figure. The medium between the plates is air. A charge +q is given to the plate X. It induces a charge –q on the upper surface of earthed plate Y. When the plates are very close to each other, the field is confined to the region between them. The electric lines of force starting from plate X and ending at the plate Y are parallel to each other and perpendicular to the plates. The capacitance is directly proportional to the area (A) of the plates and inversely proportional to their distance of separation (d). The capacitance (C) of the parallel plate capacitor is given by C= ε0A/d. if the region between the two plates is filled with dielectric like mica or oil. Its capacitance increased by εr times of the medium.

   1) The potential difference between the two plates of a parallel plate capacitor, if Q is magnitude of charge on each plate of area A separated by a distance d is
   (a) Qd/(εoA) (b)dεo/AQ (c)Ad/(εoQ) (d)QA/dεo

   2. A capacitor is charged by a battery and the charging battery is disconnected and a dielectric slab is inserted in it. Then for the capacitor
   a) charge remain constant (b) Charge increases
   (c) Potential difference remains constant (d) Potential difference increases

   3. A parallel plate capacitor has a capacitance of 10 µF. If the distance between two plates is doubled then the new capacitance will be
   (a) 20 µF (b) 15 µF (c)10 µF (d)5 µF

   4. Capacitance of a parallel plate capacitor does not depend on: (a) Area of the plates (b) Type of metal used for plates
   (c) Separating distance between the plates
   (d) Dielectric constant of the medium between the plates

Section-E

31)
(a) Derived an expression for the electric potential at any point on the axial line of electric dipole.
(b) Two identical point charge q each are kept 10 m apart in air. If a unknown charge of Q magnitude is place on the line joining the charges, such that the system remain in equilibrium. Find the position and nature of Q.   **0r**
a) Conducting slab of thickness t is introduced without touching between the plates of parallel plate capacitor separated by a distance d (t<d). Derive an expression for the capacitance of that capacitor.
b) Two charges 5×10^{-3} c and -3×10^{-3}c. are located 16m apart. At what point on the line joining the two charges is the electric potential zero.

32)
    (a) Define drift velocity. Derive an expression for it.   (1+2+2)
    (b) Find a relation between current and drift velocity.
                     Or
What do you mean by coefficient of mutual induction? Derived an expression for it.

33)   a) Why is the core of a transformer laminated?   (1+2+2)
    b) Why is the use of a.c. voltage preferred over d.c. voltage?
    c) Define capacitor reactance. Write its S.I. units.
                   Or
a) A variable frequency AC source is connected to a capacitor. Will the displacement current change if the frequency of the AC source is decreased?
b) Plot a graph showing variation of capacitive reactance with the change in the frequency of the AC source.
c) Define 'quality factor' of resonance in series LCR circuit. What is its SI unit   (2+1+2)