

Question 4

The surface charge density of a conductor, in the absence of another conductor: [1]

- (a) Is proportional to the charge on the conductor and its surface area
- (b) Inversely proportional to the charge and directly proportional to the surface area
- (c) Directly proportional to the charge and inversely proportional to the surface area
- (d) Inversely proportional to the charge and the surface area

Question 5

Which of the following is not the characteristic of resonance in an LCR series circuit? [1]

- (a) $X_L = X_C$
- (b) $\omega L = \frac{1}{\omega C}$
- (c) $2\pi fL = 2\pi fC$
- (d) $f_0 = \frac{1}{2\pi\sqrt{LC}}$

Question 6

A graph showing variation in impedance Z of a series LCR circuit, with frequency f of alternating emf applied to it is shown below. What is the minimum value of this impedance? [1]

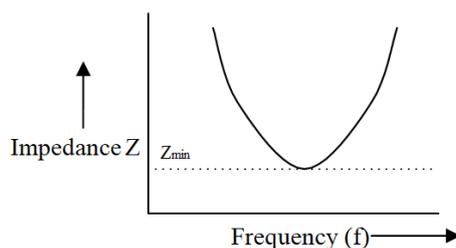


figure 2

- (a) R
- (b) $Z = \sqrt{R^2 + (X_L - X_C)^2}$
- (c) Z_{min}
- (d) $X_L = X_C$

Question 7

An electric dipole of moment \vec{p} is placed in a uniform electric field \vec{E} . It has maximum (negative) potential energy when the angle between \vec{p} and \vec{E} is: [1]

- (a) $\frac{\pi}{2}$
- (b) Zero
- (c) π
- (d) $\frac{3\pi}{2}$

Question 8

A charge placed at a distance from a short electric dipole in the end-on position [1] experiences a force F . If the distance is halved, then the force will become:

- (a) $4F$
- (b) $8F$
- (c) $F/4$
- (d) $F/8$

Question 9

In *figure 3* given below, Electric field intensity 'E' at a point P, at a perpendicular distance [1] 'r' from an infinitely long line charge X'X having linear charge density λ is given by:

- (a) $E = \left(\frac{1}{4\pi\epsilon_0}\right) \frac{2\lambda}{r^2}$
- (b) $E = \left(\frac{1}{4\pi\epsilon_0}\right) \frac{2\lambda}{r}$
- (c) $E = \left(\frac{1}{4\pi\epsilon_0}\right) \frac{\lambda}{r^2}$
- (d) $E = \left(\frac{1}{4\pi\epsilon_0}\right) \frac{\lambda}{r}$

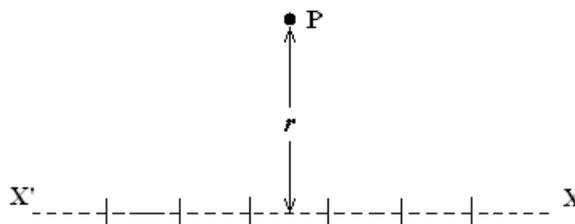


figure 3

Question 10

Three capacitors, each of capacitance C , are connected in series. Their equivalent capacitance is C_s . The same three capacitors are now connected in parallel. Their equivalent capacitance becomes C_p . The ratio of C_p to C_s is: [1]

- (a) $9 : 1$
- (b) $1 : 9$
- (c) $3 : 1$
- (d) $1 : 3$

Question 11

The charges $q_1 = 3\mu\text{F}$, $q_2 = 4\mu\text{F}$ and $q_3 = -7\mu\text{F}$ are placed on the circumference of a circle [1] of radius 1.0m as shown in the figure below. What is the value of charge q_4 placed on the same circle if the potential at the centre is?

- (a) $-4\mu\text{F}$
- (b) $-3\mu\text{F}$
- (c) $7\mu\text{F}$
- (d) 0

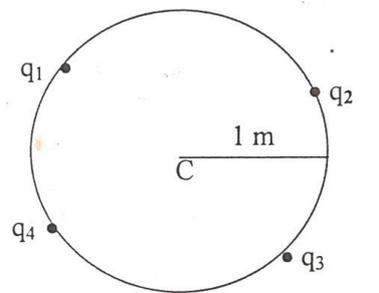


figure 4

Question 12

Three equal charges of $5.0\mu\text{C}$ each, are placed at the three vertices of an equilateral triangle of side 5.0cm each. The electrostatic potential energy of the system of charges is: [1]

- (a) 13.5 J
- (b) 17.5 J
- (c) 27 J
- (d) 15 J

Question 13

Three capacitors $C_1 = 3\mu\text{F}$, $C_2 = 6\mu\text{F}$ and $C_3 = 10\mu\text{F}$ are connected to a 50V battery as shown in the figure below: [1]

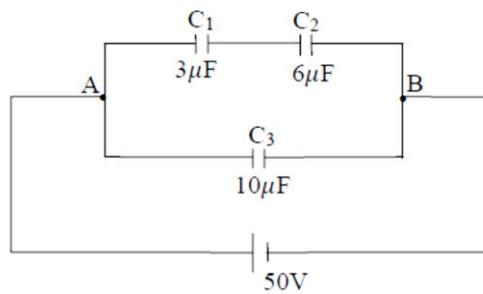


figure 5

The equivalent capacitance of the circuit between point A and B and the charge on C_1 are...

- (a) $12\mu\text{F}$, 150C
- (b) $4.75\mu\text{F}$, 100C
- (c) $12\mu\text{F}$, 100C
- (d) $4.75\mu\text{F}$, 150C

Question 14

A substance behaves like a magnet only if there are: [1]

- (a) at least some tiny current loops within the magnet
- (b) stationary charges within the magnet
- (c) magnet within the magnet
- (d) none of these

Question 15

A straight long wire is turned into a loop of radius $R = 10 \text{ cm}$, as shown in **figure 6** [1] below. If a current $I = 16 \text{ A}$ is passed through the wire, then the magnetic field at the centre of the loop is:

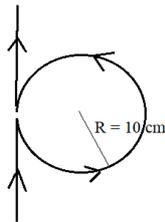


figure 6

- (a) $3.4 \times 10^{-5} T$ (b) $6.8 \times 10^{-5} T$
(c) $1.7 \times 10^{-5} T$ (d) $5.1 \times 10^{-5} T$

Question 16

The current in the circuit shown in **figure 7** below, will be: [1]

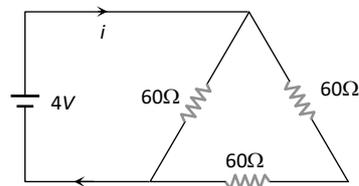


figure 7

- (a) $1/45 \text{ A}$ (b) $1/15 \text{ A}$
(c) $1/10 \text{ A}$ (d) $1/5 \text{ A}$

Question 17

A cell of e.m.f. E is connected to an external resistance R . The potential difference across [1] cell is V . The internal resistance of cell will be:

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

Question 18

The *figure 8* given below shows currents in a part of an electric circuit. The current i is: [1]

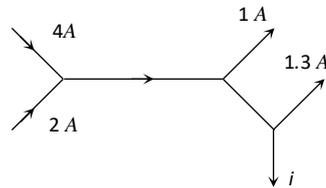


figure 8

- (a) 1.7 A (b) 3.7 A
(c) 2.7 A (d) 4.7 A

Question 19

n identical cells each of e.m.f. E and internal resistance r are connected in parallel. [1]
An external resistance R is connected in series to this combination. The current through R is:

- (a) $\frac{nE}{R+nr}$ (b) $\frac{nE}{nR+r}$
(c) $\frac{E}{R+nr}$ (d) $\frac{nE}{R+r}$

Question 20

The circuit shown in *figure 9* below is used to compare the e.m.f. of two cells E_1 and E_2 [1]
where $E_2 > E_1$. The null point is at C when the galvanometer is connected to E_1 . When the galvanometer is connected to E_2 , the null point will be:

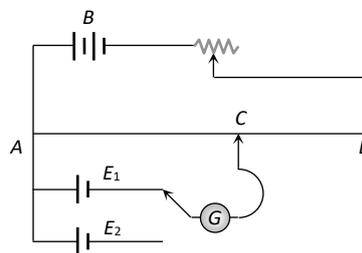


figure 9

- (a) To the left of C (b) To the right of C
(c) At C itself (d) Nowhere on AB

Question 21

Figure 10 given below shows a graph of emf ‘ ϵ ’ generated by an ac generator verses [1]
time. What is the frequency of the emf?

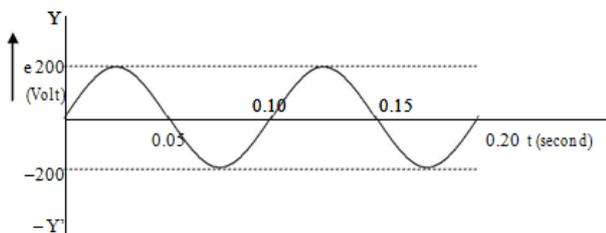


figure 10

- (a) 10 Hz
- (b) 0.10 Hz
- (c) 20 Hz
- (d) 50 Hz

Question 22

If m , e , τ and n respectively represent the mass, charge, average relaxation time and density of the electron, then what will be the resistance of a wire of length l and area of cross-section A ? [1]

- (a) $\frac{ml}{ne^2\tau A}$
- (b) $\frac{m\tau^2 A}{ne^2 l}$
- (c) $\frac{ne^2\tau A}{2ml}$
- (d) $\frac{ne^2 A}{2m d}$

Question 23

The drift velocity of a current carrying conductor is v . What will be the drift velocity [1]
if the current flowing through the wire is doubled?

- (a) $v/4$
- (b) $v/2$
- (c) $2v$
- (d) $4v$

Question 24

The resistance of a wire is 10Ω . It is stretched so that its length becomes four times. What [1]
will be the new resistance of the wire?

- (a) 40Ω
- (b) 160.0Ω
- (c) 120Ω
- (d) 80.0Ω

Question 25

What is the angle between the current element \vec{dl} and the magnetic flux density \vec{B} at point 'P' in the *figure 11* given below? [1]

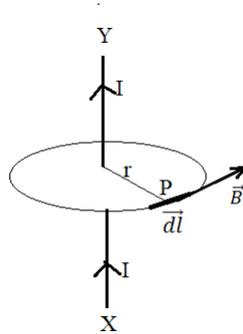


figure 11

- (a) Parallel to each other (b) Perpendicular to each other
(c) Normal to each other (d) Any angle between them is possible

Question 26

An A.C. generator generating an e.m.f of $\varepsilon = 300 \sin (100\pi) t$ is connected to a **series** combination of 16μ F capacitor, 1H inductor and 100Ω resistor. What is the frequency of A.C.? [1]

- (a) 100 Hz (b) 50 Hz
(c) 300 Hz (d) 25 Hz

Question 27

Four identical cells each having an e.m.f. of $4V$ are connected in parallel. What will be the e.m.f. of this combination? [1]

- (a) 1 V (b) 16 V
(c) $1/4V$ (d) 4 V

Question 28

A 2 volt battery, a 15Ω resistor and a potentiometer of 100 cm length, all are connected in series. If the resistance of potentiometer wire is 5Ω , then the potential gradient of the potentiometer wire is... [1]

- (a) 0.005 V/cm (b) 0.05 V/cm
(c) 0.02 V/cm (d) 0.2 V/cm

Question 29

The potential gradient along the length of a uniform wire is 20 volt/metre. B and C are the two points at 40cm and 70cm point on a meter scale fitted along the wire. What is the potential difference between B and C? [1]

- (a) 6 V (b) 0.4 V
(c) 0.6 V (d) 4 V

Question 30

In an experiment of meter bridge, a null point is obtained at the centre of the bridge wire. When a resistance of 5 is connected in one gap, what is the value of resistance in the other gap? [1]

- (a) 10Ω (b) 5Ω
(c) 1/5Ω (d) 500Ω

Question 31

What is the locus of an electron, projected perpendicular to a uniform magnetic field? [1]

- (a) Circle (b) Right bisector
(c) Parabola (d) Straight line

Question 32

Which of the following is the right expression to define the magnetic field B? [1]

- (a) $\vec{F} = q(\vec{v} \times \vec{B})$ (b) $\vec{F} = B(\vec{l} \times \vec{l})$
(c) $\frac{\vec{F}}{l} = \frac{\mu_0 I^2}{2\pi a}$ (d) $B = \mu_0 n i$

Question 33

What is the SI (base unit) unit of permeability? [1]

- (a) $\text{kg m s}^{-2} \text{A}^{-2}$ (b) $\text{kg m}^2 \text{s}^{-2} \text{A}^{-2}$
(c) $\text{kg m}^2 \text{s A}^{-2}$ (d) $\text{kg m s}^2 \text{A}^{-2}$

Question 34

The loss of power in a transformer can be reduced by: [1]

- (a) Increasing the number of turns in primary.
(b) Using solid core made of steel.
(c) Increasing ac voltage applied to primary.
(d) Using a laminated core of soft iron.

Question 46

A $2 \mu\text{F}$ capacitor, 100Ω resistor and 8 H inductor are connected in series with an ac source. At a certain frequency of about 40 Hz for this ac source, the current drawn in the circuit is maximum. If the peak value of e.m.f. of the source is 200V : [3]

- (i) What is the peak value of current in the circuit?
 - (a) 1.4 A
 - (b) 2.2 A
 - (c) 2.0 A
 - (d) 1.8 A
- (ii) What is the phase relation between voltages across inductor and resistor?
 - (a) $\pi/2$ radian
 - (b) $\pi/3$ radian
 - (c) $\pi/4$ radian
 - (d) π radian
- (iii) What is the phase difference between voltages across inductor and capacitor?
 - (a) $\pi/2$ radian
 - (b) $\pi/3$ radian
 - (c) $\pi/4$ radian
 - (d) π radian

Question 47

Given below is a neat, labelled diagram to obtain balancing condition of **Wheatstone** bridge. [3]

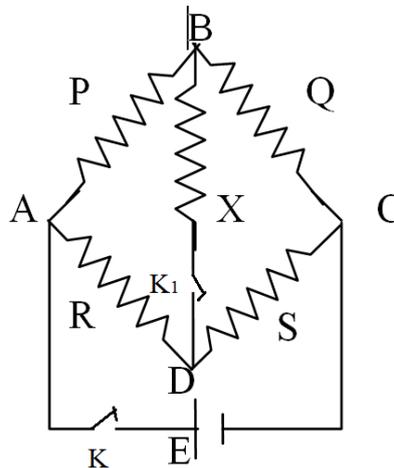


figure 16

- (i) Why is the key 'K' pressed before the key K_1 ?
 - (a) There is no such requirement
 - (b) To avoid a back emf in the closed loops
 - (c) There is no current till the key 'K' is pressed
 - (d) None of these

(ii) The magnitude and the direction of the magnetic induction B at P due to wire at 'R':

(a) $B = \frac{\mu_0 I}{\sqrt{2} \pi a}$ acting along PQ

(b) $B = \frac{\mu_0 I}{\sqrt{2} \pi a}$ acting along PR

(c) $B = \frac{\mu_0 I}{\sqrt{2} \pi a}$ towards the mid-point of QR

(d) $B = \frac{\mu_0 I}{\pi a}$ towards the mid-point of QR

(iii) The net magnitude and the direction of the magnetic induction B at P :

(a) $B = \frac{\mu_0 I}{\sqrt{2} \pi a}$ acting along PQ

(b) $B = \frac{\mu_0 I}{\sqrt{2} \pi a}$ acting along PR

(c) $B = \frac{\mu_0 I}{\sqrt{2} \pi a}$ towards the mid-point of QR

(d) $B = \frac{\mu_0 I}{\pi a}$ towards the mid-point of QR

Question 49

An alternating e.m.f of 100V is applied to a circuit containing a resistance of 40Ω and an inductance L in series. The current is found to lag behind the voltage by an angle $\alpha = \tan^{-1} \frac{3}{4}$. [4]

(i) The inductive reactance in this case is:

(a) 40Ω

(b) 30Ω

(c) 50Ω

(d) $10\sqrt{5} \Omega$

(ii) The impedance of the circuit is:

(a) 40Ω

(b) 30Ω

(c) 50Ω

(d) $10\sqrt{5} \Omega$

(iii) The current flowing through the circuit is:

(a) 2.5 A

(b) 3.33 A

(c) 2.0 A

(d) $2\sqrt{5}$ A

