Sample Paper

10

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 25multiple 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 value of electric potential at any point due to any electric dipole is

(a) $k \cdot \frac{\vec{p} \times \vec{r}}{r^2}$ (b) $k \cdot \frac{\vec{p} \times \vec{r}}{r^3}$ (c) $k \cdot \frac{\vec{p} \cdot \vec{r}}{r^2}$ (d) $k \cdot \frac{\vec{p} \cdot \vec{r}}{r^3}$

2. If a charge q is placed at the centre of the line joining two equal charges Q such that the system is in equilibrium then the value of q is

(a) Q/2 (b) –Q/2 (c) Q/4 (d) –Q/4

3. On decreasing the distance between the two charges of a dipole which is perpendicular to electric field and decreasing the angle between the dipole and electric field, the torque on the dipole

(a) increases (b) decreases (c) remains same (d) cannot be predicted

4. In a certain region of space with volume 0.2 m^3, the electric potential is found to be 5 V throughout. The magnitude of electric field in this region is :

(a) 0.5 N/C (b) 1 N/C (c) 5 N/C (d) zero

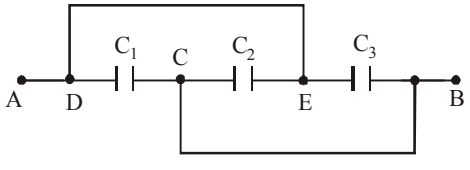
5. A cylinder of radius R and length ℓ is placed in a uniform electric field E parallel to the axis of the cylinder. The total flux over the curved surface of the cylinder is

(a) zero (b) $\pi R^2 E$ (c) $2\pi R^2 E$ (d) $E / \pi R^2$

6. Electric lines of force about a negative point charge are

(a) circular anticlockwise (b) circular clockwise
(c) radial, inwards (d) radial, outwards

7. A combination of parallel plate capacitors is maintained at a certain potential difference.



When a 3 mm thick slab is introduced between all the plates, in order to maintain the same potential difference, the distance between the plates is increased by 2.4 mm.
Find the dielectric constant of the slab.

(a) 3 (b) 4 (c) 5 (d) 6

8. A current passes through a wire of nonuniform cross-section. Which of the following quantities are independent of the cross-section?

(a) The charge crossing (b) Drift velocity
(c) Current density (d) Free-electron density

9. The number of free electrons per 100 mm of ordinary copper wire is 2×10^{21}. Average drift speed of electrons is 0.25 mm/s. The current flowing is

(a) 5 A (b) 80 A (c) 8 A (d) 0.8 A

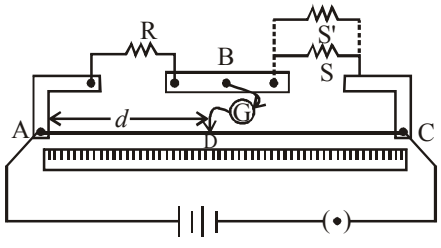
10. An energy source will supply a constant current into the load if its internal resistance is

(a) very large as compared to the load resistance
(b) equal to the resistance of the load
(c) non-zero but less than the resistance of the load
(d) zero

11. A current of 2 A, passing through a conductor produces 80 J of heat in 10 seconds. The resistance of the conductor in ohm is

(a) 0.5 (b) 2 (c) 4 (d) 20

12. The figure shows a meter bridge in which null point is obtained at a length AD = l. When a resistance S' is connected in parallel with resistance S the new position of null point is obtained



(a) to the left of D
(b) to the right of D
(c) at the same point D
(d) to the left of D if S' has lesser value than S and to the right of D if S' has more value than S

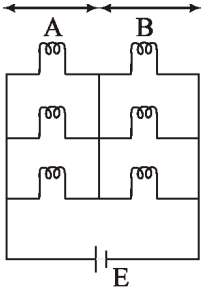
13. A proton moving with a constant velocity passes through a region of space without any change in its velocity. If E and B represent the electric and magnetic fields respectively, this region of space may not have

(a) $E = 0, B = 0$ (b) $E = 0, B \neq 0$ (c) $E \neq 0, B = 0$ (d) $E \neq 0, B \neq 0$

14. A potentiometer consists of a wire of length 4m and resistance 10Ω. It is connected to a cell of e.m.f. 3V. The potential gradient of wire is

(a) 5V/m (b) 2V/m (c) 5V/m (d) 10V/m

15. Six similar bulbs are connected as shown in the figure with a DC source of emf E, and zero internal resistance.
The ratio of power consumption by the bulbs when (i) all are glowing and (ii) in the situation when two from section A and one from section B are glowing, will be:



(a) 4 : 9 (b) 9 : 4 (c) 1 : 2 (d) 2 : 1

16. A solenoid of length 0.6 m has a radius of 2 cm and is made up of 600 turns If it carries a current of 4 A, then the magnitude of the magnetic field inside the solenoid is
(a) 6.024×10^{-3} T (b) 8.024×10^{-3} T (c) 5.024×10^{-3} T (d) 7.024×10^{-3} T

17. If we triple the radius of a coil keeping the current through it unchanged, then the magnetic field at any point at a large distance from the centre becomes approximately how much times?
(a) 9 (b) 8 (c) 4 (d) 3

18. A dip circle is taken to geomagnetic equator. The needle is allowed to move in a vertical plane perpendicular to the mangetic meridian. the needle will stay in
(a) horizontal direction only (b) vertical direction only
(c) any direction except vertical and horizontal (d) any direction it is released

19. Two identical coaxial circular loops carry a current i each circulating in the same direction. If the loops approach each other, you will observe that the current in
(a) each increases (b) each decreases
(c) each remains the same (d) one increases whereas that in the other decreases

20. The magnetic moment of a bar magnet is thus ...*A*... to the magnetic moment of an equivalent solenoid that produces the same magnetic field. Here, *A* refers to
(a) unequal (b) different (c) equal (d) same

21. Flux of magnetic field through an area bounded by a closed conducting loop can be changed by changing
(a) area of the loop (b) magnetic field $\vec{B}$
(c) angle between area vector and $\vec{B}$ (d) All of the above

22. A coil having an area A_0 is placed in a magnetic field which changes from B_0 to 4 B_0 in time interval t. The e.m.f. induced in the coil will be
(a) $3A_0B_0/t$ (b) $4A_0B_0/t$ (c) $3B_0/A_0t$ (d) $4A_0/B_0t$

23. 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) $\sqrt{2}:1$

24. In the case of an inductor
(a) voltage lags the current by $\frac{\pi}{2}$ (b) voltage leads the current by $\frac{\pi}{2}$
(c) voltage leads the current by $\frac{\pi}{3}$ (d) voltage leads the current by $\frac{\pi}{4}$

25. Current in an ac circuit is given by $i = 3 \sin \omega t + 4 \cos \omega t$ then
(a) rms value of current is 5 A
(b) mean value of this current in one half period will be $6/\pi$
(c) if voltage applied is $V = V_m \sin \omega t$ then the circuit must be containing resistance and capacitance.
(d) if voltage applied is $V = V_m \sin \omega t$, the circuit may contain resistance and inductance.

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. Two insulated charged metalic sphere *P* and *Q* have their centres separated by a distance of 60 cm. The radii of *P* and *Q* are negligible compared to the distance of separation. The mutual force of electrostatic repulsion if the charge on each is 3.2×10^{-7} C is
(a) 5.2×10^{-4} *N* (b) 2.5×10^{-3} *N*
(c) 1.5×10^{-3}*N* (d) 3.5×10^{-4} *N*

27. The capacitance of a parallel plate capacitor with air as medium is 6 μF. With the introduction of a dielectric medium, the capacitance becomes 30 μF. The permittivity of the medium is :
($\epsilon_0 = 8.85 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$)
(a) $1.77 \times 10^{-12}\ C^2\ N^{-1}\ m^{-2}$ (b) $0.44 \times 10^{-10}\ C^2\ N^{-1}\ m^{-2}$
(c) $5.00\ C^2\ N^{-1}\ m^{-2}$ (d) $0.44 \times 10^{-13}\ C^2\ N^{-1}\ m^{-2}$

28. The metal knob of a gold leaf electroscope is touched with a positively charged rod. When it is taken away the leaves stay separated. Now the metal knob is touched by negatively charged rod. The separation between the leaves

(a) increases (b) decreases

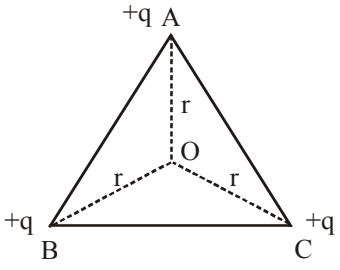
(c) remains same (d) first increases then decreases.

29. ABC is an equilateral triangle. Charges +q are placed at each corner as shown in fig. The electric intensity at centre O will be

(a) $\frac{1}{4\pi\in_o}\frac{q}{r}$

(b) $\frac{1}{4\pi\in_o}\frac{q}{r^2}$

(c) $\frac{1}{4\pi\in_o}\frac{3q}{r^2}$



(d) zero

30. 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) $\frac{Qq}{2\pi\in_0 a}$

31. If resistance of 100Ω, and inductance of 0.5 henry and capacitance of 10×10^6 farad are connected in series through 50 Hz A.C. supply, then impedance is

(a) 1.8765 Ω (b) 18.76 Ω

(c) 187.6 Ω (d) 101.3 Ω

32. In an L-C-R series circuit connected to an AC source, $V = V_0 \sin\left(100\pi t + \frac{\pi}{6}\right)$. Given $V_R = 40V$, $V_L = 40V$ and $V_C = 10V$. Resistance $R = 4\Omega$.

Peak value of current in the circuit is

(a) $10\sqrt{2}$A (b) $15\sqrt{2}$A

(c) $20\sqrt{2}$A (d) $25\sqrt{2}$A

33. A thin spherical conducting shell of radius R has a charge q. Another charge Q is placed at the centre of the shell. The electrostatic potential at a point P, a distance $\frac{R}{2}$ from the centre of the shell is

(a) $\frac{2Q}{4\pi\varepsilon_o R}$ (b) $\frac{2Q}{4\pi\varepsilon_o R}-\frac{2q}{4\pi\varepsilon_o R}$

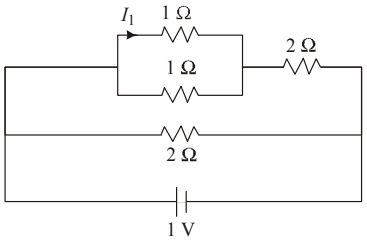
(c) $\frac{2Q}{4\pi\varepsilon_o R}+\frac{q}{4\pi\varepsilon_o R}$ (d) $\frac{(q+Q)2}{4\pi\varepsilon_o R}$

34. The solids which have the negative temperature coefficient of resistance are:

(a) insulators only (b) semiconductors only

(c) insulators and semiconductors (d) metals

35. The current I_1 (in A) flowing through 1 Ω resistor in the following circuit is:



(a) 0.4 (b) 0.5 (c) 0.2 (d) 0.25

36. Which of the following acts as a circuit protection device?

(a) conductor (b) inductor (c) switch (d) fuse

37. A resistance wire connected in the left gap of a metre bridge balances a 10 Ω resistance in the right gap at a point which divides the bridge wire in the ratio 3 : 2. If the length of the resistance wire is 1.5 m, then the length of 1 Ω of the resistance wire is :

(a) 1.0×10^{-1} m (b) 1.5×10^{-1} m (c) 1.5×10^{-2} m (d) 1.0×10^{-2} m

38. Two thin, long, parallel wires, separated by a distance 'd' carry a current of 'i' A in the same direction. They will

(a) repel each other with a force of $\mu_0 i^2/(2\pi d)$ (b) attract each other with a force of $\mu_0 i^2/(2\pi d)$

(c) repel each other with a force of $\mu_0 i^2/(2\pi d^2)$ (d) attract each other with a force of $\mu_0 i^2/(2\pi d^2)$

39. The magnetic moment of a circular coil carrying current is

(a) directly proportional to the length of the wire in the coil

(b) inversely proportional to the length of the wire in the coil

(c) directly proportional to the square of the length of the wire in the coil

(d) inversely proportional to the square of the length of the wire in the coil

40. A dip needle lies initially in the magnetic meridian when it shows an angle of dip θ at a place. The dip circle is rotated through an angle x in the horizontal plane and then it shows an angle of dip θ′. Then $\frac{\tan\theta'}{\tan\theta}$ is

(a) $\frac{1}{\cos x}$ (b) $\frac{1}{\sin x}$ (c) $\frac{1}{\tan x}$ (d) cos x

41. The north pole of a long horizontal bar magnet is being brought closer to a vertical conducting plane along the perpendicular direction. The direction of the induced current in the conducting plane will be

(a) horizontal (b) vertical (c) clockwise (d) anticlockwise

42. A transformer connected to 220 V mains is used to light a lamp of rating 100 W and 110 V. If the primary current is 0.5 A, the efficiency of the transformer is (approximately)

(a) 60% (b) 35% (c) 50% (d) 90%

43. When current in a coil changes from 5 A to 2 A in 0.1 s, average voltage of 50 V is produced. The self - inductance of the coil is :

(a) 6 H (b) 0.67 H (c) 3 H (d) 1.67 H

44. The mutual inductance of a pair of coils is 0.75 H. If current in the primary coil changes from 0.5 A to zero in 0.01 s, find average induced e.m.f. in secondary coil.

(a) 25.5 V (b) 12.5 V (c) 22.5 V (d) 37.5 V

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.

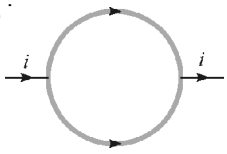
(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R also false.

45. **Assertion :** Figure shows a current carrying circular loop. The magnetic field at the centre of loop is zero.

Reason : Magnetic field at the centre of loop is given by $B = \frac{\mu_0 ni}{2R}$.



46. **Assertion :** For a charged particle moving from point P to point Q, the net work done by an electrostatic field on the particle is independent of the path connecting point P to point Q.

Reason : The net work done by a conservative force on an object moving along a closed loop is zero.

47. **Assertion :** An emf can be induced by moving a conductor in a magnetic field.

Reason : An emf can be induced by changing the magnetic field.

48. **Assertion:** To convert a galvanometer into an ammeter a small resistance is connected in parallel with it.

Reason: The small resistance increases the combined resistance of the combination.

49. **Assertion :** A point charge is brought in an electric field, the field at a nearby point will increase or decrease, depending on the nature of charge.

Reason : The electric field is independent of the nature of charge.

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. A galvanometer of resistance 5 ohms gives a full scale deflection for a potential difference of 10 mV. To convert the galvanometer into a voltmeter giving a full scale deflection for a potential difference of 1V, the size of the resistance that must be attached to the voltmeter is

(a) 0.495 ohm (b) 49.5 ohm (c) 495 ohm (d) 4950 ohm

51. The energy stored in a parallel plate capacitor is given by $V_E = \frac{Q^2}{2C}$. Now which of the following statements is not true?

I. The work done in charging a capacitor is stored in the form of electrostatic potential energy given by expression $V_E = \frac{Q^2}{2C}$.

II. The net charge on the capacitor is Q.

III. The magnitude of the net charge on one plate of a capacitor is Q.

(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.*

In a series LCR circuit with an ideal ac source of peak voltage $E_0 = 50V$, frequency $v = \frac{50}{\pi}$ Hz and $R = 300\Omega$. The average electric field energy stored in the capacitor and average magnetic energy stored in the coil are 25 mJ and 5 mJ respectively. The value of RMS current in the circuit is 0.1 A. Then find :

52. Capacitance (C) of the capacitor is

(a) 10μF (b) 15μF (c) 20μF (d) None of these

53. Inductance (L) of inductor is

(a) 0.25 henry (b) 0.5 henry (c) 1 henry (d) 2 henry

54. The sum of rms potential difference across each of the three elements is

(a) 50 volt (b) $50\sqrt{2}$ volt

(c) $\frac{50}{\sqrt{2}}$ volt (d) None of these

55. In a LCR circuit at resonance which of these will effect the current in circuit

(a) R only (b) L and R only

(c) R and C only (d) all L, C and R

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	