Sample Paper

8

Time : 90 Minutes **Max. Marks : 35**

General Instructions

1. *The Question Paper contains three sections.*
2. *Section A has **25** questions. Attempt any **20** questions.*
3. *Section B has **24** questions. Attempt any **20** questions.*
4. *Section C has **6** questions. Attempt any **5** questions.*
5. *All questions carry equal marks.*
6. *There is no negative marking.*

SECTION-A

*This section consists of 25 multiple choice questions with overall choice to attempt **any 20** questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.*

1. The voltage of an ac supply varies with time (t) as V = 120 sin 100 πt cos 100 πt. The frequency is:

(a) 100 Hz (b) $\frac{120}{\sqrt{2}}$ Hz (c) 200 Hz (d) 60 Hz

2. Two parallel large thin metal sheets have equal surface charge densities ($\sigma = 26.4 \times 10^{-12}$ C/m^2) of same signs. The electric field between these sheets is

(a) 1.5 N/C (b) 1.5×10^{-10} N/C (c) zero (d) 3×10^{-10} N/C

3. In a LCR series resonant circuit, R = 10Ω, $X_L = X_C = 40\Omega$ and $V_{rms} = 100$ volt, then potential difference across capacitor C is

(a) 100 V (b) 200 V (c) 300 V (d) 400 V

4. A bulb and a capacitor are connected in series to a source of alternating current. If its frequency is increased, while keeping the voltage of the source constant, then bulb will

(a) give more intense light (b) give less intense light

(c) give light of same intensity before (d) stop radiating light

5. A body is positively charged, it implies that

(a) there is only positive charge in the body.

(b) there is positive as well as negative charge in the body but the positive charge is more than negative charge

(c) there is equal positive and negative charge in the body but the positive charge lies in the outer regions

(d) None of these

6. An electric dipole is placed at an angle of 30° to a non-uniform electric field. The dipole will experience

(a) a translational force only in the direction of the field

(b) a translational force only in the direction normal to the direction of the field

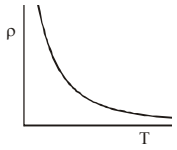
(c) a torque as well as a translational force

(d) a torque only

7. An A. C. of frequency f is flowing in a circuit containing a resistance R and capacitance C in series. The impedance of the circuit is equal to

(a) R + f (b) $R + 2\pi fC$ (c) $R + \frac{1}{2\pi fC}$ (d) $\sqrt{R^2 + X_C^2}$

8. The graph shows the variation of resistivity with temperature T. The graph can be of



(a) copper
(b) chromium
(c) germanium
(d) silver

9. A battery of emf E produces currents I_1 and I_2 when connected to external resistances R_1 and R_2 respectively. The internal resistance of the battery is

(a) $\frac{I_1R_2 - I_2R_1}{I_2 - I_1}$ (b) $\frac{I_1R_2 + I_2R_1}{I_1 - I_2}$ (c) $\frac{I_1R_1 + I_2R_2}{I_1 - I_2}$ (d) $\frac{I_1R_1 - I_2R_2}{I_2 - I_1}$

10. An electric lamp is marked 60 W, 220 V. The cost of kilo watt hour of electricity is ₹ 1.25. The cost of using this lamp on 220 V for 8 hours is

(a) ₹0.25 (b) ₹0.60 (c) ₹1.20 (d) ₹4.00

11. An electric tea kettle has two heating coils. When first coil of resistance R_1 is switched on, the kettle begins to boil tea in 6 minutes. When second coil of resistance R_2 is switched on, the boiling begins in 8 minutes. The value of R_1/R_2 is

(a) 7/3 (b) 3/7 (c) 3/4 (d) 4/3

12. In potentiometer a balance point is obtained, when

(a) the e.m.f. of the battery becomes equal to the e.m.f of the experimental cell
(b) the p.d. of the wire between the +ve end of battery to jockey becomes equal to the e.m.f. of the experimental cell
(c) the p.d. of the wire between +ve point of cell and jockey becomes equal to the e.m.f. of the battery
(d) the p.d. across the potentiometer wire becomes equal to the e.m.f. of the battery

13. Nichrome or Manganin is widely used in wire bound standard resistors because of their

(a) temperature independent resistivity (b) very weak temperature dependent resistivity.
(c) strong dependence of resistivity with temperature. (d) mechanical strength.

14. A current of 1 mA flows through a copper wire. How many electrons will pass through a given point in each second

(a) 6.25×10^8 (b) 6.25×10^{31} (c) 6.25×10^{15} (d) 6.25×10^{19}

15. An α-particle and a deuteron projected perpendicular to the uniform magnetic field with equal kinetic energies describe circular paths of radii r_1 and r_2 respectively . The ratio r_1 / r_2 is

(a) 1 (b) 2 (c) $\frac{1}{\sqrt{2}}$ (d) $\sqrt{2}$

16. The magnetic field at a distance r from a long wire carrying current i is 0.4 tesla. The magnetic field at a distance 2r is

(a) 0.2 tesla (b) 0.8 tesla (c) 0.1 tesla (d) 1.6 tesla

17. A triangular loop is side *l* carries a current *I*. It is placed in a magnetic field *B* such that the plane of the loop is in the direction of *B*. The torque on the loop is

(a) Zero (b) $IB\ell$ (c) $\frac{\sqrt{3}}{2} I\ell^2 B^2$ (d) $\frac{\sqrt{3}}{4} IB\ell^2$

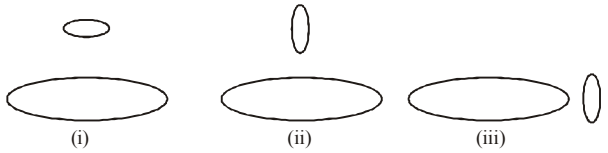
18. At the magnetic north pole of the earth, the value of the horizontal component of earth's magnetic field and angle of dip are respectively

(a) zero, 90° (b) maximum, 30° (c) maximum, 180° (d) minimum, 0°

19. If a magnet is suspended at angle 30° to the magnetic meridian, the dip needle makes an angle of 45° with the horizontal. The real dip is

(a) $\tan^{-1}(\sqrt{3/2})$ (b) $\tan^{-1}(\sqrt{3})$ (c) $\tan^{-1}(\sqrt{3}/2)$ (d) $\tan^{-1}(2/\sqrt{3})$

20. Two circular coils can be arranged in any of the three situations shown in the figure. Their mutual inductance will be

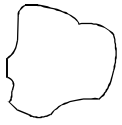


(a) maximum in situation (i)
(b) maximum in situation (ii)
(c) maximum in situation (iii)
(d) the same in all situations

21. The coefficient of self inductance of a solenoid is 0.18 mH. If a core of soft iron of relative permeability 900 is inserted, then the coefficient of self inductance will become nearly.

(a) 5.4 mH (b) 162 mH (c) 0.006 mH (d) 0.0002 mH

22. As a result of change in the magnetic flux linked to the closed loop shown in the fig, an e.m.f. V volt is induced in the loop. The work done (joule) in taking a charge Q coulomb once along the loop is



(a) QV
(b) 2QV
(c) QV/2
(d) Zero

23. A step-up transformer operates on a 230 *V* line and supplies a load of 2 ampere. The ratio of the primary and secondary windings is 1 : 25. The current in the primary is

(a) 15 *A* (b) 50 *A* (c) 25 *A* (d) 12.5 *A*

24. An LCR series circuit is connected to a source of alternating current. At resonance, the applied voltage and the current flowing through the circuit will have a phase difference of

(a) $\frac{3}{2}\pi$ (b) $\pi/2$

(c) $\pi/4$ (d) 0

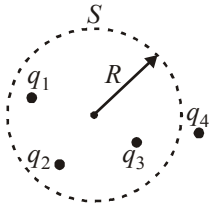
25. In an L.C.R. series a.c. circuit, the current is

(a) always in phase with the voltage (b) always lags the generator voltage
(c) always leads the generator voltage (d) None of these

SECTION-B

*This section consists of 24 multiple choice questions with overall choice to attempt **any 20** questions. In case more than desirable number of questions are attempted, ONLY first 20 will be considered for evaluation.*

26. q_1, q_2, q_3 and q_4 are point charges located at points as shown in the figure and *S* is a spherical Gaussian surface of radius *R*. Which of the following is true according to the Gauss's law?



(a) $\oint\left(\vec{E}_1+\vec{E}_2+\vec{E}_3\right).d\vec{A}=\frac{q_1+q_2+q_3}{2\varepsilon_0}$ (b) $\oint\left(\vec{E}_1+\vec{E}_2+\vec{E}_3+\vec{E}_4\right).d\vec{A}=\frac{\left(q_1+q_2+q_3\right)}{\varepsilon_0}$

(c) $\oint\left(\vec{E}_1+\vec{E}_2+\vec{E}_3\right).d\vec{A}=\frac{\left(q_1+q_2+q_3+q_4\right)}{\varepsilon_0}$ (d) None of the above

27. An electric dipole is placed at an angle of 30° with an electric field of intensity 2×10^5 NC^{-1}, It experiences a torque of 4 Nm. Calculate the charge on the dipole if the dipole length is 2 cm.

(a) 8 mC (b) 4 mC (c) 8 μC (d) 2 mC

28. The electric flux through a closed surface area S enclosing charge Q is ϕ. If the surface area is double, then the flux is:

(a) 2ϕ (b) ϕ/2 (c) ϕ/4 (d) ϕ

29. The electric potential is $V=(x^2-2x)$. What is the electric field strength at x = 1 ?

(a) –2 (b) 2 (c) 4 (d) zero

30. Four equal charges Q are placed at the four corners of a square of each side is 'a'. Work done in removing a charge –Q from its centre to infinity is

(a) 0 (b) $\frac{\sqrt{2}Q^2}{4\pi\varepsilon_0 a}$ (c) $\frac{\sqrt{2}Q^2}{\pi\varepsilon_0 a}$ (d) $\frac{Q^2}{2\pi\varepsilon_0 a}$

31. For an LCR series circuit with an A.C. source of angular frequency ω

(a) circuit will be capacitive if $\omega > \frac{1}{\sqrt{LC}}$

(b) circuit will be inductive if $\omega = \frac{1}{\sqrt{LC}}$

(c) power factor of circuit will be unity if capacitive reactance equals inductive reactance

(d) current will be leading voltage if $\omega > \frac{1}{\sqrt{LC}}$

32. A coil of inductance 300 mH and resistance 2 Ω is connected to a source of voltage 2V. The current reaches half of its steady state value in

(a) 0.1 s (b) 0.05 s (c) 0.3 s (d) 0.15 s

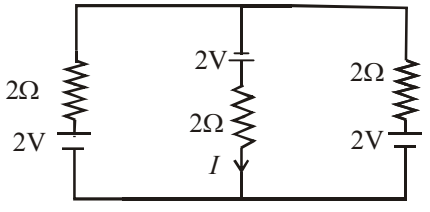
33. A parallel plate capacitor is made by stacking *n* equally spaced plates connected alternatively. If the capacitance between any two adjacent plates is '*C*' then the resultant capacitance is

(a) $(n+1)C$ (b) $(n-1)C$ (c) nC (d) C

34. A cell of emf E is connected across a resistance R. The potential difference between the terminals of the cell is found to be V volt. Then the internal resistance of the cell must be

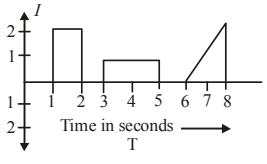
(a) $(E-V)R$ (b) $\frac{(E-V)}{V}R$ (c) $\frac{2(E-V)R}{E}$ (d) $\frac{2(E-V)V}{R}$

35. The current I in the circuit shown is



(a) 1.33A (b) Zero (c) 2.00A (d) 1.00A

36. The plot represent the flow of current through a wire at three different time intervals. The ratio of charges flowing through the wire corresponding to these time intervals is (Fig.)



(a) 2 : 1 : 2 (b) 1 : 3 : 3 (c) 1 : 1 : 1 (d) 2 : 3 : 4

37. A wire when connected to 220 V mains supply has power dissipation P_1. Now the wire is cut into two equal pieces which are connected in parallel to the same supply. Power dissipation in this case is P_2. Then $P_2 : P_1$ is

(a) 1 (b) 4 (c) 2 (d) 3

38. Two circular coils are made of two identical wires of same length. If the number of turns of the two coils are 4 and 2. Find out the ratio of magnetic induction at centres of them, if current is same in both coils.

(a) 1 : 4 (b) 1 : 2 (c) 4 : 1 (d) 2 : 1

39. A voltmeter essentially consists of

(a) a high resistance, in series with a galvanometer (b) a low resistance, in series with a galvanometer

(c) a high resistance in parallel with a galvanometer (d) None of these

40. If horizontal and vertical components of earth's magnetic field are equal, then angle of dip is

(a) 60° (b) 45° (c) 30° (d) 90°

41. In an induction coil the current increases from 0 to 6 amp in 0.3 sec by which induced emf of 30 volt is produced in it then the value of coefficient of self inductance of coil will be

(a) 3 henry (b) 2 henry (c) 1 henry (d) 1.5 henry

42. A 100 μF capacitor in series with a 40Ω resistance is connected to a 200 V, 60 Hz supply.

What is the maximum current in the circuit?

(a) 5.89 A (b) 8.25 A (c) 9.25 A (d) 11.20 A

43. A metal rod of length l moves perpendicularly across a uniform magnetic field B with a velocity v. If the resistance of the circuit of which the rod forms a part is r, then the force required to move the rod uniformly is

(a) $\frac{B^2 l^2 v}{r}$ (b) $\frac{Blv}{r}$ (c) $\frac{B^2 lv}{r}$ (d) $\frac{B^2 l^2 v^2}{r}$

44. Two identical circular loops of metal wire are lying on a table without touching each other. Loop–A carries a curent which increases with time. In response, the loop–B

(a) Remains stationary (b) is attracted by the loop-A

(c) is repelled by the loop-A (d) rotates about its CM, with CM fixed

Given below are two statements labelled as Assertion (A) and Reason (R). Select the most appropriate answer from the options given below:

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

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

(c) A is true but R is false.

(d) A is false and R is also false.

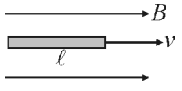
45. **Assertion :** The net charge in a current carrying wire is zero and so magnetic force on the wire in magnetic field is zero.

Reason : The force on a current carrying wire is given by $F = qVB\sin\theta$ [where q = charge, V = potential difference, B = field, θ = angle]

46. **Assertion :** A dielectric is inserted between the plates of a battery connected capacitor. The potential difference between the plates remains constant.

Reason : As the battery remains connected maintaining the same potential difference.

47. **Assertion :** Figure shows a metallic conductor moving in magnetic field. The induced emf across its ends is zero.



Reason : The induced emf across the ends of a conductor is given by $e = Bv\ell\sin\theta$.

48. **Assertion:** Electron moving perpendicular to $\vec{B}$ will perform circular motion ?

Reason: Force by magnetic field is perpendicular to velocity

49. **Assertion :** A direct current flows through a thin conductor produces magnetic field only outside the conductor.

Reason : There is no flow of charge carriers inside the conductor.

SECTION-C

*This section consists of 6 multiple choice questions with an overall choice to attempt **any 5**. In case more than desirable number of questions are attempted, ONLY first 5 will be considered for evaluation.*

50. Select the correct statements from the following.

(a) The electric field due to a charge outside the Gaussian surface contributes zero net flux through the surface.

(b) The electgric flux of the electric field $\oint \vec{E} \cdot d\vec{A}$ is zero. The electric field is zero everywhere on the surface.

(c) Total flux linked with a closed body, not enclosing any charge will be zero.

(d) Total electric flux, if a dipole is enclosed by a surface is zero.

51. Which of the following about potential difference between any two points is true?

I. It depends only on the initial and final position.

II. It is the work done per unit positive charge in moving from one point to other.

III. It is more for a positive charge of two units as compared to a positive charge of one unit.

(a) I only (b) II only (c) I and II (d) I, II and III

Case Study : *Read the following paragraph and answers the questions.*

Electrostatic potential energy of a system of point charges is the total amount of work done in bringing various charges to their respective positions from infinitely large mutual separations.

If two charges having charge q_1 and q_2 are placed at a distance r from each other, then the potential energy of the system is given by

$$U = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r}$$

The above potential energy is formed due to work done in bringing any one of the charge at the distance r of other charge from infinity so. $W = U = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r}$

52. The electric potential at point A is 1V and at another point B is 5V. A charge 3 μC is released from B. What will be the kinetic energy of the charge as it passes through A ?

(a) 8×10^{-6} J (b) 12×10^{-6} J (c) 12×10^{-9} J (d) 4×10^{-6} J

53. A square of side 'a' has charge Q at its centre and charge 'q' at one of the corners. The work required to be done in moving the charge 'q' from the corner to the diagonally opposite corner is

(a) zero (b) $\frac{Qq}{4\pi \in_0 a}$ (c) $\frac{Qq\sqrt{2}}{4\pi \in_0 a}$ (d) $\frac{Qq}{2\pi \in_0 a}$

54. When a positive charge q is taken from lower potential to a higher potential point, then its potential energy will

(a) increase (b) decrease (c) remain unchanged (d) become zero

55. If a unit charge is taken from one point to another over an equipotential surface, then

(a) work is done on the charge (b) work is done by the charge

(c) work done on the charge is constant (d) no work is done

OMR ANSWER SHEET

Sample Paper No – ☐

- ✶ Use Blue / Black Ball pen only.
- ✶ Please do not make any atray marks on the answer sheet.
- ✶ Rough work must not be done on the answer sheet.
- ✶ Darken one circle deeply for each question in the OMR Answer sheet, as faintly darkend / half darkened circle might by rejected.

Start time : _____ End time _____ Time taken _____

1. Name (in Block Letters)

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2. Date of Exam

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3. Candidate's Signature ☐

Section-A

1.	a	b	c	d	9.	a	b	c	d	17.	a	b	c	d
2.	a	b	c	d	10.	a	b	c	d	18.	a	b	c	d
3.	a	b	c	d	11.	a	b	c	d	19.	a	b	c	d
4.	a	b	c	d	12.	a	b	c	d	20.	a	b	c	d
5.	a	b	c	d	13.	a	b	c	d	21.	a	b	c	d
6.	a	b	c	d	14.	a	b	c	d	22.	a	b	c	d
7.	a	b	c	d	15.	a	b	c	d	23.	a	b	c	d
8.	a	b	c	d	16.	a	b	c	d	24.	a	b	c	d
										25.	a	b	c	d

Section-B

26.	a	b	c	d	34.	a	b	c	d	42.	a	b	c	d
27.	a	b	c	d	35.	a	b	c	d	43.	a	b	c	d
28.	a	b	c	d	36.	a	b	c	d	44.	a	b	c	d
29.	a	b	c	d	37.	a	b	c	d	45.	a	b	c	d
30.	a	b	c	d	38.	a	b	c	d	46.	a	b	c	d
31.	a	b	c	d	39.	a	b	c	d	47.	a	b	c	d
32.	a	b	c	d	40.	a	b	c	d	48.	a	b	c	d
33.	a	b	c	d	41.	a	b	c	d	49	a	b	c	d

Section-C

50.	a	b	c	d	53.	a	b	c	d
51.	a	b	c	d	54.	a	b	c	d
52.	a	b	c	d	55.	a	b	c	d

No. of Qns. Attempted		Correct		Incorrect		Marks	