Sample Paper

2

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

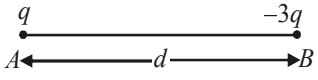
General Instructions

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. Two charge q and $-3q$ are placed fixed on x–axis separated by distance d. Where should a third charge $2q$ be placed such that it will not experience any force?



(a) $\frac{d-\sqrt{3}d}{2}$ (b) $\frac{d+\sqrt{3}d}{2}$ (c) $\frac{d+3d}{2}$ (d) $\frac{d-3d}{2}$

2. Four point charges $-Q$, $-q$, $2q$ and $2Q$ are placed, one at each corner of the square. The relation between Q and q for which the potential at the centre of the square is zero is

(a) $Q=-q$ (b) $Q=-\frac{1}{q}$ (c) $Q=q$ (d) $Q=\frac{1}{q}$

3. The Gaussian surface
(a) can pass through a continuous charge distribution.
(b) cannot pass through a continuous charge distribution.
(c) can pass through any system of discrete charges.
(d) can pass through a continuous charge distribution as well as any system of discrete charges.

4. Let V be the electric potential at a given point. Then the electric field E_x along x-direction at that point is given by

(a) $\int_0^\infty Vdx$ (b) $\frac{dV}{dx}$ (c) $-\frac{dV}{dx}$ (d) $-V\frac{dV}{dx}$

5. Which one of the following is not a property of field lines
(a) Field lines are continuous curves without any breaks.
(b) Two field lines cannot cross each other.
(c) Field lines start at positive charge and end at negative charge
(d) They form closed loop

6. A parallel plate capacitor is charged to a certain voltage. Now, if the dielectric material (with dielectric constant k) is removed then the
(a) capacitance increases by a factor of k (b) electric field reduces by a factor k
(c) voltage across the capacitor decreases by a factor k (d) None of these.

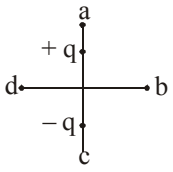
7. Four points a, b, c and d are set at equal distance from the centre of a dipole as shown in figure. The electrostatic potential V_a, V_b, V_c, and V_d would satisfy the following relation:

(a) $V_a > V_b > V_c > V_d$

(b) $V_a > V_b = V_d > V_c$

(c) $V_a > V_c = V_b = V_d$

(d) $V_b = V_d > V_a > V_c$



8. A wire X has half the diameter and half the length of a wire Y of similar material. The ratio of resistance of X to that of Y is

(a) 8 : 1 (b) 4 : 1 (c) 2 : 1 (d) 1 : 1

9. Kirchhoff's first and second laws for electrical circuits are consequences of

(a) conservation of electric charge and energy respectively

(b) conservation of electric charge

(c) conservation of energy and electric charge respectively

(d) conservation of energy

10. If in the experiment of Wheatstone's bridge, the positions of cells and galvanometer are interchanged, then balance point will

(a) change

(b) remain unchanged

(c) depend on the internal resistance of cell and resistance of galvanometer

(d) None of these

11. In a region, steady and uniform electric and magnetic fields are present. These two fields are parallel to each other. A charged particle is released from rest in this region. The path of the particle will be a

(a) helix (b) straight line (c) ellipse (d) circle

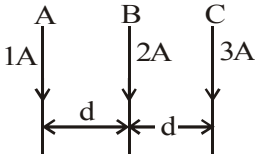
12. Three wires A, B and C are situated at the same distance. A current of 1A, 2A, 3A flows through these wires in the same direction. Then the resultant force on B is directed

(a) Towards A

(b) Towards C

(c) Perpendicular to the plane of paper and outward

(d) Perpendicular to the plane of paper and inward



13. At what temperature will the resistance of a copper wire becomes three times its value at 0°C? (Temperature coefficient of resistance of copper is 4×10^{-3}/°C)

(a) 550°C (b) 500°C (c) 450°C (d) 400°C

14. When a potential difference V is applied across a conductor at a temperature T, the drift velocity of electrons is proportional to

(a) $\sqrt{V}$ (b) V (c) $\sqrt{T}$ (d) T

15. To draw a maximum current from a combination of cells, how should the cells be grouped?

(a) Parallel (b) Series (c) Mixed grouping

(d) Depends upon the relative values of internal and external resistances.

16. For measuring voltage of any circuit, potentiometer is preferred to voltmeter because

(a) the potentiometer is cheap and easy to handle.

(b) calibration in the voltmeter is sometimes wrong.

(c) the potentiometer almost draws no current during measurement.

(d) range of the voltmeter is not as wide as that of the potentiometer.

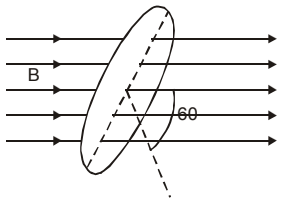
17. A current carrying conductor placed in a magnetic field experiences maximum force when angle between current and magnetic field is

(a) $3\pi/4$ (b) $\pi/2$ (c) $\pi/4$ (d) zero

18. In an inductor of self-inductance $L = 2$ mH, current changes with time according to relation $i = t^2e^{-t}$. At what time emf is zero?

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

19. Fig shown below represents an area A = 0.5 m^2 situated in a uniform magnetic field B = 2.0 weber/m^2 and making an angle of 60° with respect to magnetic field.



The value of the magnetic flux through the area would be equal to

(a) 2.0 weber (b) $\sqrt{3}$ weber (c) $\sqrt{3}/2$ weber (d) 0.5 weber

20. A metal ring is held horizontally and bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet

(a) is equal to g (b) is less than g (c) is more than g
(d) depends on the diameter of ring and length of magnet

21. The horizontal component of the earth's magnetic field is 3.6×10^{-5} tesla where the dip angle is 60°. The magnitude of the earth's magnetic field is

(a) 2.8×10^{-4} tesla (b) 2.1×10^{-4} tesla (c) 7.2×10^{-5} tesla (d) 3.6×10^{-5} tesla

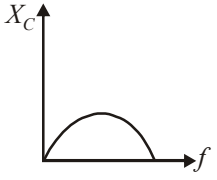
22. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole. It will

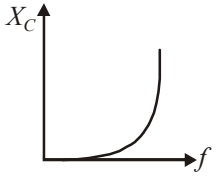
(a) stay in north-south direction only (b) stay in east-west direction only
(c) become rigid showing no movement (d) stay in any position

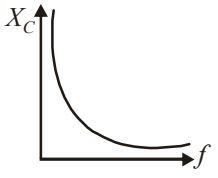
23. In an ac circuit an alternating voltage e = 200 $\sqrt{2}$ sin 100 t volts is connected to a capacitor of capacity 1 μF. The r.m.s. value of the current in the circuit is

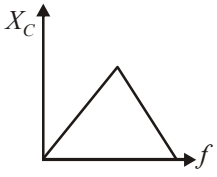
(a) 10 mA (b) 100 mA (c) 200 mA (d) 20 mA

24. Which of the following graphs represents the correct variation of capacitive reactance X_C with frequency f ?

(a) 

(b) 

(c) 

(d) 

25. In a transformer, number of turns in the primary coil are 140 and that in the secondary coil are 280. If current in primary coil is 4 A, then that in the secondary coil is

(a) 4 A (b) 2 A (c) 6 A (d) 10 A.

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.*

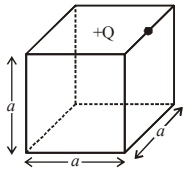
26. The electric field at a point on equatorial line of a dipole _____ to direction of the dipole moment.

(a) will be parallel (b) will be in opposite direction
(c) will be perpendicular (d) are not related

27. In figure + Q charge is located at one of the edge of the cube, then electric flux through cube due to + Q charge is

(a) $\frac{+Q}{\epsilon_0}$ (b) $\frac{+Q}{2\,\epsilon_0}$

(c) $\frac{+Q}{4\,\epsilon_0}$ (d) $\frac{+Q}{8\,\epsilon_0}$



28. On rubbing, when one body gets positively charged and other negatively charged, the electrons transferred from positively charged body to negatively charged body are

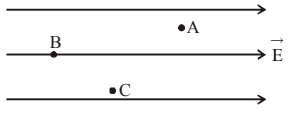
(a) valence electrons only (b) electrons of inner shells
(c) both valence electrons and electrons of inner shell (d) yet to be established

29. A system of three positive charges placed at the vertices of an equilateral triangle. To decrease the potential energy of the system,

(a) a positive charge should be placed at centroid (b) a negative charge should be placed at centroid.

(c) distance between the charges should be decreased. (d) it should be rotated by an angle of $\frac{\pi}{2}$ radian.

30. A, B and C are three points in a uniform electric field. The electric potential is



(a) maximum at B

(b) maximum at C

(c) same at all the three points A, B and C

(d) maximum at A

31. The average value of alternating current for one complete cycle is

(a) zero (b) 1 (c) $\sqrt{2}$ (d) None of these

32. The ratio of mean value over half cycle to r.m.s. value of A.C. is

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

33. A ball of mass 1 g carrying a charge 10^{-8} C moves from a point A at potential 600 V to a point B at zero potential. The change in its K.E. is

(a) -6×10^{-6} erg (b) -6×10^{-6} J (c) 6×10^{-6} J (d) 6×10^{-6} erg

34. Determine the rms value of the emf given by E (in volt) = 8 sin (ω t) + 6sin (2 ω t)

(a) $5\sqrt{2}$V (b) $7\sqrt{2}$V (c) 10V (d) $10\sqrt{2}$V

35. 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

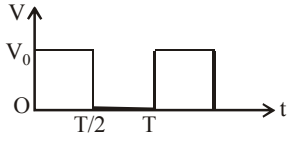
(c) give light of same intensity before (d) stop radiating light

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

(a) is always in phase with the voltage (b) always lags the generator voltage

(c) always leads the generator voltage (d) None of these

37. The r.m.s. value of potential difference V shown in the figure is



(a) V_0 (b) $V_0/\sqrt{2}$ (c) $V_0/2$ (d) $V_0/\sqrt{3}$

38. Magnetic field at the centre of a circular coil of radius *r*, through which a current *I* flows is

(a) directly proportional to *r* (b) inverseley proportional to *I*

(c) directly proportional to *I* (d) directly proprotional to I^2

39. The deflection in a moving coil galvanometer is

(a) directly proportional to the torsional constant (b) directly proportional to the number of turns in the coil

(c) inversely proportional to the area of the coil (d) inversely proportional to the current flowin g

40. Let V and H be the vertical and horizontal components of earth's magnetic field at any point on earth. Near the north pole

(a) $V>>H$ (b) $V<<H$ (c) $V=H$ (d) $V=H=0$

41. Eddy currents are produced when

(a) a metal is kept in varying magnetic field (b) a metal is kept in steady magnetic field

(c) a circular coil is placed in a magnetic field (d) through a circular coil, current is passed

42. A charged 30 μF capacitor is connected to a 27 mH inductor. The angular frequency of free oscillations of the circuit is

(a) 1.1×10^3 rad s^{-1} (b) 2.1×10^3 rad s^{-1} (c) 3.1×10^3 rad s^{-1} (d) 4.1×10^3 rad s^{-1}

43. A circular wire of radius r rotates about its own axis with angular speed ω in a magnetic field B perpendicular to its plane, then the induced e.m.f. is

(a) $\frac{1}{2}Br\omega^2$ (b) $Br\omega^2$ (c) $2Br\omega^2$ (d) zero

44. A solenoid of length 1.5 m and 4 cm diameter possesses 10 turns per cm. A current of 5A is flowing through it, the magnetic induction at axis inside the solenoid is

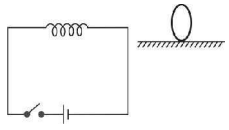
$(\mu_0 = 4\pi \times 10^{-7}$ weber amp^{-1} m$^{-1})$

(a) $4\pi \times 10^{-5}$ gauss (b) $2\pi \times 10^{-5}$ gauss (c) $4\pi \times 10^{-5}$ tesla (d) $2\pi \times 10^{-5}$ tesla

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 :** Figure shows a horizontal solenoid connected to a battery and a switch. A copper ring is placed on a smooth surface,



the axis of the ring being horizontal.

As the switch is closed, the ring will move away from the solenoid.

Reason : Induced current in the ring, $i = -\frac{d\phi}{dt}$.

46. **Assertion :** Magnetic moment of an atom is due to both the orbital motion and spin motion of every electron.

Reason : A charged particle produces magnetic field.

47. **Assertion :** A parallel plate capacitor is connected across battery through a key. A dielectric slab of dielectric constant k is introduced between the plates. The energy stored becomes k times.

Reason : The surface density of charge on the plate remains constant.

48. **Assertion :** If a proton and an electron are placed in the same uniform electric field. They experience different acceleration.

Reason : Electric force on a test charge is dependent of its mass.

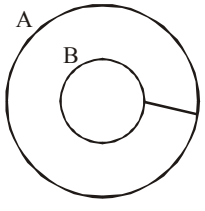
49. **Assertion :** A current I flows along the length of an infinitely long straight and thin walled pipe. Then the magnetic field at any point inside the pipe is zero.

Reason : $\oint \vec{B}.\vec{d\ell} = \mu_0 I$ and $\sum I_{in} = 0$

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. Figure shows two hollow charged conductors A and B having same positive surface charge densities. B is placed inside A and does not touches it. On connecting them with a conductor



(a) charge will flow from A to B

(b) charge will flow from B to A

(c) charge oscillates between A and B

(d) no charge will flow.

51. Which of the following statements is incorrect?

I. The charge q on a body is always given by q = ne, where n is any integer, positive or negative.

II. By convention, the charge on an electron is taken to be negative.

III. The fact that electric charge is always an integral multiple of e is termed as quantisation of charge.

IV. The quatisation of charge was experimentally demonstrated by Newton in 1912.

(a) Only I (b) Only II (c) Only IV (d) Only III

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

Heating Effect of Current: The electric energy consumed in a circuit is defined as *the total work done in maintaining the current in an electric circuit for a given time.*

Electric energy = $VIt = Pt = I^2 Rt = V^2 t / R$

The **S.I. unit** of electric energy is joule (denoted by J)

where 1 joule = 1 watt × 1 second = 1 volt × 1 ampere × 1 sec.

In **household circuits** the electrical appliances are connected in parallel and the electrical energy consumed is measured in kWh

52. An electric fan and a heater are marked as 100 W, 220 V and 1000 W, 220 V respectively. The resistance of heater is

(a) equal to that of fan (b) lesser than that of fan (c) greater than that of fan (d) zero

53. Which of the following statement is false?

(a) Some of the energy produced by the light bulb takes the form of heat.

(b) The battery is the source of all the electrons flowing around the circuit.

(c) The current entering the light bulb equals the current leaving the light bulb.

(d) The potential in the wire to the left of the light bulb differs from the potential in the wire to the right of that bulb.

54. Resistance of conductor is doubled keeping the potential difference across it constant. The rate of generation of heat will

(a) become one fourth (b) be halved

(c) be doubled (d) become four times

55. The heating element of an electric heater should be made with a material, which should have

(a) high specific resistance and high melting point (b) high specific resistance and low melting point

(c) low specific resistance and low melting point (d) low specific resistance and high melting point

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	