PHYSICS

BOOKS - DISHA PUBLICATION PHYSICS (HINGLISH)

ALTERNATING CURRENT

Jee Main 5 Years At A Glance

1. A power transmission line feeds input power at 2300 V a step down transformer with its

primary windings having 4000 turns. The output power is delivered at 230 V by the transformer. If the current in the primary of the transformer is 5A and its efficiency is $90\ \%$, the output current would be :

A. 20 A

B. 40 A

C. 45 A

D. 25 A

Answer: C

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

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

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

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

Answer: A

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3. A sinusoidal voltage of peak value 283 V and angular frequency 320/s is applied to a series LCR circuit.Given that $R = 5\Omega, L = 25mH$ and $C = 1000\mu F$.The total impedance, and phase difference between the voltage across the source and the current will respectively be:

A. 10Ω and $\tan^{-1}\left(\frac{5}{3}\right)$

B. 7Ω and 45°

C. 10Ω and $\tan^{-1}\left(\frac{8}{3}\right)$

D. 7Ω and $\tan^{-1}\left(\frac{5}{3}\right)$

Answer: B

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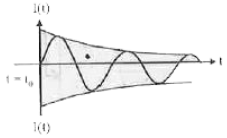
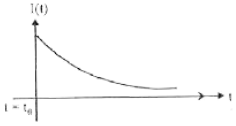
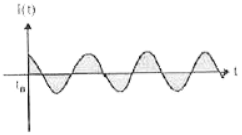
4. A seris LR circuit is connected to a voltage source with $V(t) = V_0 \sin \omega t$. After very large time, current 1(t) behaves as $\left(t_0 > > \frac{L}{R}\right)$:

A.

B. 

C. 

D. 

Answer: D

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5. An are lamp requires a direct current of 10A at 80V to function. If it is connected to a 220V(rms), 50 Hz AC supply, the series inductor needed for it to work is close to:

A. $0.044H$

B. $0.065H$

C. $80H$

D. $0.08H$

Answer: B

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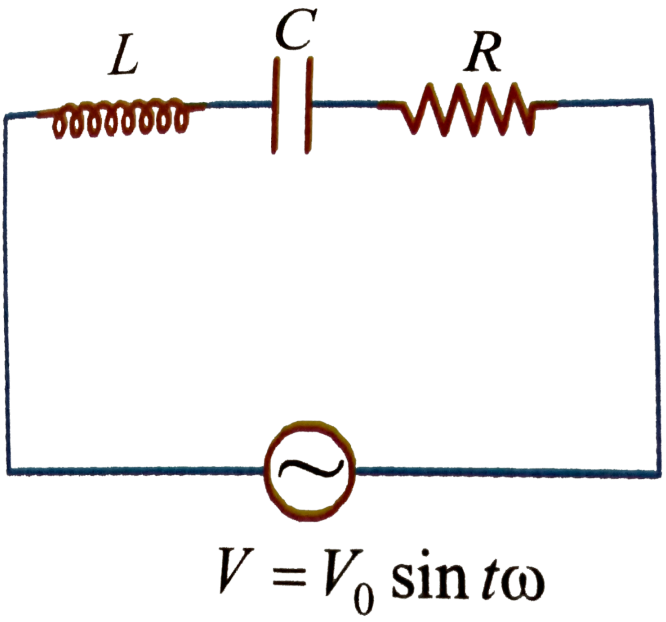
6. For the LCR circuit, shown here, the current is observed to lead the applied voltage. An additional capacitor C', when joined with the capacitor C present in the circuit, makes the power factor of the circuit unity. The capacitor C' must have been

connected in:



A. series with C and has a magnitude

$$\frac{C}{\omega^2 LC - 1}$$

B. series with C and has a magnitude

$$\frac{1 - \omega^2 LC}{\omega^2 L}$$

C. parallel with C and has a magnitude

$$\frac{1-\omega^2 LC}{\omega^2 L}$$

D. parallel with C and has a magnitude

$$\frac{C}{\omega^2 LC-1}$$

Answer: C

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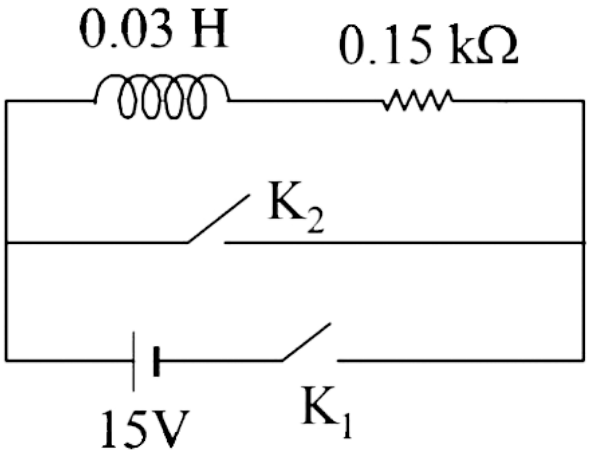
7. An inductor (L =0.03 H) and a resistor $(R=0.15k(\Omega))$ are connected in series to a battery of 15 V EMF in a circuit shown below.

The key K_1 is opened and Key K_2 is closed simultaneously. At t =1 ms, the current in the circuit will be $\left(e^5 = 150\right)$



A. 6.7 mA

B. 0.67 mA

C. 100 mA

D. 67 mA

Answer: B

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8. A sinusoidal voltage $V(t) = 100\sin(500t)$ is applied across a pure inductance of $L = 0.02H$. The current through the coil is :

A. 10 cos (500 t)

B. $-10\cos(500t)$

C. $10\sin(500t)$

D. $-10\sin(500t)$

Answer: B

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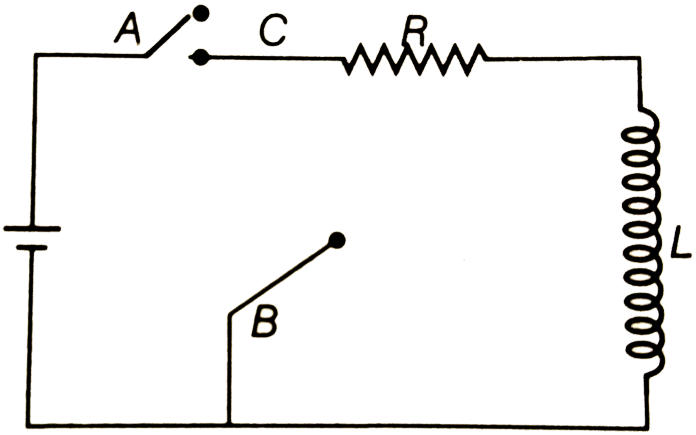
9. In the circuit shown here, the point C is kept connected to the point A till the current flowing through the circuit becomes constant. Afterward, suddenly ponit C is disconnected from point A and connected to point B at time t=0. ratio of voltage across resistance and the

inductor at t=L/R will be equal to



A. $\frac{e}{1-e}$

B. 1

C. -1

D. $\frac{1-e}{e}$

Answer: C

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Exercise 1 Concept Builder Topic 1 Alternating Current Voltage And Power

1. Alternating current can not be measured by D.C. Ammeter because

A. A.C. Cannot pass through D.C. Ammeter

B. average value of current for complete cycle is zero

C. A.C. Is virtual

D. A.C. Changes its direction

Answer: B

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2. In an AC circuit, peak value of voltage is 423 volts. Its effective voltage is

A. 400 Volts

B. 323 Volts

C. 300 Volts

D. 340 Volts

Answer: C

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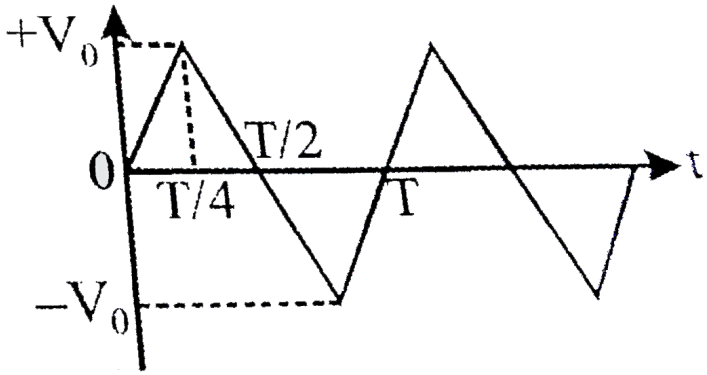
3. The voltage time (V-t) graph for triangular wave having peak value V_0 is as shown in figure.The rms value of V in time interval from

$t = 0$ to $T/4$ is



A. 5

B. 4

C. 7

D. 3

Answer: D

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4. 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. $0.71 I_0$

B. $1.412 I_0$

C. I_0

D. $\sqrt{I_0}$

Answer: A

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5. A sinusoidal ac current flows through a resistor of resistance R . If the peak current is I_p , then the power dissipated is

A. $I_P^2 R \cos\theta$

B. $\frac{1}{2} I_P^2 R$

C. $\frac{4}{\pi} I_P^2 R$

D. $\frac{1}{\pi^2} I_P^2 R$

Answer: B

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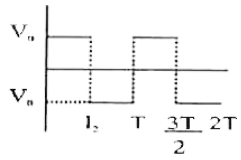
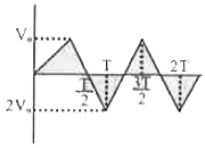
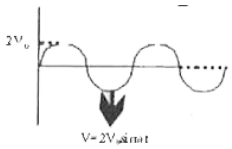
6. Current time graph of different source is given which one will have R.M.S. Value V_0:

A. 

B. 

C. 

D. 

Answer: A

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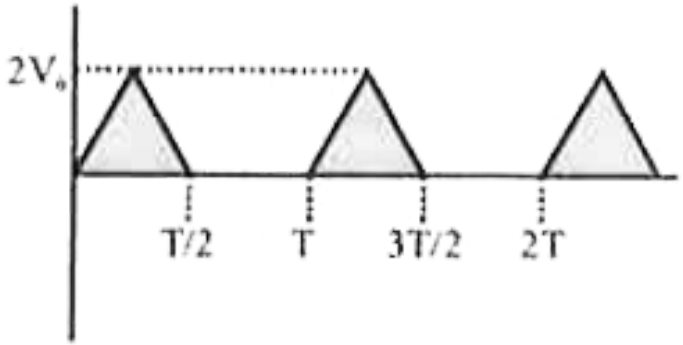
7. Average voltage for the given source is :



A. V_0

B. $2V_0$

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

D. $\frac{3V_0}{2}$

Answer: C

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8. The current I passed in any instruement in alternating current circuit is I = 2 $\sin \omega t$ amp and potential difference applied is given by V = 5 $\cos \omega t$ volt then power loss in instruement is

A. 2.5 watt

B. 5 watt

C. 10 watt

D. zero

Answer: D

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9. The voltage of an AC supply varies with time (t) as V = 120 sin $100\pi t \cos 100\pi t$. The

maximum voltage and frequency respectively are

A. 120 volt, 100 Hz

B. $\frac{120}{\sqrt{2}}$ volt, 100 Hz

C. 60 volt, 200 Hz

D. 60 volt, 100 Hz

Answer: D

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10. An alternating e.m.f. of angular frequency ω is applied across an inductance. The instantaneous power developed in the circuit has an angular frequency

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

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

C. ω

D. 2ω

Answer: D

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11. Using an AC voltmeter, the potential difference in the electrical line in a house is read to be 234 volt. If the line frequency is known to be 50 cycle per sec, the equation for the line voltage is

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

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

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

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

Answer: B

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12. An alternating current is given by

$I = i_1 \cos \omega t + i_2 \sin \omega t.$

The rms current is given by

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

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

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

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

Answer: C

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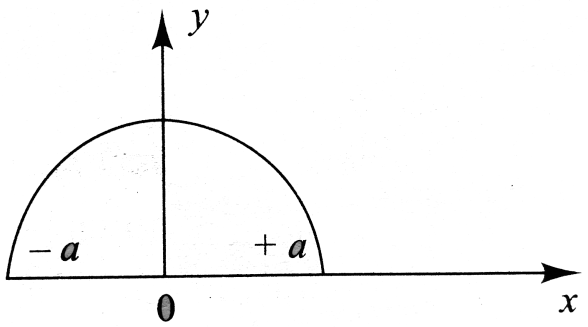
13. Determine the rms value of a semi-circular current wave which has a maximum value of a.



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

B. $\left(\sqrt{\frac{3}{2}}\right)a$

C. $\left(\sqrt{\frac{2}{3}}\right)a$

D. $\left(\sqrt{\frac{1}{3}}a\right)$

Answer: C

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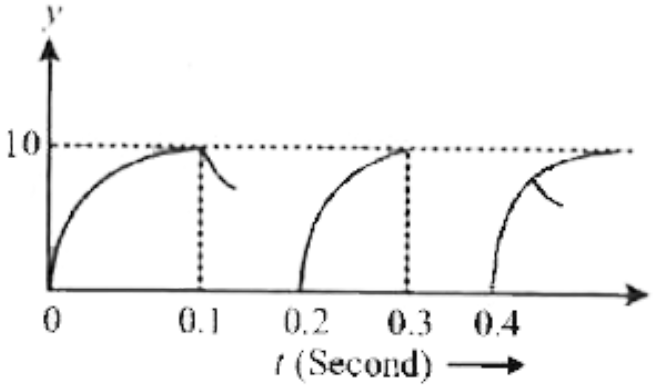
14. The rms value of the function shown in figure if it its given that for $0 < t < 0.1, y = 10\left(1 - e^{-100t}\right.$ and for

$0.1 < t < 0.2, y = 10e^{-50(t-0.1)}$ is



A. 6.2

B. 5.3

C. 4.1

D. 6.9

Answer: D

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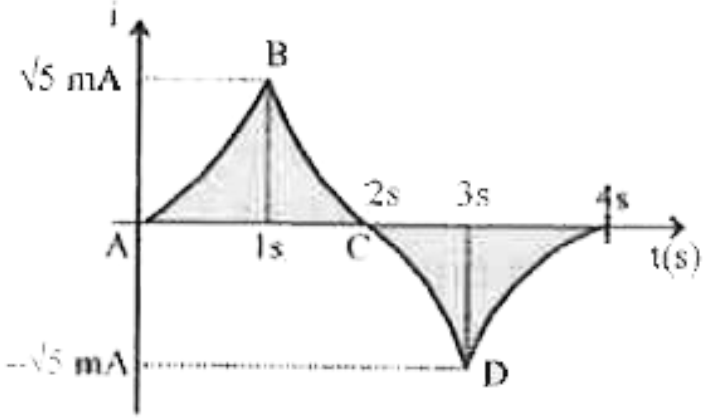
15. Figure shows one cycle of an alternating current with the segments AB, BC, CD, DE being symmetrical and parabolic. The root mean square value of this current over one cycle is x mA, find x.



A. 1 mA

B. 2 mA

C. 3 mA

D. 4 mA

Answer: A

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16. A resistance of 20 ohm is connected to a source of an alternating potential V = 200 $\cos(100\pi t)$. The time taken by the current to change from its peak value to rms value α is

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

B. $25 \times 10^{-3} s$

C. $0.25 s$

D. $0.20 s$

Answer: A

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17. 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. 10 V

D. $10\sqrt{2}V$

Answer: A

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18. An AC voltage source has an output of V = 200 sin $2\pi ft$. This source is connected to a 100Ω resistor. RMS current in the resistance is

A. 1.41 A

B. 2.41 A

C. 3.41 A

D. 0.71 A

Answer: A

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19. The r.m.s value of an a.c of $59Hz$ is $10A$. The time taken by the alternating current in

reaching from zero to maximum value and the peak value of current will be

A. 2×10^{-2} sec and $14.14 amp$

B. 1×10^{-2} sec and 7.07 amp

C. 5×10^{-3} sec and 7.07 amp

D. 5×10^{-3} sec and 14.14 amp

Answer: D

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20. Using an AC voltmeter, the potential difference in the electrical line in a house is read to be 234 volt. If the line frequency is known to be 50 cycle per sec, the equation for the line voltage is

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

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

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

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

Answer: B

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Exercise 1 Concept Builder Topic 2 A C Circuits And Power Factor

1. An ac source is connected to a resistive circuits. Which of the following statements are false ?

A. Current leads ahead of voltage in phase

B. Current lags behind voltage in phase

C. Current and voltage are in same phase

D. Any of the above may be true depending upon the value of resistance

Answer: C

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2. An inductor, a resistor and a capacitor are joined in series with an AC source. As the frequency of the source is slightly increased from a very low value, the reactance

A. inductor increases

B. resistor increases

C. capacitor increases

D. circuit increases

Answer: A

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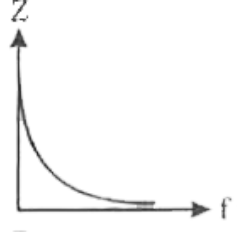
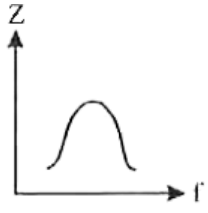
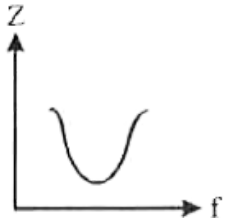
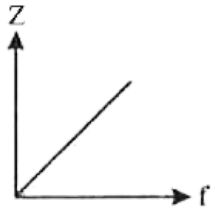
3. Which of the following curves represents the variation of impedence (Z) with frequency f in series LCR circuit?

A. 

B. 

C. 

D. 

Answer: C

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4. In a series LCR circuit containing an AC voltage source of frequency ω, current and voltage are measured. Then for the resistance, consider the statements-

[a] current is maximum at $\omega^2 = 1/LC$

[b] current is minimum at $\omega^2 = 1/LC$

[c] voltage across R is maximum at $\omega^2 = 1/LC$

[d] voltage across R is minimum at $\omega^2 = 1/LC$

the voltage statement is

A. (i) and (iii) are correct

B. (i) and (iv) are correct

C. (ii) and (iii) are correct

D. (ii) and (iv) are correct

Answer: D

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5. In the circuit shown in fig, the resonant frequency is

A. $75\frac{kc}{s}$

B. $750\frac{kc}{s}$

C. $7.5\frac{kc}{s}$

D. $75\frac{mc}{s}$

Answer: A

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6. Two coils A and B are connected in series across a $240V$, 50Hz 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. 14.4ω

D. 144ω

Answer: C

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7. Which increase in frequency of an AC supply , the impedance of an L-C-R series circuit

A. remains constant

B. increases

C. decreases

D. decreases at first, becomes minimum and then increases

Answer: D

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8. A coil of inductance $300mh$ and resistance 2Ω is connected to a source of voltage $2V$. The current reaches half of its steady state value in

A. $0.1s$

B. $0.05s$

C. $0.3s$

D. $0.15s$

Answer: A

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9. An ideal coil of 10H is connected in series with a resistance of $5(\Omega)$ and a battery of 5V. 2second after the connections is made, the current flowing in ampere in the circuit is

A. $\left(1 - e^{-1}\right)$

B. $(1-e)$

C. (e)

D. e^{-1}

Answer: A

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10. In an LR-circuit, the inductive reactance is equal to the resistance R of the circuit. An e.m.f $E = E_0 \cos(\omega t)$ applied to the circuit. The power consumed in the circuit is

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

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

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

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

Answer: C

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11. An inductance L having a resistance R is connected to an alternating source of angular

frequency ω.The quality factor Q of the inductance is

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

B. $\left(\frac{\omega L}{R}\right)^2$

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

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

Answer: D

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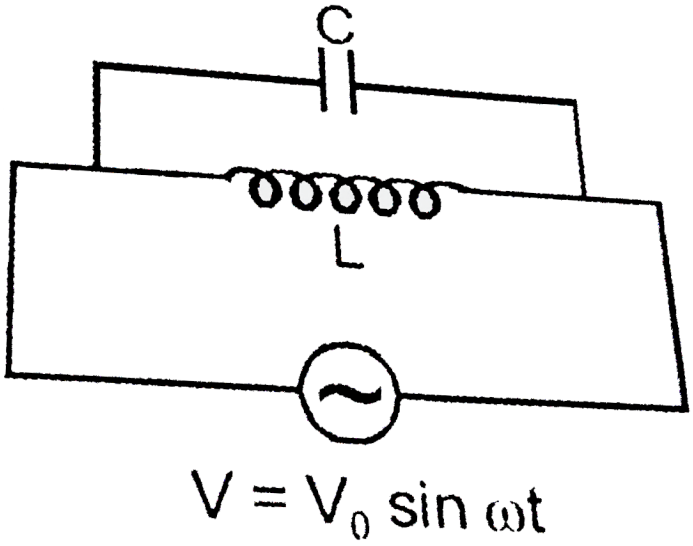
12. For the circuit shown in the fig., the current through the inductor is 0.9 A while the current through the condenser is 0.4 A. Then



A. current drawn from generator I = 1.13 A

B. $\omega = \dfrac{1}{1.5LC}$

C. $I = 0.5A$

D. $I = 0.6A$

Answer: C

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13. In a series combination of R, L and C to an A.C. Source at resonance if R = 200 hm, then impedance Z of the combination is

A. 200 hm

B. zero

C. 10 hm

D. 4000 hm

Answer: A

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14. A coil of $40H$ inductance is connected in series with a resistance of 8 ohm and the combination is joined to the terminals of a $2V$ battery. The time constant of the circuit

A. 20 seconds

B. 5 seconds

C. 1/5 seconds

D. 40 seconds

Answer: B

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

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

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

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

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

Answer: B

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16. A current of 4 A flows in a coil when connected to a 12 V dc source. If the same coil is connected to a $12V, 50rads^{-1}$ ac source, a

current of 2.4 A flows of the coil in the circuit.

The inductance of the coil is

A. 0.08H

B. 0.04 H

C. 0.02 H

D. 1 H

Answer: A

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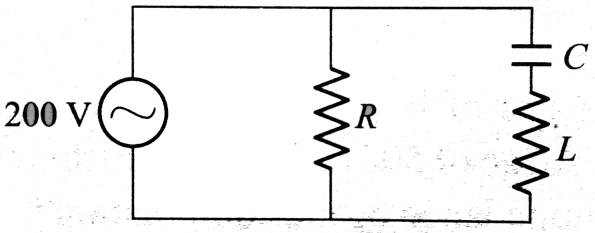
17. In the circuit shown in fig. $X_C = 100\Omega$, $(X_L) = 200\Omega$ and $R = 100\Omega$.

The effective current through the source is



A. 4

B. 3

C. 2

D. 5

Answer: D

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18. An e.m.f. of 15 volt is applied in a circuit containing 5 henry inductance and 10 ohm resistance. The ratio of the current at time $t = \infty$ and at $t = 1$ second is

A. $\frac{e^{\frac{1}{2}}}{e^{\frac{1}{2}} - 1}$

B. $\frac{e^2}{e^2-1}$

C. $1-e^{-1}$

D. e^{-1}

Answer: B

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19. 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. 350 V

B. 250 V

C. 500 V

D. 300 V

Answer: B

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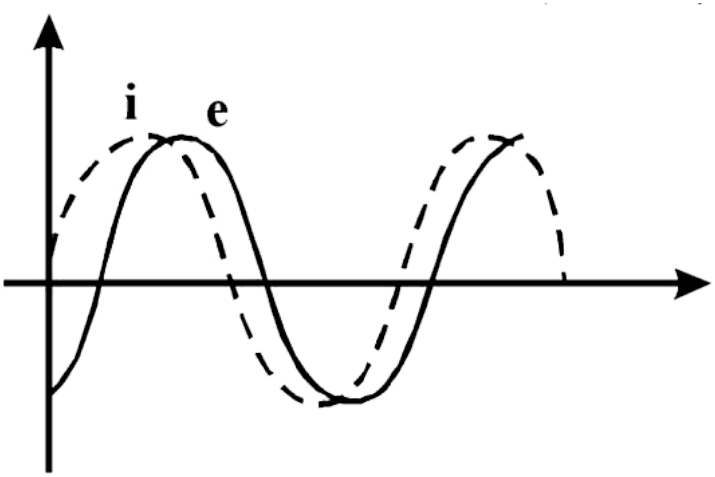
20. When an AC source of $emfe = E_0 \sin(100t)$ is connected across a circuit i in the circuit, the phase difference between the emf e and the current i in the circuit is observed to be $(\pi/4)$, as shown in the diagram. If the circuit consists possibly only of R-C or R-L or L-C in series, find the

relationship between the two elements



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

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

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

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

Answer: A

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21. In an L-C -R series circuit connected to an AC source $V = V_0 \sin\left(100\pi(t) + \frac{\pi}{6}\right)$ $V_R = 40V, V_L = 40$ and $V_C = 10V$, resistance $R = 4\Omega$

Choose the correct option

A. $10\sqrt{2}A$

B. $15\sqrt{2}A$

C. $20\sqrt{2}A$

D. $25\sqrt{2}A$

Answer: A

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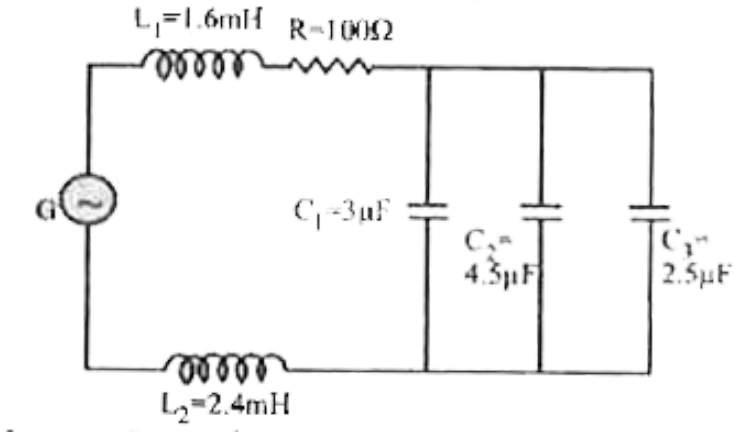
22. An ac generator G with adjustable frequency of oscillation is used in the circuit, as shown,



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

A. $10^5 ra\frac{d}{s}$

B. $10^4 ra\frac{d}{s}$

C. $5000 ra\frac{d}{s}$

D. $500 ra\frac{d}{s}$

Answer: C

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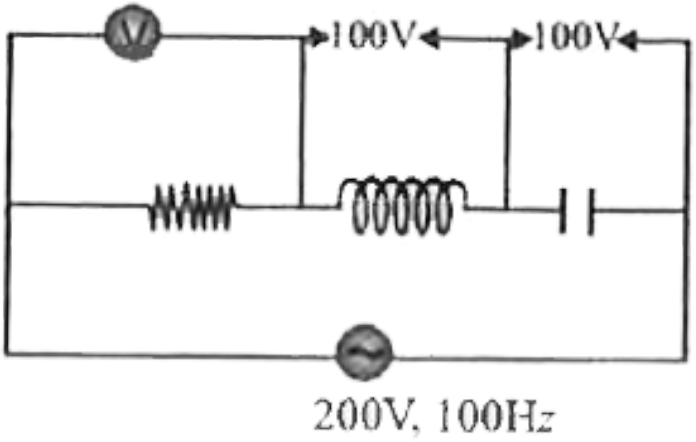
23. In the circuit given below, what will be the reading of the voltmeter?



A. 300 V

B. 900 V

C. 200 V

D. 400 V

Answer: C

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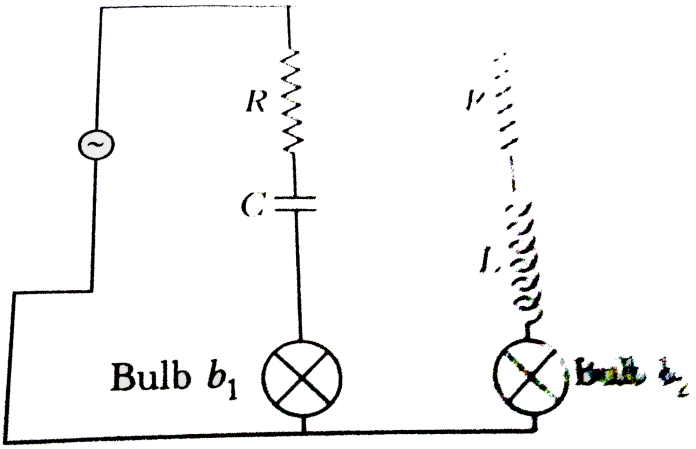
24. Two identical incandescent light bulbs are connected as shown in figure. When the circuit is an AC voltage source of frequency f, which of the following observations will be correct.



A. Both bulbs will glow alternatively

B. Both bulbs will glow with same brightness provided $f = \frac{1}{2\pi}\left(\sqrt{\frac{1}{L}C}\right)$

C. Bulb b_1 will light up initially and goes of, bulb b_2 will be ON constantly

D. Bulb b_1 will blink and bulb b_2 will be ON constantly

Answer: A

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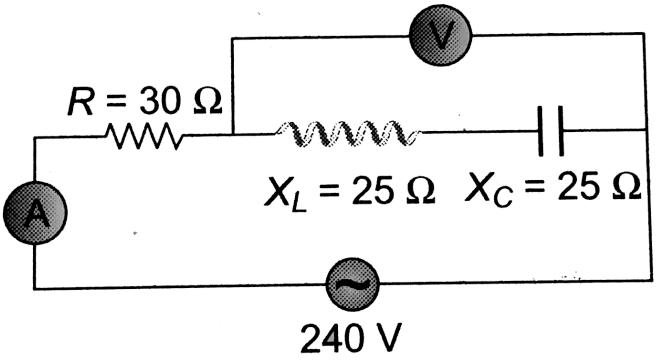
25. In the circuit shown in figure neglecting source resistance the voltmeter and ammeter reading will respectively, will be



A. $0V, 3A$

B. 150 V, 3 A

C. 150V, 6 A

D. 0V, 8A

Answer: D

Watch Video Solution

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

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

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

Answer: A

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27. A coil of inductive reactance 31Ω has a resistance of 8Ω. It is placed in series with a condenser of capacitative reactance 25Ω. The

combination is connected to an a.c. source of 110 volt. The power factor of the circuit is

A. 0.64

B. 0.80

C. 0.33

D. 0.56

Answer: B

 Watch Video Solution

28. In an AC circuit, a resistance of $Rohm$ is connected is series with an inductance L. If phase angle between volage and current be 45°, the value of inductive reactance will be

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

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

C. R

D. cannot be found with given data

Answer: C

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Watch video solution

29. A coil has an inductance of $0.7H$ and is joined in series with a resistance of 220Ω. When an alternating e.m.f of $220V$ at 50 c.p.s. is applied to it, then the wattless component of the current in the circuit is

A. $30^\circ, 1A$

B. $45^\circ, 0.5A$

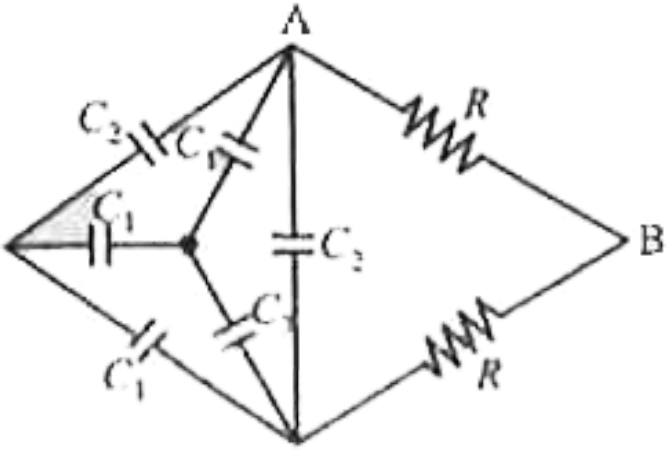
C. $60^\circ, 1.5A$

D. None of these

Answer: B

Watch Video Solution

30. In given RC circuit, capacitance of capacitor $C_1 = 3\mu F$ and $C_2 = 1\mu F$.It is given that time constant of circuit between A and B is 3 millisecond.Value of R will be



A. 1Ω

B. 10Ω

C. 1000Ω

D. 1000Ω

Answer: D

View Text Solution

31. In a circuit, an inductor (L), capacitor (C) and resistor (R) are connected in parallel across a source of emf given by $\varepsilon = \varepsilon_0 \sin \omega t$.

Find the current through the mains and draw a phasor diagram.

A. $\frac{\sqrt{3}}{\left|\omega C - \frac{1}{\omega L}\right|}$

B. $\sqrt{3}\left|\frac{1}{\omega C} - \omega L\right|$

C. $\sqrt{5}\left|\frac{1}{\omega C} - \omega L\right|$

D. None of these

Answer: A

Watch Video Solution

Exercise 1 Concept Builder Topic 3 Transformers And Lc Oscillations

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

A. choke s cheap

B. there is no wastage of energy

C. current becomes wattless

D. current strength increases

Answer: B

Watch Video Solution

2. Fleming 's left and right hand rule are used in

A. DC motor and AC generator

B. DC generator and AC motor

C. DC motor and DC generator

D. Both rules are same any one can be used

Answer: C

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3. Eddy currents in the core of transformer can't be developed by

A. increasing the number of turns in secondary coil

B. taking laminated transformer

C. making step down transformer

D. using a weak a.c at high potential

Answer: B

Watch Video Solution

4. A transformer is used to light a 140 W, 24 V lamp from 240 V AC mains. The current in mains cable is 0.7 A, find the efficiency of transformer.

A. 63.8%

B. 83.3%

C. 16.7%

D. 36.2%

Answer: B

 Watch Video Solution

5. A generator supplies 100 V to the primary - coil of a transformer of 50 turns.If the secondary coil has 500 turns, then the secondary voltage is

A. 100V

B. 550V

C. 500V

D. 1000V

Answer: D

Watch Video Solution

6. A transistor-oscillator using a resonant circuit with an inductor L (of negligible resistance) and a capacitor C in series produce oscillation of frequency f. If L is doubled and C is changed to $4C$, the frequency will be

A. 8f

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

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

D. $\frac{f}{4}$

Answer: B

Watch Video Solution

7. A capacitor in an LC oscillator has a maximum potential difference of 17V and a maximum energy of $160\mu J$.When the capacitor has a potential difference of 5V and

an energy of $10\mu J$, what is the energy stored in the magnetic field?

A. $10\mu J$

B. $150\mu J$

C. $160\mu J$

D. $170\mu J$

Answer: B

Watch Video Solution

8. In an oscillating LC circuit with L = 50 mH and $C = 4.0\mu F$, the current is initially a maximum.How long will it take before the capaciotr is fully discharged for the first time:

A. $7 \times 10^{-4} s$

B. $14 \times 10^{-4} s$

C. $28 \times 10^{-4} s$

D. none

Answer: A

Watch Video Solution

Watch Video Solution

9. An alternating current emf device has a smaller resistance than that of the resistive load, to increase the transfer of energy from the device to the load, a transformer will be connected between two.Then

A. N_S should be greater than N_P

B. N_S should be less than N_P

C. $N_S = N_P$

D. none

Answer: A

Watch Video Solution

10. A choke coil and capacitor are connected in series and the current through the combination is maximum for AC of frequency n. If they are connected in parallel, at what frequency is the current through the combination minimum?

A. n

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

C. 2n

D. 5n

Answer: A

 Watch Video Solution

11. In an oscillating LC circuit the maximum charge on the capacitor is Q. The charges on the capacitor when the energy is stored

equally between the electric and magnetic field is

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

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

C. $\frac{Q}{\sqrt{3}}$

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

Answer: B

Watch Video Solution

12. If the total charge stored in the LC circuit is Q_0, then for $t \geq 0$

A. The charge on the capacitor is Q = $Q_0 \cos\left(\frac{\pi}{2} + \frac{t}{\sqrt{LC}}\right)$

B. The charge on the capacitor is Q = $Q_0 \cos\left(\frac{\pi}{2} - \frac{t}{\sqrt{LC}}\right)$

C. The charge on the capacitor is Q = $= -LC\frac{d^2Q}{dt^2}$

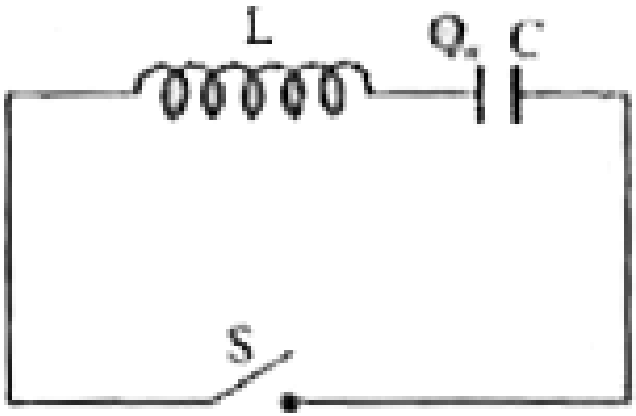
D. The charge on the capacitor is Q = $\frac{1}{\sqrt{LC}} \frac{d^2Q}{dt^2}$

Answer: C

Watch Video Solution

13. At $t < 0$, the capacitor is charged and the switch is opened.At $t = 0$ the switch is closed.The shortest time T at which the charge

on the capacitor will be zero is given by:



A. $\pi\sqrt{LC}$

B. $\frac{3}{2}\pi\sqrt{LC}$

C. $\frac{\pi}{2}\sqrt{LC}$

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

Answer: C

View Text Solution

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

A. $0.2A$

B. $2A$

C. $10A$

D. $20A$

Answer: A

Watch Video Solution

15. The tuning circuit of a radio receiver has a resistance of 50Ω , an inductor of 10 mH and a variable capacitor. A 1 MHz radio wave produces a potential difference of 0.1 mV. The values of the capacitor to produce resonance is $(\text{Take } \pi_2 = 10)$

A. $2.5pF$

B. $5.0pF$

C. $25pF$

D. $50pF$

Answer: A

Watch Video Solution

16. A step-down transformer is connected to 2400 volts line and 80 amperes of current is found to flow in output load. The ratio of the turns in primary and secondary coil is $20:1$. if

transformer efficiency is 100%, then the current flowing in primary coil will be

A. 1600 amp

B. 20 amp

C. 4 amp

D. 1.5 amp

Answer: C

 Watch Video Solution

17. The primary winding of a transformer has 100 turns and its secondary winding has 200 turns. The primary is connected to an ac supply of $120V$ and the current flowing in it is $10A$. The voltage and the current in the secondary are

A. 240V, 5A

B. 240 V, 10A

C. 60 V, 20 A

D. 120 V, 20 A

Answer: A

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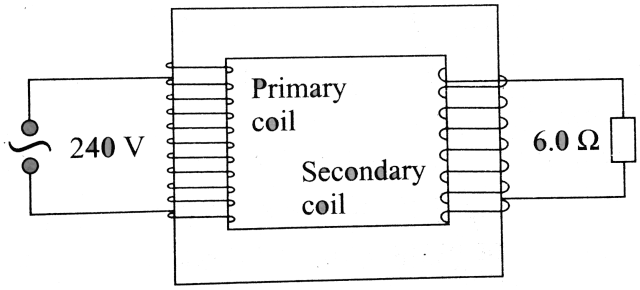
18. Figure shows an iron-cored transformer assumed to be 100% efficient. The ratio of the secondary turns to the primary turns is 1:20.



A 240 V ac supply is connected to the primary

coil and a 6Ω resistor is connected to the secondary coil. What is the current in the primary coil?

A. $0.10A$

B. $0.14A$

C. 2A

D. 40 A

Answer: A

Watch Video Solution

19. The output of a step-down transformer is measured to be $24V$ when connected to a 12 watt light bulb. The value of the peak current is

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

B. $\sqrt{2}A$

C. 2A

D. $2\sqrt{2}A$

Answer: A

Watch Video Solution

Exercise 2 Concept Applicator

1. A series LR circuit is connected to an ac source of frequency ω and the inductive reactance is equal to 2R. A capacitance of capacitive reactance equal to R is added in series with L and R. The ratio of the new power factor to the old one is

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

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

C. $\sqrt{\frac{3}{2}}$

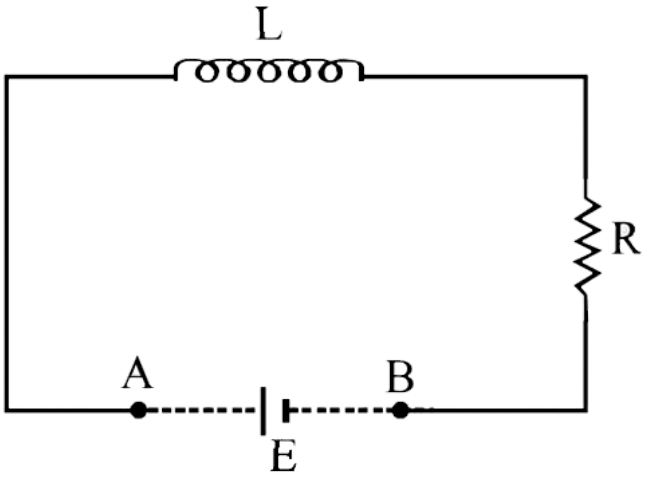
D. $\sqrt{\frac{5}{2}}$

Answer: D

Watch Video Solution

2. An inductor $(L = 100mH)$, a resistor $(R = 100(\Omega))$ and a battery $(E = 100V)$ are initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the point A

and B. The current in the circuit 1 ms after the short circuit is



A. $1/eA$

B. eA

C. $0.1A$

D. $1A$

Answer: A

Watch Video Solution

3. The primary of a transformer when connected to a dc battery of 10 volt draws a current of 1 mA. The number of turns of the primary and secondary windings are 50 and 100 respectively.The voltage in the secondary and the current drawn by the circuit in the secondary are respectively

A. 20 V and 0.5 mA

B. 20V and 2.0 mA

C. 10V and 0.5 mA

D. Zero and therefore no current

Answer: D

 Watch Video Solution

4. An inductive coil has resistance of 100Ω. When an ac signal of frequency $1000Hz$ is fed to the coil. The applied voltage leads the

current by 45°. What is the inductance of the coil?

A. 10 mH

B. 12 mH

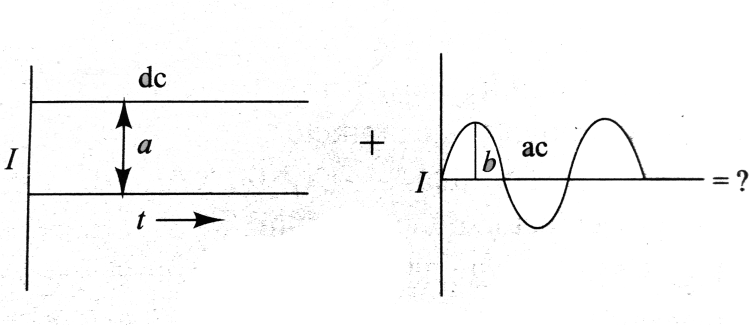
C. 16 mH

D. 20 mH

Answer: C

Watch Video Solution

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



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

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

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

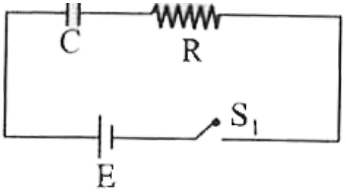
D. $\frac{\left[a^2+\frac{b^2}{2}\right]^1}{2}$

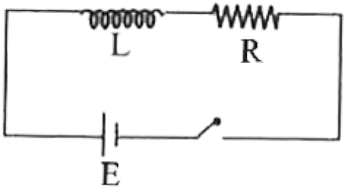
Answer: D

Watch Video Solution

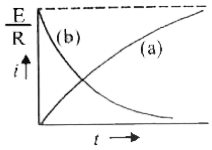
6. In the circuits (A) and (b) switches S_1 and S_2 are closed at t = 0 and are kept closed for a long time.The variation of current in the two circuits for $t \geq 0$ are roughly shown by figure

(figures are schematic and not drawn to scale):

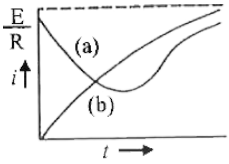




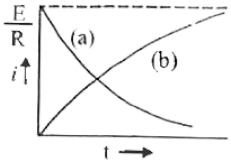
A.



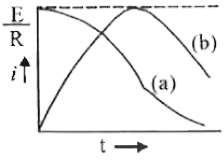
B.



C.



D.



Answer: C

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7. Combination fo two identical capacitors, a resistor R and a dc voltage source of voltage $6V$ is used in an experiment on a $(C-R)$ circuit. It is found that for a parallel combination of the capacitor the time in which the voltage of the fully charged combinatiomn reduces to half its original voltage is 10 second. For series combination the time needed for reducing teh voltage of the fully charged series combination by half is-

A. 10 second

B. 5 second

C. 2.5 second

D. 20 second

Answer: C

 Watch Video Solution

8. In an alternating current circuit in which an inductance and capacitance are joined in series, current is found to be maximum when

the value of inductance is 0.5 henry and the value of capacitance is 8μF. The angular frequency of applied alternating voltage will be

A. 5000 rad/sec

B. 4000 rad/sec

C. $2 \times 10^5 ra \frac{d}{\sec}$

D. 500 rad/ sec

Answer: D

Watch Video Solution

9. In a uniform magneitc field of induced B a wire in the form of a semicircle of radius r rotates about the diameter of hte circle with an angular frequency ω. The axis of rotation is perpendicular to hte field. If the total resistance of hte circuit is R, the mean power generated per period of rotation is

A. $\frac{(B\pi r\omega)^2}{2R}$

B. $\frac{\left(B\pi r^2\omega\right)^2}{8R}$

C. $\frac{B\pi r^2\omega}{2R}$

D. $\frac{\left(B\pi r\omega^2\right)^2}{8R}$

Answer: B

Watch Video Solution

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

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

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

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

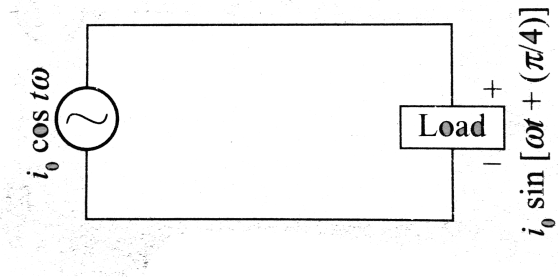
D. $\left(5\frac{10-\pi^2}{\pi}\right)\Omega$

Answer: B

Watch Video Solution

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

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



A. connecting an inductor in series with the load

B. connecting a capacitor in series with the load

C. connecting an inductor in parallel with the load

D. connecting a capacitor in parallel with the load.

Answer: C

Watch Video Solution

12. In a series LCR circuit $R = 200(\Omega)$ and the voltage and the frequency of the main supply is 220V and 50 Hz respectively. On taking out

the capacitance from the circuit the current lags behind the voltage by $30(\circ)$. On taking out the inductor from the circuit the current leads the voltage by $30(\circ)$. The power dissipated in the LCR circuit is

A. 305W

B. 210 W

C. Zero W

D. 242 W

Answer: D

Watch Video Solution

13. An ideal efficient transformer has a primary power input of 10 kW.The secondary current when the transformer is on load is 25 A. If the primary : secondary turnsratio is 8 : 1, then the potential difference applied to the primary coil is

A. $\frac{10^4 \times 8^2}{25} V$

B. $\frac{10^4 \times 8}{25} V$

C. $\frac{10^4}{25 \times 8} V$

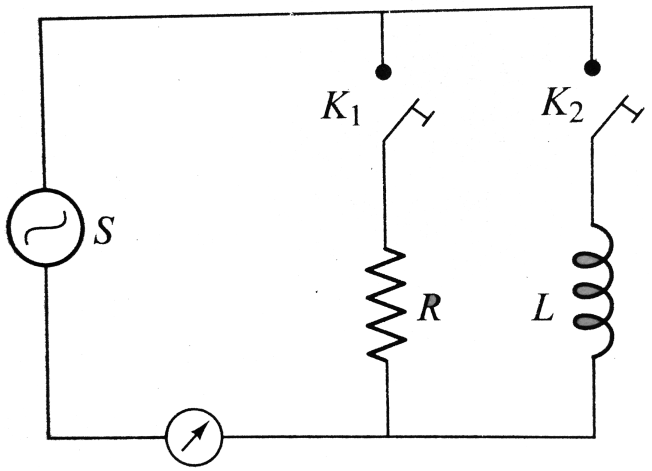
D. $\frac{10^4}{25 \times 8^2}$ V

Answer: B

Watch Video Solution

14. In the circuit shown in fig. R is a pure resistor, L is an inductor of ngligibe resistance (as compared to R), S is a 100 V , 50 Hz ac source of negligible resistnce. With either kiy $(K-1)$alone or (K_2) alone closed, the current is (I_0). If the source os changed to 100

V, 100 Hz the current with (K_1) alone closed and with (K_2) alone closed will be, respectively.



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

B. $I_0, 2I_0$

C. $2I_0, I_0$

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

Answer: A

Watch Video Solution

15. An inductive circuit contains a resistance of 10 ohms and an inductance of 2 henry. If an alternating voltage of 120 V and frequency 60 Hz is applied to this circuit, the current in the circuit would be nearly

A. $0.32A$

B. $0.16A$

C. $0.48A$

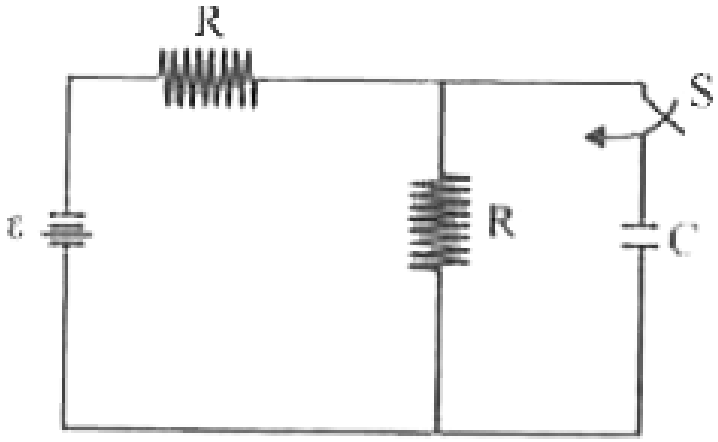
D. $0.80A$

Answer: B

 Watch Video Solution

16. In given circuit capacitorinitially uncharged.Now at t = 0 switch S is closed then

current given by source at any time t is



A. $\frac{2}{R}\left(1-e^{\frac{-2t}{CR}}\right)$

B. $\frac{\varepsilon}{2R}\left(1+e^{\frac{-2t}{CR}}\right)$

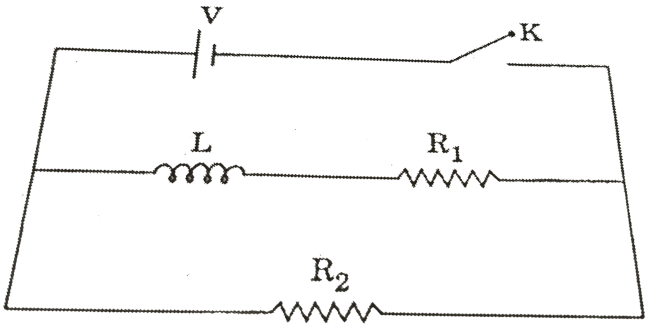
C. $\frac{\varepsilon}{2R}\left(1-e^{\frac{-2t}{CR}}\right)$

D. $\frac{2\varepsilon}{R}\left(1-e^{\frac{-2t}{CR}}\right)$

Answer: B

View Text Solution

17. In the circuit shown below, the key K is closed at t = 0. The current through the battery is



A. $\frac{VR_1R_2}{\sqrt{R_1^2+R_2^2}} att = 0$ and $\frac{V}{R_2} att = \infty$

B. $\frac{V}{R_2}$ at t - 0 and $\frac{V(R_1+R_2)}{R_1R_2}$ at $t = \infty$

C. $\frac{V}{R_2}$ at t = 0 and $\frac{VR_1R_2}{\sqrt{R_1^2+R_2^2}}$ at $t=\infty$

D. $\frac{V(R_1+R_2)}{R_1R_2}$ at t = 0 and $\frac{V}{R_2}$ at $t-\infty$

Answer: C

Watch Video Solution

18. In a sereis L-C-R circuit, $C=10^{-11}$ Farad, $L=10^{-5}$ Henry and R = 100 Ohm, when a constant D.C voltage E is applied to the circuit, the capacitor acquires a charge $10^{-9}C$. The D.C source is replaced by a sinusoidal voltage

source in which the peak voltage E_0 is equal to the constant D.C volatge E. At resonance the peak value of the charge acquired by the capacitor will be :

A. $10^{-15}C$

B. $10^{-6}C$

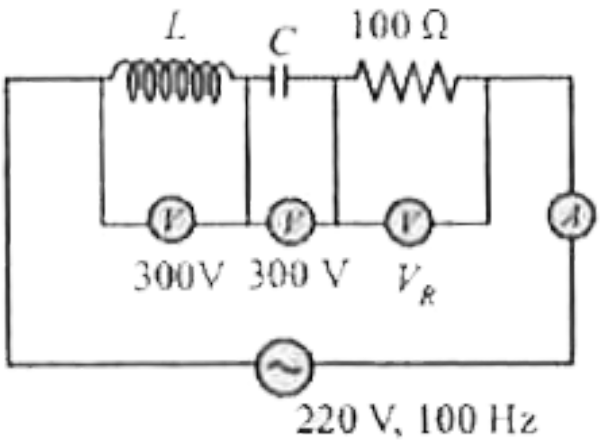
C. $10^{-10}C$

D. $10^{-8}C$

Answer: D

Watch Video Solution

19. In an LCR circuit shown in the following figure, what will be the readings of the voltmeter across the resistor and ammeter if an a.c. Source of 220 V and 100Hz is connected to it as shown?



A. 800V, 8A

B. 110 V, 1.1 A

C. 300 V, 3A

D. 220V, 2.2 A

Answer: D

Watch Video Solution

20. An AC voltage is applied to a resistance R and an inductance L in series. If R and the inductive reactance are both equal to 3Ω, the

phase difference between the applied voltage and the current in the circuit is

A. $\frac{\pi}{6}$

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

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

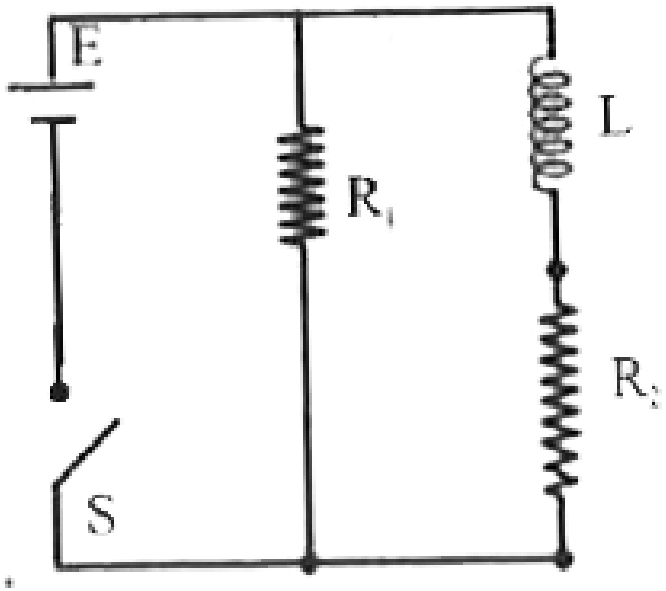
D. zero

Answer: B

Watch Video Solution

21. An inductor of inductance L = 400 mH and resistors of resistance $R_1 = 2\Omega$ and $R_2 = 2\Omega$ are connected to a battery of emf 12V as shown in the figure.The internal resistance of the battery is negligible.The switch S is closed at t = 0.The potential drop across L as a

function of time is



A. $\frac{12}{t}e^{-3t}V$

B. $6\left(1-e^{-\frac{t}{0.2}}\right)V$

C. $12e^{-5t}V$

D. $6e^{-5t}V$

Answer: C

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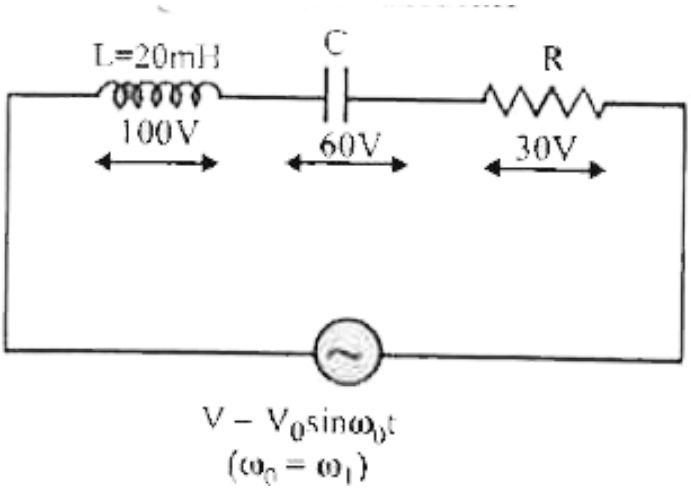
22. Consider the RLC circuit shown below connected to an AC source of constant peak voltage V_0 and variable frequency ω_0.The value of L is 20 mH.For a certain value $\omega_0 = \omega_1$, rms voltage across L,C, R are shown in the diagram. At $\omega_0 = \omega_2$, it is found that rms voltage across

resistance is 50 V. Then the value of ω_2 is



A. $\sqrt{\frac{3}{5}}\omega_1$

B. $\sqrt{\frac{5}{3}}\omega_1$

C. 50Hz

D. cannot be calculated from given data

Answer: A

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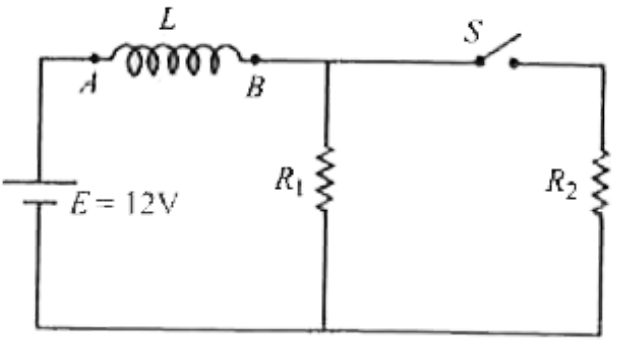
23. The circuit shown has been operating for a long time. The instant after the switch in the circuit labeled S is opened, what is the voltage across the inductor V_L and which labeled point (A or B) of the inductor is at a higher potential?Take

$R_1 = 4.0\omega, R_2 = 8.0\omega$ and $L = 2.5H.$



A. $V_L = 12V$, point A is the higher potential

B. $V_L = 12V$, point B is at the higher potential

C. $V_L = 6V$, point A is at higher potential

D. $V_L = 6V$, point B is at the higher potential

Answer: D

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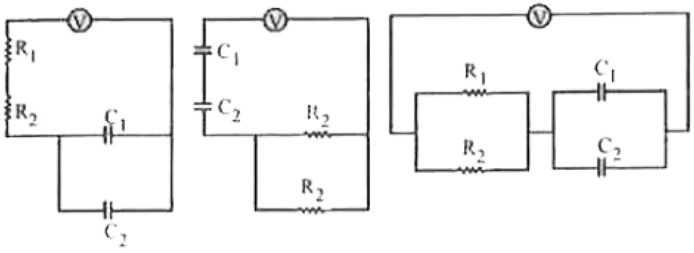
24. Find the time constant (in μs) for the given RC circuits in the given order respectively.



$R_1 = 1\omega, R_2 = 2\omega, C_1 = 4\mu F, C_2 = 2\mu F$

A. $18, 4, \frac{8}{9}$

B. $18, \frac{8}{9}, 4$

C. $4, 18, \frac{8}{9}$

D. $4, \frac{8}{9}, 18$

Answer: B

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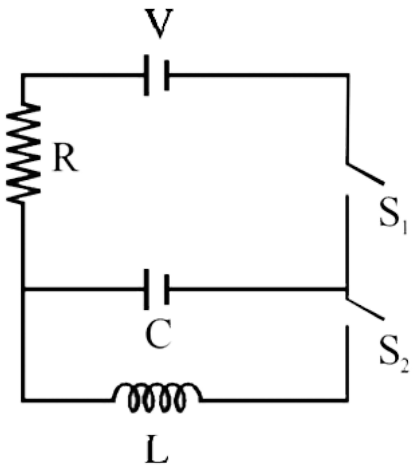
25. In an LCR circuit as shown below both switches are open initially. Now switch S_1 kept open. (q is charge on the capacitor and $\tau = RC$ is Capacitive time constant). Which of

the following statement is correct?



A. Work done by the battery is half of the energy dissipated in the resistor

B. At $t = \tau, q = CV/2$

C. $Att = 2\tau, q = CV\left(1 - e^{-2}\right)$

D. At $t = \frac{\tau}{2}, q = CV\left(1 - e^{-1}\right)$

Answer: C

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26. In an electrical circuit, R, I, C and AC voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage and current in the circuit, is $\frac{\pi}{3}$. Instead, if C is removed from the circuit, the phase difference is again $\frac{\pi}{3}$. The power factor of the circuit is

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

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

C. 1

D. $\frac{\sqrt{3}}{2}$

Answer: C

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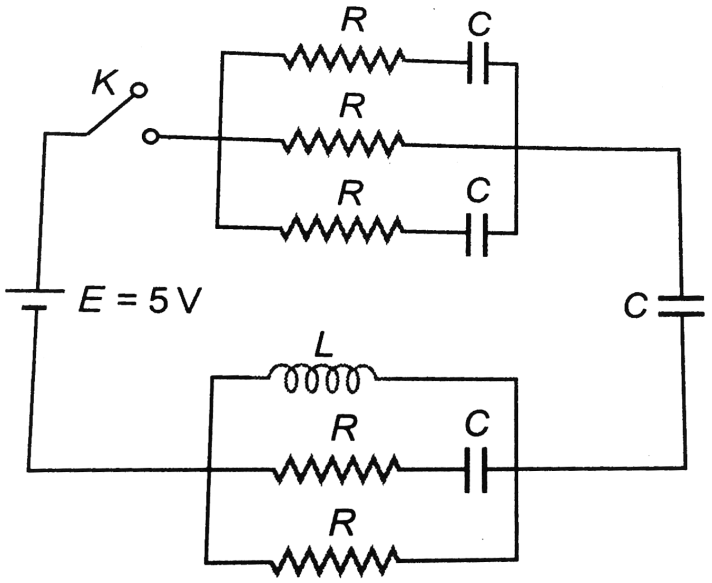
27. Find the current passing through battery immediately after key (K) is closed. It is given that initially all the capacitors are uncharged.

(Given that $R = 6\Omega$ and $C = 4\mu F$)



A. $1A$

B. $5A$

C. $3A$

D. $2A$

Answer: A

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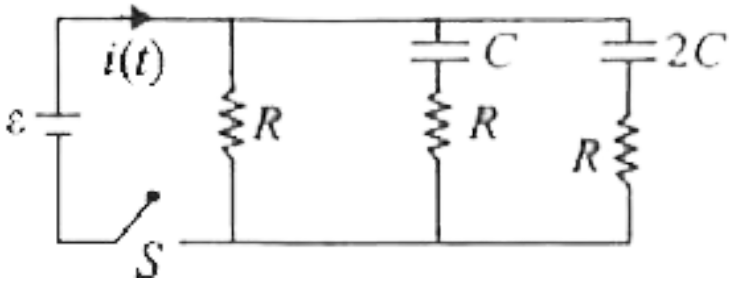
28. The two capacitors, shown in the circuit, are initially uncharged and the cell is ideal.The switch S is closed at t = 0.



Which of the following functions represents

the current i(t), through the cell as a function of time?Here i_0, i_1, i_2 are constants.

A. $i(t) = i_0 + i_1 e^{-\frac{t}{\tau}}, \tau = 3C \times \frac{R}{3}$

B. $i(t) = i_0 + i_1 e^{-\frac{t}{\tau}} + i_2 e^{-\frac{t}{2}\tau}, \tau = RC$

C. $i(t) = i_1 + i_1 e^{-\frac{t}{\tau}}, \tau = 3C \times \frac{R}{3}$

D. $i(t) = i_0 + i_1 e^{-\frac{t}{\tau}}, \tau = 3RC$

Answer: B

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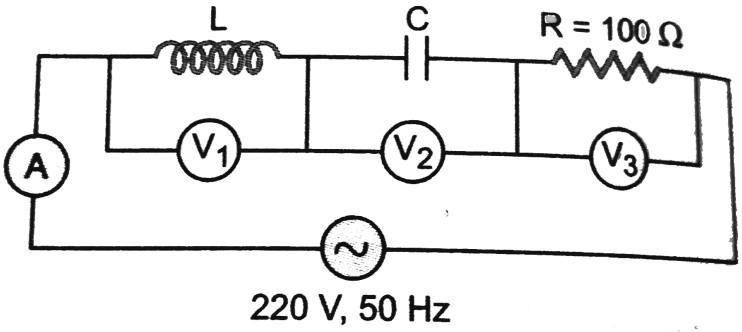
29. In the given circuit, Fig., the reading of voltmeter V_1 and V_2 300 votls each. The reading of the voltemeter V_3 and ammeter A are respectively



A. 150 V and 2.2 A

B. 220 V and 2.2 A

C. 220 V and 2.0 A

D. 100 V and 2.0 A

Answer: B

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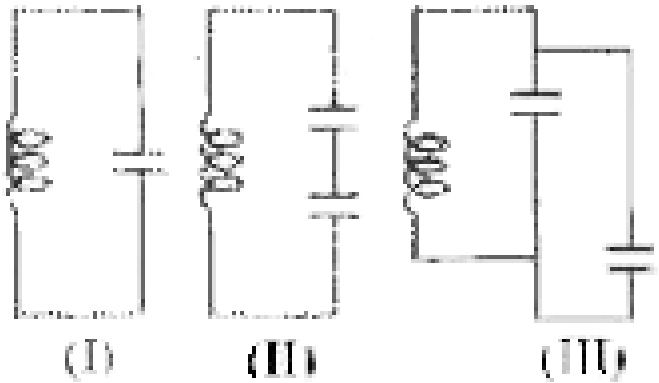
30. Figure shows three oscillating LC circuit with identical inductors and capacitors.If t_1, t_2, t_3 are the time taken by the circuits I, II,

III for fully discharge, then



A. $t_1 > t_2 > t_3$

B. $t_1 < t_2 < t_3$

C. $t_2 < t_1 < t_3$

D. $t_3 = \sqrt{t_1 t_2}$

Answer: C

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