

Alternating Current

Question1

In domestic electric mains supply, the voltage and the current are

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Options:

- A. AC voltage and DC current
- B. DC voltage and DC current
- C. DC voltage and AC current
- D. AC voltage and AC current

Answer: D

Solution:

Domestic mains use alternating voltage and thus also alternating current. That matches:

Option D: AC voltage and AC current.

Question2

A sinusoidal voltage produced by an AC generator at any instant t is given by an equation $V = 311 \sin 314 t$. The rms value of voltage and frequency are respectively

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Options:

- A. 200 V, 50 Hz
- B. 220 V, 100 Hz
- C. 220 V, 50 Hz
- D. 200 V, 100 Hz

Answer: A

Solution:

The sinusoidal voltage from an AC generator at any instant is represented by the equation $V = 311 \sin 314t$.

To determine the root mean square (rms) value of the voltage, we use the formula for the rms value of a sinusoidal voltage:

$$V_{\text{rms}} = \frac{V_0}{\sqrt{2}} = \frac{311}{\sqrt{2}} = 220 \text{ V}$$

Here, $V_0 = 311 \text{ V}$ is the peak voltage.

To find the frequency, we use the relationship between angular frequency (ω) and frequency (f):

$$\omega = 2\pi f$$

Given $\omega = 314$, we set:

$$314 = 2\pi f$$

Solving for f , we find:

$$f = \frac{314}{2\pi} \approx 50 \text{ Hz}$$

Thus, the rms value of the voltage is 220 V, and the frequency is 50 Hz.

Question3

A series LCR circuit containing an AC source of 100 V has an inductor and a capacitor of reactances 24Ω and 16Ω respectively. If a resistance of 6Ω is connected in series, then the potential difference across the series combination of inductor and capacitor only is

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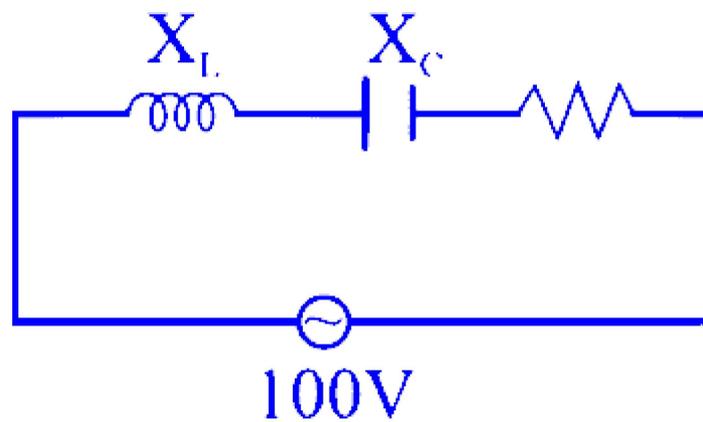


Options:

- A. 80 V
- B. 400 V
- C. 8 V
- D. 40 V

Answer: A

Solution:



$$X_C = 24\Omega$$

$$X_L = 16\Omega$$

$$R = 6\Omega$$

$$\begin{aligned} Z &= \sqrt{R^2 + (X_C - X_L)^2} \\ &= \sqrt{6^2 + 8^2} \\ &= \sqrt{100} = 10\Omega \end{aligned}$$

$$i = \frac{V}{Z} = \frac{100}{10} = 10 \text{ A}$$

Net voltage across capacitor and inductor

$$\begin{aligned} &= i(X_C - X_L) \\ &= 10(24 - 16) \\ &= 10(8) \\ &= 80 \text{ V} \end{aligned}$$

Question4

Which of the following combinations should be selected for better tuning of an $L - C - R$ circuit used for communication?



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Options:

A. $R = 20\Omega, L = 1.5\text{H}, C = 35\mu\text{F}$

B. $R = 25\Omega, L = 2.5\text{H}, C = 45\mu\text{F}$

C. $R = 25\Omega, L = 1.5\text{H}, C = 45\mu\text{F}$

D. $R = 15\Omega, L = 3.5\text{H}, C = 30\mu\text{F}$

Answer: D

Solution:

For better tuning of an $L - C - R$ circuit used in for communication, quality factor Q must be high.

$$\therefore Q = \frac{1}{R} \sqrt{\frac{L}{C}}$$

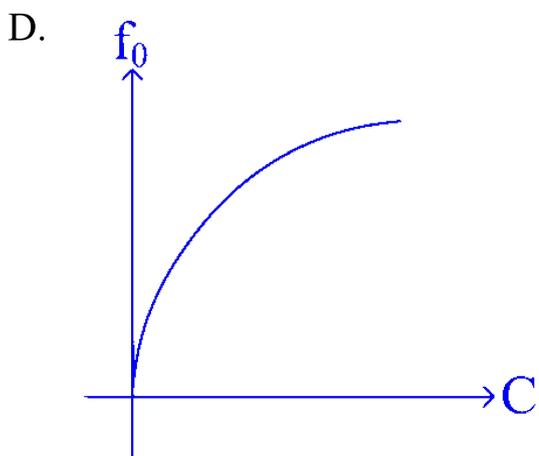
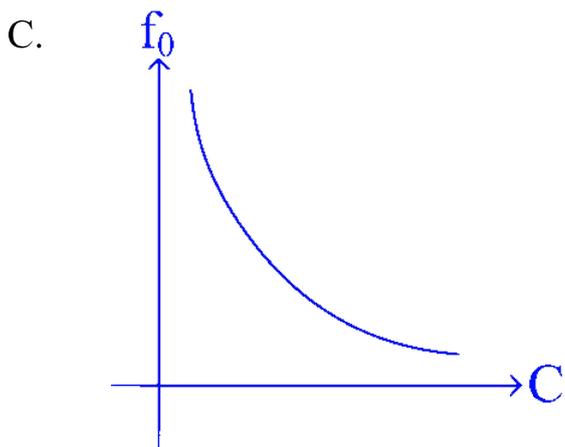
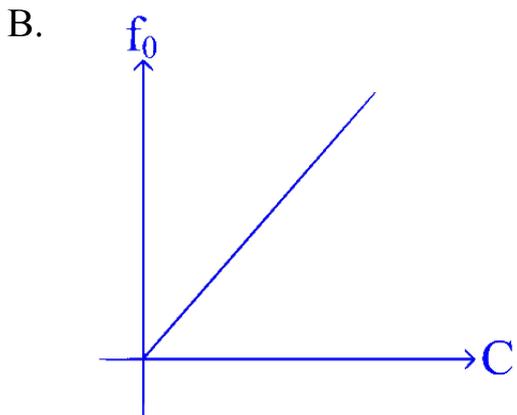
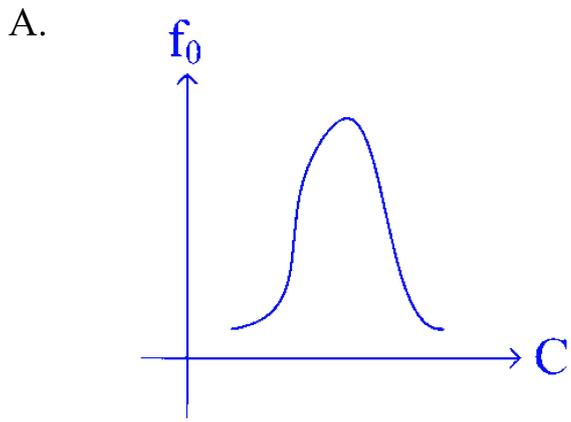
In option (d), R and C is minimum and L is maximum. Thus, the value of R, L and C given in option (d) suitable for better communication.

Question5

In an $L - C - R$ series circuit, the value of only capacitance C is varied. The resulting variation of resonance frequency f_0 as a function of C can be represented as

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Options:



Answer: C

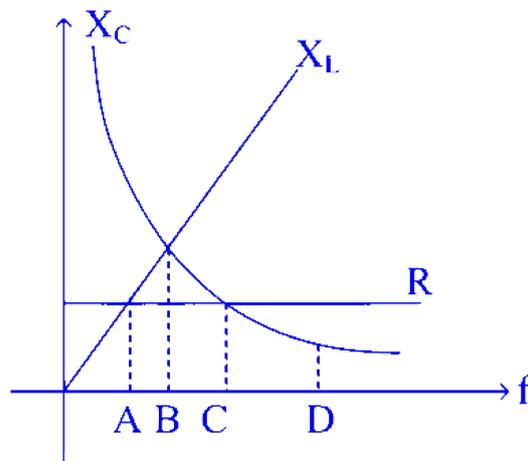
Solution:

Resonance frequency in $L - C - R$ series circuit,

$$f_0 = \frac{1}{2\pi\sqrt{LC}} \Rightarrow f_0 \propto \frac{1}{\sqrt{C}}$$

i.e. f_0 decreases with C , hence graph shown in option (c) is correct.

Question6



The figure shows variation of R , X_L and X_C with frequency f in a series $L - C - R$ circuit. Then, for what frequency point is the circuit capacitive?

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Options:

- A. B
- B. D
- C. A
- D. C

Answer: C

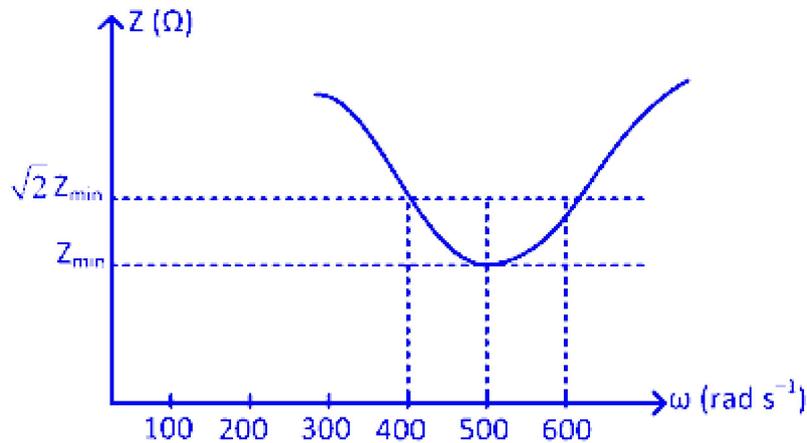
Solution:

For a capacitive circuit, $X_C > X_L$

For the given diagram in question, the value X_C corresponding to point A is greater than the value of X_L .

Question 7

Total impedance of a series $L-C-R$ circuit varies with angular frequency of the AC source connected to it as shown in the graph. The quality factor Q of the series $L-C-R$ circuit is



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Options:

- A. 0.4
- B. 2.5
- C. 5
- D. 1

Answer: B

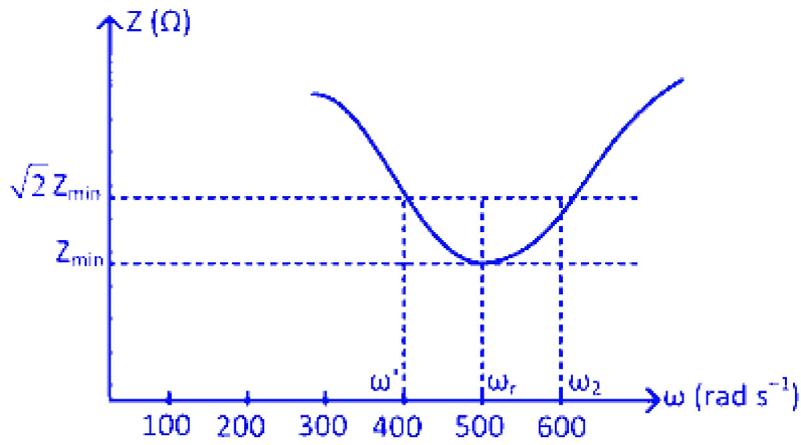
Solution:

According to given diagram,

$$\omega_1 = 400 \text{ rad/s}; \quad \omega_r = 500 \text{ rad/s}$$

$$\omega_2 = 600 \text{ rad/s}$$





Quality factor, $Q = \frac{\omega_r}{\omega_2 - \omega_1}$

$$= \frac{500}{600 - 400} = \frac{500}{200} = 2.5$$

Question8

In series LCR circuit at resonance, the phase difference between voltage and current is

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Options:

- A. Zero
- B. π
- C. $\frac{\pi}{4}$
- D. $\frac{\pi}{2}$

Answer: A

Solution:

In $L-C-R$ series resonance circuit,

$$X_L = X_C$$

$$\therefore \tan \phi = \frac{X_L - X_C}{R} = \frac{0}{R} = 0$$

$$\Rightarrow \phi = 0^\circ$$

Question9

An ideal transformer has a turns ratio of 10. When the primary is connected to 220 V, 50 Hz as source, the power output is

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Options:

- A. 10 times the power input
- B. $\frac{1}{10}$ th the power input
- C. equal to power input
- D. zero

Answer: C

Solution:

For ideal transformer, input power is equal to output power.

Question10

In a series LCR circuit, $R = 300\Omega$, $L = 0.9H$, $C = 2.0\mu F$ and $\omega = 1000 \text{ rad/s}$, then impedance of the circuit is

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Options:

- A. 900Ω
- B. 500Ω



C. 400Ω

D. 1300Ω

Answer: B

Solution:

Given, $R = 300\Omega$, $L = 0.9\text{H}$, $\omega = 1000\text{rad/s}$

$$C = 2.0\mu\text{F} = 2 \times 10^{-6} \text{ F}$$

Impedance of given R - L - C circuit,

$$\begin{aligned} Z &= \sqrt{R^2 + (X_L - X_C)^2} \\ &= \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2} \left[\because X_L = \omega L \text{ and } X_C = \frac{1}{\omega C} \right] \\ &= \sqrt{(300)^2 + \left(1000 \times 0.9 - \frac{1}{1000 \times 2 \times 10^{-6}}\right)^2} \\ &= \sqrt{90000 + (900 - 500)^2} \\ &= \sqrt{90000 + 160000} = \sqrt{250000} = 500\Omega \end{aligned}$$

Question11

A series resonant AC circuit contains a capacitance 10^{-6} F and an inductor of 10^{-4}H . The frequency of electrical oscillations will be

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Options:

A. 10 Hz

B. $\frac{10^5}{2\pi}$ Hz

C. $\frac{10}{2\pi}$ Hz

D. 10^5 Hz

Answer: B



Solution:

Given, capacitance, $C = 10^{-6}$ F

Inductance, $L = 10^{-4}$ H

Frequency of oscillation of L - C series resonant circuit,

$$f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{10^{-4} \times 10^{-6}}}$$
$$= \frac{1}{2\pi \times 10^{-5}} = \frac{10^5}{2\pi} \text{ Hz}$$

Question 12

A fully charged capacitor C with initial charge q_0 is connected to a coil of self inductance L at $t = 0$. The time at which the energy is stored equally between the electric and the magnetic field is

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Options:

A. \sqrt{LC}

B. $\pi\sqrt{LC}$

C. $\frac{\pi}{4}\sqrt{LC}$

D. $2\pi\sqrt{LC}$

Answer: C

Solution:

In LC -oscillation, maximum stored energy in inductor coil L is $\frac{1}{2}LI_0^2$ and maximum stored energy in capacitor (C) is $\frac{q_0^2}{2C}$.

Since, energy is equally divided in L and C . Hence, total stored energy $E = \frac{1}{2} \times$ maximum stored energy in either L or C

$$\Rightarrow \frac{1}{2}LI^2 = \frac{1}{2} \times \frac{1}{2}LI_0^2 \Rightarrow I^2 = \left(\frac{I_0}{\sqrt{2}}\right)^2 \Rightarrow I = \frac{I_0}{\sqrt{2}}$$



We know that, $I = I_0 \sin \omega t$

$$\Rightarrow \frac{I_0}{\sqrt{2}} = I_0 \sin \omega t \Rightarrow \sin \frac{\pi}{4} = \sin \frac{2\pi}{T} \cdot t$$

$$\Rightarrow \frac{\pi}{4} = \frac{2\pi}{T} \cdot t \Rightarrow t = \frac{T}{8} = \frac{2\pi\sqrt{LC}}{8} = \frac{\pi\sqrt{LC}}{4}$$

Question13

An alternating current is given by $i = i_1 \sin \omega t + i_2 \cos \omega t$. The rms current is given by

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Options:

A. $\frac{i_1 - i_2}{\sqrt{2}}$

B. $\sqrt{\frac{i_1^2 + i_2^2}{2}}$

C. $\sqrt{\frac{i_1^2 + i_2^2}{\sqrt{2}}}$

D. $\frac{i_1 + i_2}{\sqrt{2}}$

Answer: B

Solution:

Equation of alternating current,

$$i = i_1 \sin \omega t + i_2 \cos \omega t$$

$$\text{Let } i_1 = I \cos \phi \quad \dots \text{ (i)}$$

$$\text{and } i_2 = I \sin \phi \quad \dots \text{ (ii)}$$

$$i = I \cos \phi \sin \omega t + I \sin \phi \cos \omega t$$

$$\Rightarrow i = I \sin(\omega t + \phi)$$

\therefore rms value of i_1 ,

$$i_{\text{rms}} = \frac{I}{\sqrt{2}} \quad \dots \text{ (iii)}$$

From Eqs. (i) and (ii), we get



$$i_1^2 + i_2^2 = I^2 \cos^2 \phi + I^2 \sin^2 \phi = I^2 (\cos^2 \phi + \sin^2 \phi) = I^2$$

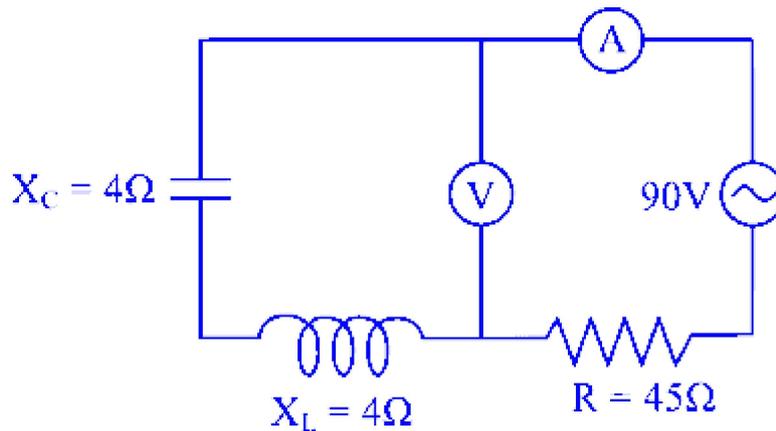
$$\Rightarrow \sqrt{i_1^2 + i_2^2} = I \dots \text{(iv)}$$

From Eqs. (iii) and (iv), we get

$$i_{\text{rms}} = \sqrt{\frac{i_1^2 + i_2^2}{2}}$$

Question14

What will be the reading in the voltmeter and ammeter of the circuit shown?



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Options:

- A. 90V, 2A
- B. 0, 2A
- C. 90V, 1A
- D. 0, 1A

Answer: B

Solution:

Given, $X_L = X_C = 4\Omega$

∴ Voltage across X_C and X_L is same in magnitude but opposite in direction. So, net voltage is

$$V_{\text{net}} = V_C - V_L = 0$$

Since, the voltmeter is connected across the series connection of capacitor and inductor. So, the reading of voltmeter is equal to V_{net} i.e., zero. Current in the circuit,

$$\begin{aligned} I &= \frac{V}{Z} \\ &= \frac{V}{\sqrt{R^2 + (X_L - X_C)^2}} \\ &= \frac{90}{\sqrt{(45)^2 + (4 - 4)^2}} = \frac{90}{45} = 2 \text{ A} \end{aligned}$$

Question15

LC-oscillations are similar and analogous to the mechanical oscillations of a block attached to a spring. The electrical equivalent of the force constant of the spring is

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Options:

- A. reciprocal of capacitive reactance
- B. capacitive reactance
- C. reciprocal of capacitance
- D. capacitance

Answer: C

Solution:

For LC-oscillations,

$$L \frac{di}{dt} + \frac{q}{C} = 0$$

Differentiating further it w.r.t t , we get

$$L \frac{d^2i}{dt^2} + \frac{I}{C} = 0 \quad \dots (i)$$



Similarly, for spring-block system,

$$m \frac{d^2x}{dt^2} + kx = 0 \quad \dots (ii)$$

Comparing Eqs. (i) and (ii), we get

$$m \propto L \text{ and } k \propto \frac{1}{C}$$

Question16

In an oscillating LC -circuit, $L = 3\text{mH}$ and $C = 2.7\mu\text{F}$. At $t = 0$, the charge on the capacitor is zero and the current is 2 A. The maximum charge that will appear on the capacitor will be

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Options:

A. $1.8 \times 10^{-5}\text{C}$

B. $18 \times 10^{-5}\text{C}$

C. $9 \times 10^{-5}\text{C}$

D. $90 \times 10^{-5}\text{C}$

Answer: B

Solution:

The charge is a function of time (t), is given by

$$q = q_0 \sin \omega t \quad \dots (i)$$

where, q_0 = maximum charge,

and ω = angular frequency.

Differentiating Eq. (i), we get

$$I = \frac{dq}{dt} = \frac{d}{dt}(q_0 \sin \omega t) = \omega q_0 \cos \omega t$$

At, $t = 0$,



$$I = \omega q_0 \cos(0) = \omega q_0$$

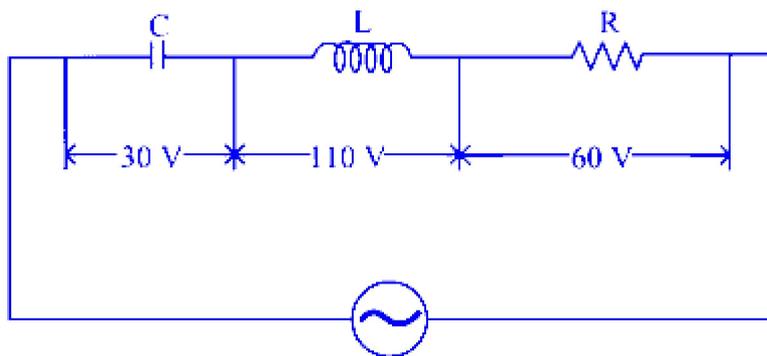
$$\therefore I = \frac{1}{\sqrt{LC}} q_0 \text{ or } q_0 = I\sqrt{LC} \quad \left[\because \omega = \frac{1}{\sqrt{LC}} \right]$$

$$= 2\sqrt{3 \times 2.7 \times 10^{-6}}$$

$$= 18 \times 10^{-5} \text{C}$$

Question17

In the given circuit the peak voltage across C , L and R are 30 V, 110 V and 60 V, respectively. The rms value of the applied voltage is



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Options:

- A. 100 V
- B. 200 V
- C. 70.7 V
- D. 141 V

Answer: C

Solution:

Given, $V_C = 30 \text{ V}$, $V_L = 110 \text{ V}$ and $V_R = 60 \text{ V}$

The peak voltage across series $L - C - R$ circuit is given by



$$\begin{aligned}
 V_O &= \sqrt{V_R^2 + (V_L - V_C)^2} \\
 &= \sqrt{(60)^2 + (110 - 30)^2} \\
 &= \sqrt{(60)^2 + (80)^2} = 100 \text{ V}
 \end{aligned}$$

$$\therefore \text{Rms value of voltage, } V_{\text{rms}} = \frac{V_0}{\sqrt{2}} = \frac{100}{\sqrt{2}} = 70.7 \text{ V}$$

Question18

The power factor of $R - L$ circuit is $\frac{1}{\sqrt{3}}$. If the inductive reactance is 2Ω . The value of resistance is

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Options:

- A. 2Ω
- B. $\sqrt{2}\Omega$
- C. 0.5Ω
- D. $\frac{1}{\sqrt{2}}\Omega$

Answer: B

Solution:

$$\text{Given, power factor} = \frac{1}{\sqrt{3}}$$

$$\text{Inductive reactance, } X_L = 2\Omega$$

The power factor in a $R-L$ circuit is given by

$$\text{power factor} = \frac{\text{Resistance}}{\text{Impedance}} = \frac{R}{\sqrt{R^2 + X_L^2}}$$

$$\Rightarrow \frac{1}{\sqrt{3}} = \frac{R}{\sqrt{R^2 + 4}}$$

Squaring both sides, we get

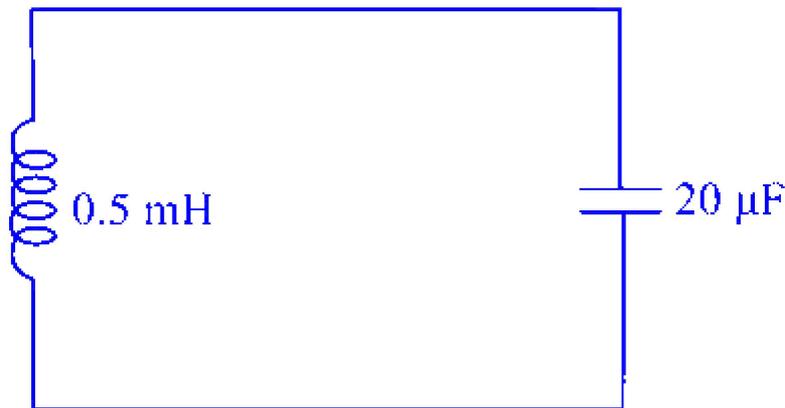


$$\frac{1}{3} = \frac{R^2}{R^2 + 4}$$

$$\Rightarrow R^2 + 4 = 3R^2 \Rightarrow R = \sqrt{2}\Omega$$

Question19

In the given circuit, the resonant frequency is



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Options:

- A. 15.92 Hz
- B. 159.2 Hz
- C. 1592 Hz
- D. 15910 Hz

Answer: C

Solution:

Given, $L = 0.5\text{mH} = 0.5 \times 10^{-3}\text{H}$

and $C = 20\mu\text{F} = 20 \times 10^{-6}\text{F}$

The resonant frequency of $L - C$ circuit is

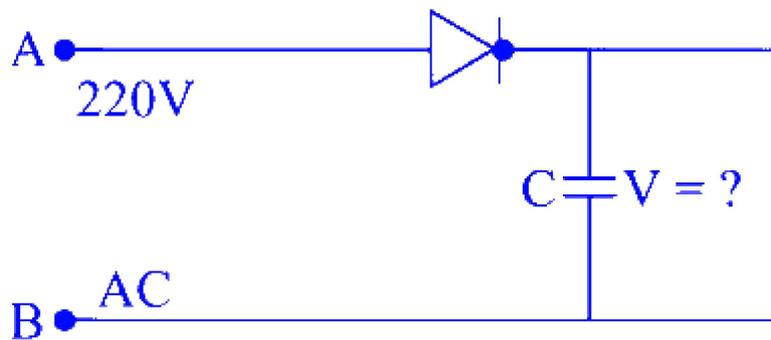


$$f = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{0.5 \times 10^{-3} \times 20 \times 10^{-6}}}$$

$$= \frac{1}{2\pi \times \sqrt{10 \times 10^{-9}}} = \frac{10^4}{2\pi} = 1592.3 \simeq 1592 \text{ Hz}$$

Question20

A 220 V AC supply is connected between points *A* and *B* as shown in figure, what will be the potential difference *V* across the capacitor?



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Options:

- A. 220 V
- B. 110 V
- C. zero
- D. $220\sqrt{2}$ V

Answer: D

Solution:

As *p-n* junction diode conducts electricity during only positive half-cycle (forward biased condition). So, the potential difference across the capacitor is

$V =$ Peak value of input AC voltage

$$= V_0 = V_{\text{rms}} \times \sqrt{2}$$

Given, $V_{\text{rms}} = 220 \text{ V}$

$$\therefore V = 220\sqrt{2} \text{ V}$$

Question21

The frequency of an alternating current is 50 Hz. What is the minimum time taken by current to reach its peak value from rms value?

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Options:

A. $5 \times 10^{-3} \text{ s}$

B. $2.5 \times 10^{-3} \text{ s}$

C. 0.02 s

D. $10 \times 10^{-3} \text{ s}$

Answer: B

Solution:

Given, Frequency of an alternating current, $f = 50 \text{ Hz}$

If t_1 be the time at rms value of alternating current, then

$$I_{\text{rms}} = I_0 \sin \omega t_1 \text{ or } \frac{I_0}{\sqrt{2}} = I_0 \sin \omega t_1$$
$$\Rightarrow \frac{1}{\sqrt{2}} = \sin \omega t_1 \Rightarrow \sin \frac{\pi}{4} = \sin \omega t_1 \Rightarrow t_1 = \frac{\pi}{4\omega} \dots (i)$$

Similarly, If t_2 be time at peak value of alternating current, then $I_0 = I_0 \sin \omega t_2$

$$1 = \sin \omega t_2$$
$$\sin \frac{\pi}{2} = \sin \omega t_2 \Rightarrow \omega t_2 = \frac{\pi}{2}$$
$$t_2 = \frac{\pi}{2\omega}$$

\therefore Minimum time taken by current to reach its peak value from rms value



$$= t_2 - t_1 = \frac{\pi}{2\omega} - \frac{\pi}{4\omega} = \frac{\pi}{4\omega}$$

$$= \frac{\pi}{4 \times 2 \times \pi \times 50} = \frac{1}{400} = 2.5 \times 10^{-3} \text{ s}$$

Question22

An inductor of inductance L and resistor R are joined together in series and connected by a source of frequency ω . The power dissipated in the circuit is

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Options:

- A. $\frac{R^2 + \omega^2 L^2}{V}$
- B. $\frac{V^2 R}{R^2 + \omega^2 L^2}$
- C. $\frac{V}{R^2 + \omega^2 L^2}$
- D. $\frac{V^2 R}{\sqrt{R^2 + \omega^2 L^2}}$

Answer: B

Solution:

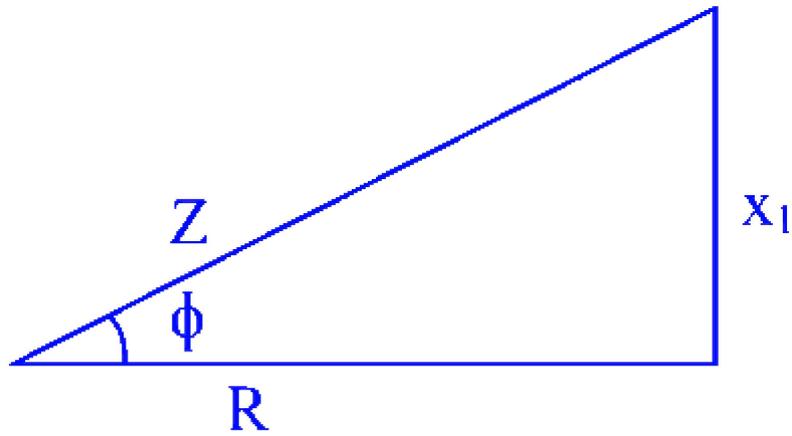
We know, power dissipated in an AC circuit. is given by $P = VI \cos \phi$ (i)

(where, V = rms voltage, I = rms current, ϕ = phase angle between r and I)

Now from Eq. (i) we get

We can draw the impedance triangle as shown below.





From impedance triangle,

$$\cos \phi = \frac{R}{Z}$$

$$P = V \times \frac{V}{Z} \times \frac{R}{Z} = \frac{V^2 R}{Z^2} = \frac{V^2 R}{R^2 + \omega^2 L^2}$$

(here, $Z = \text{impedance} = \sqrt{R^2 + (L\omega)^2}$)

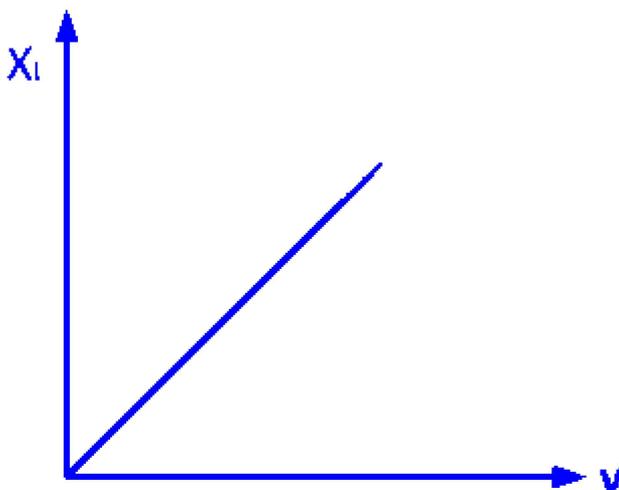
Question23

Which of the following, represents the variation of inductive reactance (X_L) with the frequency of voltage sources (ν) ?

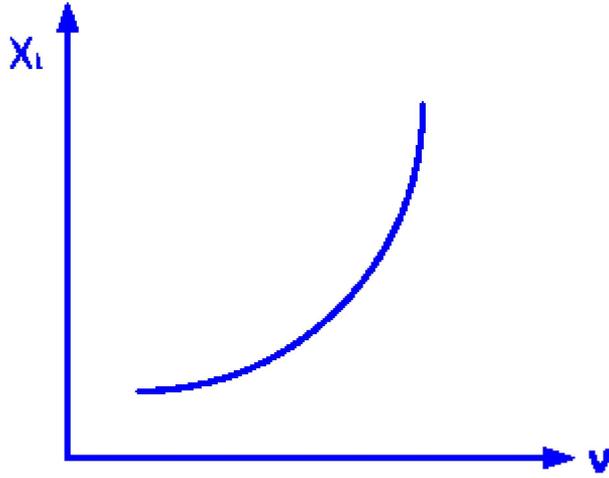
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Options:

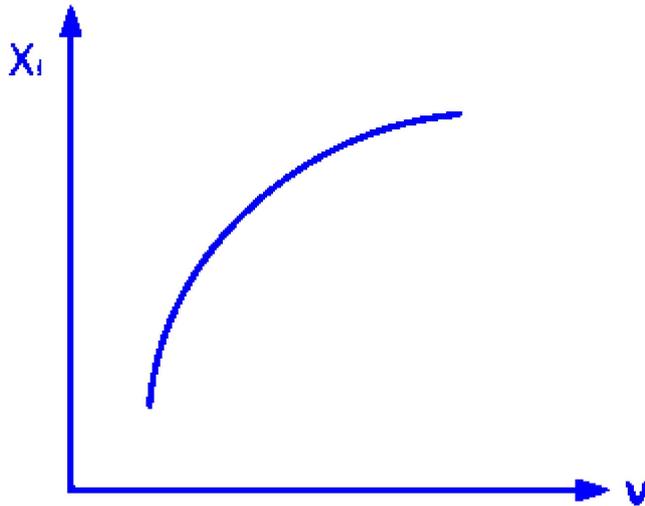
A.



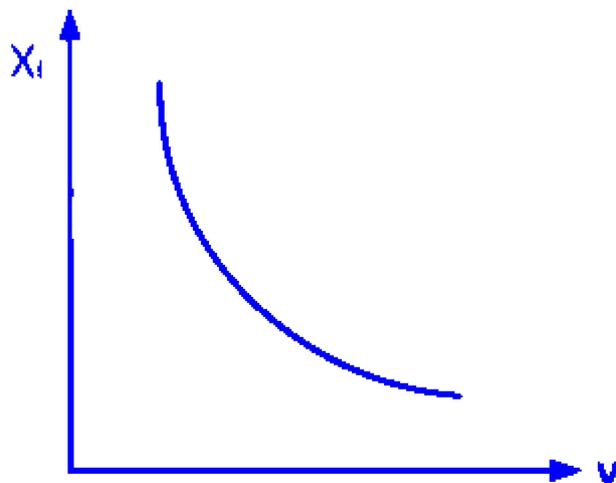
B.



C.



D.



Answer: A

Solution:

Explanation

Inductive reactance, denoted as X_L , is given by the formula:

$$X_L = \omega L = 2\pi v L$$

where:

ω is the angular frequency,

L is the inductance,

v is the frequency of the voltage source.

This equation shows that the inductive reactance is directly proportional to the frequency (v) of the voltage source. Therefore, as the frequency increases, the inductive reactance X_L also increases linearly.

Thus, the relationship between X_L and v is linear, implying that when plotted on a graph, it should form a straight line with a positive slope.

Question24

A 100 W bulb is connected to an AC source of 220 V, 50 Hz. Then, the current flowing through the bulb is

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Options:

A. $\frac{5}{11}$ A

B. $\frac{1}{2}$ A

C. 2 A

D. $\frac{3}{4}$ A

Answer: A



Solution:

To find the current flowing through the bulb, we use the power formula for resistive loads:

$$P = IV,$$

where

P is the power (in watts),

I is the current (in amperes),

V is the voltage (in volts).

Given:

$$P = 100 \text{ W},$$

$$V = 220 \text{ V}.$$

We rearrange the equation to solve for I :

$$I = \frac{P}{V}.$$

Substitute the given values:

$$I = \frac{100}{220} = \frac{10}{22} = \frac{5}{11} \text{ A}.$$

So, the current flowing through the bulb is $\frac{5}{11}$ A, which corresponds to Option A.

Question25

In the series $L - C - R$ circuit, the power dissipation is through

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Options:

A. R

B. L

C. C

D. Both L and C

Answer: A



Solution:

In an ideal series L–C–R circuit, only the resistor dissipates power as heat. The inductor (L) and capacitor (C) store energy in their magnetic and electric fields, respectively, but do not dissipate it.

Here's a brief explanation:

The resistor (R) converts electrical energy into heat, and the power dissipated by it is given by

$$P = I^2R$$

where I is the current through the resistor.

The inductor (L) and capacitor (C) temporarily store energy (in their magnetic and electric fields) and then return it to the circuit. They do not cause any net loss of energy.

Thus, the power loss in the circuit is solely due to the resistor.

If the options are interpreted as follows:

Option A: R (power dissipated here)

Option B: L

Option C: C

Option D: Both L and C

Then the correct answer is Option A.

Question26

In Karnataka, the normal domestic power supply AC is 220 V, 50 Hz. Here, 220 V and 50 Hz refer to

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Options:

A. peak value of voltage and frequency

B. ms value of voltage and frequency



C. mean value of voltage and frequency

D. peak value of voltage and angular frequency

Answer: B

Solution:

In domestic AC supplies like in Karnataka, the 220 V is not the peak voltage but the effective (or RMS: root mean square) value of the voltage. Meanwhile, 50 Hz indicates that the AC voltage completes 50 cycles every second. Let's break it down:

Effective (RMS) Voltage:

For a sinusoidal voltage, the effective value is calculated from the peak value using the formula:

$$V_{\text{rms}} = \frac{V_{\text{peak}}}{\sqrt{2}}$$

Thus, a 220 V RMS value corresponds to a peak voltage of approximately 311 V.

The RMS value is used because it reflects the equivalent DC voltage in terms of the power delivered.

Frequency:

The 50 Hz means the AC voltage cycles 50 times per second.

It is simply the standard frequency of the alternating current and is not an angular frequency (which would be measured in radians per second).

Considering the options:

Option A: Incorrect because 220 V is not the peak value.

Option B: Indicates "rms value of voltage and frequency". Here, "rms" is intended to represent the effective (RMS) value. This is the correct interpretation.

Option C: Incorrect because the mean (or average) value of a pure AC sinusoid over a complete cycle is zero.

Option D: Incorrect because 220 V is not a peak value and 50 Hz is not an angular frequency.

Therefore, the correct choice is Option B.

Question27

A coil of inductive reactance $1/\sqrt{3}\Omega$ and resistance 1Ω is connected to a 200 V, 50 Hz AC supply. The time lag between maximum voltage and current is

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Options:

A. $\frac{1}{200}$ s

B. $\frac{1}{300}$ s

C. $\frac{1}{500}$ s

D. $\frac{1}{600}$ s

Answer: D

Solution:

The coil has an inductive reactance $X_L = \frac{1}{\sqrt{3}} \Omega$ and resistance $R = 1 \Omega$. We need to determine the time lag between the maximum voltage and current when connected to a 200 V, 50 Hz AC supply.

To find this, we start by calculating the phase angle ϕ using the tangent of the phase angle:

$$\tan \phi = \frac{X_L}{R} = \frac{1/\sqrt{3}}{1} = \frac{1}{\sqrt{3}}$$

Then, the phase angle ϕ is:

$$\phi = \tan^{-1} \left(\frac{1}{\sqrt{3}} \right) = 30^\circ$$

Now, we convert the phase angle to radians to find the time lag:

$$\omega t = \frac{\pi}{6}$$

Solving for t :

$$t = \frac{\pi}{6\omega} = \frac{\pi}{6 \times 2\pi f}$$

Simplifying further:

$$t = \frac{1}{12f}$$

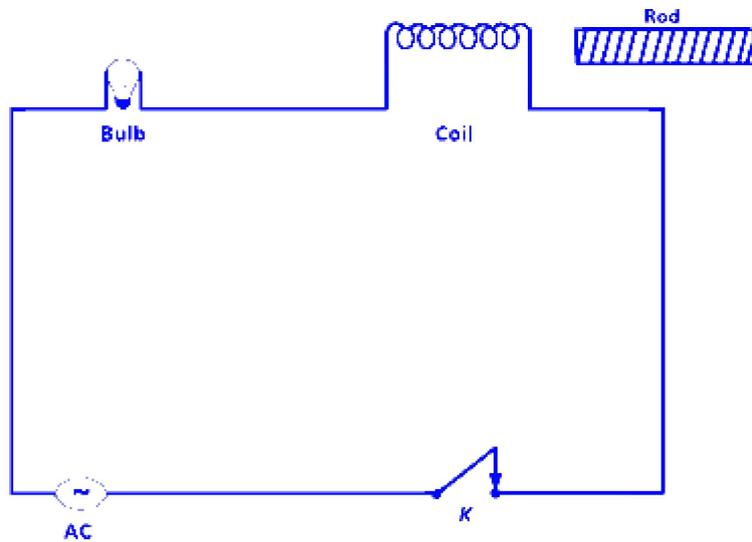
Given the frequency $f = 50$ Hz:

$$t = \frac{1}{12 \times 50} = \frac{1}{600} \text{ s}$$

Therefore, the time lag between maximum voltage and current is $\frac{1}{600}$ s.

Question28

In the A.C. circuit shown, keeping ' K ' pressed, if an iron rod inserted into the coil, the bulb in the circuit,



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Options:

- A. glows less brightly
- B. glows with same brightness (as before the rod is inserted)
- C. gets damaged
- D. glows more brightly

Answer: A

Solution:

When a rod is inserted into the coil, then its inductance increases. Therefore, current through the bulb will decrease and also brightness decreases.

Question29

The output of a step down transformers is measured to be 48 V when connected to a 12 W bulb. The value of peak current is

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Options:

- A. $\frac{1}{\sqrt{2}}$ A



B. $\sqrt{2}$ A

C. $\frac{1}{2\sqrt{2}}$ A

D. $\frac{1}{4}$ A

Answer: C

Solution:

Given:

Output of the step-down transformer, $V_s = 48$ V

Power associated with the secondary coil, $P_s = 12$ W

To find the current in the secondary coil, use the formula:

$$I_s = \frac{P_s}{V_s} = \frac{12}{48} = \frac{1}{4} = 0.25 \text{ A}$$

The amplitude of the current, I_0 , is calculated as follows:

$$I_0 = I_s \sqrt{2} = 0.25 \times \sqrt{2} = \frac{\sqrt{2}}{4} = \frac{1}{2\sqrt{2}} \text{ A}$$

