PHYSICS

BOOKS - CP SINGH PHYSICS (HINGLISH)

ALTERNATING CURRENT

Example

1. Find rms value in the following cases

(a) $I = 5 + 3\sin\omega t$

(b) $I = a\sin\omega t + b\cos\omega t$

(c) $I = i_1\sin\omega t + i_2\cos\omega t + i_3\sin 2\omega t$.

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2. If $V = 220\sqrt{2}\sin(314t - \phi)$ calculat peak and rms value of the voltage (b) average voltage for half time - period (c) frequency of ac

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3. An alternating voltage $E = 200\sqrt{2}\sin(100t)$ is connected to a 1 microfarad capacitor through an AC ammeter. The reading of the ammeter shall be

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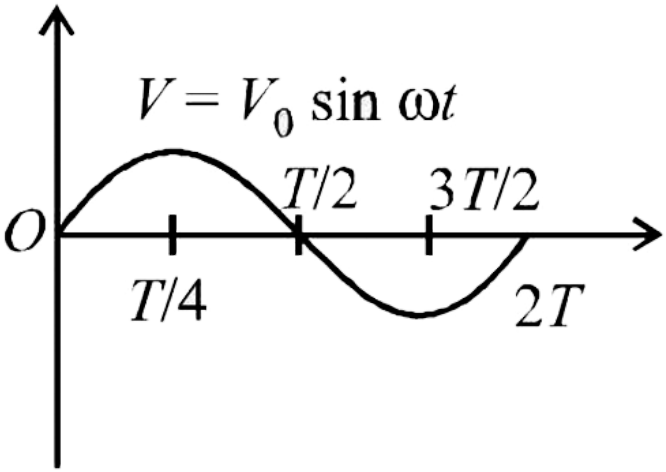
4. In a series L-R circuit $(L = 35mH \text{ and } R = 11\Omega)$, a variable emf source $(V = V_0 \sin \omega t)$ of $V_{rms} = 220V$ and frequency 50 Hz is applied. Find the current amplitude in the circuit and phase of current with respect to voltage. Draw current-time graph on given graph $\left(\pi = \frac{22}{7}\right)$.



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5. An electric bulb is designed to consume $55W$ when operated at 110 volts. It is connected to a $220V, 50Hz$ line through a choke coil in series. What should be the inductance of the coil for which the bulb gets correct voltage?

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6. A circuit consisting of a capacitor and an active resistance $R = 110\Omega$ connected in series is fed an alternating voltage with amplitude $V_m = 110V$. In this case the amplitude of steady $-$ state current is equal to $I_m = 0.50A$. Find the phase difference between the current and the voltage fed.

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

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8. A resistor R an inductance L and a capacitor C are all connected in series with an ac supply The resistance of R is $16ohm$ and for the given frequency the inductive reactance of L is 24 ohm and the capacitive reactance of C is $12ohm$ If the current in the circuit is $5A$ find

(a) the potential difference across R, L and C

(b) the impedance of the circuit

(c) the voltage of the ac supply and

(d) the phase angle .

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9. In a series LCR circuit with an AC source, $R = 300\Omega, C = 20\mu F, L = 1.0henry, \varepsilon_{rms} = 50V$ and $v = \frac{50}{\pi} Hz$. Find (a) the rms current in the circuit and (b) the rms potential differences across the capacitor, the resistor and the inductor. Note that the sum of the rms potential differences across the three elements is greater than the rms voltage of the source.

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10. A series circuit consisting of a capacitor $X_C = 80\Omega$ and a coil with active resistance

$R = 300\Omega$ and inductance $X_L = 40\omega$ is connected to a source of alternating voltage with amplitude $V_0 = 200V$ Find

(a) the current amplitude in the circuit

(b) the phase difference between the current and voltage

(c) the amplitudes of voltage across the capacitor and the coli .

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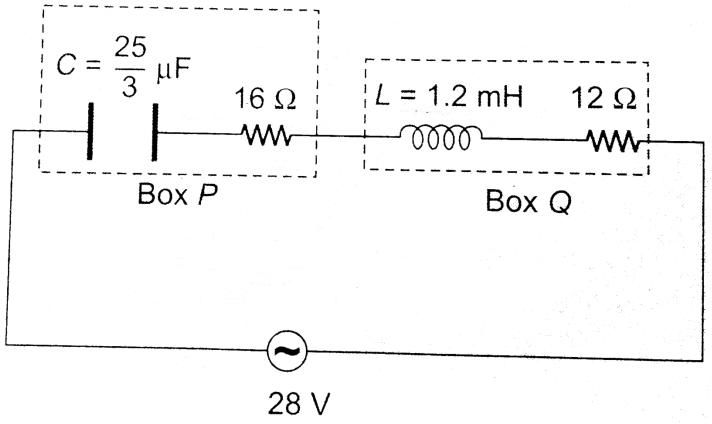
11. A box P and a coil Q are connected in series with an ac source of variable freguency The emf of the source is constant at $28V$ The frequency is so

adjusted that the maximum current flows in P and Q

Find

(a) impedance of P and Q at this frequency

(b) voltage across P and Q



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12. A $200km$ long telegraph wire has capacitance of $0.014\mu F/km$ If it carries an alternating current of

50×10^3 Hz what should be the value of an inductance required to be connected in series in series so that impedance isw minimum .

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13. An inductor-coil , a capacitor and an AC source of rms voltage $24V$ are connected in series. When the frequency of the source is varied, a maximum rms current of $6.0A$ is observed. If this inductor coil is connected to a battery of $emf 12V$ and internal resistance 4.0Ω, what will be the current?

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14. An $L-C-R$ series circuit with 100Ω resistance is connected to an AC source of $200V$ and angular frequency $300rad/s$. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed the current leads the voltage by 60°. Calculate the current and the power dissipated in the $L-C-R$ circuit

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15. A series $L-C-R$ circuit containing a resistance of 120Ω has resonance frequency $4\times10^5rad/s$. At resonance the voltages across resistance and

inductance are $60V$ and $40V$, respectively. Find the values of L and C.At what angular frequency the current in the circuit lags the voltage by $\pi/4$?

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16. A current of $4A$ flows in a coil when connected to a $12VDC$ source. If the same coil is connected to a $12V, 50rad/sAC$ source, a current of $2.4A$ flows in the circuit. Determine the inductance of the coil. Also, find the power developed in the circuit if a$2500\mu F$ capacitor is connected in series with the coil.

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17. A coil with inductive reactance $X_L = 30\Omega$ and impedance $Z = 50\Omega$ is connected to the mains with effective voltage value $V = 100V$ Find the phase difference between the current and voltage as well as the heat power generated in the coil .

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18. A solenoid with inductance $L = 7mH$ and active resistance $R = 44\Omega$ is first connected to a source of direct voltage V_0 and then to a source of sinusoidal voltage with effective value $V = V_0$. At what frequency of the oscillator will be power consumed

by the solenoid be $\eta = 5.0$ times less than in the former case ?

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19. In a series RC circuit with an AC source, $R = 300\Omega, C = 25\mu F, \varepsilon_0 = 50V$ and $v = \frac{50}{\pi} Hz.$ Find the peak current and the average power dissipated in the circuit.

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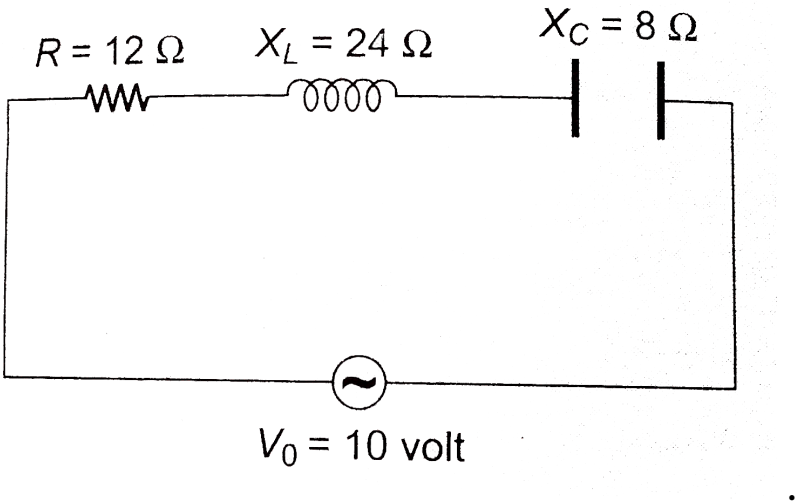
20. Consider the following $R - L - C$ circuit in which $R = 12\Omega, X_L = 24\Omega, X_C = 8\Omega$ The emf of

source is given by $V = 10\sin(100\pi t)V$ (a) Find the energey dissipated in 10 min (b) If resistance is removed from the circuit and value of inductance is doubled express variation of current with time t in the new circuit .



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21. The maximum values of the alternating voltages and current are $400V$ and $20A$ respectively in a circuit connected to $50Hz$ supply and these quantities are sinusoidal. The instantaneous values of the voltage and current are $200\sqrt{2}V$ and $10A$, respectively. At $t = 0$, both are increasing positively.

(a) Write down the expression for voltage and current at time t.

(b) Determine the power consumed in the circuit.

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22. A series circuit consisting of an inductance free resistance $R = 0.16k\Omega$ and a coil with active resistance is connected to the mains effective voltage $V = 220V$ Find the heat power generated in the coil if the effective voltage values across the resistance R an the coil equal to $V_1 = 80V$ and V_(2) =180V` respectively .

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23. A coil with inductance $L = 0.70H$ and active resistance $r = 20\Omega$ is connected in series with an inductance $-$ free resistance R. An alternating

voltage with effective value $V = 220V$ and frequency $\omega = 314s^{-1}$ is applied across the terminals of this circuit. At what value of the resistance R will the maximum heat power be generated in the circuit ? What is it equal to ?

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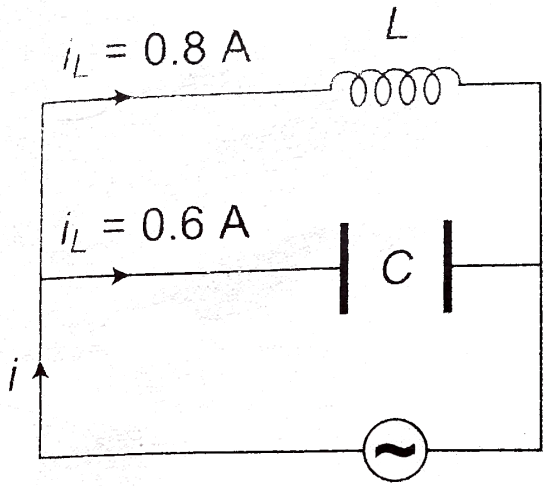
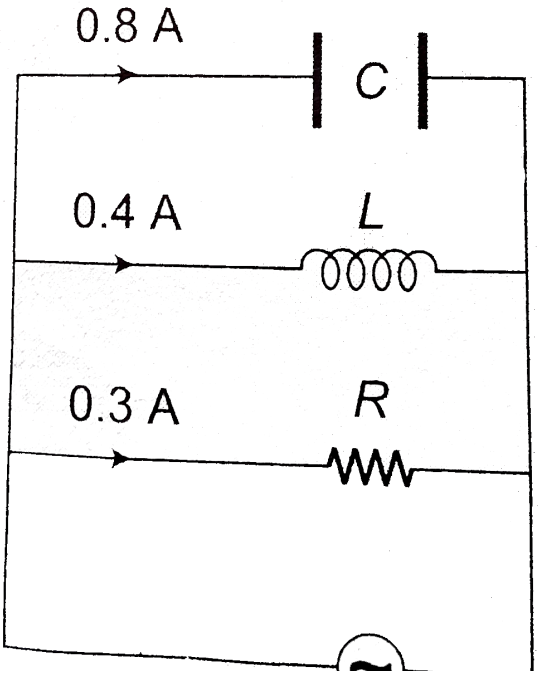
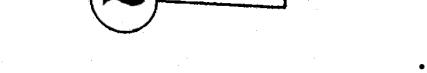
24. Determine the current drawn from the source .







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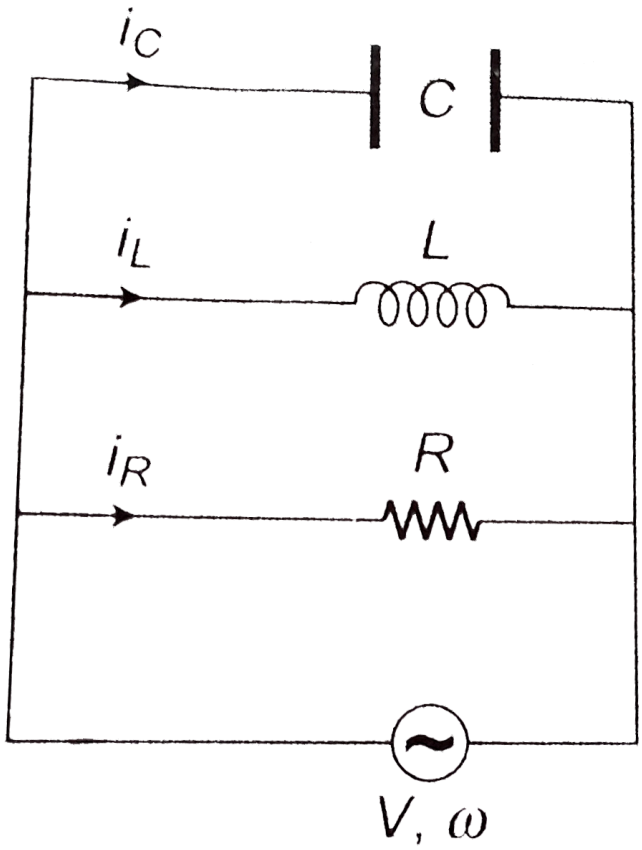
25. Determine the impedance of the circuit phase of current



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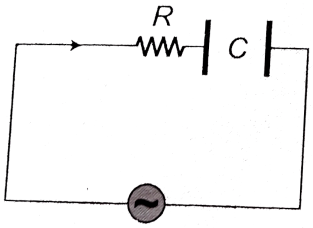
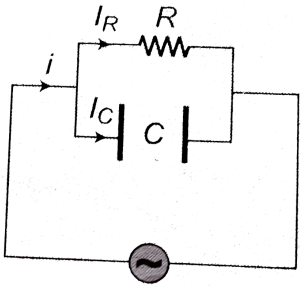
26. For a resistance R and capacitance C in series the impedance is twice that of a parallel combination of

the same elements What is the frequency of applied emf .





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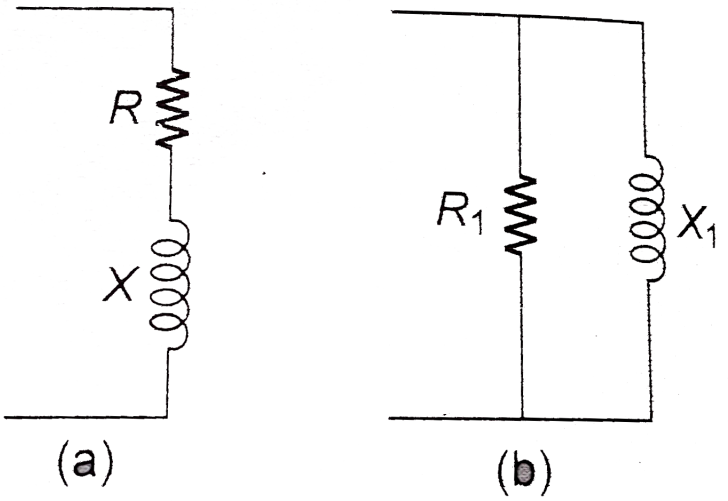
27. The series and parallel circuits shown in figure have the same impedance and the same power factor If $R = 3\Omega$ and $X = 4\Omega$ find the valuse of R_1 and X_1

Also find the impedance power factor .



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28. A coil and an inductance — free resistance $R = 25\Omega$ are connected in parallel to the $ac1$ mains. Find the heat power generated in the coil provided a current $I = 0.90A$ is drawn from the mains. The coil

and the resistance R carry currents $I_1 = 0.50A$ and $I_2 = 0.60A$ respectively.

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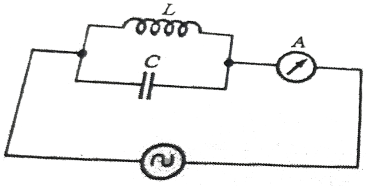
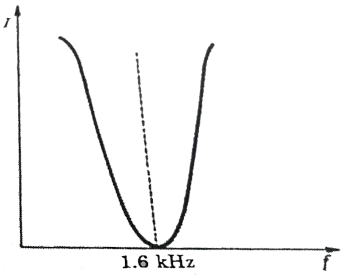
29. An LC- circuit (inductance 0.01 H and capacitance $1\mu F$) is connected to a variable a.c. source as shown in fig. 14.8. Draw rough sketch of the current - variation as the frequency is changed from 1 kHz to 2 kHz.





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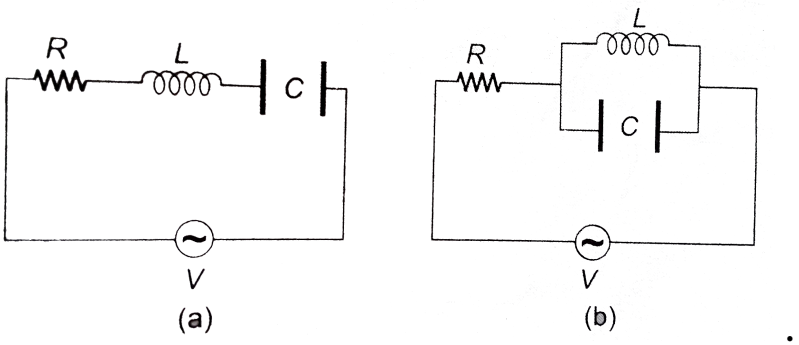
30. An ac source is connected to two circuits as shown Obtain current through resistance R at resonance in both the circuits



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31. A circuit consists of a capacitor with capacitance C and a coil with active resistance R and inductance

L connected in parallel. Find the impedane of the circuit at frequency ω of alternating voltage.

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32. A capacitor of capacitance C is connected in parallel with a choke coil having inductance I and resistancev R Calculate

(a) The resonance frequency and

(b) the circuit impedance at resonance .

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33. A box contains L, C and R When $250V$ dc is applied to the terminals of the box a current of $0.1A$ flows in the circuit When an ac source of $250V$ rms at 2250 rad//sec is connected a current of 1.25 A rms flows it is observed that the current rises with frequency and becomes maximum at 4500rad/sec Find the value of L, C and R Draw the circuit diagram .

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34. In a step - down transformer having primary to secondary turn ratio $20:1$ the input voltage applied

is $250V$ and output current is $8A$ Assuming $100\,\%$ efficiency calculate the

(a) voltage across secondary coil

(b) current in primary coil

(c) power output .

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

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Exercises

1. The peak voltage in a $220V\,AC$ source is

A. $220V$

B. about 160V

C. about 310V

D. 440 V

Answer: C

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2. An alternating emf given by $V = V_0 \sin \omega t$ has peak value 10 volt and freguency 50 Hz The instantaneous emf at .

A. $10V$

B. $5\sqrt{3}V$

C. $5V$

D. $1V$

Answer: C

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3. The average emf during the positive half cycle of an ac supply of peak value E_0 is .

A. $\frac{E_0}{\pi}$

B. $\frac{E_0}{\sqrt{2}\pi}$

C. $\frac{E_0}{2\pi}$

D. $\frac{2E_0}{\pi}$

Answer: D

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

A. 2×10^{-2} and 14.14 amp

B. 1×10^{-2} and 7.07 amp

C. 5×10^{-3} and 7.07amp

D. 5×10^{3} and 14.14amp

Answer: D

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5. An ac ammeter is used to measure currnet in a circuit. When a given direct current passes through the circuit. The ac ammeter reads 3 A. When another alternating current passes through the circuit, the ac ammeter reads 4A. Then find the reading of this ammeter (inA), if dc and ac flow through the circuit simultaneously.

A. $3A$

B. $4A$

C. $7A$

D. $5A$

Answer: C

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6. The rms value of the emf given by $E = 8\sin\omega t + 6\sin 2\omega t$.

A. $5\sqrt{2}V$

B. $7\sqrt{2}V$

C. $10V$

D. $10\sqrt{2}V$

Answer: A

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7. An AC is given by the equation $i = i_1 \cos \omega t + i_2 \sin \omega t$. The r.m.s. current is given by

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

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

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

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

Answer: C

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

A. $7.5A$

B. $2\sqrt{3}A$

C. $5\sqrt{3}A$

D. $15A$

Answer: C

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9. An AC source is rated $220V, 50Hz$. The average voltage is calculated in a time interval of $0.01s$. It

A. must be zero

B. may be zero

C. is never zero

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

Answer: B

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10. The magnetic field energy in an inductor changes from maximum value to minimum value in $5.0ms$ when connected to an AC source. The frequency of the source is

A. $20HZ$

B. $50HZ$

C. $200HZ$

D. $500HZ$

Answer: B

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11. An AC source producing emf

$$\varepsilon = \varepsilon_0 \left[\cos\left(100\pi s^{-1}\right)t + \cos\left(500\pi s^{-1}\right)t\right]$$

is connected in series with a capacitor and a resistor.

The steady-state current in the circuit is found to be

$$I = i_1 \cos\left[\left(100\pi s^{-1}t + \varphi_1\right] + i_2 \cos\left[\left(500\pi s^{-1}\right)t + \phi_2\right]$$

.

A. $i_1 > i_2$

B. $i_1 = i_2$

C. $i_1 < i_2$

D. none

Answer: C

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

A. $0.5A$

B. $0.25\sqrt{2}A$

C. $0.25A$

D. $0.5\sqrt{2}A$

Answer: A

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13. The heat produced in a given resistor in a given time by the sinusoidal current $I_0 \sin \omega t$ will be the same as that by a steady current of magnitude .

A. $\frac{I_0}{\sqrt{2}}$

B. I_0

C. $I_0\sqrt{2}$

D. $\frac{I_0}{2}$

Answer: A

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14. An alternating current having peak value $14A$ is used to heat a metal wire. To produce the same heating effect, a constant current i can be used where i is

A. $14A$

B. about $20A$

C. $7A$

D. about $10A$

Answer: D

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15. An alternating voltage $V = 200\sqrt{2}\sin 100t$ where V is in volt and t in sec is connected to a series combination of $i\mu F$ capacitor and 10Ω resistor throught an ac ammeter The reading of the ammeter will be .

A. $\sqrt{2}mA$

B. $10\sqrt{2}mA$

C. $2mA$

D. $20mA$

Answer: B

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16. What is the r.m.s. value of an alternating current which when passed through a resistor produces heat which is thrice of that produced by a direct current of 2 amperes in the same resistor?

A. $6A$

B. $3A$

C. $2A$

D. $2\sqrt{3}A$

Answer: D

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17. A constant current of $2.8A$ exists in a resistor. The rms current is

A. $2.8A$

B. about 2A

C. $1.4A$

D. none

Answer: A

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18. Choose the currect option .

A. In an ac circuit having resistance only voltage and current are in same plane .

B. In a ac circuit having inductance only voltage leads the current by $\pi/2$

C. In a ac circuit having capacitance only current leads the voltage by $\pi/2$

D. All

Answer: D

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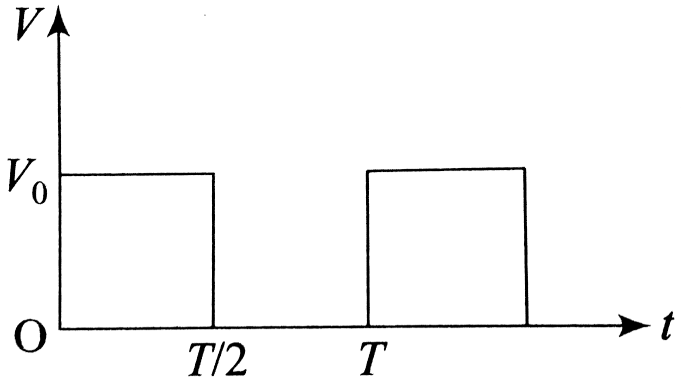
19. The rms value of potential difference V shown in the figure is



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

B. $V_0/\sqrt{3}$

C. V_0

D. $V_0/\sqrt{2}$

Answer: D

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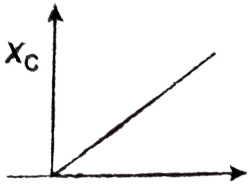
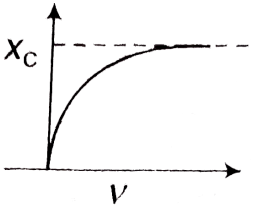
20. Which one of the follwing represents the variation of capacitive reactance (X_C) with the frequency (v) of the voltage source ? .

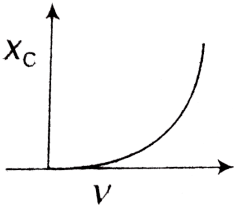
A.

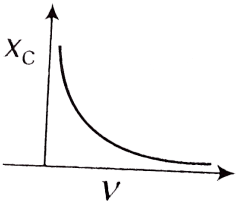


B.



C.



D. 

Answer: D

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21. A resistor R and the capacitor C are connected in series across an ac source of rms voltage $5V$ if the rms voltage across C is $3V$ then that across R is .

A. $1V$

B. $2V$

C. $3V$

D. $4V$

Answer: D

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22. An alternating voltage is connected in series with a resistance R and inductance L if the potential drop across the resistance is $200V$ and across the inductance is $150V$, then the applied voltage is

A. $350V$

B. $350\sqrt{2}V$

C. $250V$

D. $250\sqrt{2}V$

Answer: C

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23. An ideal inductor of $(1/\pi)$ is connected in series with a 300γ resistor If a $20V.200H_z$ ac source is connected across the combination the phase difference between the voltage and the current is .

A. $\frac{\tan^{-5}}{4}$

B. $tan^{-1}\frac{4}{5}$

C. $tan^{-1}\frac{3}{4}$

D. $tan^{-1}\frac{4}{3}$

Answer: D

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

A. $\frac{1}{10\pi}H$

B. $\frac{1}{20\pi}H$

C. $\frac{1}{40\pi}H$

D. $\frac{1}{60\pi}H$

Answer: B

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25. When $100V$ dc is applied across a coil a current of 1 A flows through it When $100V$ ac of $50Hz$ is applied across the same coil only $0.5A$ flows The resistance and inductance of the coil are ($take\pi^2 = 10$) .

A. $50\Omega 0.3H$

B. $50\Omega\sqrt{(0.3)H}$

C. $100\Omega 0.3H$

D. $100\Omega\sqrt{0.3}H$

Answer: D

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26. An ideal inductor takes a current of 10 A when connected to a $125V$ 50Hz ac supply A if the two are connected in series across a $100\sqrt{2}$ V ,40 Hz supply the current throught the circuit will be .

A. $10A$

B. $12.5A$

C. $20A$

D. $25A$

Answer: A

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27. An ac source of angular frequency ω is fed across a resistor R and a capacitor C in series. The current registered is I. If now the frequency of source is changed to $\omega/3$ (but maintaining the same voltage), the current in the circuit is found to be halved.

Calculate the ratio of the reactance to resistance at the original frequency ω.

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

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

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

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

Answer: A

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28. An inductor-coil having some resistance is connected to an AC source. Which of the following

quantities have zero average value over a cycle?

A. (i),(ii)

B. $(ii), (iii)$

C. $(ii), (iv)$

D. $(iii), (iv)$

Answer: A

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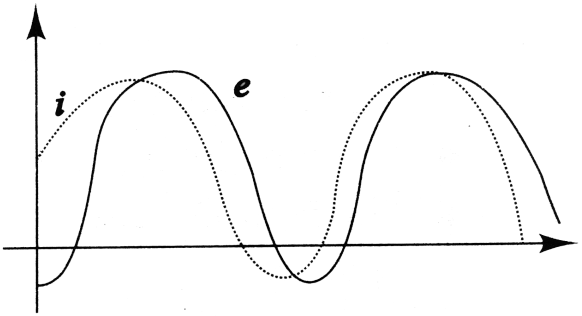
29. When an ac source of emf$e = E_0 \sin(100t)$ is connected across a circuit, the phase difference between emf e and currnet I in the circuit is observed

to be $(\pi)/(4)$ as shown in fig. If the circuit consists possibly only of R-C or R-C of L-R series, find the relationship find the relationship between the two elements.



A. $R = 1k\Omega, C = 10mF$

B. $R = 1k\Omega, C = 1mF$

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

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

Answer: A

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30. In an LCR series ac circuit the voltage across L, C and R are V_1, V_2 and V_3 respectively The voltage of the source is .

A. $\sqrt{(V_1 - V_2)^2 + V_3^2}$

B. $\sqrt{V_1^2 + (V_2 - V_3^2}$

C. $\sqrt{V_2^2 + (V_1 - V_3)^2}$

D. $V_1 + V_2 + V_3$

Answer: A

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31. A resistor an inductor and a capacitor are connected in series to an ac source An ac voltmeter measures the votage across them as $800V, 30V$ and $90V$ respectively The rms value of the supply voltage is .

A. $100V$

B. $100\sqrt{2}V$

C. $200V$

D. $200\sqrt{2}V$

Answer: A

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32. The phase difference between the current and voltage of LCR circuit in series combination at resonance is

A. zero

B. $\pi/4$

C. $\pi/2$

D. π

Answer: A

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33. An LCR series circuit contains $L = 8H, C = 0.5\mu F$ and $R = 100\Omega$ The resonant frequency of the circuit is .

A. $\frac{1000}{\pi} Hz$

B. $\frac{500}{\pi} Hz$

C. $\frac{250}{\pi} Hz$

D. $\frac{125}{\pi} Hz$

Answer: C

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34. In an LCR series circuit the capacitance is changed from C to $4C$ For the same resonant fequency the inductance should be changed from L to .

A. $\frac{L}{3}$

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

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

D. $\frac{L}{8}$

Answer: C

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35. A $200V$ ac source is applied in a LCR series circuit which consists of an inductive reactance of 50Ω a capacitive reactance of 50Ω and the resistance of 10Ω The potential difference across the resistance is .

A. $50V$

B. $100V$

C. $150V$

D. $200V$

Answer: D

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36. In an LCR series circuit the voltages across R, L and C at resonance are $40V$ and 60V` respectively the applied voltage is .

A. $60V$

B. $40V$

C. $160V$

D. $\sqrt{(40)^2 + (120)^2 V}$

Answer: B

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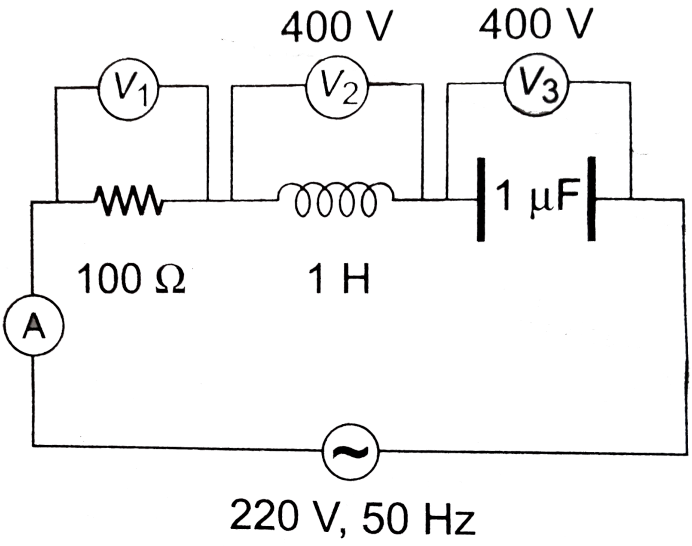
37. In the given circuit the readings of the voltmeter V_1 and the ammeter A are



A. $220V, 2.2A$

B. $110V, 1.1A$

C. $220V, 1.1A$

D. $110V, 2.2A$

Answer: A

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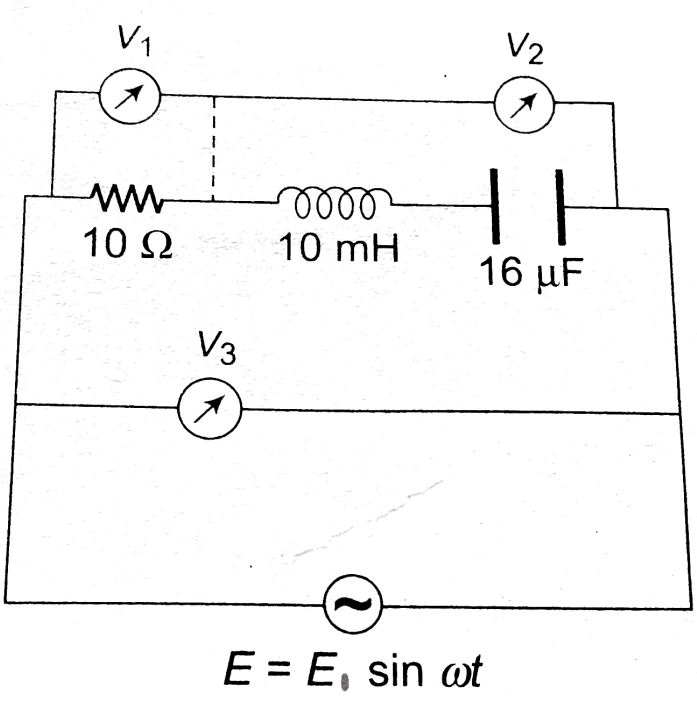
38. In figure which voltmeter reads zero when ω is equal to the resonant frequency of series LCR circuit



A. V_1

B. V_2

C. V_3

D. none

Answer: B

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39. An LCR series circuit consists of a resistance of a 10Ω a capacitance of reactance 60Ω and an inductor coil The circuit is found to resonate when put across

a $300V, 100$ Hz supply The inductance of the coil is $(takenπ = 3)$.

A. $0.1H$

B. $0.01H$

C. $0.2H$

D. $0.02H$

Answer: A

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40. In previous question the current in the circuit at resonance is .

A. $10A$

B. $15A$

C. $30A$

D. $60A$

Answer: C

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41. In an LCR circuit .

A. current always lags behind voltage if

B. current and voltage are always in phase

C. current in the voltage if $\omega > \frac{1}{\sqrt{LC}}$

D. current lags behind the voltage if $\omega < \frac{1}{\sqrt{LC}}$

Answer: C

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42. A resistor R, an inductor L and a capacitor C are connected in series to a source of frequency n. If the resonant frequency is n_r, then the current lags behind voltage when

A. $\omega < \omega_0$

B. $\omega > \omega_0$

C. $\omega = \omega_0$

D. $\omega = \omega_0$

Answer: B

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43. An LCR series circuit containing resistance of 20ω has angular resonat frequency $4 \times 10^5 ms^{-1}$ At resonance the voltage across resistance and inductance are $600V$ and $40V$ respectively The values of L and C are .

A. $0.2mH, \frac{1}{32}\mu F$

B. $0.4mH, \frac{1}{16}\mu F$

C. $0.2mH, \frac{1}{16}\mu F$

D. $0.4mH, \frac{1}{16}\mu F$

Answer: A

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44. Power dissipated in an $L-C-R$ series circuit connected to an AC source of emf ε is

A. $\frac{E^2R}{\left[R^2+\left(L\omega-\frac{1}{C\omega}\right)^2\right]}$

B. $\frac{E^2\sqrt{R^2+\left(L\omega-\frac{1}{C\omega}\right)^2}}{R}$

C. $\frac{E^2\left[R^2+\left(L\omega-\frac{1}{C\omega}\right)^2\right]}{R}$

D. $\frac{E^2R}{\sqrt{R^2+\left(L\omega\frac{1}{C\omega}\right)^2}}$

Answer: A

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45. A coil of inductive reactance 31Ω has a resistance of $8ohm$. It is placed in series with a condenser of capacitive reactance 25Ω. The combination is

connected to an ac source of $110V$. The power factor of the circuit is

A. 0.80

B. 0.33

C. 0.56

D. 0.64

Answer: A

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46. An $L-C-R$ series circuit with 100Ω resistance is connected to an AC source of $200V$ and angular

frequency $300 rad/s$. When only the capacitance is removed, the current lags behind the voltage by 60°. When only the inductance is removed the current leads the voltage by 60°. Calculate the current and the power dissipated in the $L-C-R$ circuit

A. $2A, 200W$

B. $2A, 400W$

C. $4A, 200W$

D. $4A, 400W$

Answer: B

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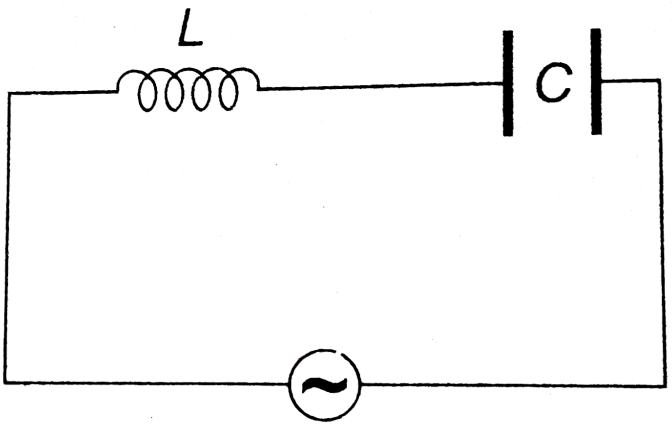
47. In the circuit shown in figure the voltage in L and in C are



A. in phase

B. out of phase by 90°

C. out of phase by 180°

D. in a phase difference which depends upon the values of $L\,C$.

Answer: C

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48. A capacitor of $10\mu F$ and an inductor of 1 H are joined in series An ac of $100 rad/\sec$ is applied to this combintaion The impedance of the combintaion .

A. 900Ω

B. 1000Ω

C. 1100Ω

D. 1200Ω

Answer: A

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49. The reactance of a circuit is zero It is possible that the circuit contains

(i) an inductor and a capacitor

(ii) an inductor but no capacitor

(iii) a capacitor but no inductor

(iv) neither an inductor nor a capacitor .

A. (i),(ii)

B. (ii),(iii)

C. (i),(iv)

D. (iii),(iv)

Answer: C

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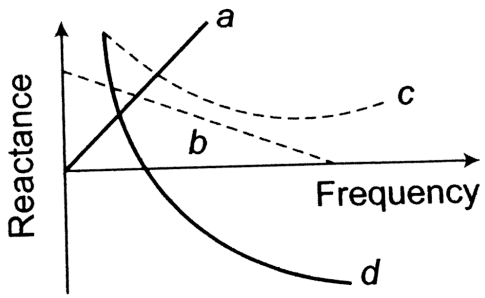
50. Which of the following plots may represent the reactance of a series LC combination?



A. a

B. b

C. c

D. d

Answer: D

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51. In an a.c. Circuit the voltage applied is $E = E_0 \sin(\omega)t$. The resulting current in the circuit is $I = I_0 \sin\left((\omega)t - \left(\frac{\pi}{2}\right)\right)$. The power consumption in the circuit is given by

A. $\frac{E_0 I_0}{\sqrt{2}}$

B. $\frac{E_0 I_0}{2}$

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

D. zero

Answer: D

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52. In an AC circuit, V and I are given by $V = 100\sin(100t)vo < s, I = 100\sin\left(100t + \frac{\pi}{3}\right)mA$. The power dissipated in circuit is

A. 10^4W

B. $10W$

C. $2.5W$

D. $5W$

Answer: C

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53. The power in ac circuit is given by $P = E_{rms} I_{rms} \cos \phi$. The vale of cos phi in series LCR circuit at resonance is:

A. zero

B. 1

C. 0.5

D. $\sqrt{2}$

Answer: B

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54. The potential differences V and the current i flowing through an instrument in an AC circuit of frequency f are given by $V = 5\cos\omega t$ and $I = 2\sin\omega t$ amperes (where $\omega = 2\pi f$). The power dissipated in the instrument is

A. zero

B. $10W$

C. $5W$

D. $2.5W$

Answer: A

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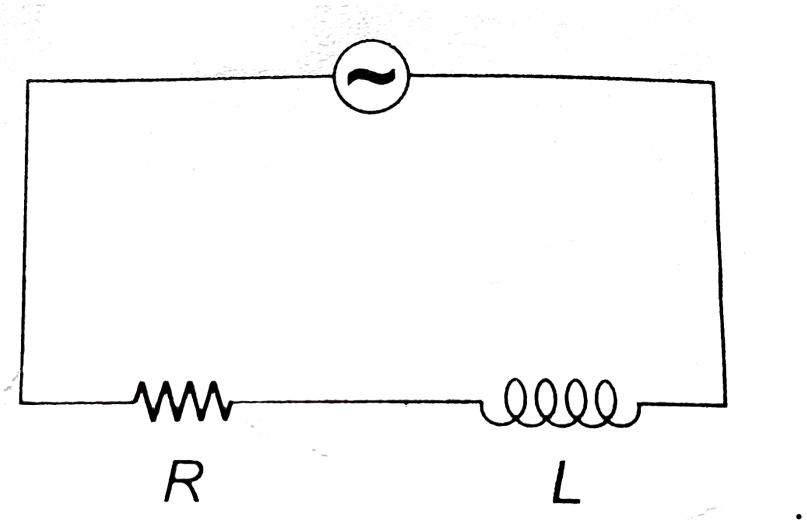
55. In the given LR circuit the source has angular frequency ω The power factore of the circuit is



A. L/R

B. $R/\omega L$

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

D. $R+\omega L$

Answer: C

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56. An ac source is connected across a resistance of 10Ω The power dissipated in the resistor is $100W$ The rms valuse of the current and voltge are .

A. $\sqrt{10}A, \sqrt{1000}V$

B. $2\sqrt{10}A, 2\sqrt{1000}V$

C. $2\sqrt{10}A, 2\sqrt{1000}V$

D. $\sqrt{10}A, 2\sqrt{1000}V$

Answer: A

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57. In an AC circuit, the power factor

A. unity when the circuit contains only an inductance

B. unity when the circuit contains only a resistance

C. zero when the circuit contains only a resistance

D. unity when the circuit contains only a capacitance

Answer: B

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58. The average power dissipated in a pure inductor `L carrying an alternating current of rms value I is .

A. $\frac{1}{2}LI^2$

B. LI^2

C. $\frac{1}{4}LI^2$

D. zero

Answer: D

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59. An AC source rated $100V(rms)$ supplies a current of $10A(rms)$ to a circuit. The average power delivered by the source

A. must be $1000W$

B. may be $1000W$

C. may be greater than $1000W$

D. may be less than $100W$

Answer: C

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60. In an LCR circuit the energy is dissipated in

A. R only

B. R and L only

C. R and C only

D. R, L and C

Answer: A

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61. Power delivered by an ac source of angular frequency Ω_0 to an LCR series circuit is maximum when .

A. $\omega L = \omega C$

B. $\omega L = \dfrac{1}{\omega C}$

C. $\omega L = R - \dfrac{1}{\omega C}$

D. $\omega C = R - \dfrac{1}{\omega L}$

Answer: B

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62. Two coils A and B are connected in series across a $240V, 50$Hz supply The resistance of A is 5Ω and the inductance of B is 0.02 H The power factor is 0.75 The impedance of the circuit is (if power consumed is 3kW) .

A. 0.144Ω

B. 1.44Ω

C. 14.4Ωs

D. 144Ω

Answer: C

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63. In previous question the resistance of coil B is

A. 0.58Ω

B. $5.8\Omega s$

C. 1.16Ω

D. 11.6Ω

Answer: B

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64. In previous question the resistance of coil A is .

A. $0.01H$

B. $0.02H$

C. $0.03H$

D. $0.04H$

Answer: A

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65. A choke coil has.

A. high inductance and high resistance

B. high inductance and low resistance

C. low inductance and high resistance

D. low inductance and low resistance

Answer: B

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66. A choke coil is preferred to a resistance for reducing current in an ac circuit because .

A. choke coil is cheaper

B. choke coil is easier to design

C. choke coil consumers much less power

D. the eddy currents produced in a choke coil reduce the current .

Answer: C

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67. An electric lamp which runs at 80 volt d.c. and consumes 10 ampere is connected to 100 volt, 50 Hz a.c. mains. Calculate the inductance of the choke required.

A. $0.01H$

B. $0.02H$

C. $0.04H$

D. $0.08H$

Answer: B

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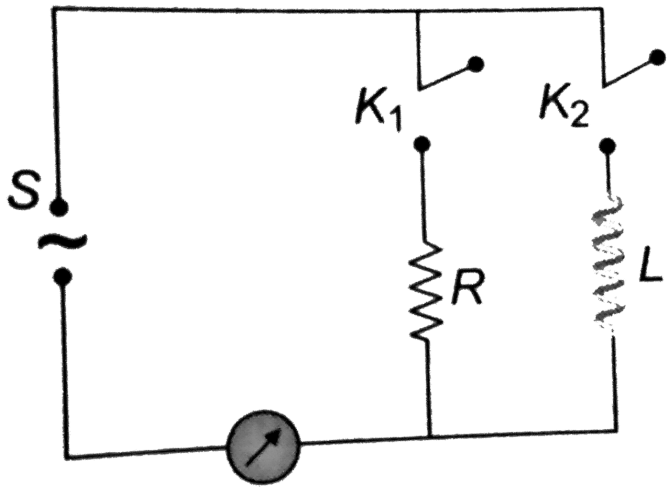
68. In the circuit shown, R is a pure resistor, L is an inductor of negligible resistance (as compared to R) and S is a$100V, 50HzAC$ source of negligible resistance. With eigther key k_1 alone or k_2 alone closed, the current is I_0. if the source is changed to $100V, 100Hz$, the current with k_1 alone closed and

with k_2 alone closed will be respectively



A. $I, \frac{1}{2}$

B. $I, 2I$

C. $2I, I$

D. $2I, \frac{1}{2}$

Answer: A

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69. A capacitor and an inductor are connected in parallel across an ac source If the current through the inductor is 0.4 A and that through the capacitor is 0.3 A then the current drawn from the source is .

A. $0.7A$

B. $0.5A$

C. $0.1A$

D. $\sqrt{0.07}A$

Answer: C

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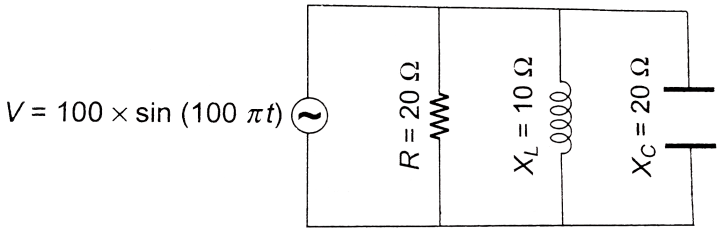
70. In the given circuit the current drawn from the source is



A. $20A$

B. $10A$

C. $5A$

D. $5\sqrt{2}A$

Answer: D

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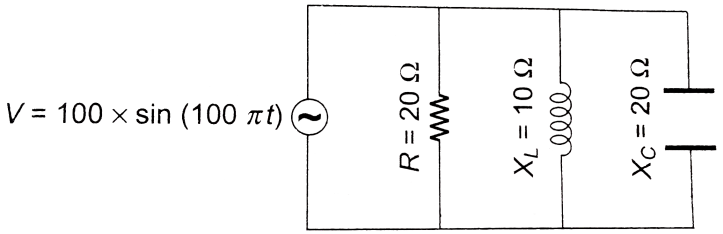
71. An inductor of $10mH$ an a capacitor of $16mF$ are connected in the circuit as shown in figure The frequency of the power supply is equal to the resonant frequency of the circuit Which ammeter will read will zero ampere



A. A_1

B. A_2

C. A_3

D. none

Answer: C

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72. The AC voltage across a resistance can be measured using

A. a potentiometer

B. a hot - wire voltmeter

C. am moving- coil galvanometer

D. a moving - magnet galvanometer

Answer: B

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73. Alternating current can be measured by

A. moving coil galvanometer

B. hot wire ammeter

C. tangent galvanometer

D. none of the above

Answer: B

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74. Hot wire ammeters can be used for measuring

A. alternating current only

B. direct current only

C. both alternating and direct current

D. neither alternating nor direct current

Answer: C

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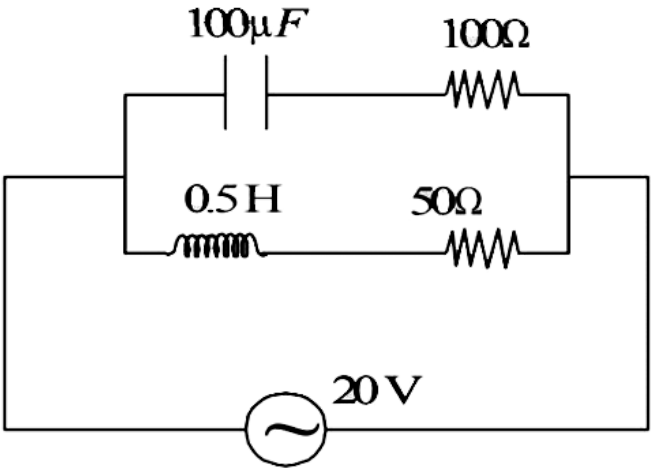
75. In the given circuit, the AC source has $(\omega) = 100 rad/s$. Considering the inductor and capacitor to be ideal, the correct choice(s) is (are)



A. the current through the circuit I is $0.4A$.

B. the current through the circuit I is $0.3\sqrt{2}A$.

C. the voltage across 100Ω resistor $= 10\sqrt{2}V$.

D. the voltage across 50Ω resistor $= 10V$.

Answer: C

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76. In a dc motor if E is the applied emf and e is the back emf then the efficiency is .

A. $\frac{E-e}{E}$

B. $\frac{e}{E}$

C. $\left(\frac{E-e}{E}\right)^2$

D. $\left(\frac{e}{E}\right)^2$

Answer: B

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77. Armature current in dc motor will be maximum when

A. just started moving

B. picked up maximum speed

C. intermediate speed

D. just been switched off

Answer: A

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78. The armature of a dc motor has 20Ω resistance It draws a currrent of 1.5 A when run by a $220V$ dc supply The value of the block emf induced in it is .

A. $150V$

B. $170V$

C. $180V$

D. $190V$

Answer: D

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79. In a step - down transformer the input voltage is $22kV$ and the output voltage is $550V$ The ratio of the number of turns in the secondary to that in the primary is .

A. $1:20$

B. $20:1$

C. $1:40$

D. $40:1$

Answer: C

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80. An ideal transformer is used to step up an alternating emf of $220V$ to $4.4kV$ to transmit $6.6kW$ of power The current rating of the secondary is

A. $30A$

B. $3A$

C. $1.5A$

D. $1A$

Answer: C

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81. in a transformer the number of rurns in the primary and secondary coils are 1000 and 3000 respectively If the primary is connected across $80V$ AC the potential difference across each turn of the secondary will be .

A. $240V$

B. $0.24V$

C. $0.8V$

D. $0.08V$

Answer: D

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82. in a step-up transformer, the turn ratio is $1:2$ leclanche cell (e.m.f. 1.5V) is connected across the primary. The voltage devloped in the secondary would be

A. zero

B. $3.0V$

C. $1.5V$

D. $0.75V$

Answer: A

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83. Eddy currents are produced in a matterial when it is

A. heated

B. placed in a time varying magnetic field

C. placed in an electric field

D. placed in a unifrom magnetic field

Answer: B

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84. The core of any transformaer is laminated so as to

A. magnetic field increases

B. magnetic saturation level in core increases

C. residual magnetism in core decreases

D. loss of energey in core due to to eddy currents decreases .

Answer: D

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