PHYSICS

BOOKS - CHHAYA PHYSICS (BENGALI ENGLISH)

ALTERNATING CURRENT

Examples

1. Equation of an ac is I=10 sin $\left(200\pi t - \frac{\pi}{15}\right)$ ampere. Determine the frequency and peak

value of the current.

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2. If an arc is represented by $I = 100 \sin 200\pi t$ ampere, determine the peak value of current and time period.

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3. An alternating current having peak value 141 A is used to heat a metal wire. To produce the

same rate of heating effect, another constant current IA is used. What is the value of I?

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4. The peak value of an alternating magnetic field B is 0.01 T and Frequency is 100 Hz. IF a conducting ring of radius 1 m is held normal to the field , what emf will be induced in the ring?

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5. In an LCR series ac circuit $R = 10\Omega$, L=50 mH and $C = 5\mu F$. Find out the resonant frequency and Q-factor. Find also the bandwidth and half-power frequencies.

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6. In an LCR series combination, R=400Ω L=100mH and $C = 1\mu F$. This combination is connected to a $25 \sin 2000t$ volt source. Find the impedance,

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7. In an LCR series combination, R=400Ω L=100mH and $C = 1\mu F$. This combination is connected to a $25 \sin 2000t$ volt source. Find peak value of current,

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8. In an LCR series combination, R=400Ω L=100mH and $C = 1\mu F$. This combination is

connected to a $25\sin 2000t$ volt source. Find phase difference of voltage and current

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9. In an LCR series combination, R=400Ω L=100mH and $C = 1\mu F$. This combination is connected to a $25\sin 2000t$ volt source. Find power factor

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10. In an LCR series combination, R=400Ω L=100mH and $C = 1\mu F$. This combination is connected to a $25 \sin 2000t$ volt source. Find dissipated power in the circuit.

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11. Power factor of an LR circuit is $\frac{1}{\sqrt{2}}$. If the frequency of ac is doubled, what will be the power factor?

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12. IF the value of inductor L is 1mH and the applied ac source frequency is 50 Hz, find the inductive reactance in the above case.

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13. A series LC circuit has L=0.405 H and $C = 25\mu F$. The resistance R is zero, Find the frequency of resonance.

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14. In an LCR series circuit, the rms voltages across R, L and C are found to be 10 V, 10 V and 20 V respectively. The rms voltage across the entire combination is

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15. A capacitor, a resistor of 5Ω and an inductor of 50mH are in series with an ac source marked 100V,50Hz. It is found that the voltage is in phase with the current. Calculate

the capacitance of the capacitor and the impedance of the circuit.

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16. A capacitor and the resistor are connected in series with an ac source. IF the potential differences acorrs C,R are 120 V, 90 V respectively and if the rms current of the circuit is 3A , calculate the impedance.

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17. A capacitor and the resistor are connected in series with an ac source. IF the potential differences acorrs C,R are 120 V, 90 V respectively and if the rms current of the circuit is 3A , calculate the power factor of the circuit.

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18. A $200\mu F$ capacitor is in series with a 50Ω resistor and is connected to a 220 V, 50 Hz ac source

(i) What is the maximum current in the circuit

(ii) What is the difference in time when the current and the voltage attain maximum values?

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19. A resistor, $R = 300\Omega$ and a capacitor , $C = 25\mu F$ are connected in series with an ac source. The peak value of voltage (V_0) and the frequency (f) of the source are 150 V and and $\frac{50}{\pi}$ Hz respectively. Find the peak value of

current and the power dissipated in the circuit.

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20. A series LCR circuit containing a resistance of 120Ω has angular resonance frequency $4 \times 10^5 rad/s$ .At resonance, the voltages across resistance and inductancr are 60V and 40V, respectively. Find the values of L and C. At what frequency , does not current in the circuit lag behind the voltage by 45° ?

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21. The instantaneous value of emf and current in an A.C. circuit are; $E=1.414\sin(100\pi t-4\pi)$, $I=0.707\sin(100\pi t)$. The impedance of the circuit will be

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22. A 220V, 50Hz ac source is connected to an inductance of 0.2H and a resistance of 20Ω in series . What is the current in the circuit?

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23. An ac source of frequency 50 Hz is connected with a resistance $(R = 36\Omega)$ and L of 0.12 H in series. What is the phase different between current and voltage?

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24. A current of 1 A flows in a coll when connected to a 100 V dc source. IF the same

coll is connected to a 100 V, 50 Hz ac source, a current od 0.5 A flows in the coll. Calculate the inductance of the coll.

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25. A lamb in which 10 A current can flow at 15 V is connected with an alternating source of potential 220 V and frequency 50 Hz. What should be the inductance of choke coll required to light the bulb?

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26. What will be the peak value of the alternating current when a condenser of $1\mu F$ is connected to an alternating voltage of 200V, 60 Hz?

27. The number of turns in the primary and secondary coils of an ideal transformer are 140 and 280, respectively. If the current through

the primary coils is 4 A, what will be the current in the secondary coil?

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28. Initial voltage and input power of a transformer of effieciency 80% are 100 V and 4 kW, respectively. IF the voltage of the secondary coil is 200 V, determine the currents flowing through the primary and the second ary coils?

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High Order Thinking Skill Hots Questions

1. In an oscillating LC circuit the maximum charge on the capacitor is Q. When the charge is stored equally between the electric and magnetic fields, what is the charge on the capacitor?

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2. In the LCR circuit, capacitance is changed from C to 2C. For the resonant frequency to remain unchanged what should be the change in the value of inductance L?

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3. If the emf of an ac circuit be $E = E_0$ sinomegatand current $I = I_{\text{cosomegat}}$, what is the power dissipated in the circuit?

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4. What should be the nature of the graph of the impedance Z with respect to frequency in an alternating LCR circuit?

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5. How does the wattless current conforms to the particle of energy conservation?

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6. The current through a circuit is given by $I = I_0 \sin(\omega t + \pi/6)$ when the supplied emf is $V = V_0 \sin \omega t$Find the power dissipated in the circuit in one complete cycle. Draw the phasor diagram for the given current and voltage. What are the possible two elements in the circuit?

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7. How the resistance R changes with the change in frequency of ac? Show graphically.

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8. Sketch a graph to show how the reactance of an inductor varies as a function of frequency.

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9. Sketch a graph to show how the reactance of a capacitor varies as a function of frequency.

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10. How does an inductor behave in a dc circuit?

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11. Comparing the L-C oscillations with the oscillations of a spring-block system

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12. In the given circuit, the switch K_2 is opened and the switch K_1 is closed at time t=0. At time $t = t_0$, the switch K_1 is opened and the switch K_2 is simultaneously closed. Sketch the variation of the inductor current I with time.

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13. Show that in the free oscillations of an LC circuit, the sum of energies stored in the capacitor and the inductor is constant in time.

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Ncert Textbook Questions With Answer Hint

1. $60\mu F$ capacitor to a 110 V, 60 Hz ac supply. Determine the rms value of the current in the

circuit. What is the net power absorbed by the circuit over a complete cycle?

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2. Determine the resonant frequency ω_r of a series LCR circuit with L=2.0 H,C=32μF and R= 10Ω. What is the Q-value of this circuit?

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3. A charged $30\mu F$ capacitor is connected to a 27mH inductor.

What is the angular frequency of free oscillations of the circuit?

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4. A charged $30\mu F$ capacitor is connected to a 27mH inductor.

If the initial charge on the capacitor is 6mC then What is the total energy stored in the

circuit initially. What is the total energy at a later time?

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5. A series LCR circuit with R=20Ω , L=1.5 H and C=35μF is connected to a variable frequency 200 V ac supply. When the frequency of the supply equals the natural frequency of the circuit, what is the average power transferred to the circuit in one complete cycle?

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6. A radio can tune over the frequency range of a portion of MW broadcasr band: 800kHz to 1200kHz. IF its LC circuit has an effective inductance of $200\mu H$, what must be the range of the variable capacitor?

[Hint: for tuning, the natural frequency of the LC circuit should be equal to the frequency of the radio wave.]

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7. A series LCR circuit is connected to a variable frequency 230 V source , L=5.0 H, $C = 80\mu F, R = 40\Omega$

Determine the source frequency for which resonance occurs in the circuit.

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8. A series LCR circuit is connected to a variable frequency 230 V source , L=5.0 H, $C = 80\mu F, R = 40\Omega$

Obtain impedance of the circuit and aplitude of current at resonance.

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9. A series LCR circuit is connected to a variable frequency 230 V source , L=5.0 H, $C = 80\mu F, R = 40\Omega$

Determine the rms potential drop across L and C. Show that at resonance the potential drop across LC combination is zero.

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10. An LC circuit has L =20 mH , $C = 50\mu F$ and initial charge 10 mC the resistance being negligible.

what is the total energy stored initially? IT is conserved during LC oscillator?

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11. An LC circuit has L =20 mH , $C = 50\mu F$ and initial charge 10 mC the resistance being

negligible.

What is the natural frequency of the circuit?

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12. An LC circuit has L =20 mH , $C = 50\mu F$ and initial charge 10 mC the resistance being negligible.

After what time interval from the moment the circuit is switched on the energy stored is (i) completely electrical i.e., stored only in the

capacitor and (ii) completely magnetic ,i.e., stored only in the indicator?

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13. An LC circuit has L =20 mH , $C = 50\mu F$ and initial charge 10 mC the resistance being negligible.

At what time is the total energy shared equally between the inductor and the capacitor?

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14. An LC circuit has L =20 mH , $C = 50\mu F$ and initial charge 10 mC the resistance being negligible.

If a resistor is inserted in the circuit, how much energy is dissipated as heat?

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

what is the maximum current in the coil?

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16. A coil of inductance 0.50 H and resistance 100Ω is connected to a 240 V, 50Hz ac supply. what is the time lag between the voltage maximum and current maximum?

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17. A coil of inductance 0.50 H and resistance 100Ω is connected to a 240 V, 50 Hz ac supply. What is the maximum current in the coil?

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18. A coil of inductance 0.50 H and resistance 100Ω is connected to a 240 V, 50Hz ac supply. How does an inductor behave in a dc circuit after the steady state?

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19. A circuit containing a 80 mH inductor and a $60\mu F$ capacitor in series is connected to a 230 V , 50 Hz supply. The resistance of the circuit is

negligible.

Obtain the current amplitude and rms values.

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20. A circuit containing a 80 mH inductor and a $60\mu F$ capacitor in series is connected to a 230 V , 50 Hz supply. The resistance of the circuit is negligible.

Obtain rms values of potential drop across the inductor and capacitor.

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21. A circuit containing a 80 mH inductor and a $60\mu F$ capacitor in series is connected to a 230 V , 50 Hz supply. The resistance of the circuit is negligible.

What is the average power transferred to the inductor?

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22. A circuit containing a 80 mH inductor and a $60\mu F$ capacitor in series is connected to a 230

V , 50 Hz supply. The resistance of the circuit is negligible.

What is the average power transferred to the capacitor?

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23. A circuit containing a 80 mH inductor and a $60\mu F$ capacitor in series is connected to a 230 V , 50 Hz supply. The resistance of the circuit is negligible.

What is the total average power absorbed by the circuit?

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24. A series LCR circuit with L=0.12H, C=480nF, R=23Ω is connected to a 230V variable frequency supply.

What is the source frequency for which current amplitude is maximum. Obtain this maximum value.

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25. A series LCR circuit with L=0.12H, C=480nF, R=23Ω is connected to a 230V variable frequency supply.

What is the source frequency for which average power absorbed by the circuit is maximum. Obtain the value of this maximum power.

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26. A series LCR circuit with L=0.12H, C=480nF, R=23Ω is connected to a 230V variable frequency supply.

What is the Q-factor of the circuit?

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27. In any ac circuit, is the applied instanteneous voltage equal to the algebraic sum of the instantneous voltages across the

series elements of the circuit?Is the same true for rms value?

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28. The instantaneous value of emf and current in an A.C. circuit are; $E=1.414\sin(100\pi t-\frac{\pi}{4})$, $I=0.707\sin(100\pi t)$. The impedance of the circuit will be

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29. Why a capacitor is used in the primary circuit of an induction coil?

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30. When a choke is connected in series with a lamp in dc line, the lamp shines brightly. Insertion of an iron core in the choke does not affect the brightness. What happens in case of ac line?

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31. Why a choke is needed with a fluorescent lamp with ac mains? Why a normal resistor can not be used in place of the choke?

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32. A small town with a demand of 800 kW of power at 220 V is situated 15 km away from an electric plant generating power at 440 V. The resistance of the two wire line carrying power is $0.5\Omega.km^{-1}$. The line gets power from the

line through a 4000-220 V step-down transformer at a substation in the town. Estimate the line power loss in the form of heat?

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33. A small town with a demand of 800 kW of power at 220 V is situated 15 km away from an electric plant generating power at 440 V. The resistance of the two wire line carrying power is $0.5\Omega.km^{-1}$. The line gets power from the

line through a 4000-220 V step-down transformer at a substation in the town.

How much power must the plant supply, assuming there is negligible power loss due to leakage.

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Ncert Textbook Questions With Answer Hint Mcq 1

1. A small town with a demand of 800 kW of power at 220 V is situated 15 km away from an electric plant generating power at 440 V. The resistance of the two wire line carrying power is $0.5\Omega.km^{-1}$. The line gets power from the line through a 4000-220 V step-down transformer at a substation in the town. Characterise the step-up transformer at the plant.

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2. The internal resistance and internal reactance of an alternating current generator are R_g and X_g respectively. Power from this source is supplied to a load consisting of resistance R_g and reactance X_L. For maximum power to be delivered from the generator to the load. The value of X_L is equal to

A. zero

B. X_g

C. $-X_g$

D. R_g

Answer: C

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3. To reduce the resonant frequency in an LCR series circuit with a generator,

A. the frequency of the generator should be reduced

B. another capacitor should be connected is parallel with the first capacitor

C. the iron core of the inductor should be removed

D. the dielectric in the capacitor should be removed

Answer: B

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4. Which of the following combinations should be selected for fine tuning of an LCR circuit used for communication?

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

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

C. $R = 15\Omega, L = 3.5H, C = 30\mu F$

D. $R = 25\Omega, L = 1.5H, C = 45\mu F$

Answer: C

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Ncert Textbook Questions With Answer Hint Mcq 2

1. The current through an ac circuit first increases and then decreases as its frequency is increased. Which among the followings are most likely combination of the circuit?

A. inductor and capacitor

B. resistor and inductor

C. resistor and capacitor

D. resistor,inductor and capacior

Answer: A::D

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2. The current through an ac (series) circuit increases as the source frequency is increased. Which of the followings are the most suitable combinations of the circuit?

A. only resistor

B. resistor and an inductor

C. resistor and a capacitor

D. only capacitor

Answer: C::D

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3. When an ac voltage of 220 V is applied to a capacitor C

A. the maximum voltage between plated is 220V

B. the current is in phase with the applied voltage

C. the charge on the plates is in phase with the applied voltage

D. power delivered to the capacitor is zero

Answer: C::D

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4. The line that draws power supply to your house has

A. zero average current

B. 220 V average voltage

C. voltage and current out of phase by 90°

D. voltage and current possibly differing in phase ϕ such that $|\phi| < \frac{\pi}{2}$

Answer: A::D

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Exercise Multiple Choice Question

1. An alternating current is given by the equation $I = i_1 \sin \omega t \cos \omega t$.The rms current is given by

A. $(i_2 + i_1) / \sqrt{2}$

B. $(i_2 - i_1) / \sqrt{2}$

C. $\sqrt{\{(i_1^2 + i_2^2) / 2\}}$

D. $\sqrt{\{(i_1^2 + i_2^2) / (\sqrt{2})\}}$

Answer: C

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2. An ac having a peak value 1.41 A is used to heat a wire. A dc producing the same heating rate will be

A. 1.41A

B. 2.0A

C. 0.705A

D. 1.0A

Answer: D

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3. The general equation for the instantneous voltage of a 50 Hz generator with peak voltage 220 V is

A. $220 \sin 50\pi t$

B. $220 \sin 100\pi t$

C. $\pm 220 \sin 100\pi t$

D. $220 \sin 25\pi t$

Answer: B

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4. The relation between angular velocity (ω) and driving frequency(f) of an alternating current is

A. $\omega = 2\pi f$

B. $\omega = \frac{2\pi}{f}$

C. $f = \frac{2\pi}{\omega}$

D. $f = 2\pi\omega$

Answer: A

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5. Form factor of an alternating voltage is the ratio of

A. peak value and rms value

B. peak value and average value

C. rms value and average value

D. rms value and peak value

Answer: C

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6. The value of an ac voltage at time $0 \leq t \leq \frac{\pi}{\omega}$ is given by $V = V_0 \sin \omega t$ and at time $\frac{\pi}{\omega} \leq t \leq \frac{2\pi}{\omega}$ is given by $V = -V_0 \sin \omega t$. The average value of V for a complete cycle is

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

B. $\left(\frac{2}{\pi}\right) V_0$

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

D. zero

Answer: B

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7. The rms value of potential difference V shown in the Fig.2.42 is

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

B. V_0

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

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

Answer: C

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8. The rms value and frequency of an ac current are 5A and 50 Hz respectively. The value of the current after $\frac{1}{300}s$ from the time when its value becomes zero is

A. $5\sqrt{2}A$

B. $5\sqrt{\frac{3}{2}}A$

C. $\frac{5}{6}A$

D. $\frac{5}{\sqrt{2}}A$

Answer: B

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9. In an ac circuit containing capacitance , only the current

A. leads the voltage by 180°

B. is in phase with the voltage

C. leads the voltage by 90°

D. lags behind the voltage by 90°

Answer: C

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10. In an LR circuit , the phase angle between alternating voltage and alternating current is 45°. The value of inductive reactance will be

A. $\frac{R}{4}$

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

C. R

D. data insufficient

Answer: C

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11. In an LCR series circuit, the capacitance is reduced to one-fourth, when in resonance. What change should be made in the

inductance, so that the circuit remains in resonance?

A. 4 times

B. $\frac{1}{4}$ times

C. 8 times

D. 2 times

Answer: A

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12. The phase difference between V and I of an LCR circuit in series resonance is

A. π

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

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

D. 0

Answer: D

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13. The reactance of an inductor of inductance $\frac{1}{\pi}$H at frequency 50 Hz is

A. $\frac{50}{\pi}\Omega$

B. $\frac{\pi}{50}\Omega$

C. 100Ω

D. 50Ω

Answer: C

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14. Which quantity in an ac circuit is not dependent on frequency?

A. resistance

B. impedance

C. inductive reactance

D. capacitative reactance

Answer: A

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15. The condition of getting maximum current in an LCR series circuit is

A. $X_L = 0$

B. $X_C = 0$

C. $X_L = X_C$

D. $R = X_L - X_C$

Answer: C

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16. The series resonant frequency of an LCR circuit is f. IF the capacitance is made 4 times the initial value, then the resonant frequency will come

A. $f/2$

B. 2f

C. f

D. $f/4$

Answer: A

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17. A coil has resistance 30Ω and inductive reactance 20Ω at 50 Hz frequency. If an ac source of 200V, 100 Hz is connected across the coil, the current in the coil will be

A. 2.0A

B. 4.0A

C. 8.0A

D. $\frac{20}{\sqrt{13}}A$

Answer: B

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18. 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

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

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

C. $\sqrt{LC}$

D. $\pi\sqrt{LC}$

Answer: A

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19. A voltage $V_0 \sin \omega t$ is applied across a series combination of resistance R and inductor L. The peak value of the current in the circuit is

A. $\frac{V_0}{\sqrt{R^2+\omega^2L^2}}$

B. $\frac{V_0}{\sqrt{R^2-\omega^2L^2}}$

C. $\frac{V_0}{\sqrt{R^2+\omega^2L^2}}\sin\omega t$

D. $\frac{V_0}{R}$

Answer: A

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20. When an ideal choke is connected to an ac source of 100V and 50Hz, a current of 8 A flows through the circuit, A current of 10 A flows

throught the circuit when a pure resistor is connected instead of the choke coil. IF the two are connected in series with an ac supply of 100 V and 40 Hz, then the current in the circuit is

A. $10A$

B. $8A$

C. $5\sqrt{2}A$

D. $10\sqrt{2}A$

Answer: C

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21. In an LCR circuit voltages across R,L and C are 10V,10V and 20V respectively. Voltage between the two end points of the whole combination is

A. 30V

B. $10\sqrt{3}V$

C. 20V

D. $10\sqrt{2}V$

Answer: D

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22. In an ac circuit alternating voltage E= $200\sqrt{2}$ sin 100t volt is connected to a capacitor of capacity$1\mu F$. The rms value of the current in the circuit is

A. 10 mA

B. 100 mA

C. 200 mA

D. 20 mA

Answer: D

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23. The power factor of an LR circuit carrying an ac of angular frequency ω is

A. $\frac{R}{\omega L}$

B. $\frac{\omega L}{R}$

C. $\frac{R}{\sqrt{R^2+\omega^2 L^2}}$

D. $\frac{R}{\sqrt{R^2 - \omega^2 L^2}}$

Answer: C

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24. One of the condions to get a wattless current in an ac circuit is

A. L=0

B. C=0

C. R=0

D. L=C

Answer: C

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25. If an emf=E=$E_0 \cos \omega t$ is applied to a circuit, the current becomes $I = I_0 \cos \omega t$. What is the power factor of the circuit?

A. zero

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

C. 1

D. ∞

Answer: C

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26. In an ac circuit , V and I are given by V=100sin(100t)V,and I=100sin $\left(100t + \frac{\pi}{3}\right)$ a respectively. The power dissipated in the circuit is

A. 10^4W

B. 10 W

C. 2500 W

D. 5 W

Answer: C

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27. The inductance and capacitance in a closed circuit are 20 mH and $2\mu F$ respectively. The natural frequency will be

A. 796 Hz

B. 5000 Hz

C. 40 Hz

D. 31400 Hz

Answer: A

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28. For an LC oscillator which one of the followings is not true?

A. IT converts dc current to ac current

B. IT can be used as filter

C. IT can sustain stable oscillations only for frequencies less than resonance frequency

D. The resonance frequency is $\frac{1}{\sqrt{LC}}$ radians per second

Answer: C

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29. An ideal transformer is used to decrease an alternating voltage from 880 V and 220 V. If the number of turns of its primary coil is 4000, then what is that in the secondary coil?

A. 16000

B. 4000

C. 2000

D. 1000

Answer: D

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30. The core of any transformer is laminated so as to

A. increase the secondary voltage

B. reduce the energy loss due to eddy currents

C. reduce the energy loss due to hysteresis

D. make it robust and strong

Answer: B

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31. In a non -ideal transformer the primary and secondary voltages and currents are V_1, I_1 and V_2, I_2 respectively. The efficiency of the transformer is

A. $\frac{V_2}{V_1}$

B. $\frac{I_2}{I_1}$

C. $\frac{V_2 I_2}{V_1 I_1}$

D. $\frac{V_1 I_1}{V_2 I_2}$

Answer: C

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32. The turns ratio of an ideal transformer is 1:n. the input to output power transfer ratio is

A. $1:1$

B. $1:n$

C. $n:1$

D. $1:n^2$

Answer: A

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Exercise Very Short Answer Type

1. If the frequency of an alternating emf be 50 Hz, how many times the direction of emf will be reversed per second?

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2. What percentage of its peak value is the rms value of an ac?

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3. What is the peak value of the voltage of a 220V ac line?

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4. If an alternating current is represented by $I = \sin 100\pi t$ mA. What is the peak value?

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5. If an alternating current is represented by . $I = \sin 100\pi t$mA,then what is the frequency of that current?

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6. After what time will the direction of current is an electric supply line of frequency 50 Hz be reversed?

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7. An alternating source of emf E=$E_0 \sin \omega t$ and of negligible resistance is connected directly to an ac voltmeter. What reading will it show?

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8. What changes are observed in the rms value of an ac with changes in the frequency?

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9. What is the rms value of an alternating current , $I = I_0 \sin \omega t$?

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10. What is the ratio between the peak value and the average value of a sinusoidal emf?

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11. The instantaneous current in an ac circuit is $I = 6 \sin 314t A$. What is the rms value of current ?

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12. An alternating current is $I = \cos 100\pi t A$. Find out its frequency, peak value and rms value.

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13. Why a dc voltmeter and dc ammeter cannot read ac?

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14. What will be the phase difference between current and emf when 220 V, 50 Hz ac source is connected to a circuit containing pure resistor?

Watch Video Solution

15. What is the unit of impedance?

Watch Video Solution

16. What is the reactance of pure resistances in an ac circuit?

Watch Video Solution

17. If an LCR circuit is connected to a dc source , what will be the current through the circuit?

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18. What will be the reactance if a current of frequency f flows through an inductor of self-inductance L?

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19. What will be the reactance if a current of frequency f flows through a capacitor of capacitance C?

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20. If the frequency of an circuit is increased, how would the reactance of an inductor change?

Watch Video Solution

21. If the frequency of an circuit is increased, how would the reactance of a capacitor change?

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22. In an LR circuit, the alternating current_____the alternating emf by a certain phase angle.[Fill in the blanks]

Watch Video Solution

23. In a CR circuit, the alternating current _____the alternating emf by a certain phae angle.[Fill in the blanks]

Watch Video Solution

24. In an alternating series LCR circuit ,what is the phase difference between the voltage drop across L and C?

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25. When does LCR series circuit have minimum impedance?

Watch Video Solution

26. What is the reactance of a capacitor of capacitance C at fHz?

Watch Video Solution

27. What is the power factor of a circuit having a pure resistance only?

Watch Video Solution

28. What is the power dissipated in an ac circuit in which voltage and current are given by $V = 230 \sin\left(\omega t + \frac{\pi}{2}\right)$ and $I = 10 \sin \omega t$?

Watch Video Solution

29. What is the natural frequency of an LC oscillator?

Watch Video Solution

30. Indicate the change in emf produced by an ac dynamo in the following cases: the magnetic field is doubled

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31. Indicate the change in emf produced by an ac dynamo in the following cases: the angular velocity of the coil is decreased.

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32. If the area of the coil of an ac dynamo is halved, how would the emf generated change?

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33. If the angular velocity of coil of an ac dynamo is doubled ,how would the emf produced change?

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34. By what factor would the output voltage of an ac generator change, if the number of turns in its coil is doubled?

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35. The turns ratio of an ideal transformer is 4:1 what will be the current in the secondary if that in the primary is 1.2A?

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Exercise Short Answer Type I

1. The number of turns in the coil of an AC generator are 100 and its cross-sectional area is 2.5 m^2 . The coil is revolving in a uniform magnetic field of strength 0.3T with the uniform angular velocity of 60rad/s. The value of maximum voltage produced is ____kV

Watch Video Solution

2. What is the form factor of a sinsoidal alternating current.How can it be obtained?

Watch Video Solution

3. The inductance of a resistanceless coil is 0.5 henry. In the coil, the value of alternating current is 0.2 A, whose frequency is 50 Hz. The reactance of circuit is

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4. What type of voltmeters or ammeters are used for measuring alternating voltage or current?

Watch Video Solution

5. Why a moving coil galvanometer cannot be used with an alternating current.

Watch Video Solution

6. Write down the conditions for which there will be no phase difference between alternating voltage and alternating current in a series LCR circuit?

Watch Video Solution

7. Why does a series LCR circuit conneted to a DC source register zero current?

Watch Video Solution

8. In a circuit, the frequency is $f = 1000/2\pi$ Hz and the inductance is 2 henry, then the reactance will be

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9. Show with a vector diagram the phase relations among the quantities related to an alternating CR circuit.

Watch Video Solution

10. What remedial steps are to be taken to minimise damping in LC oscillations.

Watch Video Solution

11. Show that a purely capacitative ac circuit dissipates no power.

Watch Video Solution

12. Show that a purely inductive ac circuit dissipates no power.

Watch Video Solution

13. Why is the use of a capacitor of variable capacitance less costly than the use of a variable resistance for regulating the speed of an electric fan?

Watch Video Solution

14. How would you explain wattless current in view of the law of conservation of energy?

Watch Video Solution

15. How does an LC oscillations behave in a closed LC circuit which includes a resistance?

Watch Video Solution

16. Explain whether the rms voltages are always the same for two alternating voltages of the same peak value and of the same frequency.

Watch Video Solution

17. Prove that high frequency ac can pass through a pure capacitor easily but not through a pure indicator.

Watch Video Solution

18. An alternating voltage $E = E_0 \sin \omega t$ is applied across an inductor L. Show by calculation that the current lags the voltage

by a phase angle $\pi/2$(Assume inductor L has no resistance).

Watch Video Solution

Exercise Short Answer Type Ii

1. The natural frequency of an LC oscillations is f_0. Show that , during periodic oscillations the maximum current I_0 flowing through the oscillator is related to the maximum charge Q_0, on the capacitor as $I_0 = 2\pi f_0 Q_0$.

Watch Video Solution

2. Sketch graphs to show the variation of (i) current and (ii) impedance of a series LCR circuit with the frequency of the ac source.

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3. Can the voltage drop across the inductor or the capacitor in a series LCR circuit be greater than the applied voltage of the ac source? Justify your answer.

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Problem Set I

1. The frequency of an alternating current is 50 Hz .In what time will the value of current rise to rms value from zero?

Watch Video Solution

2. An alternating current is given by the equation $I = I_1 \sin \omega t + I_2 \cos \omega t$ .What will be its rms value?

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3. The line voltage of a house, measured by an ac voltmeter is 324 V. If the frequency is 50Hz, establish the equation of the line voltage.

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4. The voltage of an source varies with time according to the equation , $V = 100 \sin 100\pi t \cos 100\pi t$,where t is in second and V is in volt. What are the values of peak voltage and frequency of the source?

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5. What is the rms value of the alternating emf $E = 10 \sin 100\pi t \cos 100\pi t$?

Watch Video Solution

6. Resistance , inductive reactance and capacitative reactance of an LCR series ac circuit are 30Ω, 60Ω and 20Ω respectively. What is the phase difference between the ac-voltage and current in the circuit?

Watch Video Solution

7. The rms values of the terminal potential differences of R ,L and C of a series circuit are

80V ,70V and 10V respectively.What is the rms value of the applied emf in the circuit?

Watch Video Solution

8. A $15.0\mu F$ capacitor is connected to 220V,50Hz source. Find the capacitive reactance and the rms current.

Watch Video Solution

9. An ac voltage of 100V,50Hz is connected across a 20Ω resistor and 2mH inductor in series. Calculate (i) impedance of the circuit (ii) rms current in the circuit.

Watch Video Solution

10. A bulb of resistance 10Ω connected to an inductor pf inductance L is in series with an ac source marked 100V, 50Hz. IF the phase angle

between voltage and current is $\frac{\pi}{4}$ radian,calculate the value of L.

Watch Video Solution

11. A capacitor, a resistor ad a 40 mH inductor are connected in series to an ac source of frequency 60Hz. Calculate the capacitance of the capacitor , if current is in phase with the voltage.

Watch Video Solution

12. The frequency of applied of ac voltage to an inductive coil is 1000Hz.L=25 mH and the power factor of the circuit is 0.1.Find the resistance of the coil.

Watch Video Solution

13. What should be the percentage rise of impedance, the pure resistance remaining the same, so that the power factor of a circuit will be half?

Watch Video Solution

14. What is the Q factor of a series LCR circuit with L = 2 H, C=32μF and R=10Ω ?

Watch Video Solution

15. The inductance in a closed circuit is 40mH and the capacitance is $1\mu F$. What is the frequency of LC oscillation?

Watch Video Solution

16. The length and breadth of a rectangular coil are 10cm and 8cm, respectively and the coil contains 500 turns . IF it is rotated with an angular velocity of $1200 rad / \min$ in a magnetic field of intensity 10Wb m^{-2}, find out the peak value of the inducted emf.

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17. A rectangular coil of area $20 cm \times 15 cm$ and of 485 turns is rotating with a speed pf 1800 rpm in a magnetic field of intensity

$20Wb.\, m^{-2}$.When the coil is inclined at 60° with the magnetic field , what will be the induced emf in the coil?

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18. A transformer carries 8 A current in the primary of 100 turns. If the inpur power is 1kW, what should be the number of turns in the secondary to have a 500 V output?

Watch Video Solution

Problem Set Ii

1. Expression of an alternating current is $I = 0.5 \sin 100\pi t A$. Determine the frequency , peak value and rms value of the current.

Watch Video Solution

2. An alternating voltage is represented by

$$E = 311 \sin\left(100\pi t - \frac{\pi}{6}\right) V$$

Determine its frequency, time period , peak value and rms value.

Watch Video Solution

3. In an LCR circuit , R=125Ω, L=100 mH and C=10^{-7}F. Find out the resonance frequency and the Q-value of the circuit.

Watch Video Solution

4. A $25\mu F$ capacitor, a 0.10 henry inductor and a 25.0Ω resistor are connected in series with an ac source whose emf is given by

E=310sin314t. what is the frequency of the emf?

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5. A $25\mu F$ capacitor, a 0.10 henry inductor and a 25.0Ω resistor are connected in series with an ac source whose emf is given by E=310sin314t.Calculate (a) the reactance of the circuit,(b) the impedance of the circuit and (c) current in the circuit.

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6. An alternating current of 1.5mA and angular frequency 300 radian s^{-1} flows through a 10 $k\Omega$ resistor and a $0.50\mu F$ capacitor in series. Find the rms voltage across the capacitor and impedance of the circuit.

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7. An ac source of 200 V, 50 Hz is connected in series to a capacitor with a 20 V-5W. Lamp. Determine the capacitance of the capacitor

needed to light the lamp with maximum brightness.

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8. For the series connection of an inductor (L) , a capacitor (C) and a resistor (R) , show that the current flowing through the circuit is maximum for a particular value of the capacitor. IF L=10 mH, R=100Ω and frequency is $1000s^{-1}$, then what is the value of C for which current flowing in the circuit is maximum?

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9. When 100 volt dc is applied across a conducting coil, a current of 1A flows through it. When 100 volt ac of 50 cycles per second is applied to the same coil, only 0.5 A current flows through it. Calculate resistance of coil

Watch Video Solution

10. When 100 volt dc is applied across a conducting coil, a current of 1A flows through

it. When 100 volt ac of 50 cycles per second is applied to the same coil, only 0.5 A current flows through it. Calculate impedance of coil

Watch Video Solution

11. When 100 volt dc is applied across a conducting coil, a current of 1A flows through it. When 100 volt ac of 50 cycles per second is applied to the same coil, only 0.5 A current flows through it. Calculate inductive reactanc of coil

Watch Video Solution

12. When 100 volt dc is applied across a conducting coil, a current of 1A flows through it. When 100 volt ac of 50 cycles per second is applied to the same coil, only 0.5 A current flows through it. Calculate inductance of coil.

Watch Video Solution

13. An LR circuit contains a resistance of 40Ω and an inductance of 25 mH .What would be

the power dissipated in the circuit for an applied alternating voltage of frequency 1000 Hz and peak value of 10 V?

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14. An alternating emf of E=20sin 1000tV is applied on a circuit containing a pure resistance of 25Ω in series with a coil of self-inductance 40 mH and resistance 15Ω. Find out the phase difference between E and the current I.

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15. An alternating emf of E=20sin 1000tV is applied on a circuit containing a pure resistance of 25Ω in series with a coil of self-inductance 40 mH and resistance 15Ω. Find out the power factor of the circuit , Also , find out this capacitance of a capacitor that should be connected in series to raise the power factory to unity.

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16. A sinusoidal voltage v=200 sin 314 t is applied to a resistor of 10Ω resistance. Calculate the frequency of the supply

Watch Video Solution

17. A sinusoidal voltage v=200 sin 314 t is applied to a resistor of 10Ω resistance. Calculate the rms value of the voltage

Watch Video Solution

18. A sinusoidal voltage v=200 sin 314 t is applied to a resistor of 10Ω resistance. Calculate the rms value of the current

Watch Video Solution

19. A sinusoidal voltage v=200 sin 314 t is applied to a resistor of 10Ω resistance. Calculate the power dispated as heat in watt.

Watch Video Solution

20. A circuit is set up connecting L=100 mH, C= $5\mu F$ and R=100Ω is series, An alternating emf of $\left(150\sqrt{2}\right)volt$, $\frac{500}{\pi}Hz$ is applied across this series combination. Calculate the impedance of the circuit. What is the average power dissipated in the resistor

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21. A circuit is set up connecting L=100 mH, C= $5\mu F$ and R=100Ω is series, An alternating emf of $\left(150\sqrt{2}\right)volt$, $\frac{500}{\pi}Hz$ is applied across this

series combination. What is the average power dissipated in the capacitor

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22. A circuit is set up connecting L=100 mH, C= $5\mu F$ and R=100Ω is series, An alternating emf of $\left(150\sqrt{2}\right)volt$, $\frac{500}{\pi}Hz$ is applied across this series combination. Calculate the impedance of the circuit. What is the average power dissipated in the inductor?

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23. A circuit draws a power of 550 W from a 220V-50 Hz source. The power factor of the circuit is 0.8. A 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 connected in the circuit to bring its power factor to unity.

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24. Find out the inductance of an inductor which should be connected in series with a capacitor of $5\mu F$,a resistance of 10Ω and an ac source of 50 Hz so that the power factor of the circuit is 1.

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25. An ac source is connected in series with an inductor of 5H and a resistor of 1000Ω. The rms value of voltage of the source is 100 V and

the frequency of the source is 50cps. What is the rms value of the current in the circuit? What is the phase difference of the voltage and the current in the circuit? What is the power dissipated in the circuit?

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26. The primary coil of an ideal step-up transformer has 100 turns, and the transformation ratio is also 100. The input voltage and power are 220 V and 1100 W ,

respectively, Calculate number of turns in the secondary

Watch Video Solution

27. The primary coil of an ideal step-up transformer has 100 turns, and the transformation ratio is also 100. The input voltage and power are 220 V and 1100 W , respectively, Calculate the current in the primary

Watch Video Solution

28. The primary coil of an ideal step-up transformer has 100 turns, and the transformation ratio is also 100. The input voltage and power are 220 V and 1100 W , respectively, Calculate the voltage across the secondary

Watch Video Solution

29. The primary coil of an ideal step-up transformer has 100 turns, and the

transformation ratio is also 100. The input voltage and power are 220 V and 1100 W , respectively, Calculate the current in the secondary

Watch Video Solution

30. The primary coil of an ideal step-up transformer has 100 turns, and the transformation ratio is also 100. The input voltage and power are 220 V and 1100 W ,

respectively, Calculate the power in the secondary.

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Hots Numerical Problems

1. When an ac signal of frequency 1200 Hz is applied to a coil of reactance 120Ω, the applied voltage leads the current by 45° .Calculate the self inductance of the coil.

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2. A circuit draws 280 W from a 110V, 60Hz ac line. The current lags the voltage and the power factor is 0.5. Find the value of a capacitance which can be connected in series to make the power factor of the circuit unity.

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Entrance Corner Assertion Reason Type

1. Statement I: In series L–C–R AC circuit, current and voltage are in same phase at resonance. Statement II: In series L–C–R AC circuit, resonant frequency does not depend on the value of resistance. Hence current, at resonance, does not depend on resistance.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I

C. Statement I is true, statement II is false

D. Statement I is false, statement II is true

Answer: D

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2. Statement I: Q-factor of a series LCR circuit is $\frac{1}{R}\sqrt{\frac{L}{C}}$

Statement II: Resonant frequency of an LCR circuit does not depend on the resistance of the circuit.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation

for statement I

C. Statement I is true, statement II is false

D. Statement I is false, statement II is true

Answer: B

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3. When the values of inductance and capacitance in an L–C circuit are 0.5 H and 8 μF respectively then current in the circuit is

maximum. The angular frequency of alternating e.m.f. applied in the circuit will be

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4. Statement I: Form factor becomes different for different waveforms of alternating voltage and current.

Statement II: The mean value of alternating voltage or current $= \frac{2}{\pi}$ $\text{rms value}=1/(\text{sqrt}2) \times peakvalue$ for any wave form.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I

C. Statement I is true, statement II is false

D. Statement I is false, statement II is true

Answer: C

View Text Solution

5. Statement I: A series LCR circuit when connected to an ac source gives the terminal potential difference 50 V across each of resistor R, inductor L and capacitor C. Then the terminal potential difference across LC is zero.
Statement II: The terminal alternating voltages across the inductor and capacitor in a series LCR circuit are in opposite phase.

A. Statement I is true, statement II is true, statement II is a correct explanation for

statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I

C. Statement I is true, statement II is false

D. Statement I is false, statement II is true

Answer: A

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6. Statement I: If the value of the output voltage of an ideal transformer is half the value of the input voltage, then the output current will become twice.

Statement II: No energy is dissipated in an ideal transformer.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I

C. Statement I is true, statement II is false

D. Statement I is false, statement II is true

Answer: A

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7. Statement I: the alternating current lags behind the voltage by a phase angle $\frac{\pi}{2}$ when ac flows through an inductor,

Statement II: The inductive reactance increases as the frequency of ac source decreases.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I

C. Statement I is true, statement II is false

D. Statement I is false, statement II is true

Answer: C

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8. Statement I: An inductor acts as perfect conductor for dc.

Statement II: dc remains constant in magnitude and direction.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I

C. Statement I is true, statement II is false

D. Statement I is false, statement II is true

Answer: B

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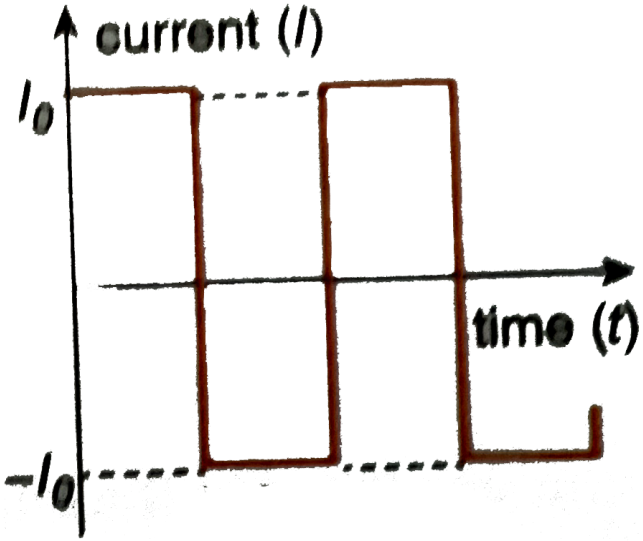
Entrance Corner Multiple Correct Answer

1. For the circuit in Fig.2.47,



A. mean value=I_0

B. rms value =$\frac{I_0}{\sqrt{2}}$

C. form factor=1

D. form factor =$\frac{1}{\sqrt{2}}$

Answer: A::C

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2. An emf of V=$V_0 \sin \omega t$ is applied on a series LCR circuit. IF there is no phase difference between the voltage and current then,

A. $I = \frac{V_0}{R} \sin \omega t$

B. $\omega L = \frac{1}{\omega L}$

C. effective power=$\frac{V_0^2}{R}$

D. ratio of terminal potential difference across L and R $= \frac{1}{\omega CR}$

Answer: A::B::D

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3. A coil of resistance 8Ω and self -inductance 19.1 mH is connected with an ac source of peak voltage 200 V and frequency 50 Hz

A. reactance due to induction $= 0.955\Omega$

B. impedance of the circuit $=10\Omega$

C. rms value of current $=10\sqrt{2}$ A

D. power dissipated =2000 W

Answer: B::C::D

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4. IF only a capacitor is connected to an ac circuit

A. wattless current is obtained

B. the current is 90° ahead of voltage

C. the current lags the voltage by 90°

D. effective power is inversely proportional to ωC

Answer: A::B

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5. The alternating current in an alternating circuit is given by $I = I_0 \sin \omega t$ In this case

A. the time taken by the current to reach maximum value of I_0 from zero is $\frac{\pi}{2\omega}$

B. the time taken by the current to reach maximum value I_0 from zero is $\frac{\pi}{4\omega}$

C. the time taken by the current to reach rms value from zero is $\frac{\pi}{4\omega}$

D. the time taken by the current to reach $-I_0$ from zero is $\frac{\pi}{\omega}$

Answer: A::C

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6. In a series LCR circuit the resonant frequency f_0, alternating voltae $V = V_0 \sin \omega t$ and current $I = I_0 \sin(\omega t + \theta)$. So if frequency

A. $f < f_0 \text{then} \theta > 0$

B. $f < f_0 \text{then} \theta < 0$

C. $f > f_0 \text{then} \theta > 0$

D. $f > f_0 \text{then} \theta < 0$

Answer: A::D

Watch Video Solution

7. In an ideal transformer, number of turns in the primary and secondary are N_1 and N_2, current and power in the input and output are I_1, $I_2$and P_1, P_2 respectively. Then

A. $I_2 = I_1 \frac{N_1}{N_2}$

B. $I_2 = I_1 . \frac{N_2}{N_1}$

C. $P_2 = P_1$

D. $P_2 = P_1 \frac{N_1}{N_2}$

Answer: A::C

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8. L,C,R represents the inductance, capacitance and reactance respectively. Which of the following combinations have the same dimensions as that of frequency?

A. $\frac{1}{RC}$

B. $\frac{R}{L}$

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

D. $\frac{C}{L}$

Answer: A::B::C

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9. In a resonant LCR circuit,

A. power factor is zero

B. power factor is one

C. power dissipated in the resistor is zero

D. power dissipated in the capacitor is zero

Answer: B::D

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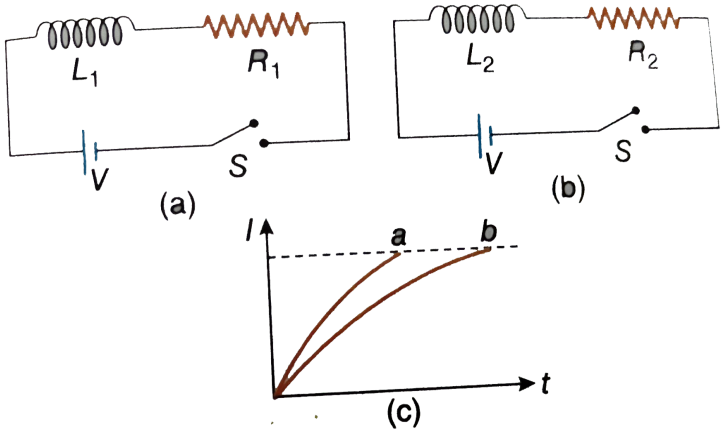
10. Two LR circuit show in the fig.2.48(A) and (b). The change in current in this circuit shown in the fig.2.48(c). Chosse the correct options.



A. $R_1 > R_2$

B. $R_1 = R_2$

C. $L_1 > L_2$

D. $L_1 < L_2$

Answer: B::D

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Entrance Corner Matrix Match Type

1. Match the columns for a series LCR circuit.

Column I	Column II
(i) Impedance	Ⓐ $\omega L - \frac{1}{\omega C}$
(ii) Reactance	Ⓑ $\frac{1}{\omega CR}$
(iii) Power factor	Ⓒ $\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$
(iv) Q -factor	Ⓓ $\frac{R}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$

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2. An LCR circuit $(R = 40\Omega, L = 100mH, C = 0.242\mu F)$ is connected with an ac voltage source of peak

voltage 200 V and frequency 1000 Hz.

Column I	Column II
(i) Impedance of the circuit (in Ω)	(A) 2512
(ii) Potential difference across R (in V)	(B) 2632
(iii) Potential difference across L (in V)	(C) 160
(iv) Potential difference across C (in V)	(D) 50

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3. Colum I describes some action and column II the required device.

Column I	Column II
(i) Increase or decrease of ac line voltage	(A) Dynamo
(ii) Selection of signal of a particular frequency	(B) Motor
(iii) Transfer of mechanical energy to electrical energy	(C) LC oscillator
(iv) Transfer of electrical energy to mechanical energy	(D) Transformer

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4. In an LR circuit instantaneous voltage and instantaneous current are V=100 sin 100 t, and $i = 10\sin\left(100t - \frac{\pi}{4}\right)$ respectively.

Column I	Column II
(i) Resistance	(A) $\frac{1}{10\sqrt{2}}$ unit
(ii) Inductive reactance	(B) $5\sqrt{2}$ unit
(iii) Inductance	(C) $10\sqrt{2}$ unit
(iv) Average power in a cycle	(D) $250\sqrt{2}$ unit

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5. Referring to the given circuit, match the following .

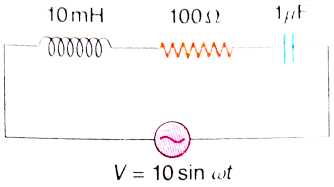

Fig 2.49

Column I	Column II
(i) When $\omega = 8000$ rad/s	(A) peak current in the circuit is less than 0.1 A
(ii) When $\omega = 10000$ rad/s	(B) voltage and current across the circuit are in the same phase
(iii) When $\omega = 1000$ rad/s	(C) voltage leads the current across the circuit
(iv) When $\omega = 10500$ rad/s, if $R = 50\,\Omega$ instead of $100\,\Omega$	(D) current leads the voltage across the circuit

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Entrance Corner Comprehension Type

1. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$,where $I_0 = \dfrac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1} \dfrac{1}{R}\left(\omega L - \dfrac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \dfrac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are $V_{rms} = \dfrac{V_0}{\sqrt{2}}$ and $I_{rms} = \dfrac{I_0}{\sqrt{2}}$ respectively.

These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the power factor.

$V = V_0 \sin\omega t$ electromotive force is applied to an alternating circuit consisting of resistance R' and an inductor of self-inductance L. The phase difference between the voltage and current is

A. 90°

B. $\tan^{-1}\frac{\omega L}{R'}$

C. $\tan^{-1}\frac{R'}{\sqrt{R'^2+\omega^2L^2}}$

D. $\frac{\sqrt{R'^2+\omega^2L^2}}{R'}$

Answer: B

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2. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating

voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$,where $I_0 = \dfrac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1} \dfrac{1}{R}\left(\omega L - \dfrac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \dfrac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are $V_{rms} = \dfrac{V_0}{\sqrt{2}}$ and $I_{rms} = \dfrac{I_0}{\sqrt{2}}$ respectively. These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the

circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the power factor.

the power factor of the circuit is question (i) is

A. zero

B. $\frac{\omega L}{R'}$

C. $\frac{R'}{\sqrt{R'^2 + \omega^2 L^2}}$

D. $\frac{\sqrt{R'^2 + \omega^2 L^2}}{R'}$

Answer: C

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3. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$,where $I_0 = \dfrac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1} \dfrac{1}{R}\left(\omega L - \dfrac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \dfrac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are

$V_{rms} = \frac{V_0}{\sqrt{2}}$ and $I_{rms} = \frac{I_0}{\sqrt{2}}$ respectively. These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the power factor.

In the circuit in question (i) the inductor is replaced by a pure capacitor, the phase difference between the current and terminal voltage of the capacitor is

A. -90°

B. between -90° and zero

C. zero

D. $+90^\circ$

Answer: A

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4. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating

voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$,where $I_0 = \dfrac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1} \dfrac{1}{R}\left(\omega L - \dfrac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \dfrac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are $V_{rms} = \dfrac{V_0}{\sqrt{2}}$ and $I_{rms} = \dfrac{I_0}{\sqrt{2}}$ respectively. These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the

circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the power factor.

The power factor of the circuit in question (iii) is

A. -1

B. zero

C. between zero and 1

D. 1

Answer: C

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5. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$,where $I_0 = \frac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1} \frac{1}{R}\left(\omega L - \frac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \frac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are

$V_{rms} = \frac{V_0}{\sqrt{2}}$ and $I_{rms} = \frac{I_0}{\sqrt{2}}$ respectively. These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the power factor.

The voltage applied in an LCR circuit having $R = 10\Omega, L = 10mH$ and $C = 1\mu F$ is $V = 20 \sin \omega t$ volt. For what frequency of the applied voltage will the current reach its peak value?

A. 159 Hz

B. 1592 Hz

C. $1.59 \times 10^4 Hz$

D. $1.59 \times 10^5 Hz$

Answer: B

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6. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating

voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$,where $I_0 = \dfrac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1} \dfrac{1}{R}\left(\omega L - \dfrac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \dfrac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are $V_{rms} = \dfrac{V_0}{\sqrt{2}}$ and $I_{rms} = \dfrac{I_0}{\sqrt{2}}$ respectively. These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the

circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the power factor.

The phase difference between the voltage and peak current in question (v) is

A. zero

B. -90°

C. $+90^\circ$

D. 180°

Answer: A

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7. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$,where $I_0 = \frac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1} \frac{1}{R}\left(\omega L - \frac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \frac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are

$V_{rms} = \frac{V_0}{\sqrt{2}}$ and $I_{rms} = \frac{I_0}{\sqrt{2}}$ respectively. These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the power factor.

Which element is responsible for the power consumption in an alternating current circuit?

A. only resistor

B. only inductor

C. only capacitor

D. resistor,inductor and capacior

Answer: A

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8. A series combination of an inductor of self-inductance L, capacitor of capacitance C and resistor R is connected to an alternating voltage source of $V = V_0 \sin \omega t$. The current through the circuit is $I = I_0 \sin(\omega t - \theta)$

,where $I_0 = \dfrac{V_0}{\sqrt{R^2 + \left(\omega - \frac{1}{\omega C}\right)^2}}$ and $\theta = \tan^{-1}\dfrac{1}{R}\left(\omega L - \dfrac{1}{\omega C}\right)$.

Now that, the frequency of both voltage and current is $f = \dfrac{\omega}{2\pi}$. The rms value of these parameters during one complete cycles are $V_{rms} = \dfrac{V_0}{\sqrt{2}}$ and $I_{rms} = \dfrac{I_0}{\sqrt{2}}$ respectively. These values are shown in alternating voltmeter and ammeter.

The power consumed by the circuit P=VI. The mean value i.e., the effective power of the circuit in a complete cycle is $\overline{P} = V_{rms} I_{rms} \cos\theta$. This $\cos\theta$ is termed the

power factor.

The frequency of the applied alternating voltage in an ac circuit is 50 Hz.Resistance and self inductance are 37.6Ω and 120 mH . The phase difference between the voltage and current is

A. zero

B. 45°

C. 60°

D. 90°

Answer: B

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9. Transformer is a device used to increase or decrease the voltage in the transmission line according to requirement, Generally the input line voltage is fed in a primary coil and the output line voltage is obtained from the terminals of another coil In an ideal transformer, the primary and secondary coils are linked is such a way that there is no loss of magnetic flux and electrical energy.

In an ideal transformer, if the number of turns

and input voltage across the terminals of the primary coils be N_1 and V_1, then the output voltage at the two terminals of the secondary coil $V_2 = V_1 . \frac{N_2}{N_1}$, where N_2 is the number of turns in the secondary coil .

The ratio of number of turns of the primary and secondary coils of an ideal transformer is 2:1 IF the input voltage is 440 V, then output voltage is if the input power of the transformer be 44 W, then output power is In the above mentioned transformer the input and output currents are respectively.

A. 220 V

B. 440 V

C. 880V

D. None of these

Answer: A

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10. Transformer is a device used to increase or decrease the voltage in the transmission line according to requirement, Generally the input

line voltage is fed in a primary coil and the output line voltage is obtained from the terminals of another coil In an ideal transformer, the primary and secondary coils are linked is such a way that there is no loss of magnetic flux and electrical energy.

In an ideal transformer, if the number of turns and input voltage across the terminals of the primary coils be N_1 and V_1, then the output voltage at the two terminals of the secondary coil $V_2 = V_1 . \frac{N_2}{N_1}$, where N_2 is the number of turns in the secondary coil .

In question (i) if the input power of the transformer be 44 W, then output power is

A. 22 W

B. 44 W

C. 88 W

D. None of these

Answer: B

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11. Transformer is a device used to increase or decrease the voltage in the transmission line according to requirement, Generally the input line voltage is fed in a primary coil and the output line voltage is obtained from the terminals of another coil In an ideal transformer, the primary and secondary coils are linked is such a way that there is no loss of magnetic flux and electrical energy.

In an ideal transformer, if the number of turns and input voltage across the terminals of the primary coils be N_1 and V_1, then the output

voltage at the two terminals of the secondary coil $V_2 = V_1 . \frac{N_2}{N_1}$, where N_2 is the number of turns in the secondary coil .

In the above mentioned transformer the input and output currents are respectively.

A. 100 mA,100mA

B. 200 mA,200mA

C. 100mA,200mA

D. 200mA,100mA

Answer: C

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Entrance Corner Integer Answer Type

1. A resistance and a capacitor is connected in series with an alternating voltage of rms value 13 V. The terminal voltage of the resistor is 12V and that across the capacitor is (n+0.38)V. What is the value of n?

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2. The current and voltage in an ac circuit are $I = \sin\left(100t + \frac{\pi}{3}\right)$ A and V=20sin100tV. Calculate the power of the circuit in W.

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3. In a series LCR circuit the capacitance C is replaced by 2C. To keep the resonance frequency unchanged, the inductance has to be replaced by an inductance of L'Find the ratio of L and L'.

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4. An alternating voltage 5V of frequency 50 Hz is connected to a series LCR circuit. The potential difference across the inductor and resistor are 6V and 4V respectively. What is the voltage across the capacitor (in V)?

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5. In a seris LCR circuit $R = 1k\Omega, C = 2\mu F$ and potential difference across R is 2V. At

resonance $\omega = 200 rad.\, s^{-1}$. What is the potential difference (in V) across L at resonance?

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6. In a series LCR circuit R=25Ω,L=10 mH and $C = 1\mu F$. The circuit is connected with an ac source of varible frequency . What is the Q-factor of the circuit?

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7. A current of 50mA flows through a $4\mu F$ capacitor connected to a 500 Hz ac source. The terminal potential difference (in V) across the capacitor is $(\eta + 0.98)$ .what is the value of η? (π=3.14)

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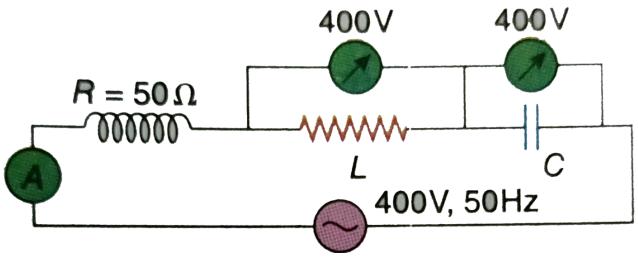
8. In the figure an LCR series circuit is shown. What would be the ammeter reading in

ampere?



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Examination Archive With Solutions Wbchse

1. An ac having a peak value 1.41 A is used to heat a wire. A dc producing the same heating rate will be approximately

A. 1.41 A

B. 2.0 A

C. 0.705 A

D. 1.0 A

Answer: D

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2. An ac voltage $e = E_0 \sin \omega t$ is applied across an ideal inductor of self-inductance [L]. Write down the peak current.

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3. The instantaneous voltage from an ac source is given by e=200sin 314t volt. Find the rms voltage .What is the frequency of the source?

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4. State the condition under which the phenomenon of resonance occurs in series

LCR circuit when ac voltage is applied. In a series LCR circuit, the current is in same phase with voltage. Calculate the value of self-inductance if the capacitor used in $20\mu F$ and resistance used in 10 ohm with the ac source of frequency 50 Hz.

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5. A series LCR circuit acts as a purely resistive circuit, when

A. $\omega L > \frac{1}{\omega C}$

B. $\omega L < \frac{1}{\omega C}$

C. $\omega L = \frac{1}{\omega C}$

D. None of these

Answer: C

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6. What is Q-factor?

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7. Define the term 'root mean square' (rms) value of alternating current.

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8. An ac source $e = E_0 \sin \omega t$ is applied across an ideal inductor of inductance L. Show mathematically that the current lags the voltage by a phase angle of $\frac{\pi}{2}$.

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9. IF L is 100mH and the applied ac source frequency be 50 Hz, find the inductive reactance in the above case.

Watch Video Solution

10. Define wattless current.

Watch Video Solution

11. Show that in ac circuit the average power dissipated per cycle in a pure inductor is zero.

Watch Video Solution

12. Compare between inductive reactance and capacitive reactance.

Watch Video Solution

13. State the factors on which the peak value of alternating emf depends.

Watch Video Solution

14. In an LCR series combination, R=400Ω, L=100 mH and C=1μF. This combination is connected to a 25sin2000t volt voltage source. Find the impedance of the circuit and the peak value of the circuit current.

Watch Video Solution

15. State the working principle of ac generator.

Watch Video Solution

16. Why is the use of ac voltage preferred over dc voltage?

Watch Video Solution

17. The power factor of LR circuit is $\frac{1}{\sqrt{3}}$. IF the frequency of ac be doubled, what will be the power factor?

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18. IF the rotating speed of a dynamo is doubled, the induced electromotive force will be

A. doubled

B. halved

C. four times as much

D. unchanged

Answer: A

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19. The number of turns of the primary and secondary of a transformer are 500 and 5000 respectively. The primary is connected to a 20

V, 50Hz ac supply. The output of the secondary will be

A. 2V,50Hz

B. 200 V,50 Hz

C. 200V,5 Hz

D. 200V,500Hz

Answer: B

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20. What is the rms value of the current $i = 5\sqrt{2}\sin 100\pi t A$?

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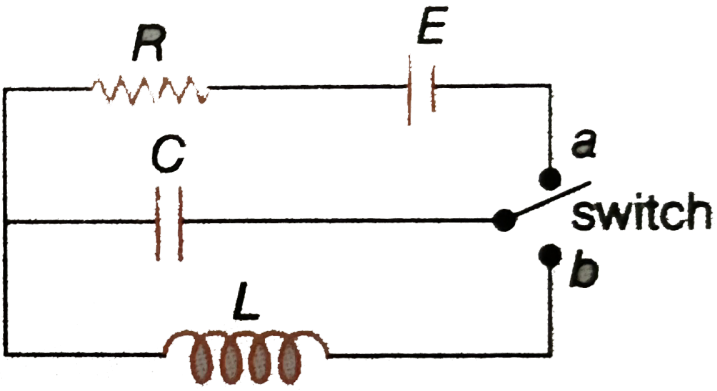
Examination Archive With Solutions Wbjee

1. In the circuit shown below , the switch is kept in position a for a long time and is then thrown to position b. The amplitude of the

resulting oscillating current is given by



A. $E\sqrt{L/C}$

B. E/R

C. infinity

D. $E\sqrt{C/L}$

Answer: D

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2. When the frequency of the ac voltage applied to a series LCR circuit is gradually increased from a low value , the impedance of the circuit.

A. monotonically increases

B. first increases and then decreases

C. first decreases and then increases

D. monotonically decreases

Answer: C

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3. An alternating current is flowing through a series LCR circuit. IT is found that the current reaches a value of 1mA at both 200 Hz and 800Hz frequency. What is the resonance frequency of the circuit?

A. 600 Hz

B. 300 Hz

C. 500 Hz

D. 400 Hz

Answer: D

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Examination Archive With Solutions Jee Main

1. An inductor (L=0.03H) and a resistor (R=0.15k Ω) are connected in series to a battery of 15 V emf in a circuit shown below. The key K_1 has

been kept closed for a long time. Then at t=0 , K_1 is opened and key K_2 is closed simulatenously. At t=1 ms, the current in the circuit will be $\left(e^5 \cong 150\right)$

A. 100 mA

B. 67 mA

C. 6.7mA

D. 0.67 mA

Answer: D

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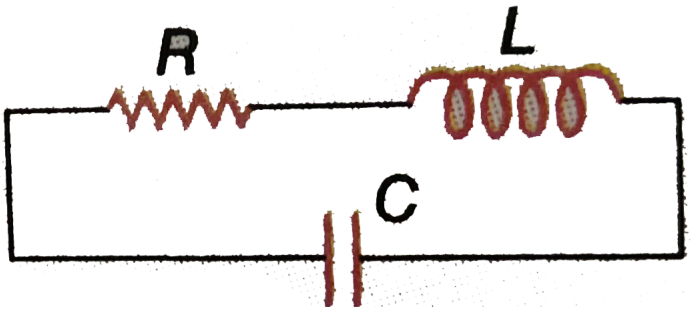
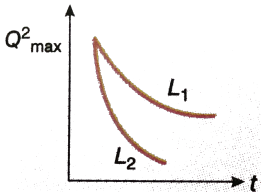
2. An LCR circuit is equivalent to a damped pendulam. In an LCR circuit the capacitor is charged to Q_0 and then connected to the L and R as shown below:



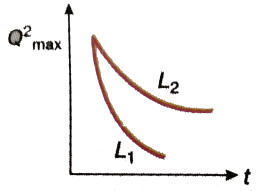
If the students plots graphs of the square of maximum charge $\left(Q_{\max}^2\right)$ on the capacitor with time (t) for two different values L_1 and $L_2(L_1 > L_2)$ of L then which of the following

represents this graph correctly?(plots are schematice are not drawn to scale)

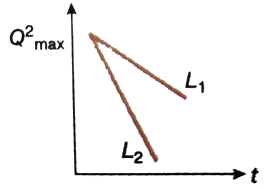
A.



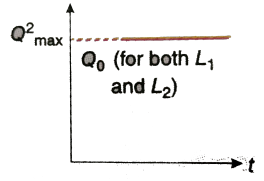
B.



C.



D.



Answer: A

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3. An arc lamp requires a direct current of 10A at 80V to function . It is connected to a 220V(rms), 50 Hz ac supply, the series inductor needed for it to work is close to

A. 80 H

B. 0.08 H

C. 0.044 H

D. 0.065 H

Answer: D

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4. For an RLC circuit driven with voltage of amplitude v_m and frequency $\omega_0 = \frac{1}{\sqrt{LC}}$ the current exibits resonance. The quality factor, Q is given by

A. $\frac{R}{(\omega_0 C)}$

B. $\frac{CR}{\omega_0}$

C. $\frac{\omega_0 L}{R}$

D. $\frac{\omega_0 R}{L}$

Answer: C

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5. In an ac circuit, the instantaneous emf and current are given by $e = 100 \sin 30t, i = 20 \sin\left(30t - \frac{\pi}{4}\right)$. In one cycle of ac, the average power consumed by the circuit and the wattless current are, respectively

A. $\frac{50}{\sqrt{2}}, 0$

B. $50, 0$

C. 50,10

D. $\frac{1000}{\sqrt{2}}, 10$

Answer: D

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Examination Archive With Solutions Aipmt

1. A transformer having effieciency of 90% is working on 200 V and 3kW power supply. If the current in the secondary coil is 6A, the voltage across the secondary coil and the current in the primary coil respectively are

A. 300V,15A

B. 450V,15A

C. 450V,13.5A

D. 600V,15A

Answer: B

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2. A resistance R draws power P when connected to an ac source. IF an inductance is now placed in series with the resistance, such that the impedance of the circuit becomes Z, the power drawn will be:

A. $P\left(\frac{R}{Z}\right)^2$

B. $P\sqrt{\frac{R}{Z}}$

C. $P\left(\frac{R}{Z}\right)$

D. P

Answer: A

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Examination Archive With Solutions Neet

1. A small signal voltage V(t) $=V_0 \sin \omega t$ is applied across an ideal capacitor C.

A. over a full cycle, the capacitor C does not consume any energy from the voltage source

B. current I(t) is in phase with voltageV(t)

C. current I(t) leads voltage V(t) by 180°

D. current I(t) lags voltage V(t) by90°

Answer: A

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2. An inductor 20mH, a capacitor $50\mu F$ and a resistor 40Ω are connected in series across a source of emf V=10sin340t. The power loss in ac circuit is

A. 0.67W

B. 0.76W

C. 0.89W

D. 0.51W

Answer: D

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3. An inductor 20mH, a capacitor $100\mu F$ and a resistor 50Ω are connected in series across a source of emf V=10sin314t. The power loss in the circuit is

A. 2.74 W

B. 0.43 W

C. 0.79 W

D. 1.13 W

Answer: C

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Cbse Scanner

1. Mention the two characteristic properties of the material suditable for making core of a transformer.

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2. State the underlying principle of a transformer. How is the large scale transmission of electrical energy over long distances done with the use of transformer?

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3. An alternating voltage given by V=140sin314t is connected across a pure resistor of 50Ω. Find the frequency of the source

Watch Video Solution

4. An alternating voltage given by V=140sin314t is connected across a pure resistor of 50Ω. Find the rms current through the resistor.

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5. In an A.C. circuit, the potential difference across an inductance and a resistance joined in series are respectively 16V and 20V. The total potential difference across the circuit is

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6. For a given ac $i = i_m \sin \omega t$, show that the average power dissipated in a resistor R over complete cycle is $\frac{1}{2} i_m^2 R$.

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7. A light bulb is rated at 100 W for a 220V ac supply. Calculate the resistance of the bulb.

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8. Why is the use of ac voltage preferred over dc voltage? Given two reasons.

Watch Video Solution

9. A voltage $V_0 \sin \omega t$ is applied to a series LCR circuit, Derive the expression for the average power dissipated over a cycle.

Under what condition is (i) no power dissipated even though the current flows

through the circuit,(ii) maximum power dissipated in the circuit?

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10. Define the term 'quality factor' of resonance in series LCR circuit. What is its SI unit?

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11. Show that the average power consumed in an inductor L connected to an source is zero.

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12. In a series LR circuit, $X_L = R$ and the power factor of the circuit is P_1.When a capacitor with capacitance C such that $X_C = X_L$ is put in series , the power factor becomes P_2.Find out P_1 / P_2.

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13. State the principle of an ac generator.

Watch Video Solution

14. Explain briefly, with the help of labelled diagram, and obtain the expression for the emf generated in the rotating coil in the magnetic field.

Watch Video Solution

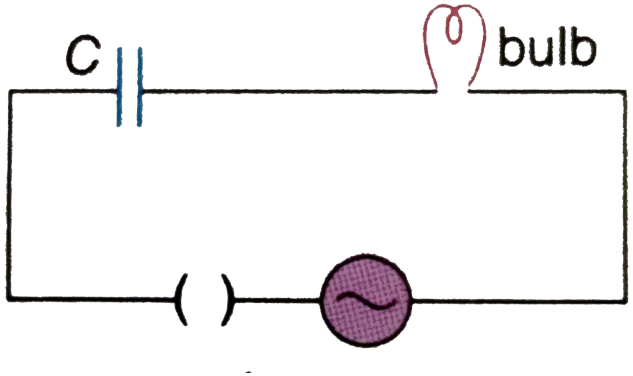
15. Draw a schematic diagram showing the nature of the alternating emf generated by the rotating coil in the magnetic field during one cycle.

Watch Video Solution

16. When an ac source is connected to an ideal capacitor, show that the average power supplied by the source over a complete cycle is zero.

Watch Video Solution

17. A bulb is connected in series with a variable capacitor and an ac source as shown . What happens to the brightness of the bulb when the key is plugged in an capacitance of the capacitor is gradually reduced?



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18. In a series LCR circuit connected to an ac source of voltage $v = v_m \sin \omega t$, use phasor diagram to derive an expression for the current in the circuit. Hence obtain the expression for the power dissipated in the circuit.Show that power dissipated at resonance is maximum.

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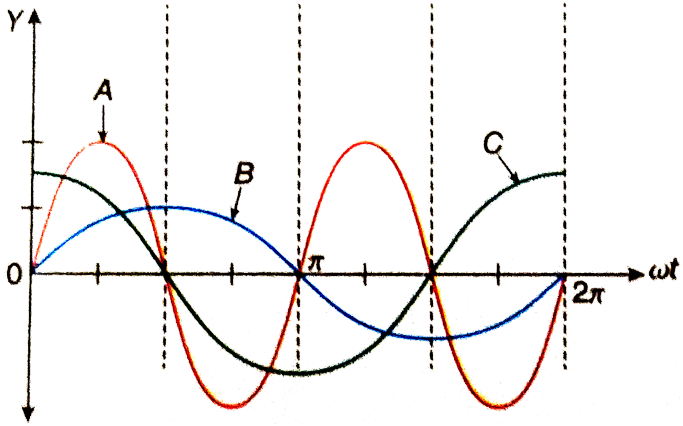
19. A derive 'X' is connected to an ac source $V = V_0 \sin \omega t$.The variation of voltage ,current

and power in one cycle is shown in the following graph:



Identify the device 'X'.

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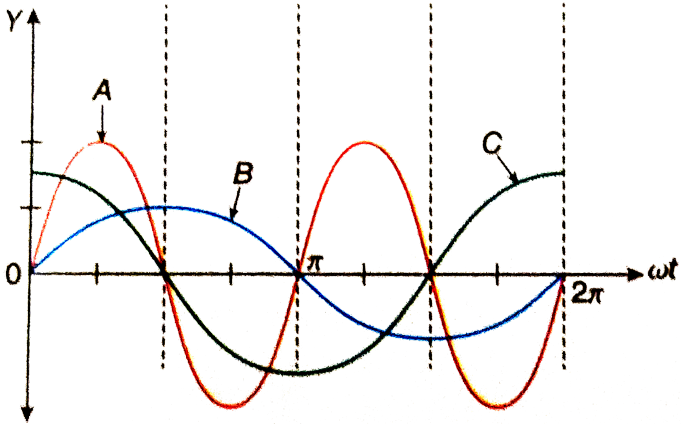
20. A derive 'X' is connected to an ac source $V = V_0 \sin \omega t$.The variation of voltage ,current

and power in one cycle is shown in the following graph:



Which of the curves A,B and C represent the voltage , current and the power consumed in the circuit ? Justify your answer .

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21. How does its impedance vary with frequency of the ac source ?Show graphically.

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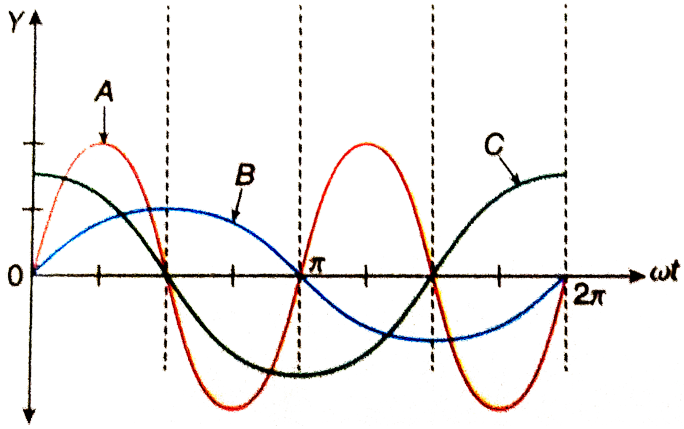
22. A derive 'X' is connected to an ac source $V = V_0 \sin \omega t$.The variation of voltage ,current and power in one cycle is shown in the following graph:



Which of the curves A,B and C represent the voltage , current and the power consumed in the circuit ? Justify your answer .

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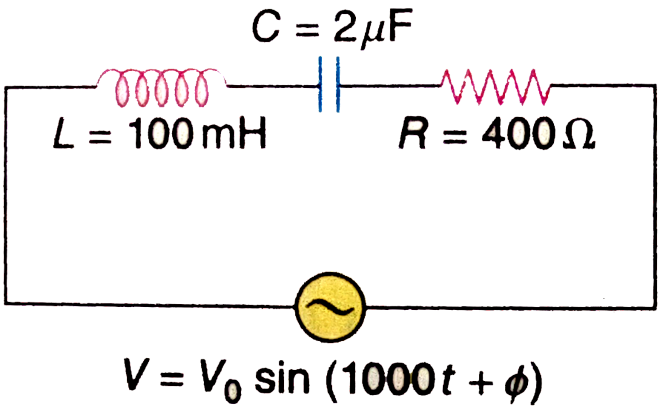
23. Find the value of the phase difference between the current and the voltage in the

series LCR circuit shown below. Which one leads in phase:current or voltage?



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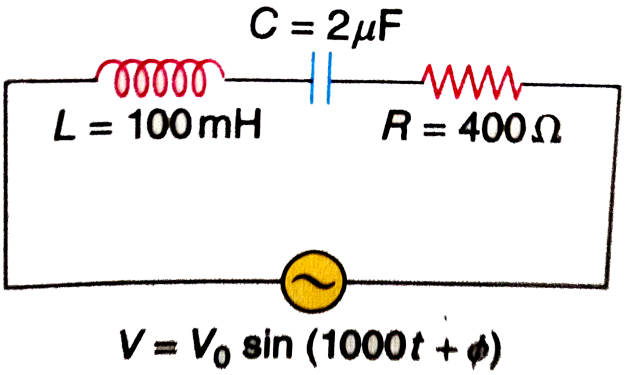
24. Without making any other change, find the value of the additional capacitor C_1, to be connected in parallel with the capacitor C, in

order to make the power factor of the circuit unity.



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25. Draw a labelled diagram of a step-up transformer. Obtain the ratio of secondary to

primary voltage in terms of number of turns and current in the two coils.

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26. A power transmission line feeds input power at 2200 V to a step-down transformer with its primary windings having 3000 turns. Find the number of turns in the secondary to get the power output at 220 V.

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27. A device X is connected across an ac source of voltage $V = V_0 \sin \omega t$. The current through X is given as $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$.

Identify the device X and write the expression for its reactance.

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28. A device X is connected across an ac source of voltage $V = V_0 \sin \omega t$. The current through X is given as $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$.

Draw graphs showing variations of voltage

and current with time over one cycle of ac, for X.

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29. A device X is connected across an ac source of voltage $V = V_0 \sin \omega t$. The current through X is given as $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$.

Draw the phasor diagram for the device X.

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30. A device X is connected across an ac source of voltage $V = V_0 \sin \omega t$. The current through X is given as $I = I_0 \sin\left(\omega t + \frac{\pi}{2}\right)$.

Device X is a capacitor.

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31. The teachers of Geeta's school took the students on a study trip to a power generating station, located nearly 200km away from the city. The teacher explained that

electrical energy is transmitted over such a long distance to their city. In the form of alternating current (ac) raised to a high voltage. At the receiving end in the city, the voltage is reduced to operate the devices. As a result, the power loss is reduced. Geeta listened to the teacher and asked questions about how the ac is converted to a higher or lower voltage.

Name the device used to change the alternating voltage to a higher or lower value.

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32. The teachers of Geeta's school took the students on a study trip to a power generating station, located nearly 200km away from the city. The teacher explained that electrical energy is transmitted over such a long distance to their city. In the form of alternating current (ac) raised to a high voltage. At the receiving end in the city, the voltage is reduced to operate the devices. As a result, the power loss is reduced. Geeta listened to the teacher and asked questions about how the ac is converted to a higher or

lower voltage.

Explain with an example , how power loss is reduced if the energy is transmitted over long distances as an alternating current rather than a direct current .

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33. The teachers of Geeta's school took the students on a study trip to a power generating station, located nearly 200km away from the city. The teacher explained that

electrical energy is transmitted over such a long distance to their city. In the form of alternating current (ac) raised to a high voltage. At the receiving end in the city, the voltage is reduced to operate the devices. As a result, the power loss is reduced. Geeta listened to the teacher and asked questions about how the ac is converted to a higher or lower voltage.

Write two values each shown by the teachers and geeta,

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