PHYSICS

BOOKS - CENGAGE PHYSICS (ENGLISH)

ALTERNATING CURRENT

Illustrations

1. The electric mains in a house are marked 220V-50Hz. Write down the equation for instantaneous voltage.

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2. The plate on the back of a personal computer says that it draws 2.7 A from a 120-V, 60-Hz line. For this computer, what is (a)

the average of the square of the current, (b) the current amplitude, (c) the average current for a positive half cycle, and (d) the average current for a full cycle?

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3. An alternating current is given by the following equation: $I = 3\sqrt{2}\sin(100\pi t + \pi/4)$. Give the frequency and rms value of the current.

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4. A voltage , $E = 60\sin(314t)$, is applied across a resistor of 20Ω . What will be the reading of I_{rms}.

(a) in an ac ammeter?

(b) in an ordinary moving coil ammeter in series with the resistor?

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5. Suppose you want the current amplitude in a pure inductor in a radio receiver to be $250\mu A$ when the voltage amplitude is $3.60V$ at a frequency of 1.60 MHz,(corresponding to the upper is 3.60 V AM broadcast band). What inductive reactance is needed? What inductance is required?

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6. A pure inductance of 1.0H is connected across a 110V, 70Hz Source. Find the (a) reactanace, (b) current and (c) peak value of current.

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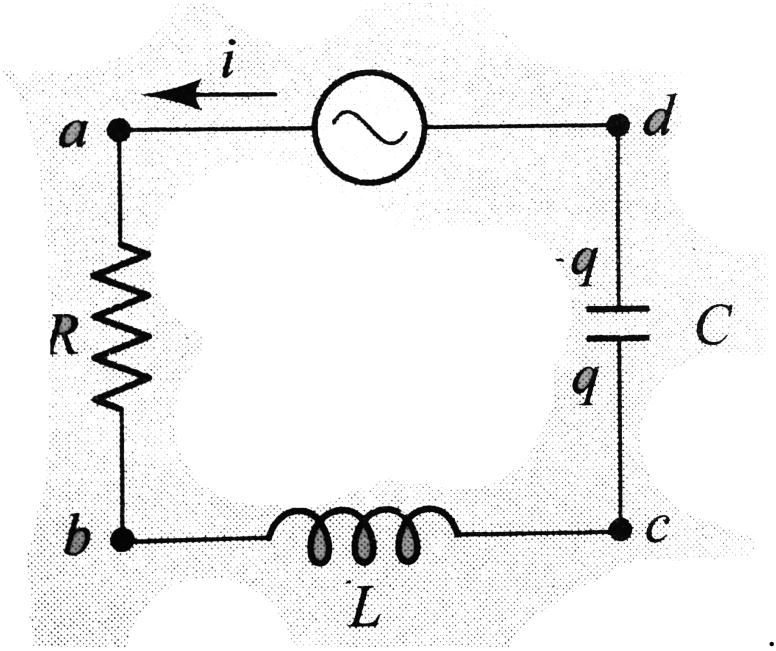
7. In the series curcuit of fig, suppose $R = 300\Omega, L = 60mH, C = 0.50(\mu)F,$ source amplitude is $E_0 = 50V$ and $\omega = 10000rads^{-1}$. Find the reactances X_L and X_C, the impedance Z and the current amplitude I_0.



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8. The numerical value of the ratio of instantaneous velocity to instantaneous speed is.

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9. A 200Ω resistor is connected in series with a $5(\mu)F$ capacitor. The voltage across the resistor is $V_R = (1.20V)\cos\left(2500 rads^{-1}\right)t$.

(a) Derive an expression for the circuit current.

(b) Determine the capacitive reactance of the capacitor.

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10. A 200Ω resistor and 1H inductor are joined in series with an ac source of emf $10\sqrt{2}\sin(200t)V$. Calculate the phases difference between emf and current.

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11. A lamp with a resistance of 8Ω is connected to a choke coil. This arrangement is connected to an alternating source of 110V. The current in the circuit is 11A. The frequency of the ac is 60 Hz. Find

(a) the impedance of the circuit and

(b) the value of inductive reactance of the choke coil.

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12. A resistor of 200 Ω and a capacitor of 15.0μF are connected in series to a 22V. 50Hz ac source. (a) Calculate the current in the circuit. (b) Calculate the voltage (rms) across the resistor and the capacitor. Is the algebraic sum of these voltages more than the source voltage? if yes, resolve the paradox.

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13. In a series L-R circuit (L = 35 mH and $R = 11\Omega$),a variable emf source $(V = V_0 \sin \omega t)$ of $V_{rms} = 220V$ and frequency 50 Hz is applied. The current amplitude in the circuit is

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14. The potential difference E and current I flowing through the ac circuit is given by $E = 5\cos(\omega t - \pi/6)V$ and $I = 10\sin(\omega)tA$. Find the average power dissipated in the circuit.

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15. A series LCR circuit with L = 0.12 H, C = 480 nF, R = 23 Ω is connected to a 230 V variable frequency supply. (a) What is the source frequency for which current amplitude is maximum.

Obtain this maximum value. (b) What is the source frequency for which average power absorbed by the circuit is maximum. Obtain the value of this maximum power. (c) For which frequencies of the source is the power transferred to the circuit half the power at resonant frequency? What is the current amplitude at these frequencies? (d) What is the Q-factor of the given circuit?

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Solved Examples

1. A $25(\mu)F$ capacitor, a 0.1 H inductor and a 25Ω resistor are connected in series with an ac source of emf $E = 310\sin 314t$. Find

(a) the frequency of the emf

(b) the impedance of the circuit

(c) the current in the circuit.

(d) the phase angle

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2. A circuit containing a 80 mH inductor and a 60 μF capacitor in series is connected to a 230 V, 50 Hz supply. The resistance of the circuit is negligible. (a) Obtain the current amplitude and rms values. (b) Obtain the rms values of potential drops across each element. (c) What is the average power transferred to the inductor? (d) What is the average power transferred to the capacitor? (e) What is the total average power absorbed by the circuit? ['Average' implies 'averaged over one cycle'.]

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3. An emf $E = 100 \sin 314tV$ is applied across a pure capacitor of $637(\mu)F$. Find

(a) the instantaneous current I

(b) the instantaneous power p.

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4. A radio can be turned over a frequency range from $500kHz \to 1.5MHz$. If its L-C circuit has an effective inductance of $400(\mu)H$, what is the range of its variable capacitor.

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5. Obtain the resonant frequency and Q-factor of a series LCR circuit with $L = 3.0H, C = 27(\mu)F,$ and $R = 7.4\Omega$. How will

you improve the shapness of resonance of the circuit by a factor of 2 by readucing its full width at half maximum?

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6. An inductive circuit draws a power 550 W from a 220V-50Hz source. The power factor of the circuit is 0.8. The current in the circuit lags behind the voltage. Show that a capacitor of about $\frac{1}{42\pi} \times 10^{-2} F$ will have to be commected in the circuit to bring its power factor to unity.

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Exercise 5 1

1. Can we use 15 Hz ac for lightig purpose?

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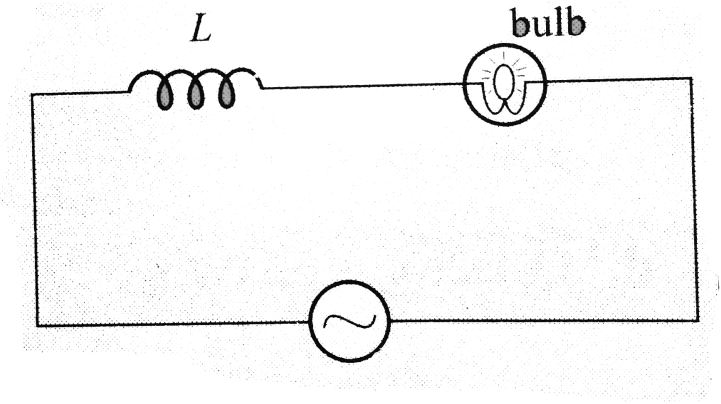
2. A soft iron rod is inserted in the solenoid. After this what will be the effect on the brightness of the bulb?



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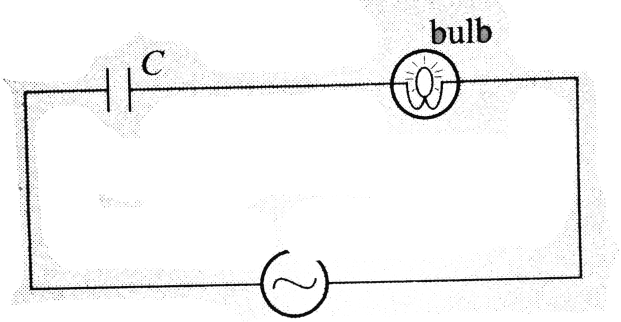
3. In the circuit, shown in fig. what will be the effect on the brightness of blub if frequency of the source ω is increased?



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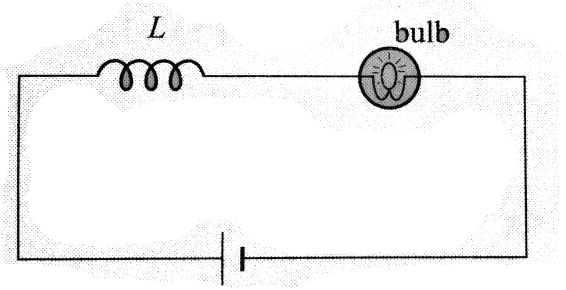
4. An soft iron rod is inserted in the inductor, what will be the effect on the brightness of the bulb?



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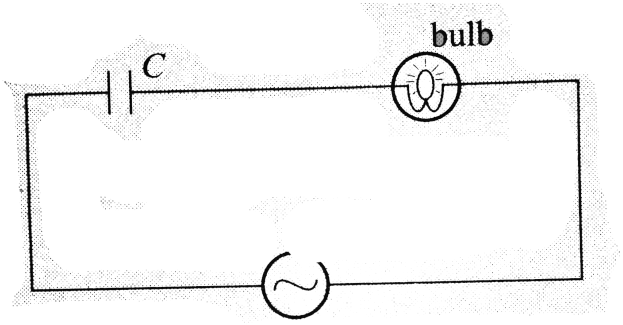

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6. In the above question, what will be the effect on the brightness of bulb if capacitance C is reduced?

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7. An inductor wire has some resistnce R when connected to dc. It is connected to an ac source. Now the impedance of the wire will be more than R. (ture/false)

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8. The element of an electric heater is in the form of a coil. Once it is heated by dc volatage and then by ac voltage of equal potential difference. Will the production of heat in both cases be same of different?

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9. When L and C are in series, voltage across them is in phase (True/false). The current in them is in phase (true/false).

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10. In a series LCR circuit, the frequency of the source is more than resonance frequency. The current in the circuit leads the voltage in phases(True/false).

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11. In a series LCR circuit, voltage drop axross L can be more than applied voltage (True/false).

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12. For circuits used for transporting elecrtric power, a low power factor impleis larger power loss in transmission. Explain?

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13. At very high frequency of ac, capacitor behave like a conductor.

(True/false)

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14. For a series LCR circuit the power loss at resonance is : -

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15. Can we have resonance in LR or CR circuits?

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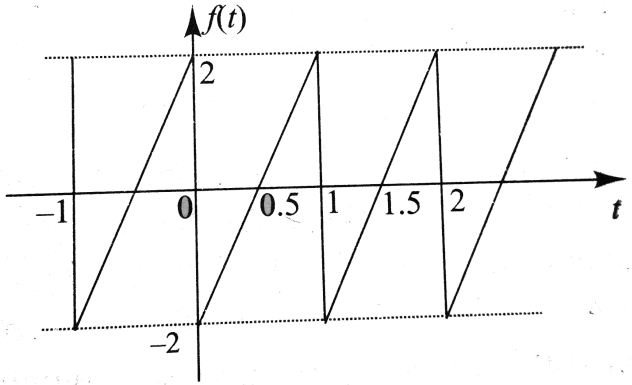
Exercises Subjective

1. Find the rms and the average values of the saw tooth waveform shown in fig.



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2. An inductor 20×10^{-3} a capacitor $100(\mu)F$ and a resistor 50Ω are connected in series across a source of emf $V = 10\sin 314t$. Then the energy dissipated in the circuit in 20 mim is

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3. Show graphically that the average of simusoidally varying current in half cycle may of may not be zero.

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4. Current in an ac circuit is given by $i = 2\sqrt{2}\sin[(\pi t + ((\pi)/4)]$. Then find the average value of current during time t=0 to t=1 s.

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5. Find the effective value of current.

$i = 2\sin 100(\pi)t + 2\cos(100\pi t + 30^\circ)$.

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6. When a voltage $V_s = 200\sqrt{2}\sin(100t)V$ is applied to an ac circuit the current in the circuit is found to be $i = 2\sin[\omega t + (\pi/4)]A$. Find the average power consumed in the circuit.

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7. An alternating voltage E = $200\sqrt{2}$sin(100t) is connected to a μF capacitor through an AC ammeter. The reading of the ammeter shall be

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8. In an RC series circuit the rms voltage of source is 200V and its frequency is 50 Hz, if $R = 100\Omega$ and $C = \frac{100}{\pi}(\mu)F$, find

(a) impedance of the circuit.

(b) power factor angle,

(c) power factor,

(d) current,

(e) maximum current

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9. An ac source of angular frequency ω is fed across a resistor R and a capacitor C in series. The current registered is I. If now the freqency of source is chaged to $(\omega)/3$ (but maintainging the same voltage), the current in the circuit is found to be halved. Calculate the ration of hte reactance to resistance at the original frequency ω.

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10. A $9/100(\pi)$ inductor and a 12Ω resistanace are connected in series to a 225 V, 50 Hz ac source. Calculate the current in the circuit and the phase angle between the current and the source voltage.

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11. When an inductor coil is connected to an ideal battery of emf 10V, a constant current 2.5 A flows. When the same inductor coil is connected to an ac source of 10V and 50 HZ then the current is 2A. Find out the inductance of the coil.

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12. A bulb is rated at 100V, 100W. It can be treated as a resistor. Find out the inductance of an inductor (called choke coil) that

should be connected in series with the bulb at its rated power with the help of an ac source of 200V and 50Hz.

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13. A choke coil is needed to operate an arc lamp at 160 V (rms) and 50 Hz. The lamp has an effective resistance of 5Ω when running at 10 A (rms). Calculate the inductance of the choke coil. If the same arc lamp is to be operated on 160 V (DC), what additionalresistance is required ? Compare the power loses in both cases.

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14. A coil of inductance 0.50H and resistance 100 Ω is connected to a 240V. 50Hz ac supply.

(a) What is the maximum current in the coil? (b) What is the time lag between the voltage maximum and the current maximum?

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15. A 100 μF capacitor in series with a 40Ω resistance is connected to a 110V, 60Hz supply.

(a) What is the maximum current in the circuit? (b) What is the time lag between the current maximum and the voltage maximum?

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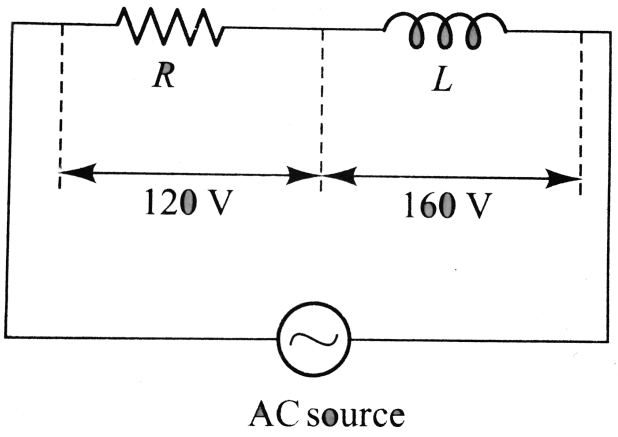
Exercises Single Correct

1. The circuit given in fig. has a resistanceless choke coil L and a resistance R. The voltage across R and L are also given in the figure. The virtual value of the applied voltage is



A. 100V

B. 200V

C. 300V

D. 400V

Answer: B

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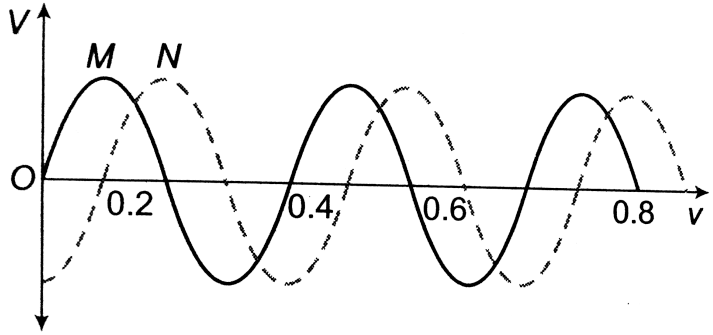
2. Two sinusoidal voltage of the same frequency are shown in the diagram. What is the frequency, and the phase relationship between the voltage? Frequency in Hz phase lead of N over M in radius .



A. Frequency/Hz =0.4, phase lead of N over M in rad $s^{-1} = -\frac{\pi}{4}$

B. Frequency/Hz =2.5, phase lead of N over M in rad $s^{-1} = -\frac{\pi}{2}$

C. Frequency/Hz =2.5, phase lead of N over M in rad $s^{-1} = 2\frac{\pi}{2}$

D. Frequency/Hz =2.5, phase lead of N over M in rad $s^{-1} = -\frac{\pi}{4}$

Answer: B

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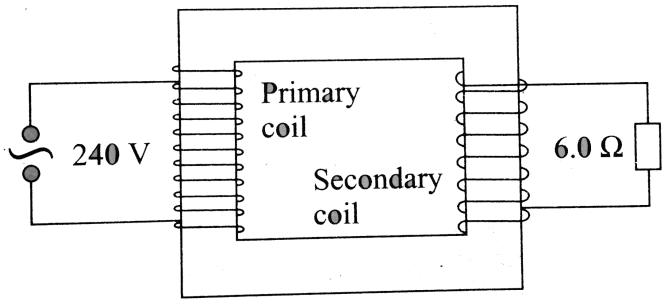
3. Figure shows an iron-cored transformer assumed to be 100% efficient. The ratio of the secondaty turns to the primary turns is 1:20.



A 240 V ac supply is connected to the primary coil and a 6Ω resistor is connected to the secondary coil. What is the current in the primary coil?

A. 0.10A

B. 0.14A

C. 2A

D. 40A

Answer: A

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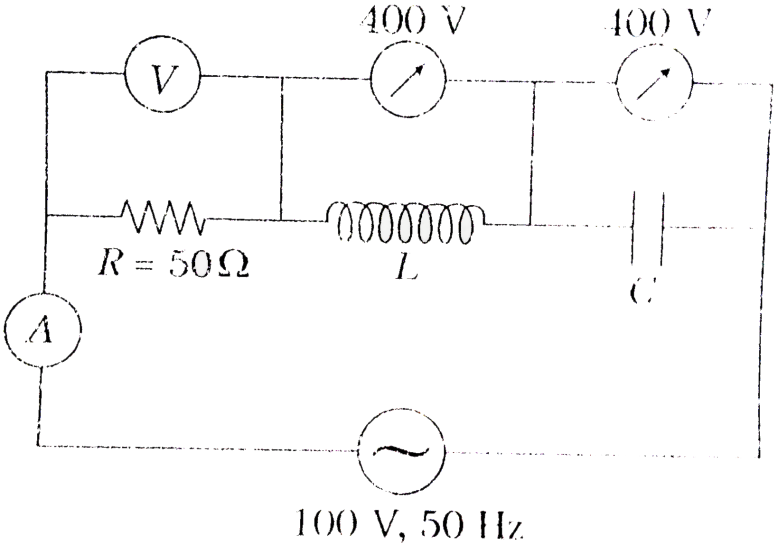
4. In the series L-C-R circuit , the voltmeter and ammeter readings are



A. $V = 100V, I = 2A$

B. $V = 100V, I = 5A$

C. $V = 1000V, I = 2A$

D. $V = 300V, I = 1A$

Answer: A

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5. In an AC - circuit , the current lags behind the voltage by $\pi/3$. The components in the circuit may be

A. 1A

B. 1.5A

C. 2A

D. 2.5A

Answer: C

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6. The rms value of an AC of 50Hz is 10 A. the time taken by an alternating current in reaching from zero to maximum value and the peak value of current will be

A. $2 \times 10^{-2} s$ and $14.14 A$

B. $1 \times 10^{-2} s$ and $7.07 A$

C. $5 \times 10^{-3} s$ and $7.07 A$

D. $5 \times 10^{-3} s$ and $14.14 A$

Answer: D

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7. The peak value of an alternating emf E given by

E = $\underset{o}{E}$ cos ωt

is 10 V and frequency is 50 Hz . At time t = (1/600) s, the instantaneous value of emf is

A. 10V

B. $5\sqrt{3} V$

C. $5V$

D. 1 V

Answer: B

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8. A coil has a inductance of 0.7π H and is joined in series with a resistance of 220Ω. When an alternating emf of 220V at 50 cps is applied to it, then the watt-less component of the current in the circuit is $(take 0.7\pi = 2.2)$

A. 5A

B. 0.5A

C. 0.7A

D. 7A

Answer: B

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9. When 100V. DC is applied across a solenoid a current of 1A flows in it. When 100V, AC is applied across the same coil, the current drops to 0.5A. The frequency of the AC is 50Hz. The impendence and inductance of the solenoid are

A. $200\Omega \text{ and } 0.55H$

B. $100\Omega \text{ and } 0.86H$

C. $200\Omega \text{ and } 0.1H$

D. $100\Omega \text{ and } 0.93H$

Answer: A

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10. An ideal inductive coil has a resistance of 100Ω When an ac signal of frequency $1000Hz$ is applied to the coil the voltage leads the current by 45° The inductance of the coil is .

A. 2 mH

B. 3.3 mH

C. 16 mH

D. $\sqrt{5}mH$

Answer: C

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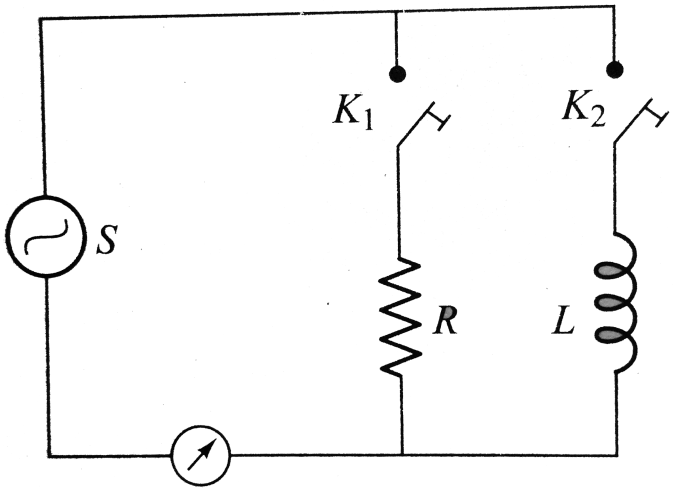
11. In the circuit shown in fig. R is a pure resistor, L is an inductor of ngligibe resistance (as compared to R), S is a 100 V , 50 Hz ac

source of negligible resistnce. With either kiy $(K-1)$alone or (K_2) alone closed, the current is (I_0). If the source os changed to 100 V, 100 Hz the current with (K_1) alone closed and with (K_2) alone closed will be, respectively.



A. $(I_0), \frac{I_0}{2}$

B. $(I_0), 2(I_0)$

C. $2(I_0), (I_0)$

D. $2(I_0), \frac{I_0}{2}$

Answer: A

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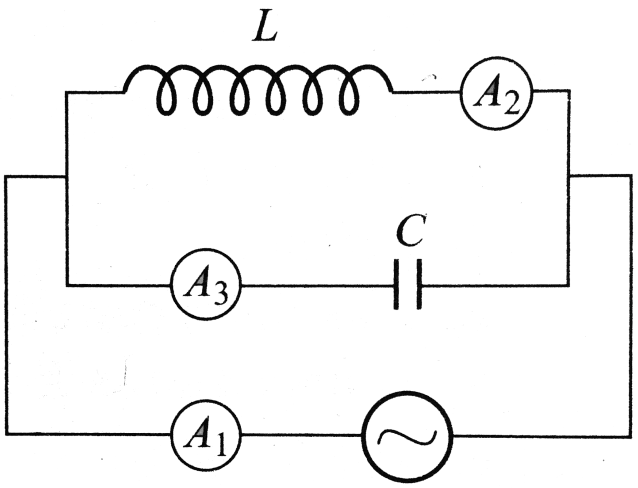
12. For the circuit shown in fig, the ammeter A_2 reads 1.6A and ammeter (A_3) reads 0.4A. Then



A. (A) $\omega = \frac{4}{\sqrt{LC}}$

B. (B) $f = \frac{2\pi}{\sqrt{LC}}$

C. (C)The ammeter (A_1) reads 1.2 A

D. (D)the ammeter (A_1) reads 2A

Answer: C

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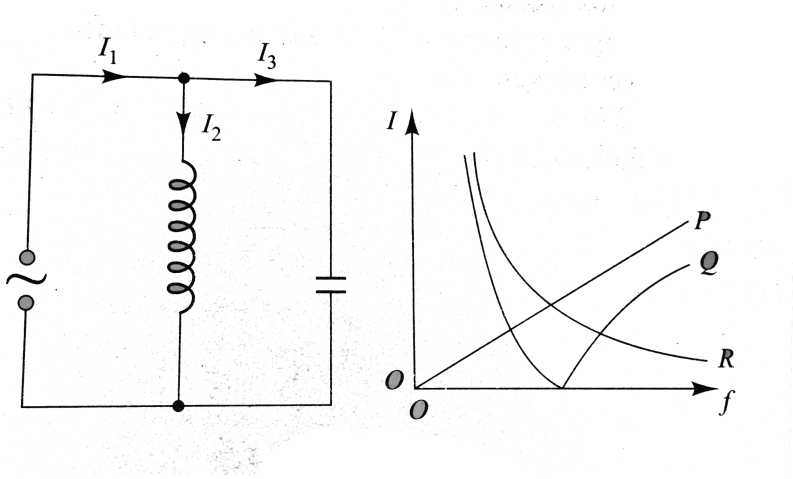
13. In the circuit shown if fig, the rms currents (I_1), (I_2) and(I_3) are altered by varying the frequency f of the oscillator. The output voltage of the oscillator remains sinusoidal and has a fixed amplitude.

When curves in figure correctly indicate the variation with

frequency of the currents $(I_1), (I_2),$ and (I_3).



A. (A) $(I_1) = Q, (I_2) = Q, (I_3) = Q$

B. (B) $(I_1) = R, (I_2) = Q, (I_3) = Q$

C. (C) $(I_1) = Q, (I_2) = P, (I_3) = R$

D. (D) $(I_1) = Q, (I_2) = R, (I_3) = P$

Answer: D

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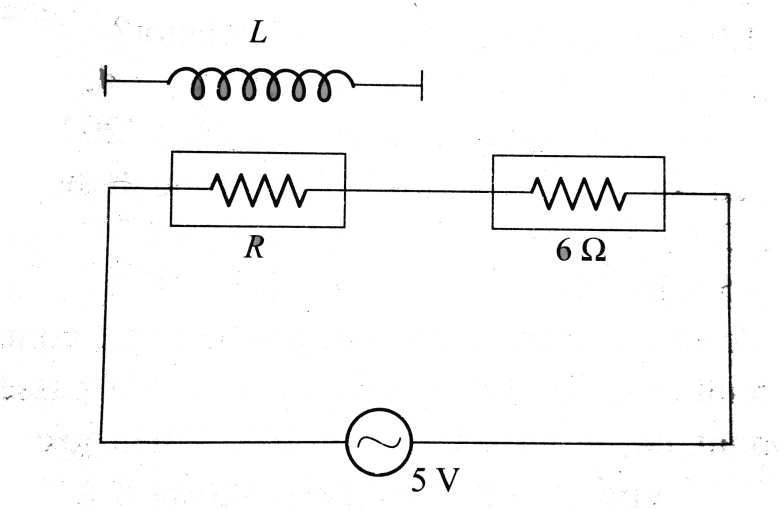
14. Two resistor are connected in series across a 5 V rms source of alternating potential. The potential difference across 6Ω resistor is 3V. If R is replaced by a pure inductor L of such magnitude that current reamins same. Then the pontential difference across L is



A. (A) 1 V

B. (B) 2 V

C. (C) 3 V

D. (D) 4 V

Answer: D

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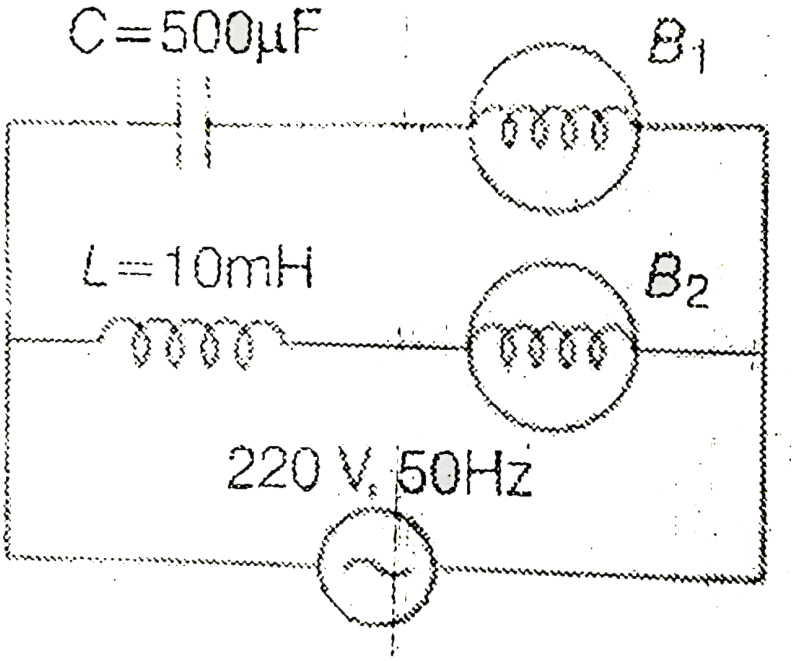
15. In the circuit shown in the figure, if both the bulbs B_1 and B_2 are identical



A. (A) their brightness will be the same

B. (B) (B_2) will be brighter than (B_1)

C. (C) (B_1) will be brighter than (B_2)

D. (D) only (B_2) will glow because the capacitor has infinite impedance

Answer: B

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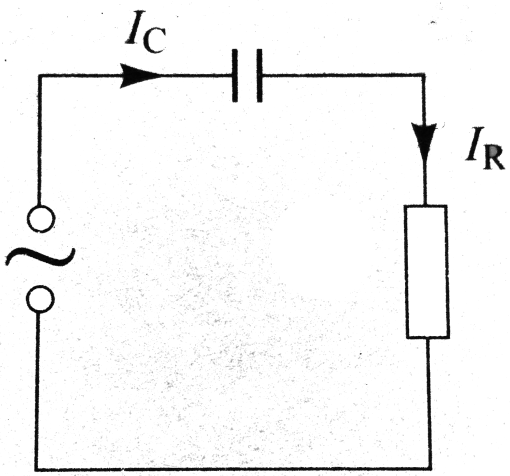
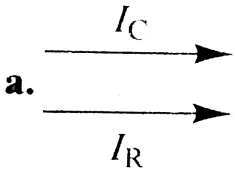
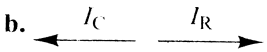
16. figure, shows a source of alternating voltage connected to a capacitor and a resistor. Which of the following phasor diagrams correctly describes the phase relationshop between (I_C) the current between the source and the capacitor and (I_R) the

current between the source and the resistor?

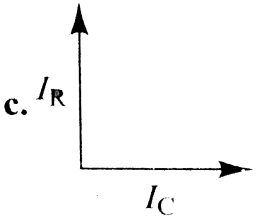




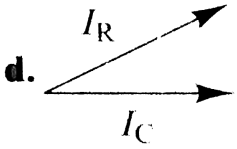
A.



B.



C.

d. 

D.

Answer: B

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17. A sinusoidal alternating current of peak value (I_0) passes through a heater of resistance R. What is the mean power output of the heater?

A. (A) $I_0^2 R$

B. (B) $\frac{I_0^2 R}{2}$

C. (C) $2I_0^2 R$

D. (D) $\sqrt{2} I_0^2 R$

Answer: B

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18. Power factor is one for

A. (A) pure resistor

B. (B) pure inductor

C. (C) pure capacitor

D. (D) either an inductor or a capacitor

Answer: A

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19. A resistance of 20ohms is connectred to a source of an alternating potential V=220 sin (100 pi). The time taken by the current to change from its peak value to r.m.s value is

A. (A) $0.2s$

B. (B) $0.25s$

C. (C) $2.5 \times 10^{-3}s$

D. (D) $2.5 \times 10^{-3}s$

Answer: D

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20. In LCR circuit currnet resonant frequency is 600Hz and half power points are at 650 and 550 Hz. The quality factor is

A. (A) $\frac{1}{6}$

B. (A) $\frac{1}{3}$

C. (C) 6

D. (D) 3

Answer: C

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21. An ac voltage is represented by

$E = 220\sqrt{2}\cos(50\pi)t$

How many times will the current become zero in 1 s?

A. (A) 50 times

B. (B) 100 times

C. (C) 30 times

D. (D) 25 times

Answer: A

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22. A resistor and an inductor are connected to an ac supply of 120 V and 50 Hz, the current in the circuit is 3 A. If the power consumed in the circuit is 108 W, then the resistance in the circuit is

A. (A) 12Ω

B. (B) 40Ω

C. (C) $\sqrt{(52 \times 28)}\Omega$

D. (D) 360Ω

Answer: A

Watch Video Solution

23. A transmitter transmits at a wavelength of 300 m. A condenser of capacitance $2.4(\mu)F$ is being used. The value of the inductance for the resonant circuit is approximately

A. (A) $10^{-4}H$

B. (B) $10^{-6}H$

C. (C) $10^{-8}H$

D. (D) $10^{-10}H$

Answer: C

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24. A capacitor of capacitance $1\mu F$ is charged to a potential of 1V . It is connected in parallel to an inductor of inductance 10^{-3}H. The maximum current that will flow in the circuit has the value

A. (A) $\sqrt{1000}mA$

B. (B) $1mA$

C. (C) $1(\mu)A$

D. (D) $1000mA$

Answer: A

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25. Using an AC voltmeter, the potential difference in the electrical line in a house is found to be 234 V. If the line frequency

is known to be 50 cycles per second, the equatioin for the line voltage is

A. (A) $V = 165 \sin(100\pi t)$

B. (B) $V = 331 \sin(100\pi t)$

C. (C) $V = 220 \sin(100\pi t)$

D. (D) $V = 440 \sin(100\pi t)$

Answer: B

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26. An inductance and a resistance are connected in series with an AC potential . In this circuit

A. (A) the current and the PD across the resistance lead the PD across the inductance

B. (B) the current and the PD across the resistance lag behid the PD across the inductance by an angle $(\pi)/(2)$.

C. (C) the current and the PD across the resistance lag behid the PD across the inductance by an angle (π).

D. (D) the PD across the resistance lag behind the PD across the inductance by an angle $(\pi)/(2)$ but the current in resistance leads the PD across the inductance by $(\pi)/(2)$.

Answer: B

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27. A resistor and a capacitor are connected to an ac supply of 200 V, 50 Hz, in series. The current in the circuit is 2A. If the power

consumed in the circuit is 100 W then the resistance in the circuit is

A. (A) 100Ω

B. (B) 25Ω

C. (C) $\sqrt{125 \times 75}\Omega$

D. (D) 400Ω

Answer: B

Watch Video Solution

28. A resistor and capacitor are connected to an ac supply of 200 V, 50 Hz in series. The current in the circuit is 2 A. If the power consumed in the circuit is 100 W then in the above question, the capacitive reactance in the circuit is

A. 100Ω

B. 25Ω

C. $\sqrt{125 \times 75}\Omega$

D. 400Ω

Answer: C

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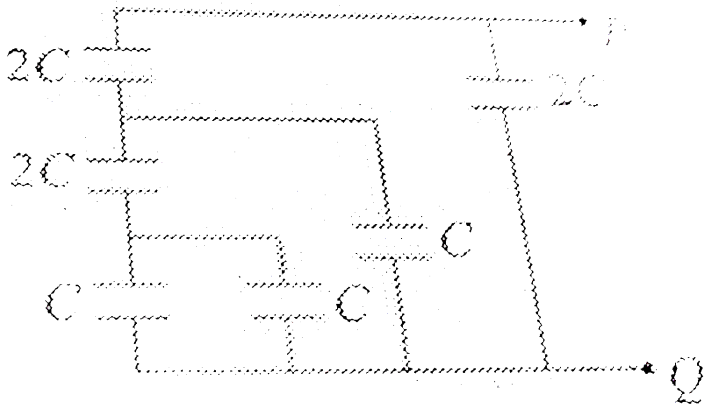
29. The resultant capacitance of given circuit is



A. $\frac{100}{100\pi} f$

B. $\frac{25}{100\pi} F$

C. $\frac{\sqrt{125 \times 75}}{100\pi} F$

D. $\frac{1}{100\pi\sqrt{125 \times 75}} F$

Answer: D

Watch Video Solution

30. In a series LCR circuit the voltage across the resistance, capacitance and inductance is 10V each. If the capacitance is short circuited, the voltage across the inductance will be

A. (A) 10 V

B. (B) $10/(\sqrt{2})V$

C. (C) $(10/3)V$

D. (D) $20V$

Answer: B

Watch Video Solution

31. An ideal choke takes a current of 10 A when connected to an ac supply of 125 V and 50 Hz. A pure resistor under the same conditions takes a current of 12.5 A. If the two are connected to an ac supply of 100 V and 40 Hz, then the current in series combination of above resistor and inductor is

A. (A) $10/\sqrt{2}A$

B. (B) 12.5 A

C. (C) 20A

D. (D) 10A

Answer: A

Watch Video Solution

32. A direct current of 5 amp is superimposed on an alternating current $I = 10 \sin \omega t$ flowing through a wire. The effective value of the resulting current will be:

A. (A) $(15/2)A$

B. (B) $5\sqrt{3}A$

C. (C) $5\sqrt{5}A$

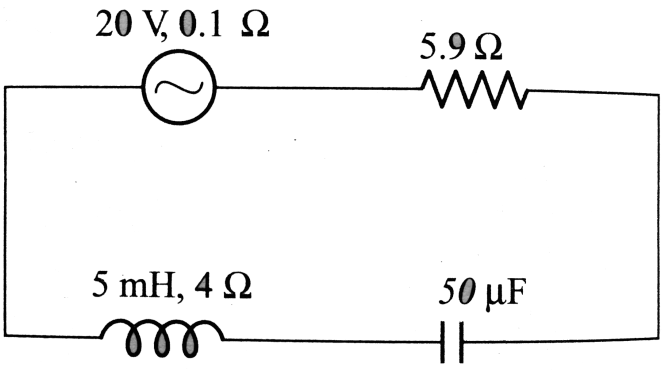
D. (D) $15A$

Answer: B

Watch Video Solution

33. In the circuit of fig, the source freqency is $\omega = 2000 rads^{-1}$.

The current in the will be



A. (A) $2A$

B. (B) $3.3A$

C. (C) $2/\sqrt{5}A$

D. (D) $\sqrt{5}A$

Answer: A

Watch Video Solution

34. 110 $\underset{rms}{V}$ is applied across a series circuit having resistance 11Ω and impedance 22Ω . The power consumed is

A. (A) $275W$

B. (B) $366W$

C. (C) $550W$

D. (C) $1100W$

Answer: A

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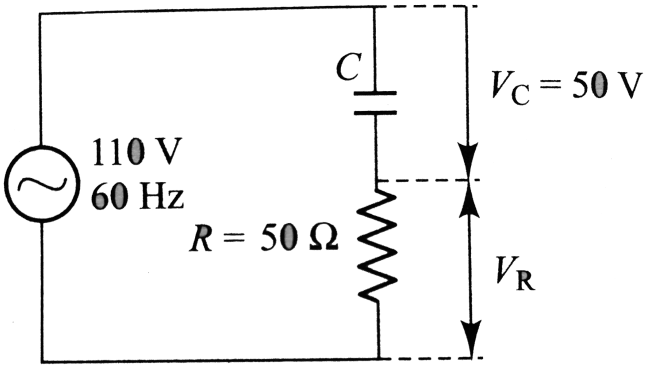
35. In the circuit given in fig. $(V_C) = 50V$ and $R = 50\Omega$. The values of C and (V_R) are



A. (A) $3.3mF, 60V$

B. (B) $104\mu F, 98V$

C. (C) $52\mu F, 98V$

D. (D) $2\mu F, 60V$

Answer: B

Watch Video Solution

36. A 220-V, 50 Hz, ac generator is connected to an inductor and a 50Ω resistance in series. The current in the circuit is $1.0A$. What is the PD across inductor?

A. (A) $102.2V$

B. (B) $186.4V$

C. (C) $214V$

D. (D) $170V$

Answer: C

Watch Video Solution

37. An $8(\mu)F$ capacitor is connected across a 220√2 V, 50 Hz line. What is the peak value of charge through the capacitor?

A. (A) $2.5 \times 10^{-3} C$

B. (B) $2.5 \times 10^{-4} C$

C. (C) $5 \times 10^{-5} C$

D. (D) $7.5 \times 10^{-2} C$

Answer: A

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38. A DC ammeter and n AC thermal ammeter are connected to a circuit in series. When a direct current is passed through the cirucit, the DC ammeter shows. $i_1 = 6A$. When a sinusoidal alternating current flows through the cirucit, the DC ammeter shows $i_2 = 8A$. If both i_1 and i_2 are passed through the circuit

A. dc=6 A, ac=10A

B. dc=3 A, ac=5A

C. dc=5 A, ac=8A

D. dc=2 A, ac=3A

Answer: A

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39. Current in an AC circuit is given by $i = 3\sin\omega t + 4\cos\omega t$, then

A. $\frac{I_1 + I_2}{2}$

B. $\left(\frac{I_1 + I_2^2}{\sqrt{2}}\right)$

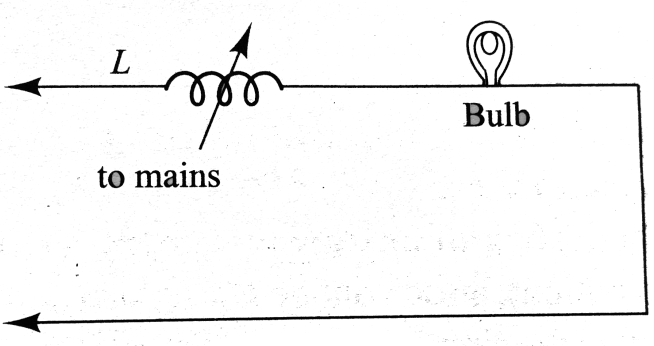
C. $\sqrt{\frac{I_1^2 + I_2^2}{2}}$

D. $\frac{I_1^2 + I_2^2}{2}$

Answer: C

Watch Video Solution

40. A typical light dimmer used to dim the stage lights in a theater consists of a variable induction for L (where inductance is adjustable between zero and $L_{\max}$) conneced in series with a light bulb B as shown in fig. the mains electrical supply is 220 V at 50 Hz, the light bulb is rated at 220 V, 1100 W. What $(L_{\max})$ is required if the rate of energy dissipated in the light blub is to be varied by a factor of 5 from its upper limits of 1100 W?



A. (A) 0.69H

B. (B) 0.28 H

C. (C) 0.38 H

D. (D 0.56 H

Answer: B

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41. Two alternating voltage generators produce emfs of the same amplitude(E_0) but with a phase difference of $(\pi)/3$. The resultant emf is

A. (A) $E_0 \sin[\omega t + (\pi)/3)]$

B. (B) $E_0 \sin[\omega t + (\pi)/6)]$

C. (C) $\sqrt{3}E_0 \sin[\omega t + (\pi)/6)]$

D. (D) $\sqrt{3}E_0 \sin[\omega t + (\pi)/2)]$

Answer: C

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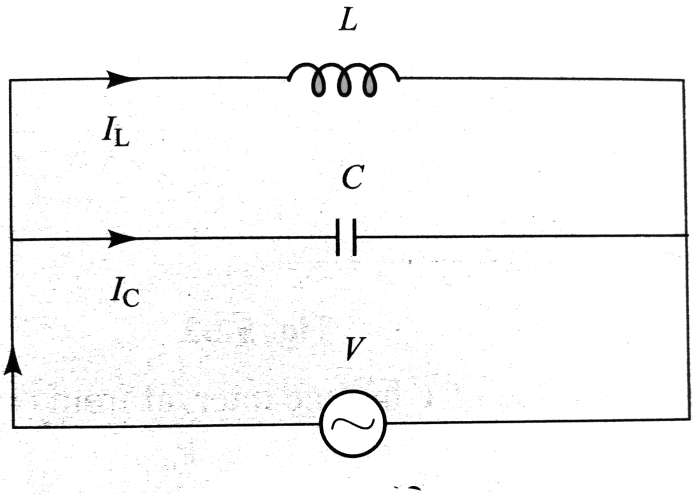
42. For the circuit shown in fig, current in inductance is 0.8A while that in capacitance is 0.6 A. What is the current drawn from the source?



A. $0.1A$

B. $0.3A$

C. $0.6A$

D. $0.2A$

Answer: D

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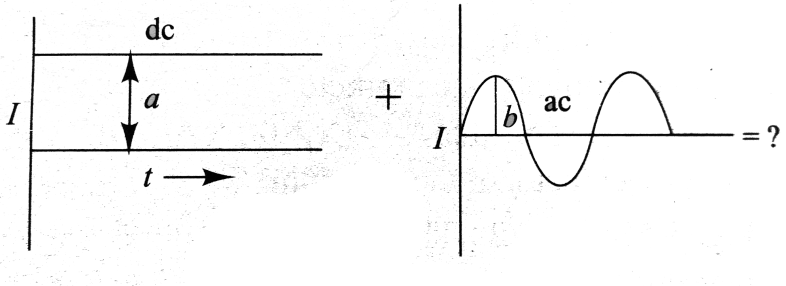
43. If a direct current of value a ampere is superimposed on an alternative current I=b $\sin\omega t$ flowing through a wire, what is the effective value of the resulting current in the circuit?



A. $\left[a^2 - \frac{1}{2}b^2\right]^{1/2}$

B. $\left[a^2 + b^2\right]^{1/2}$

C. $\left[\frac{a^2}{2} + b^2\right]^{1/2}$

D. $\left[a^2 + \frac{1}{2}b^2\right]^{1/2}$

Answer: D

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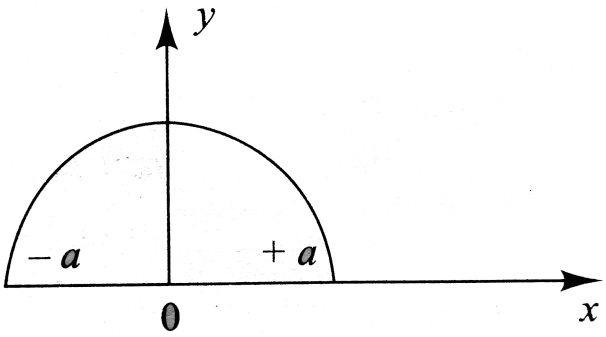
44. Determine the rms value of a semi-circular current wave which has a maximum value of a.



A. $(1/\sqrt{2})a$

B. $\sqrt{(3/2)a}$

C. $\sqrt{(2/3)a}$

D. $(1/\sqrt{3})a$

Answer: C

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45. An alternating voltage E = $200\sqrt{2}\sin(100t)$ is connected to a μ F capacitor through an AC ammeter. The reading of the ammeter shall be

A. $10mA$

B. $5mA$

C. $5\sqrt{2}mA$

D. $10\sqrt{2}mA$

Answer: B

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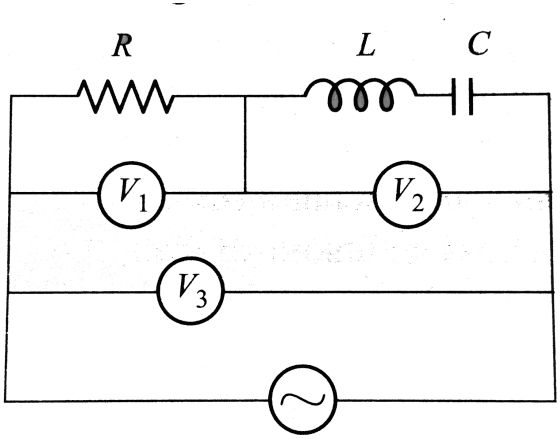
46. Which voltmeter will give zero reading at resonance?



A. (V_1)

B. (V_2)

C. (V_3)

D. None

Answer: B

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47. A 50 W, 100V lamp is to be connected to an ac mains of 200V, 50 Hz. What capacitor is essential to be put in series with the lamp?

A. $\frac{25}{\sqrt{2}}(\mu)F$

B. $\frac{50}{\pi\sqrt{2}}(\mu)F$

C. $\frac{50}{\sqrt{2}}(\mu)F$

D. $\frac{100}{\pi\sqrt{3}}(\mu)F$

Answer: B

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48. A capacitor of $10(\mu)F$ and an inductor of 1 H are joined in series. An ac of 50 Hz is applied to this combination. What is the impedance of the combination?

A. $\frac{5(\pi^2 - 5)}{\pi}\Omega$

B. $\frac{10(10 - \pi^2)}{\pi}\Omega$

C. $\frac{10(\pi^2 - 5)}{\pi}\Omega$

D. $\frac{5(10 - \pi^2)}{\pi}\Omega$

Answer: B

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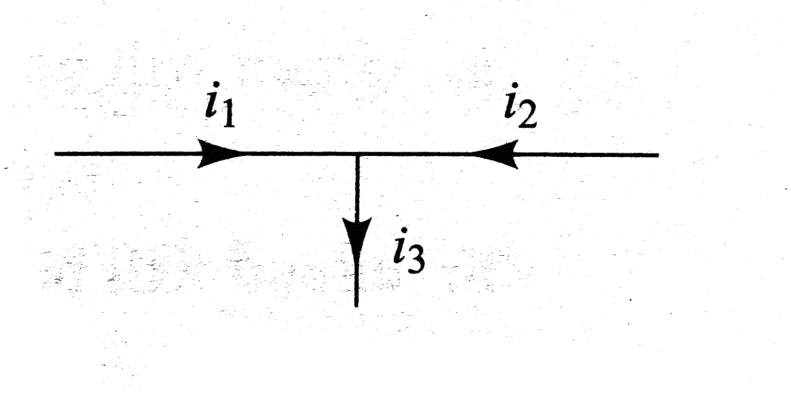
49. If $i_1 = 3\sin\omega t$ and $(i_2) = 4\cos\omega t$, then (i_3) is



A. $5\sin(\omega t + 53^\circ)$

B. $5\sin(\omega t + 37^\circ)$

C. $5\sin(\omega t + 45^\circ)$

D. $5\sin(\omega t + 35^\circ)$

Answer: A

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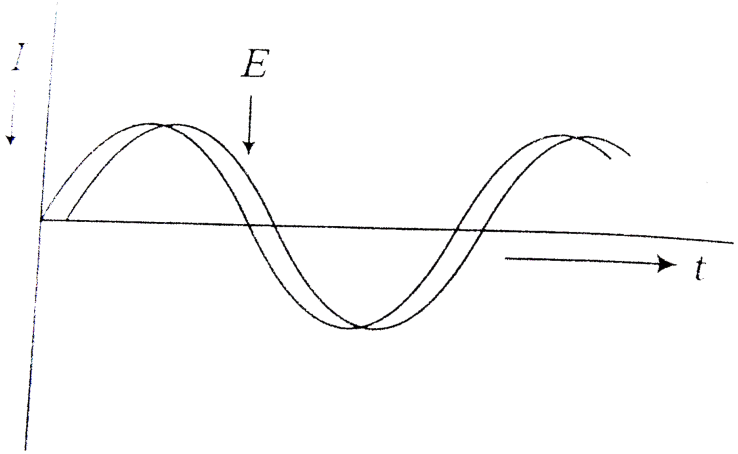
50. When an AC source of emf $E = E_0\sin(100t)$ is connected across a circuit, the phase difference between the emf E and the current I is observed be $\frac{\pi}{4}$, as shown in the figure. If the circuit consists possibly only of R-C or R-L in series, which of the

following combinations is possible?



A. $R = 1k\Omega, C = 10(\mu)F$

B. $R = 1k\Omega, C = 1(\mu)F$

C. $R = 1k\Omega, L = 10(\mu)F$

D. $R = 1k\Omega, L = 1(\mu)F$

Answer: A

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51. In an ac circuit the potential differences across an inductance and resistance joined in series are, respectively, 16 V and 20 V. The total potential difference across the circuit is

A. 20 V

B. 25.6 V

C. 31.9 V

D. 53.5 V

Answer: B

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52. Current in an ac circuit is given by $I = 3\sin\omega t + 4\cos\omega t$, then

A. rms value of current is 5A.

B. mean value of this current in any one half period will be $(6/\pi)$.

C. If voltage applied is $V = V_m \sin \omega t$, then the circuit may be containing resistance and capacitance only.

D. If voltage applied is $V = V_m \sin \omega t$, then the circuit may be contain resostamce and inductance only.

Answer: C

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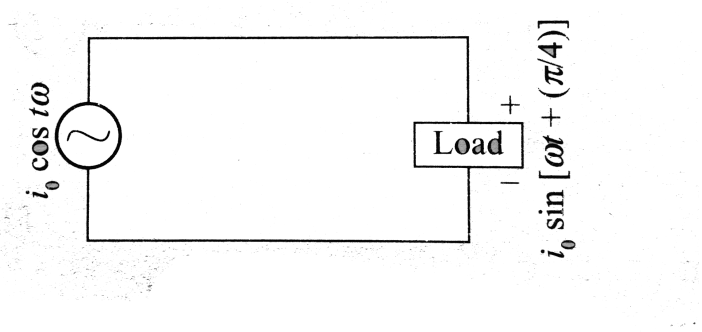
53. A current source sends a current $I = (i_0)\cos(\omega t)$, When connected across an unknown load, it gives a voltages output of $v = v_0 \sin[\omega t + (\pi/4)]$ across that load. Then the voltage across

the current source may bebroaught in phase with the current through it by



A. Connecting an inductor in series with the load

B. Connecting an capactor in series with the load

C. Connecting an inductor in parallel with the load

D. Connecting an capactor in parallel with the load

Answer: A

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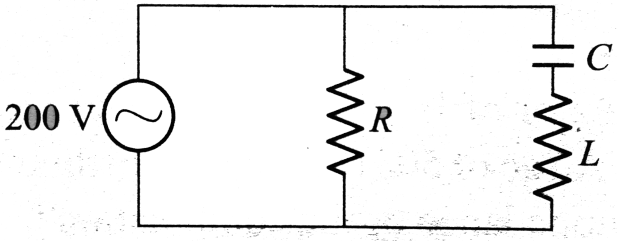
54. In the circuit shown in fig. $X_C = 100\Omega, (X_L) = 200\Omega$ and $R = 100\Omega$. The effective current through the source is



A. $2A$

B. $2\sqrt{2}A$

C. $0.5A$

D. $\sqrt{0.4}A$

Answer: B

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55. For an LCR series circuit with an aac 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. circuit will be leading voltage if $\omega > \frac{1}{\sqrt{LC}}$

Answer: C

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56. The value of current in two series LCR circuits at resonance is same, then

A. both circuits must be having same value of capacitance and inductance

B. in both circuits ratio of L and C will be same

C. for both the circuits $(X_L)/(X_C)$ must be same at that frequency

D. both circuits must have same impedance at all frequencies

Answer: C

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57. In series L-C-R circuit voltage drop across resistance is 8 V and across inductor is 6 V and across capacitor is 12 V . Then

A. voltage of the source will be leading current in the circuit

B. voltage drop across each element will be less than the applied voltage.

C. power factor of circuit will be $4/3$

D. none of these.

Answer: D

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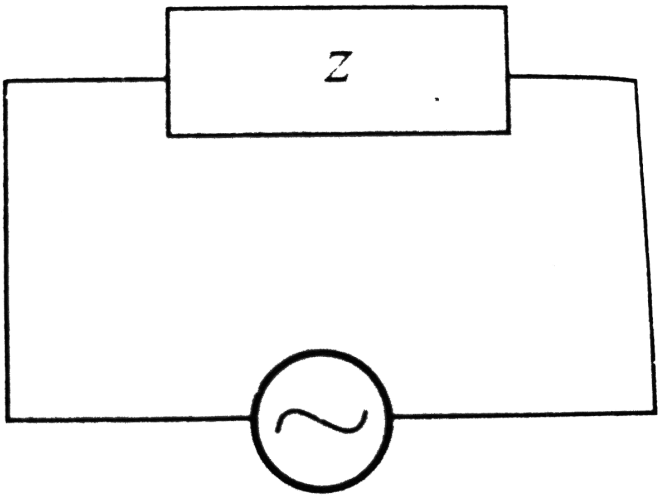
58. In a black box of unknown elements (L or R or any other combination), an ac voltage $E = E_0 \sin(\omega t) + \phi)$ is applied and current in the circuit was found to be

$I = (I_0)\sin[\omega t + \phi + (\pi/4)]$. Then the unknown elements in the box may be



A. only capacitor

B. inductor and resistor both

C. either capacitor, resistor, and inductor or only capacitor and resistor

D. only resistor

Answer: C

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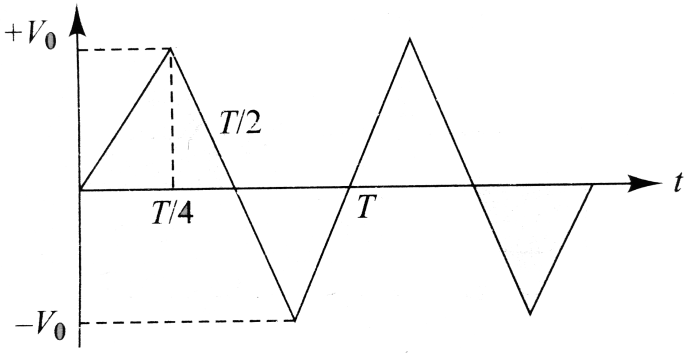
59. The voltage time (V-t) graoh for triangular wave having peak value (V_0) is as shown in fig. The rms value V in time interval $t = 0$ to $t = T/4$ is



A. $\frac{V_0}{\sqrt{3}}$

B. $\frac{V_0}{2}$

C. $\frac{V_0}{\sqrt{2}}$

D. none of these.

Answer: A

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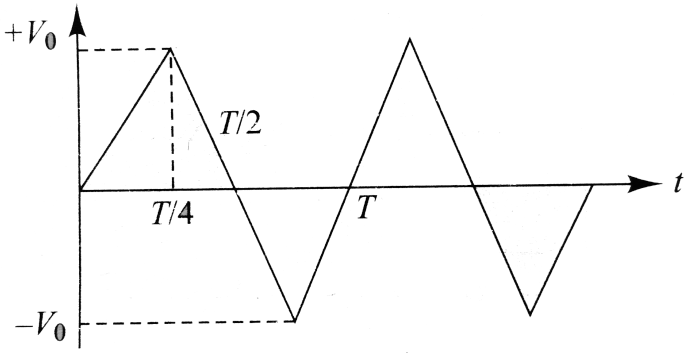
60. The average value of voltage (V) in one time period will be



A. $\frac{V_0}{\sqrt{3}}$

B. $\frac{V_0}{2}$

C. $\frac{V_0}{\sqrt{2}}$

D. 0

Answer: D

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61. What reading would you expact of a square-wave current, suitching rapodly between +0.5 A and -0.5 A, when passed through an ac ammeter?

A. 0

B. 0.5A

C. 0.25A

D. 1.0A

Answer: B

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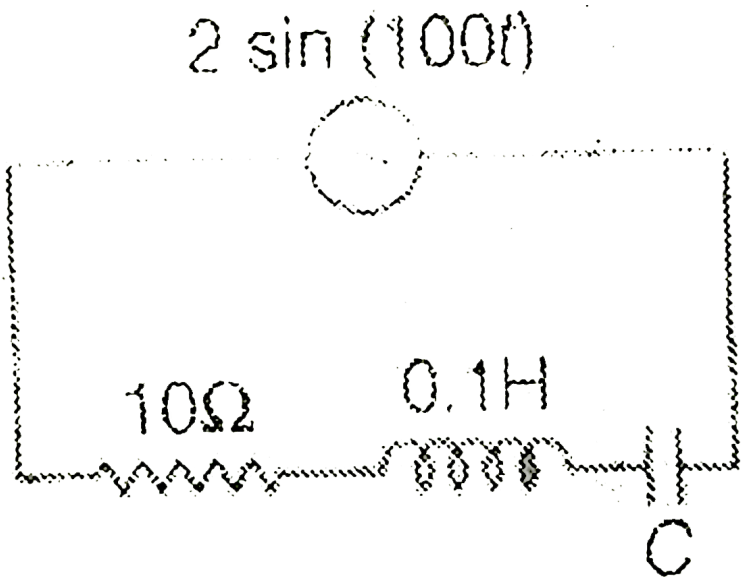
62. The power factor of the circuit is $\left.\frac{1}{\sqrt{2}}\right)$. The capacitance of the circuit is equal to



A. $400(\mu)F$

B. $300(\mu)F$

C. $500(\mu)F$

D. $200(\mu)F$

Answer: C

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63. In an ideal transformer, the voltagae and the current in the primary coil are 200V and 2 A, respectively. If the voltage in the secondary coil is 200 V, then the value of current in the secondary coil will be

A. 0.2A

B. 2A

C. 10A

D. 20A

Answer: A

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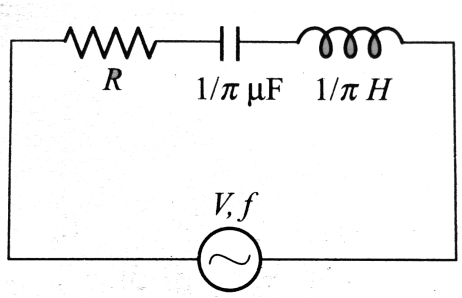
Exercises Multiple Correct

1. In an ac circuit shown in fig , the supply voltage has a constant rms value v but variable frequency f. At resonance, the circuit



A. has current I given by $I = \frac{V}{R}$

B. has a resonance frequenv=cy 500 Hz

C. has a voltage across the capacitor which is 180° out of phase with that across the inductor

D. Has a current given by $I = \frac{V}{\sqrt{R^2 + \left(\frac{1}{\pi} + \frac{1}{\pi}\right)^2}}$

Answer: A::C

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2. Resonance occures in a series LCR circuit when the frequency of the applied emf is 1000 Hz.

A. when frequency = 900Hz then the current through the voltage source will be ahead of emf of the source

B. the impedance of the circuit is minimum at $f = 1000Hz$

C. at only resonance the voltages across L and C differ in phase by 180°

D. if the value of C is double, resonance occurs at $f = 2000Hz$.

Answer: A::B

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3. Which of the following statements is true? Heat produced in a current carrying conductor depends upon

A. the time for which the current flows in the conductor

B. the resistance of the conductor

C. the strength of the current

D. the nature of current

Answer: A::C::D

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4. A choke coil of resistance 5Ω and inductance 0.6 H is in series with a capacitance of $10(\mu)F$. If a voltage of 200 V is applied and the frequency is adjusted to resonance, the current and voltage across the inductance and capacitance are $(I_0), (V_0)$ and (V_1) respectively. we have

A. $(I_0) = 40A$

B. $(V_0) = 9.8kV$

C. $(V_1) = 9.8kV$

D. $(V_1) = 19.6kV$

Answer: A::B::C

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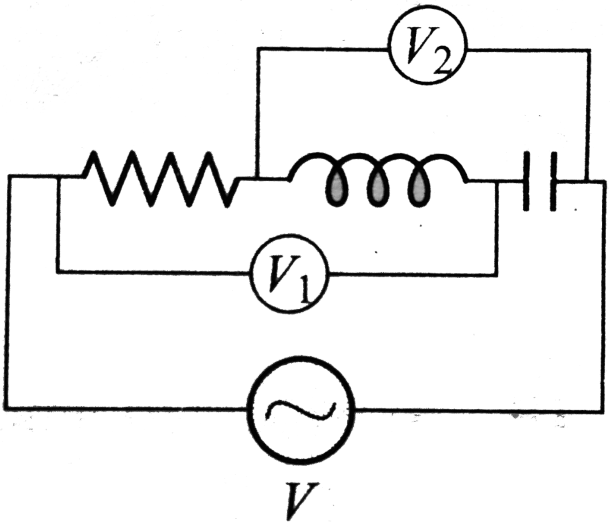
5. In an RLC series circuit shown in fig. the reading of voltmeters (V_1) and (V_2) are 100 V and 200 V respectively. The source voltage is 130 V. for this situation, mark out the correct statements (s).



A. Voltage across resistor inductor and capacitor are 50 V $50\sqrt{3}V$, and$120 + 50\sqrt{3}$ V, respectively

B. Voltage across resistor inductor and capacitor are 50 V $50\sqrt{3}V$, and $120 - 50\sqrt{3}V$, respectively

C. Power factor of the corcuit is $\frac{5}{13}$

D. The circuit is capactive in nature

Answer: A::C::D

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Exercises Assertion Reasoning

1. Statement 1: In the purely resistive element of a series LCR, ac circuit the maximum value of rms current increase with increase in the angular frequency of the applied emf.

Statement 2: $I_{\max} = \frac{\varepsilon_{\max}}{Z}, Z = \sqrt{R^2 + \left(\omega L - \frac{1}{(\omega C)^2}\right)}$,

where $(I_{\max})$ is the peak current in a cycle.

A. Statement 1 is true, statement 2 is true, Statement 2 is the correct explanation for statement 1.

B. Statemet 1 is True, Statement 2 is true , Statement 2 is NOT the correct explanation for Statement 1

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is true

Answer: D

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2. Statement 1: In a series LCR circuit at resonance condition power consumed by ciccuit is maximum.

Statement 2 : At resonance condition, the effective resistance of circuit is maximum.

A. Statement 1 is true, statement 2 is true, Statement 2 is the correct explanation for statement 1.

B. Statemet 1 is True, Statement 2 is true , Statement 2 is NOT the correct explanation for Statement 1

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is true

Answer: C

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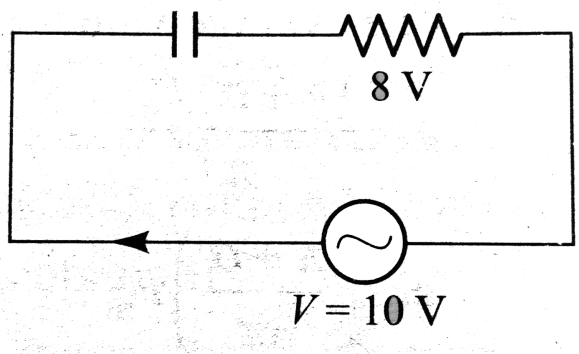
3. Statement 1: KVL rule is also being applied in ac circuit shown in fig. (V_C) in the circuit =2V

Statement 2:vc in the ckt is 2 volt



A. Statement 1 is true, statement 2 is true, Statement 2 is the correct explanation for statement 1.

B. Statemet 1 is True, Statement 2 is true , Statement 2 is NOT the correct explanation for Statement 1

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is true

Answer: C

Watch Video Solution

4. An inductor, a capacitor, and a resistor are connected in series. The combination is connected across an ac source.

Statement 1: Peak current through each remains same.

Statement 2: Average power dielivered by source is equal to average power developed across resistance.

A. Statement 1 is true, statement 2 is true, Statement 2 is the correct explanation for statement 1.

B. Statemet 1 is True, Statement 2 is true , Statement 2 is NOT the correct explanation for Statement 1

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is true

Answer: B

Watch Video Solution

Watch Video Solution

5. Assertion : An alternating current does not show any magnetic effect.

Reason : Alternating current does not vary with time.

A. Statement 1 is true, statement 2 is true, Statement 2 is the correct explanation for statement 1.

B. Statemet 1 is True, Statement 2 is true , Statement 2 is NOT the correct explanation for Statement 1

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is true

Answer: B

Watch Video Solution

6. Statement 1: Both dc and ac can be measured by a hot wire instrument.

Statement 2: the hot wire instrument is based on the principle of magnetic effect of current.

A. Statement 1 is true, statement 2 is true, Statement 2 is the correct explanation for statement 1.

B. Statemet 1 is True, Statement 2 is true , Statement 2 is NOT the correct explanation for Statement 1

C. Statement 1 is True, Statement 2 is False.

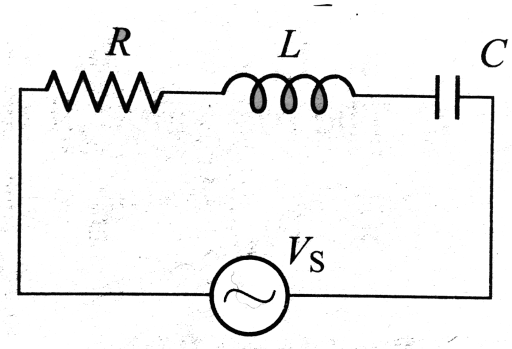
D. Statement 1 is False, Statement 2 is true

Answer: C

 Watch Video Solution

7. Statement 1: In a series RLC circuit if $(V_R), (V_L)$ and (V_C) denote rms voltage across R,L and C respectively and (V_S) is the rms voltage across the source. Then $(V_s) = (V_R) + (V_L) + (V_C)$

Statement 2: In ac circuit, Kirchhoff's voltage law is correct at every instant of same.



A. Statement 1 is true, statement 2 is true, Statement 2 is the correct explanation for statement 1.

B. Statemet 1 is True, Statement 2 is true , Statement 2 is NOT the correct explanation for Statement 1

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is true

Answer: D

Watch Video Solution

Exercises Linked Comprehension

1. If the voltage in an ac circuit is reparesented by the equation $V = 220\sqrt{2}\sin(314t - \phi)$, calculate

rms value of the voltage

A. 220 V

B. 314 V

C. $220\sqrt{2}V$

D. $200/\sqrt{2}V$

Answer: A

Watch Video Solution

2. If the voltage in an ac circuit is reparesented by the equation $V = 220\sqrt{2}\sin(314t - \phi)$, calculate

average voltage

A. 220 V

B. $622/(\pi V)$

C. $220/\sqrt{2}V$

D. $200\sqrt{2}V$

Answer: B

Watch Video Solution

3. If the voltage in an ac circuit is reparesented by the equation $V = 220\sqrt{2}\sin(314t - \phi)$, calculate

frequency of ac

A. $50Hz$

B. $50\sqrt{2}Hz$

C. $50/\sqrt{2}Hz$

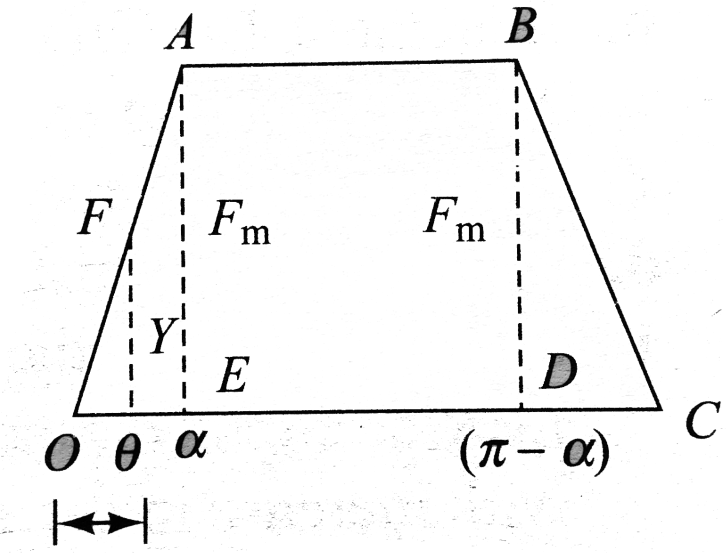
D. $75Hz$

Answer: A

Watch Video Solution

4. The half cycle of an alternating singnal is shown in fig. It increases uniformly form zero at $0^\circ \to F_mat(\alpha)^\circ$ and decrease

uniformly from $(F_m) at 180^\circ$



The effective value of the singnal is

A. $F_m \sqrt{\left(1 - \frac{4\alpha}{3\pi}\right)}$

B. $F_m \sqrt{\left(1 + \frac{4\alpha}{3\pi}\right)}$

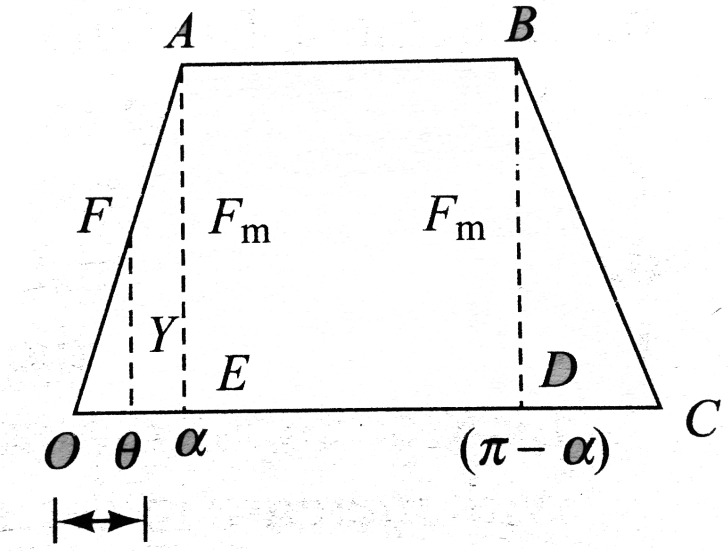
C. $F_m \sqrt{\left(1 - \frac{3\alpha}{4\pi}\right)}$

D. $F_m \sqrt{\left(1 + \frac{3\alpha}{4\pi}\right)}$

Answer: A

Watch Video Solution

5. The half cycle of an alternating singnal is shown in fig. It increases uniformly form zero at $0^\circ \rightarrow F_m at(\alpha)^\circ$ and decrease uniformly from $(F_m) at 180^\circ$



The average value of the singnal is

A. $\frac{(\pi + \alpha)F_m}{\pi}$

B. $\frac{(\pi - \alpha)F_m}{\pi}$

C. $\left(\frac{\pi+\alpha}{3\pi}\right)F_m$

D. $\left(\frac{2\pi+\alpha}{2\pi}\right)F_m$

Answer: B

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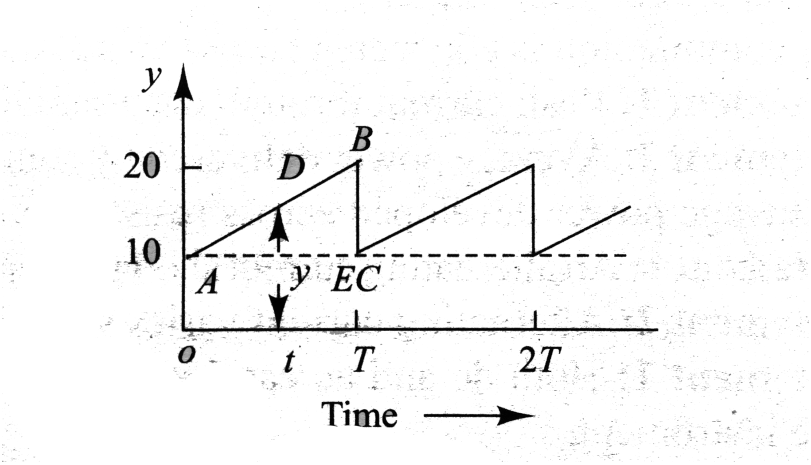
6.



the average value of the wave-from shown in fig. is

A. $15\sqrt{2}$

B. $10\sqrt{2}$

C. 10

D. 15

Answer: D

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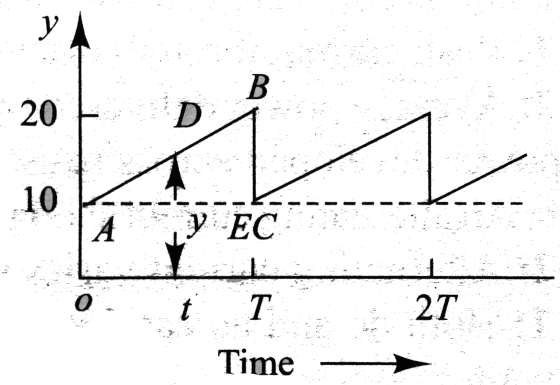
7.



The rms value of the signal is

A. $10\sqrt{\frac{7}{3}}$

B. $\frac{10}{\sqrt{3}}$

C. $10\sqrt{7}$

D. $10\sqrt{3}$

Answer: A

Watch Video Solution

8. A 0.21 H inductor and a 12Ω resistance are connected in series to a `220 V, 50 Hz ac source.

The current in the circuit is

A. $\frac{220}{\sqrt{4400}}A$

B. $\frac{22}{3\sqrt{5}}A$

C. $\frac{220}{\sqrt{4600}}A$

D. $\frac{22}{5\sqrt{3}}A$

Answer: B

Watch Video Solution

9. A 0.21 H inductor and a 12Ω resistance are connected in series to a `220 V, 50 Hz ac source.

the phase angle between the current and the source voltage is

A. $\tan^{-1}\left(\frac{7\pi}{4}\right)$

B. $\cos^{-1}\left(\frac{7\pi}{4}\right)$

C. $\tan^{-1}\left(\frac{4\pi}{7}\right)$

D. $\cos^{-1}\left(\frac{4\pi}{7}\right)$

Answer: A

Watch Video Solution

10. When 100 V DC is applied across a solenoid , a current of 1 A flows in it. When 100 V AC is applied across the same solenoid the current drops to 0.5A . If the frequency of the AC source is 50 Hz , the impedance and inductance of the solenoid are

A. 200Ω

B. 50Ω

C. 100Ω

D. $50\sqrt{3}\Omega$

Answer: A

Watch Video Solution

11. When 100 V DC is applied across a solenoid , a current of 1 A flows in it. When 100 V AC is applied across the same solenoid the

current drops to 0.5A . If the frequency of the AC source is 50 Hz , the impedance and inductance of the solenoid are

A. 5.5 H

B. $3/(\pi)H$

C. $\sqrt{3}/(\pi)H$

D. $2.5H$

Answer: C

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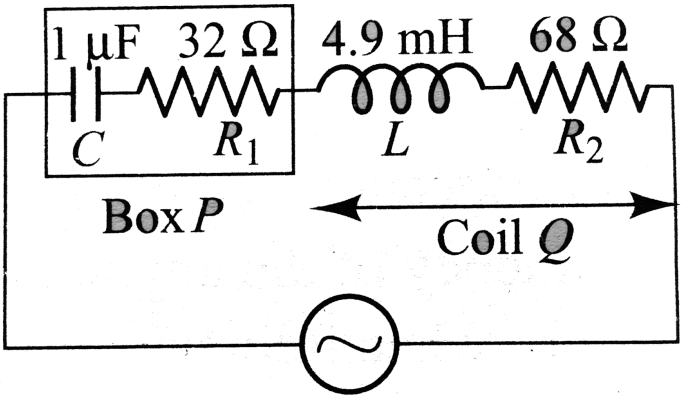
12. A box P and a coil Q are connected in series with an ac source of variable frequency. The emf of the source is constant at 10 V. Box P contains a capacitance of 32Ω. Coil Q has a self inductance of 4.9 mH and a resistance of 68Ω in series. The frequency is adjusted so that maximum current flows in P and Q.



The impedance of P at this frequency is

A. 77Ω

B. 36Ω

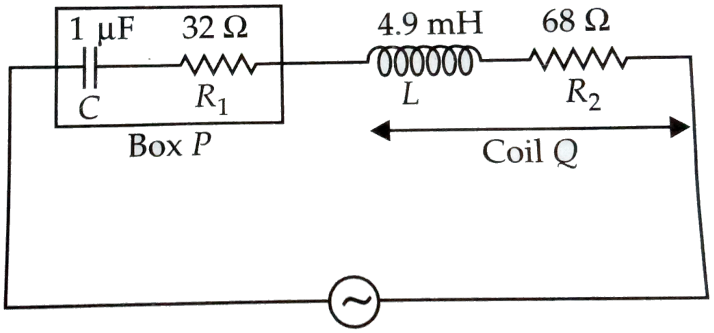
C. 40Ω

D. 125Ω

Answer: A

Watch Video Solution

13. A box P and a coil Q are connected in series with an ac source of variable frequency. The emf of source is constant at 10 V. Box P contains a capacitance of $1\mu F$ in series with a resistance of 32Ω. Coil Q has self inductance $4.9mH$ and a resistance 68Ω in series. The frequency is adjusted so that the maximum current flows in P and Q . At this frequency the voltage across P and Q respectively



A. 200Ω

B. $\sqrt{1350}\Omega$

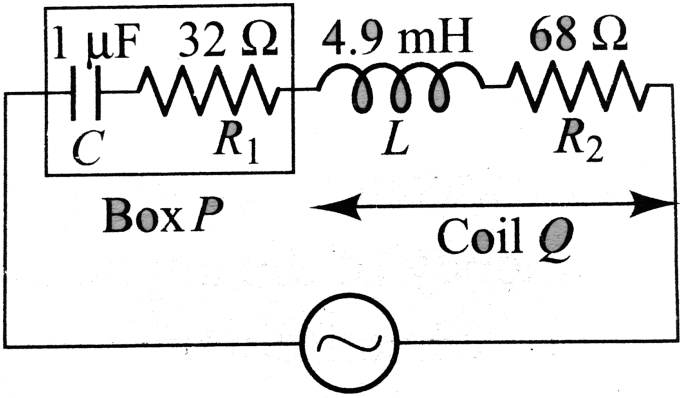
C. 55Ω

D. $\sqrt{9524}\Omega$

Answer: D

Watch Video Solution

14. A box P and a coil Q are connected in series with an ac source of variable frequency. The emf of the source is constant at 10 V. Box P contains a capacitance $1\mu f$ and a resistance of 32Ω. Coil Q has a self inductance of 4.9 mH and a resistance of 68Ω in series. The frequency is adjusted so that maximum current flows in P and Q.



The voltage across P is

A. 12 V

B. 7.7 V

C. 10 V

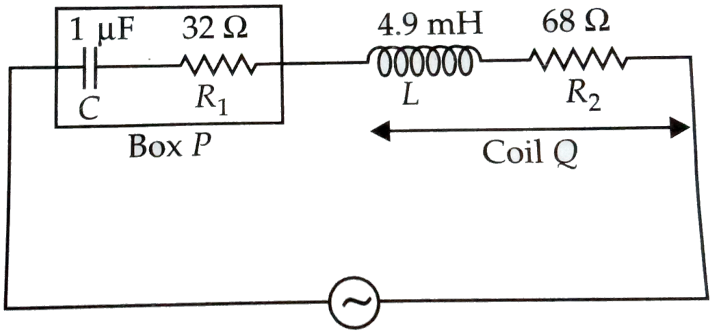
D. 24 V

Answer: B

 Watch Video Solution

15. A box P and a coil Q are connected in series with an ac source of variable frequency. The emf of source is constant at 10 V. Box P contains a capacitance of $1\mu F$ in series with a resistance of 32Ω. Coil Q has self inductance $4.9mH$ and a resistance 68Ω in series. The frequency is adjusted so that the maximum current flows in P

and Q . At this frequency the voltage across P and Q respectively



A. 20 V

B. $\frac{\sqrt{1350}}{10}V$

C. $5.5V$

D. $\frac{\sqrt{9524}}{10}V$

Answer: D

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16. A series LCR circuit containing a resistance of 120Ω has angular resonance frequency $4 \times 10^5 rads^{-1}$. At resonance the vlotage across resistance and inductance are 60V and 40 V, repectively,

the value of inductance L is

A. $0.1mH$

B. $0.2mH$

C. $0.35mH$

D. $0.4mH$

Answer: B

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17. A series LCR circuit containing a resistance of 120Ω has angular resonance frequency $4 \times 10^5 rads^{-1}$. At resonance the vlotage across resistance and inductance are 60V and 40 V, repectively,

The value of capacitance C is

A. $\frac{1}{32}(\mu)F$

B. $\frac{1}{16}(\mu)F$

C. $32(\mu)F$

D. $16(\mu)F$

Answer: A

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18. A series LCR circuit containing a resistance of 120Ω has angular resonance frequency $4 \times 10^5 \mathrm{rad}\ \ s^{-1}$.At resonance the voltage across resistance and inductance are 60 V and 40 V respectively. The angular frequency at which current in the circuit lags the voltage by 45° is

A. $4 \times 10^5 rads^{-1}$

B. $3 \times 10^5 rads^{-1}$

C. $8 \times 10^5 rads^{-1}$

D. $2 \times 10^5 rads^{-1}$

Answer: C

Watch Video Solution

19. When 100 volt DC source is applied across a coil, a current of $1A$ flows through it. When $100VAC$ source of $50Hz$ is applied to the same coil, only$0.5A$ current flows. Calculate the inductance of the coil

A. 0.02H

B. 0.04H

C. 0.08H

D. 1.0H

Answer: C

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20. When 100 volt DC source is applied across a coil, a current of $1A$ flows through it. When $100VAC$ source of $50Hz$ is applied to

the same coil, only$0.5A$ current flows. Calculate the inductance of the coil

A. 17.28 W

B. 8.64 W

C. 10 W

D. 15 W

Answer: A

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21. An inductor 20×10^{-3} a capacitor $100(\mu)F$ and a resistor 50Ω are connected in series across a source of emf $V = 10\sin 314t.$

Then the energy dissipated in the circuit in 20 mim is

A. 960 J

B. 900 J

C. 250J

D. 500J

Answer: A

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22. An inductor 20×10^{-3} a capacitor $100(\mu)F$ and a resistor 50Ω are connected in series across a source of emf $V = 10\sin 314t$.

If resistance is removed from the circuit and the value of inductance is doubled, the variation of current with time in the new circuit is

A. $0.52\cos 314t$

B. $0.52 \sin 314t$

C. $0.52 \sin(314t + \pi/3)$

D. none of these.

Answer: A

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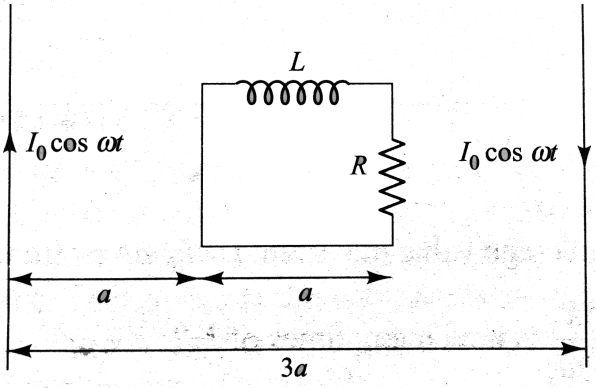
23. In fig, a square loop consistaing of an inductor of inductance L and resistor of resistance R is placed between two long parallel wires. The two long straight wires have time - varing current of magnitude $I = (I_0)\cos \omega t$ but the direction of current in them are opposite



Total magnetic flux in this loop is

A. $\frac{\mu_0 Ia}{\pi} 1n2$

B. $\frac{2\mu_0 Ia}{\pi} 1n2$

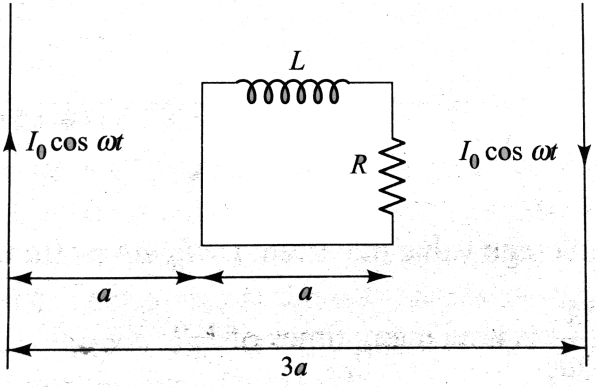
C. $\frac{4\mu_0 Ia}{\pi} 1n2$

D. $\frac{\mu_0 Ia}{2\pi} 1n2$

Answer: A

Watch Video Solution

24. In fig, a square loop consistaing of an inductor of inductance L and resistor of resistance R is placed between two long parallel wires. The two long straight wires have time - varing current of magnitude $I = (I_0)\cos \omega t$ but the direction of current in them are opposite



Magnitude of emf in this circuit only due to flux change associated with two long straight current carrying wires will be

A. $\frac{\mu_0 a 1 n 2 I_0 \omega}{\pi} \sin \omega t$

B. $\frac{2\mu_0 a 1 n 2 I_0 \omega}{\pi} \sin \omega t$

C. $\frac{\mu_0 a 1 n 2 I_0 \omega}{2\pi} \cos \omega t$

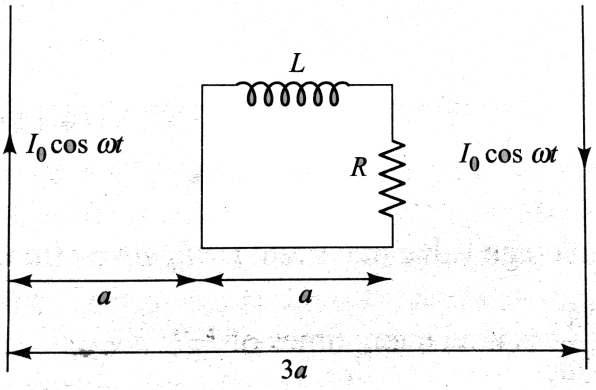
D. $\frac{\mu_0 a 1 n 2 I_0 \omega}{\pi} \cos \omega t$

Answer: A

Watch Video Solution

25. In fig, a square loop consistaing of an inductor of inductance L and resistor of resistance R is placed between two long parallel wires. The two long straight wires have time - varing current of magnitude $I = (I_0) \cos \omega t$ but the direction of current in them are opposite.

The instantaneous current in the circuit will be



A. $\frac{2\mu_0 a 1n 2 I_0 \omega}{\pi\sqrt{R^2+\omega^2 L^2}} \sin(\omega t - \phi)$

B. $\frac{2\mu_0 a 1n 2 I_0 \omega}{\pi\sqrt{R^2+\omega^2 L^2}} \sin(\omega t + \phi)$

C. $\frac{2\mu_0 a 1n 2 I_0 \omega}{\pi\sqrt{R^2+\omega^2 L^2}} \sin(\omega t)$

D. $\frac{\mu_0 a 1n 2 I_0 \omega}{\pi\sqrt{R^2+\omega^2 L^2}} \sin(\omega t - \phi)$

Answer: D

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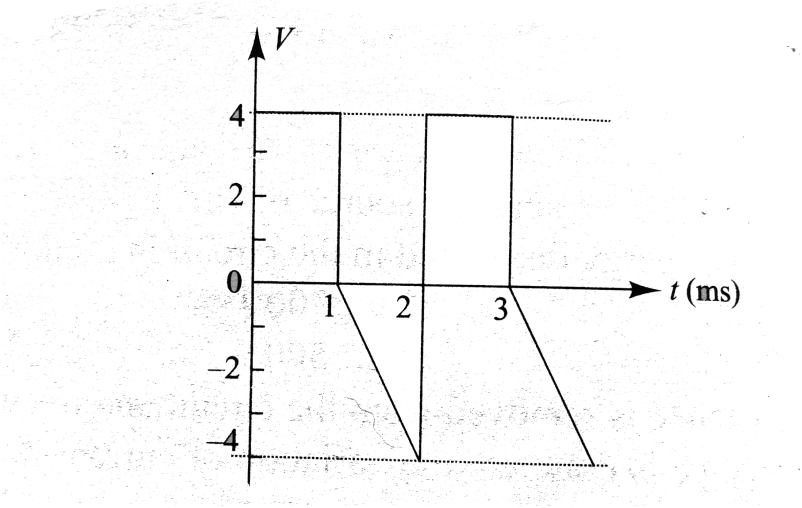
Exercises Integer

1. Variation of voltage with time is shown in fig



(a) The rms voltage is found to be $N\sqrt{\frac{2}{3}}V$. Find N.

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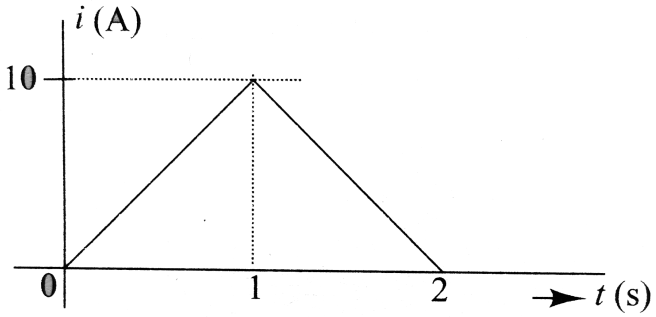
2. Find the avarage value of current (in A) shown graphically in fig.

From $t = 0 \rightarrow t = 2s$.



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3. The average value of current $i = I_m \sin \omega t omt = \frac{\pi}{2\omega}$ to $t = \frac{3\pi}{2\omega}$ si how many times of (I_m)?

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4. An AC ammeter is used to measure current is a circuit . When a given data current pass through the circuit , the AC ammeter reads 3 A. When another alternating current passes through the

circuit, the AC ammeter reads 4A. Then the rading of this ammeter simultaneously is

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Archives Subjective

1. In a series L-R circuit (L = 35 mH and $R = 11\Omega$),a variable emf source $(V = V_0 \sin \omega t)$ of $V_{rms} = 220V$ and frequency 50 Hz is applied. The current amplitude in the circuit is

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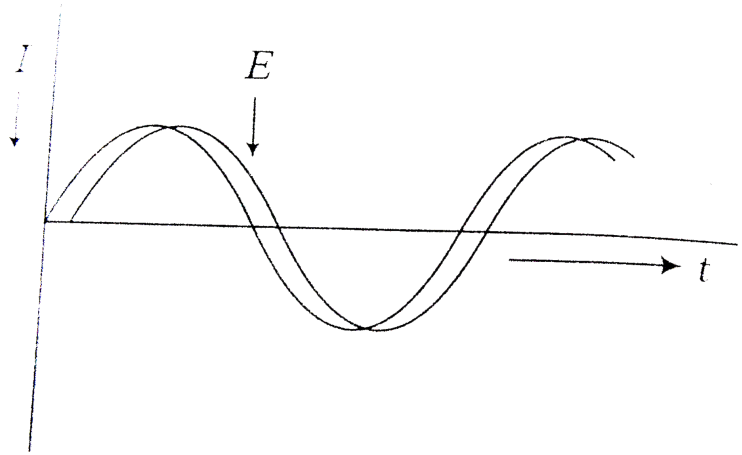
Archives Single Correct

1. When an AC source of emf $E = E_0 \sin(100t)$ is connected across a circuit, the phase difference between the emf E and the current I is observed be $\frac{\pi}{4}$, as shown in the figure. If the circuit consists possibly only of R-C or R-L in series, which of the following combinations is possible?



A. $R = 1k\Omega, C = 10(\mu)F$

B. $R = 1k\Omega, C = 1(\mu)F$

C. $R = 1k\Omega, L = 10H$

D. $R = 1k\Omega, L = H$

Answer: A

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2. An AC voltage source of variable angular frequency ω and fixed amplitude V connected in series with a capacitance C and an electric bulb of resistance R (inductance zero). When ω is increased

A. the bulb glows dimmer

B. the bulb glows brighter

C. total impedance of the circuit is unchanged

D. total impedance of the circuit increases

Answer: B

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Archives Multiple Correct

1. A series R-C circuit is connected to AC source Consider two cases,(A) When C is without a dielectric medium and (b) When C is filled with dielectric of constatn 4. The current I_R through the resistor and voltage V_c across the capacitor are comapared in two cases. Which of the following is true?

A. $I_R^A > I_R^B$

B. $I_R^A < I_R^B$

C. $V_C^A > V_C^B$

D. $V_C^A < V_C^B$

Answer: B::C

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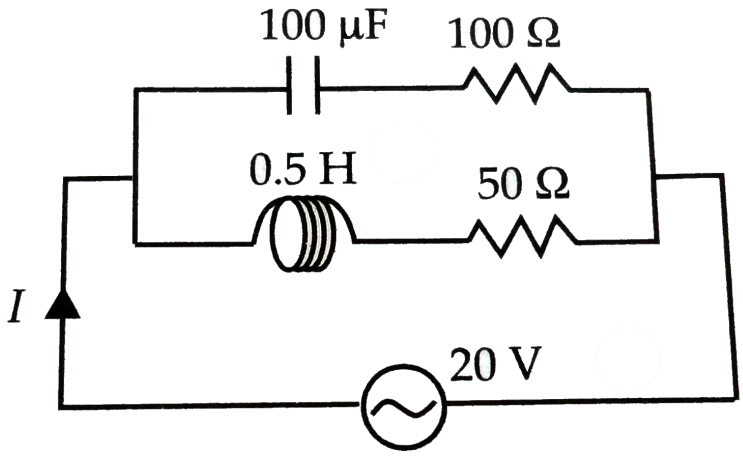
2. In the given circuit, the AC source has $\omega = 100$ red/s. Considering the inductor and capacitor to be ideal, the correct choice is



A. the current through the circuit, $Iis 0.3A$

B. the current through the circuit, $Iis 0.3\sqrt{2}A$

C. the voltage across $100\Omega resis \rightarrow ris 10\sqrt{2}V$

D. the voltage across $50\Omega resis \rightarrow ris 10V$.

Answer: A::C

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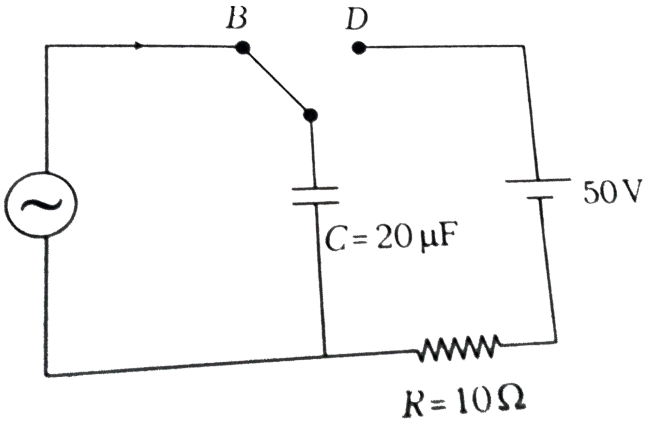
3. At time t = 0 , terminal A in the circuit shown in the figure is connected to B by a key and alternating current I(t) = $I_o \cos(\omega t)$, with I_o = 1 A and ω = 500 $rads^{-1}$ starts flowing in it with the initial direction shown in the figure . At t = $7\pi/6\omega$, the keys is switched from B to D . Now onwards only A and D are connected . A total charge Q flows from the battery to charge the capacitor fully. If C = 20 μ , R = 10 Ω and the battery is deal with emf of 50 V , identify the correct statement(s).



A. Magnitude of the maximum charge on the capacitor before $t = \frac{7\pi}{6\omega} is 1 \times 10^{-3} C$

B. The current in the left part of the circuit just before $t = \frac{7\pi}{6\omega}$ is clockwise.

C. Immidiately after A is connected to D, the current in R is 10

A.

D. $Q = 2 \times 10^{-3} C$

Answer: C::D

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Archives Integer

1. A series R-C combination is connected to an AC voltage of angular frequency $\omega = 500$ radian/s. If the impedance of the R-C circuit is $R\sqrt{1.25}$, the time constant (in millisecond) of the circuit is

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Single Correct Asnwer Type

1. A generator produces a time varying voltage given by $V = 240 \sin 120t$, where t is in second. The rms voltage and frequency are

A. 60Hz and 240V

B. 189Hz and 120V

C. 9Hz and 170V

D. 754Hz and 70V

Answer: C

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2. The peak value of an alternating emf E given by

$E = \underset{o}{E} \cos \omega t$

is 10 V and frequency is 50 Hz . At time t = (1/600) s, the instantaneous value of emf is

A. 10V

B. $5\sqrt{3}V$

C. 5V

D. 1V

Answer: B

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3. A resistance of $20 ohms$ is connected to a source of an alternating potential $V = 220 \sin(100\pi t)$. The time taken by the current to change from its peak value to r.m.s. value is

A. 0.2sec

B. 0.25sec

C. 25×10^{-3} sec

D. 2.5×10^{-3} sec

Answer: D

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4. Voltage and current in an AC circuit are given by V = 5sin(100π t-π/6) and I = 4sin(100πt+π/6)

A. Voltage leada the current by 30°

B. Voltage leada the voltage by 30°

C. Voltage leada the voltage by 60°

D. Voltage leada the current 60°

Answer: C

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5. In a certain circuit, current chages with according to $i = 2\sqrt{t}.\ R\infty tmean\ \square\ valuecurrentbetweent = 2 \to t = 4swillbe$ sqrt(2x)` A. Find value of x.

A. 3A

B. $3\sqrt{3}A$

C. $2\sqrt{3}A$

D. $\left(2-\sqrt{2}\right)A$

Answer: C

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6. Match the following

	Currents	r.m.s. values
(1)	$x_0 \sin \omega t$	(i) x
(2)	$x_0 \sin \omega t \cos \omega t$	(ii) $\frac{x_0}{\sqrt{2}}$
(3)	$x_0 \sin \omega t + x_0 \cos \omega t$	(iii) $\frac{x_0}{\left(2\sqrt{2}\right)}$

A. 1.(i),2.(ii),3.(iii)

B. 1.(ii),2.(iii),3.(i)

C. 1.(i),2.(iii),3.(ii)

D. none of these

Answer: B

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7. If $i = t^2, 0 < t < T$ then $r.\ m.\ s.$ value of current is

A. $\frac{T^2}{\sqrt{2}}$

B. $\frac{T^2}{2}$

C. $\frac{T^2}{\sqrt{5}}$

D. none of these

Answer: C

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8. The rms voltage of the wave form shown is

A. 10V

B. 7V

C. 6.37V

D. none of these

Answer: A

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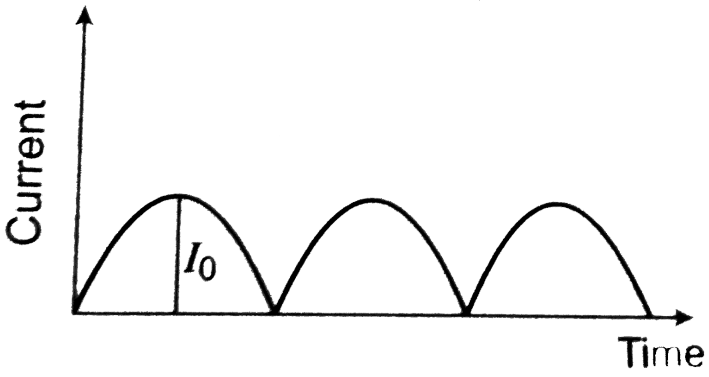
9. The output current versus time curve of a rectifier is shown in the figure. The average value of output current in this case is



A. 0

B. $\frac{I_2}{2}$

C. $\frac{2I_2}{\pi}$

D. I_0

Answer: C

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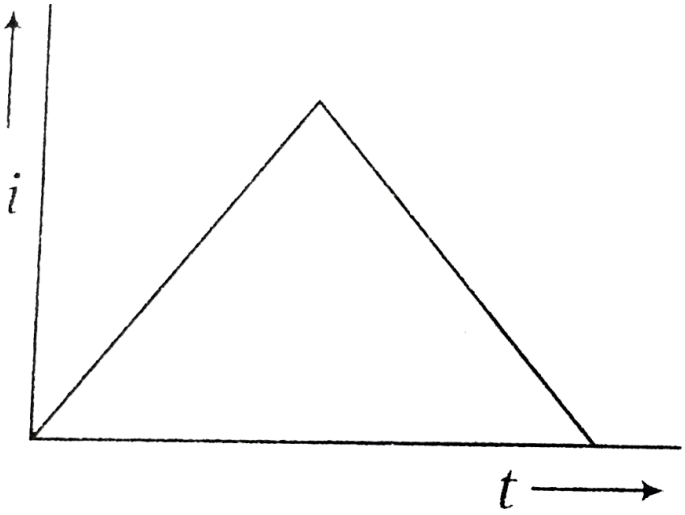
10. an alternating current I in an inductance coil with time according to the graph below. We one of the following graphs gives the variation voltage with time?



A.

B.

C.

D.

Answer: B

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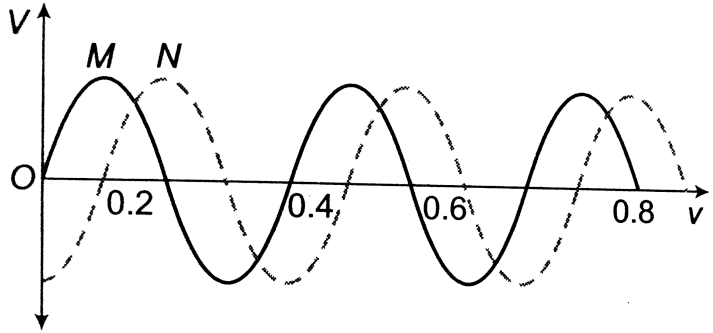
11. Two sinusoidal voltage of the same frequency are shown in the diagram. What is the frequency, and the phase relationship between the voltage?



Frequency in Hz phase lead of N over M in radius

A. (a) Frequency in Hz 0.4 Phase lead of N over M in radian $-\pi/4$

B. (b) Frequency in Hz 2.5 Phase lead of N over M in radian $-\pi/2$

C. (c) Frequency in Hz 2.5 Phase lead of N over M in radian $+\pi/2$

D. (d) Frequency in Hz 2.5 Phase lead of N over M in radian $-\pi/4$

Answer: B

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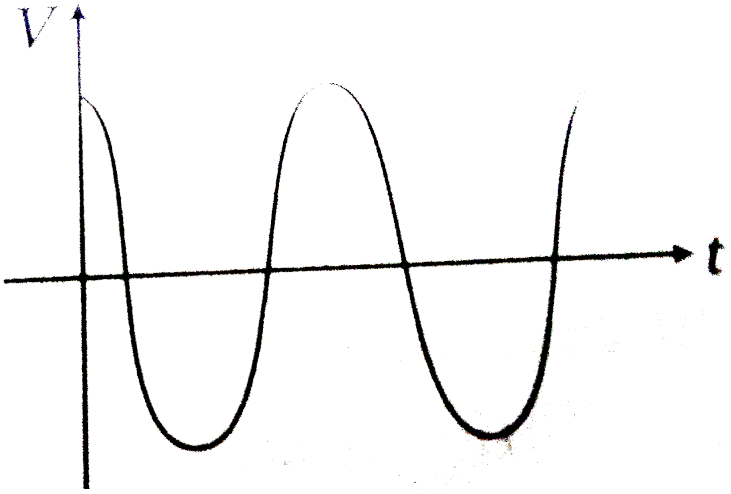
12. the voltage across a pure inductor is represent in figure. Which one of the following curves in the figure will represent the current?



A.

B.

C. 

D. 

Answer: D

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13. In pure inductive circuit, the curves between frequency f and reciprocal of inductive reactance $1/X_L$ is

A. 

B. 

C. 

D. 

Answer: C

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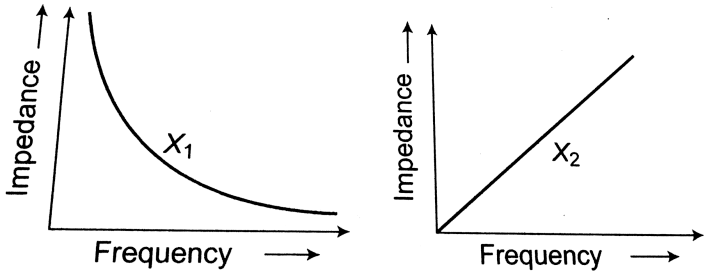
14. The graphs given below depict the dependence of two reactive impedences X_1 and X_2 on the frequency of the alternating e.m.f. applied individually to them. We can then say that



A. X_1 is an inductor and X_2 is a capacitor

B. X_1 is an resistor and X_2 is a capacitor

C. X_1 is an capacitor and X_2 is a inductor

D. X_1 is an inductor and X_2 is a resistor

Answer: C

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15. Which of the following graphs represent the correct variation of capacitive reactance X_C with frequency upsilon` ?

A. 

B. 

C. 

D. 

Answer: B

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16. Is the following circuit correctly drawn 

A. Yes

B. no

C. cannot be predicted

D. Insufficient data is applied

Answer: A

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17. An alternating emf is applied across a parallel combination of a resistance R, capacitance C and an inductance L. If I_R, I_L and I_C are the currents through R,L and C respectively, the phase relationship among I_R, I_L and I_C and source emf E, is given by

A. 

B. 

C. 

D. 

Answer: C

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18. When 100V. DC is applied across a solenoid a current of 1A flows in it. When 100V, AC is applied across the same coil, the current drops to 0.5A. The frequency of the AC is 50Hz. The impendence and inductance of the solenoid are

A. 200Omega and 0.55H

B. 100Omega and 0.86H

C. 200Omega and 1.0H

D. 100Omega and 0.93H

Answer: A

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19. An electric bulb and a capacitor are connected in series with an AC source.On increasing the freqency of the source, the brightness of the bulb

A. The glow decrease

B. The glow increase

C. The glow remains the same

D. Bulb quenches

Answer: B

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20. For a series RLC circuit $R = X_L = 2X_C$. The impedence of the current and phase different (between) V and i will be

A. $\frac{\sqrt{5}R}{2}, \tan^{-1}(2)$

B. $\frac{\sqrt{5}R}{2}, \tan^{-1}\left(\frac{1}{2}\right)$

C. $\sqrt{5}X_C, \tan^{-1}\left(\frac{1}{2}\right)$

D. $\sqrt{5}R, \tan^{-1}\left(\frac{1}{2}\right)$

Answer: B

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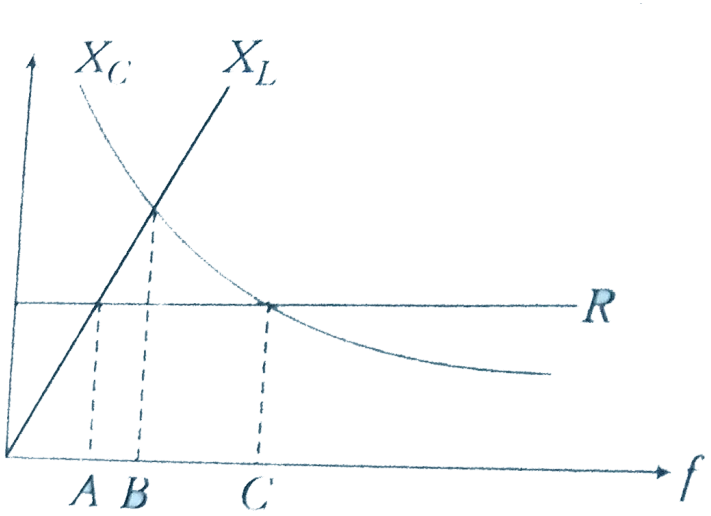
21. The figure shows variation of R, $\underset{L}{X}$ and $\underset{C}{X}$ with frequency f in a series L, C , R circuit . Then , for what frequency point, the circuit

is inductive?



A. A

B. B

C. C

D. All points

Answer: C

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22. Same current is flowing in two alternating circuits. The first circuit contains only inductances and the other contains only a capacitor, if the frequency of the e.m.f of AC is increased, the effect on the value of the current will be

A. increased in the first circuit an decreased in the other

B. increased in both circuits

C. decreased in both the circuits

D. decreased in the first circuit and increased in the other

Answer: D

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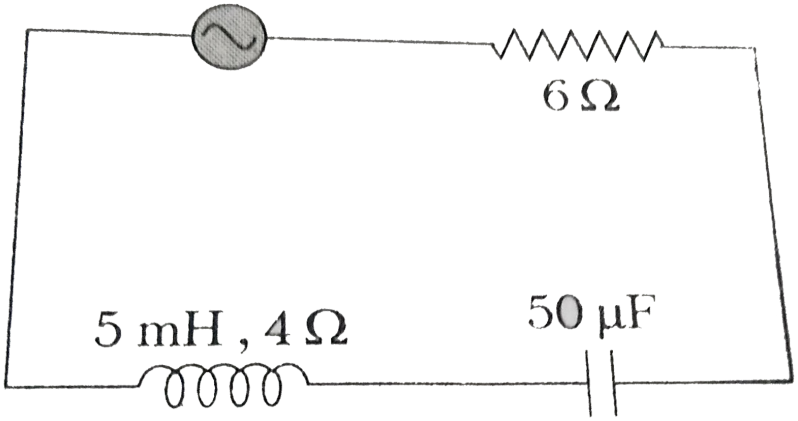
23. In the circuit shown, the AC source has voltage V = 20cos(ω t)volt with ω = 200 $rads^{-1}$ the amplitude of the current will be

nearest to



A. 2A

B. 3.3A

C. $2/\sqrt{5}A$

D. $\sqrt{5}A$

Answer: A

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24. In an LCR circuit R=100 ohm. When capacitance C is removed, the current lags behind the voltage by $\pi/3$. When inductor L is removed, the current leads the voltage by $\pi/3$ The impedence of the circuit is:

A. 50Ω

B. 100Ω

C. 200Ω

D. 400Ω

Answer: B

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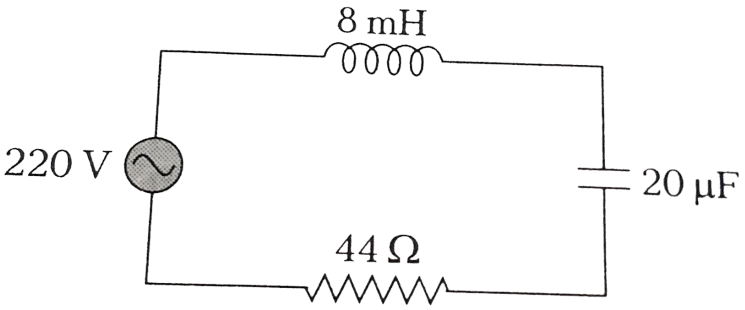
25. For the series L-C-R circuit shown in the figure, what is the resonance frequency and the current at the resonating

frequency?



A. $2500 rads^{-1}$ and $\sqrt{5}A$

B. $2500 rads^{-1}$ and $5A$

C. $2500 rads^{-1}$ and $\frac{5}{\sqrt{2}}A$

D. $2500 rads^{-1}$ and $5\sqrt{2}A$

Answer: B

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26. Following figure, as shown an an generator connected to a "block box" through a pair fo terminal.The box contains possible

R,L,C of their combination, whoe elements and arrangements are not known to us. Measurements outside the box revals that $e=75\sin(\omega t)$ volts, $i=1.5\sin(\omega t+45^\circ)$ amp then. the wrong statements is

A. There must be a capacitor in the box.

B. There must be an inductor in the box.

C. There must be a resistance in the box.

D. The power factor is 0.707.

Answer: B

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27. A resistor R, an inductor L and a capacitor C are connected in series to an oscillator of frequency n. If the resonant frequency

is n_r, then the current lags behind voltage, when

A. n=0

B. $n < n_f$

C. $n < n_r$

D. $n > n_r$

Answer: D

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Comphension Based

1. In a series L-R circuit, connected with a sinusoidal ac source, the maximum potential difference across L and R are respectivaly 3 volts and 4 volts.

At an instant the potemtial difference across resistor is 2 volts.

The potential difference in volt, across the inductor at the same instant will be:

A. $3\cos 30^\circ$

B. $3\cos 50^\circ$

C. $6\cos 45^\circ$

D. 6

Answer: A

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2. In a series $L - R$ circuit, connected with a sinusoidal ac source, the maximum potential difference acrosssd L and R are respectively 3 volts and 4 volts

At the same instant, the magnitude of the potential difference in volt, across the ac source will be

A. $3\cos 67^\circ$

B. $5\sin 37^\circ$

C. $6\cos 97^\circ$

D. 0

Answer: B

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3. In a series $L-R$ circuit, connected with a sinusoidal ac source, the maximum potential difference acrosssd L and R are respectively 3 volts and 4 volts

If the current at this instant is decreasing the magnitude of potential difference at that instant across the ac source is

A. Increasing

B. Decreasing

C. Constant

D. Cannot be said

Answer: A

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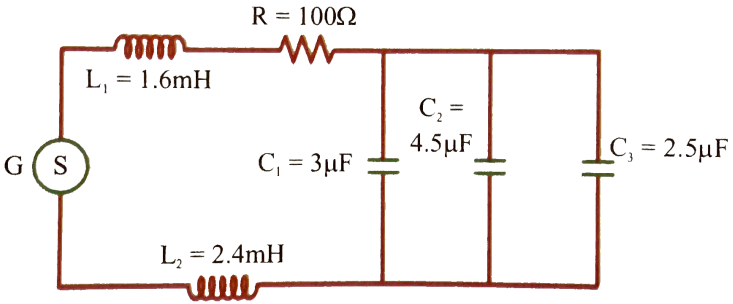
4. An ac generator G with an adjustable frequency of oscillation is used in the circuit, as shown.



Current drawn from the ac souce will be maximum if its angular frequency is

A. $10^5 rad/s$

B. $10^4 rad/s$

C. 5000 rad/s

D. 500 rad/s

Answer: C

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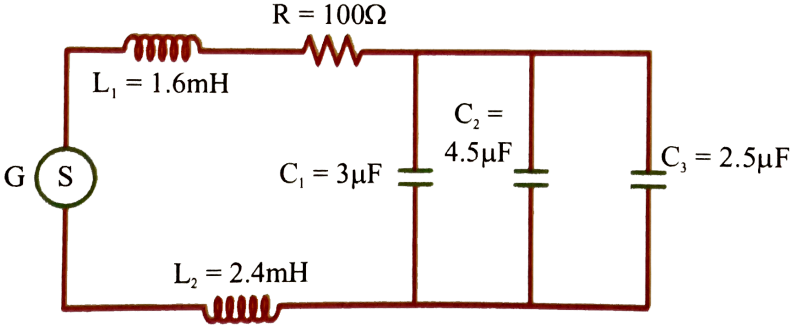
5. An ac generator G with an adjustable frequency of oscillation is used in the circuit, as shown.



To increase resonant frequency of the circuit, some of the

changes in the circuit are carried out. Which changes would certainly result in the increase in resonnatn frequency ?

A. R is increased.

B. L_1 is increased and C_1 is decreased.

C. L_2 is decreased and C_2 is increased

D. C_3 is removed from the circuit.

Answer: D

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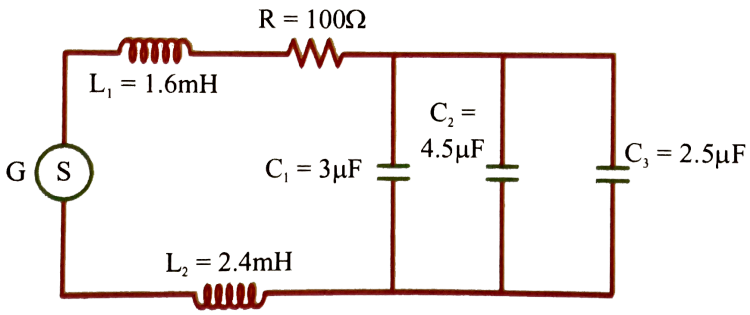
6. An ac generator G with an adjustable frequency of oscillation is used in the circuit, as shown.



If the ac source G is $100V$ rating at resonant frequency of the circuit, then average power supplied by the source is

A. 50W

B. 100W

C. 500W

D. 1000W

Answer: B

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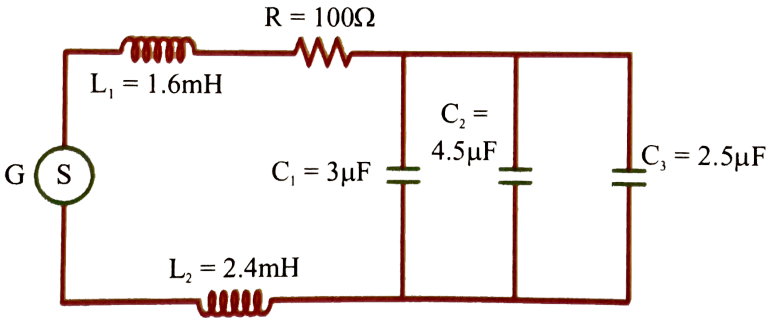
7. An ac generator G with an adjustable frequency of oscillation is used in the circuit, as shown.



Average energy stored by the inductor L_2 (source is at resonance frequency) is equal to

A. zero

B. 1.2mJ

C. 2.4mJ

D. 4mJ

Answer: B

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8. Ratio of amplitude for two wave is 1:2 .Find the ratio of intensity?

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Single Correct

1. The rms current in an AC circuit is 2A. If the wattless current be $\sqrt{3}$A , what is the power factor of the circuit?

A. $\frac{1}{\sqrt{3}}$

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

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

D. $\frac{1}{3}$

Answer: C

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2. $\frac{2.5}{\pi}\mu F$ capacitor and $3000-$ ohm resistance are joined in series to an AC source of 200volts and $50\,\text{sec}^{-1}$ frequency. The power factor of the circuit and the power dissipated in it will respectively

A. 0.6, 0.06W

B. 0.06, 0.6W

C. 0.6, 4.8W

D. 4.8, 06W

Answer: C

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3. The self inductance of a choke coil is 10 mH. When it is connected with a 10 V DC source, then the loss of power is 20 W. When its is connected with 10 V AC source loss of power is 10 W. The frequency of AC source will be

A. 50Hz

B. 60Hz

C. 80Hz

D. 100Hz

Answer: C

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4. A group of electric lamps having a total power rating of 1000 W is supplied by an AC voltage $E = 200\sin(310t + 60^\circ$, thenthe rms value of the circuit current is

A. $10A$

B. $10\sqrt{2}A$

C. $20A$

D. $20\sqrt{2}A$

Answer: B

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5. In an L-R circuit, the inductive reactance is equal to the resistance R of the circuit. An emf $E = E_0 \cos \omega t$ is applied to the circuit. The power consumed in the circuit is

A. $\frac{E_0^2}{R}$

B. $\frac{E_0^2}{R}$

C. $\frac{E_0^2}{4R}$

D. $\frac{E_0^2}{8R}$

Answer: C

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6. An L-C-R seriescircuit with a resistance of 100Ω connected to an AC source of 200V (rms) and angular frequency $300rod/s$. When only the capacitor is removed, the current lags behind the voltage by 60°. When only the inductor is removed the current leads the voltage by 60° . The average power dissioated in original L-C-R circuit (50x) Watt. Find the value of x.

A. 50W

B. 100W

C. 200W

D. 400W

Answer: D

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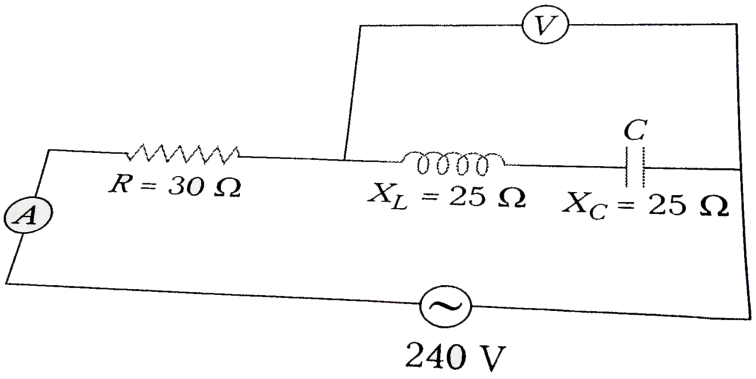
7. In the circuit shown in figure neglecting source resistance, the voltmeter and ammeter readings will be respectively



A. 0V,3A

B. 150V,3A

C. 150V, 6A

D. 0V,8A

Answer: D

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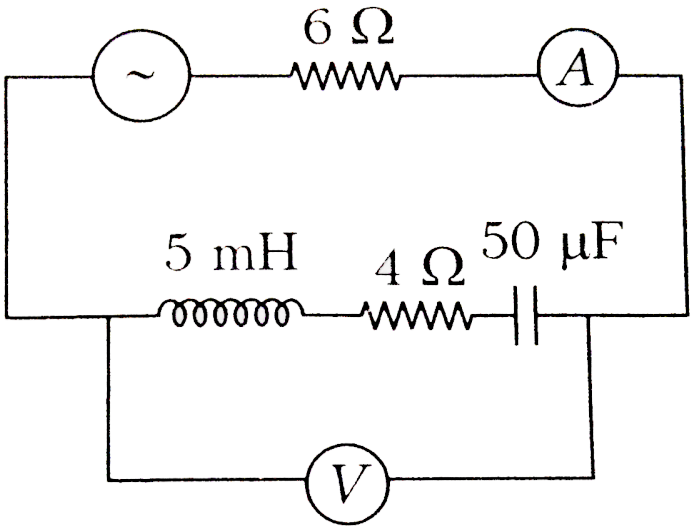
8. In the circuit shown in the figure , the ac source gives a voltage $V = 20 \cos(200t)$. Neglecting source resistance , the voltmeter and

ammeter reading will be



A. 0V, 0.47A

B. 1.68V, 0.47A

C. 0V,1.4A

D. 5.6V, 1.4A

Answer: D

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9. A series combination of resistor (R), capacitor (C) is connected to an AC source of angular frequency ω. Keeping the voltage same, If the frequency is changed to $\frac{\Omega}{3}$, the current becomes half of the original current. Then, the ratio of the capacitance reactance and resistance at the former frequency is

A. $\sqrt{\frac{3}{5}}$

B. $\sqrt{\frac{2}{5}}$

C. $\sqrt{\frac{1}{5}}$

D. $\sqrt{\frac{4}{5}}$

Answer: A

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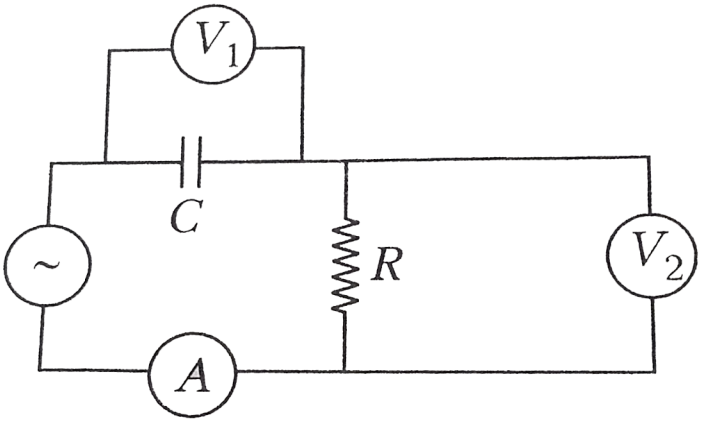
10. The diagram shows a capacitor C and a vlaue a resistor R connected in series to an AC source V_1 and V_2 are voltmeters and A is an ammeter



Consider the following statements

I . Readings in A and V_2 are always in phase

II . Readings in V_1 is ahead in phase with reading in V_2

III . Reading in A and V_1 are always in phase. Which of these statements are/is correct

A. I only

B. II only

C. I and II only

D. II and III only

Answer: B

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