

TEST

JEE Mains PYQs Alternatign Current (Physics Master Academy)

QUESTIONS

SECTIONS

1. Section A - 25 Questions

Section 1 : Section A - 25 Questions

SECTION INSTRUCTIONS

This section contains 25 MCQs. +4 for every correct answer., -1 for every incorrect answer

1 The alternating current is given by $i = \left[\sqrt{42} \sin \left(\frac{2\pi}{T} t + 10 \right) \right] A$

The rms value of the current is ___A

- 9
- 10
- 11
- none of these

Correct: +4 · Incorrect: -1

2 An alternating voltage $v(t) = 220 \sin 100 \pi t$ volt is applied to a purely resistive load of 50Ω . The time taken for the current to rise from half of the peak value to the peak value is:

- 5ms
- 2.2ms
- 7.2 ms
- 3.3 ms

Correct: +4 · Incorrect: -1

3 A small circular loop of wire of radius a is located at the centre of a much larger circular wire loop of radius b . The two loops are in the

same plane. The outer loop of radius b carries an alternating current $I = I_0 \cos(\omega t)$. The emf induced in the smaller inner loop is nearly

- $\frac{\pi \mu_0 I_0}{2} \cdot \frac{a^2}{b} \omega \sin(\omega t)$
- $\frac{\pi \mu_0 I_0}{2} \cdot \frac{a^2}{b} \omega \cos(\omega t)$
- $\pi \mu_0 I_0 \cdot \frac{a^2}{b} \omega \sin(\omega t)$
- $\frac{\pi \mu_0 I_0 b^2}{a} \omega \cos(\omega t)$

Correct: +4 · Incorrect: -1

4 Alternating current cannot be measured by DC ammeter because

- Average value of current for complete cycle is zero
- AC changes direction
- AC cannot pass through DC Ammeter
- DC Ammeter will get damaged

Correct: +4 · Incorrect: -1

5 An ac circuit has an inductor and a resistor of resistance R in series such that $X_L = 3R$. Now a capacitor is added in series such that $X_C = 2R$. The ratio of new power factor with the old power of the circuit is

$\frac{\sqrt{5}}{x}$. The value of x is ____

- 1
- 2
- 3
- 4

Correct: +4 · Incorrect: -1

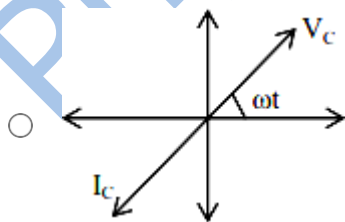
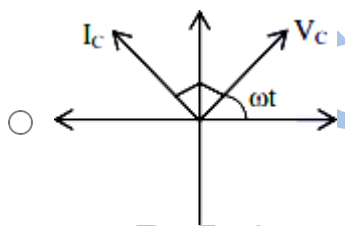
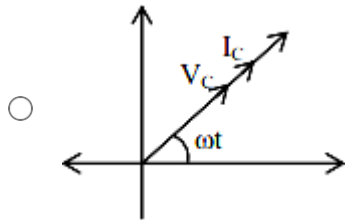
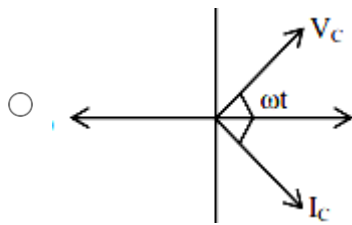
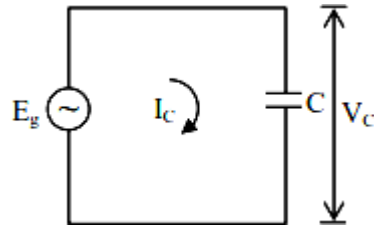
6 A series LCR circuit driven by 300V at a frequency of 50 Hz contains a resistance $R = 3k\Omega$, an inductor of inductive resistance $X_L = 250\pi\Omega$ and an unknown capacitor, The value of capacitance to maximize the average power should be (take $\pi^2 = 10$)

- 4 μF

- 25 μF
- 400 μF
- 40 μF

Correct: +4 · Incorrect: -1

7 In a circuit consisting of a capacitance and a generator with alternating emf $E_g = E_{g0} \sin \omega t$, V_c and I_c are the voltage and current. Correct phasor diagram for such circuit is



Correct: +4 · Incorrect: -1

8 In an LCR circuit, an inductor 30 mH and a resistor 1Ω are connected to an AC source of angular frequency 300 rad/s. The value of capacitance for which the current leads the voltage by 45° is $1/x \times 10^{-3}\text{F}$. The value of x is __

- 1
- 2
- 3
- 4

Correct: +4 · Incorrect: -1

9 In a series LCR resonance circuit, if we change the resistance only, from a lower to higher value.

- The quality factor and the resonance frequency will remain constant.
- The resonance frequency will increase
- The bandwidth of resonance circuit will increase
- The quality factor will increase

Correct: +4 · Incorrect: -1

10 A series LCR circuit is designed to resonate at an angular frequency $\omega_0 = 10^5$ rad/s. The circuit draws 16W power from 120V source resonance. The value of resistance 'R' in the circuit is ___ Ω .

- 750
- 800
- 900
- 950

Correct: +4 · Incorrect: -1

11 An LCR circuit contains resistance of 110Ω and a supply of 220V at 300 rad/s angular frequency. If only capacitance is removed from the circuit, current lags behind the voltage by 45° . If on the other hand, only inductor is removed the current leads by 45° with the applied voltage. The rms current flowing in the circuit will be

- 1.5A
- 1A
- 2A

2.5A

Correct: +4 · Incorrect: -1

12 An inductance coil has a reactance of 100Ω . When an AC signal of frequency 1000Hz is applied to the coil, the applied voltage leads the current by 45° . The self inductance of the coil is

$1.1 \times 10^{-2}\text{H}$

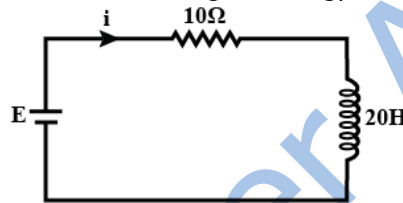
$1.1 \times 10^{-1}\text{H}$

$5.5 \times 10^{-5}\text{H}$

$6.7 \times 10^{-7}\text{H}$

Correct: +4 · Incorrect: -1

13 A 20H conductor coil is connected to a 10Ω resistance in series as shown in figure. The time at which rate of dissipation of energy (Joule's heat) across resistance is equal to the rate at which magnetic energy is stored in the inductor is



$2/\ln 2$

$\frac{1}{2} \ln 2$

$2 \ln 2$

$\ln 2$

Correct: +4 · Incorrect: -1

14 A circuit connected to an AC source for $e = e_0 \sin(100t)$ with t in seconds, gives a difference of $\pi/4$ between the emf e and current i . Which of the following circuits will exhibit this?

RL circuit with $R = 1\text{k}\Omega$ and $L = 10\text{mH}$

RL circuit with $R = 1\text{k}\Omega$ and $L = 1\text{mH}$

RL circuit with $R = 1\text{k}\Omega$ and $L = 1\mu\text{H}$

RL circuit with $R = 1\text{k}\Omega$ and $L = 10\mu\text{H}$

Correct: +4 · Incorrect: -1

15 In LC circuit the inductance $L = 40\text{mH}$ and capacitance $C = 100\ \mu\text{F}$. If a voltage $V(t) = 10 \sin(314t)$ is applied to the circuit, the current in the circuit is given as

- 0.52 $\cos 314 t$
- 10 $\cos 314 t$
- 5.2 $\cos 314 t$
- 0.52 $\sin 314 t$

Correct: +4 · Incorrect: -1

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

- $\frac{\omega_0 L}{R}$
- $\frac{\omega_0 R}{L}$
- $\frac{R}{(\omega_0 C)}$
- $\frac{CR}{\omega_0}$

Correct: +4 · Incorrect: -1

17 In an AC generator, a coil with N turns, all of the same area A and total resistance R , rotates with frequency ω in a magnetic field B . The maximum value of emf generated in the coil is

- $NAB\omega$
- NAB
- $NABR$
- $NAB\omega$

Correct: +4 · Incorrect: -1

18 The phase difference between the alternating current and emf is $\pi/2$. Which of the following cannot be the constituent of the circuit?

- R, L

- C alone
- L alone
- L, C

Correct: +4 · Incorrect: -1

19 In an LCR circuit series ac circuit, the voltage across each of the components L, C and R is 50V. The voltage across the LC combination will be

- 100V
- $50\sqrt{2}$ V
- 50V
- 0V (zero)

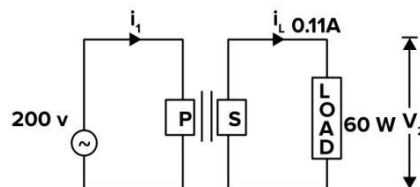
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20 In a LCR circuit capacitance is changed from C to 2C. For the resonant frequency to remain unchanged, the inductance should be change from L to

- L/2
- 2L
- 4L
- L/4

Correct: +4 · Incorrect: -1

21 For the given circuit, comment on the type of transformer



- Step up transformer
- Auto transformer
- Step down transformer

Auxillary transformer

Correct: +4 · Incorrect: -1

22 A common transformer radio set requires 12V(DC) for its operation. The DC source is constructed by using a transformer and a rectifier circuit, which are operated at 220V(AC) on standard domestic AC supply. The number of turns of secondary coil are 24, then the number of turns of primary are ____

220

330

440

110

Correct: +4 · Incorrect: -1

23 A power transmission line feeds input power at 2300V at a step down transformer with its primary windings having 4000 turns. The output power is delivered at 230V by the transformer. If the current in the primary of the transformer is 5A and its efficiency is 90%, the output current would be

50A

45A

35A

25A

Correct: +4 · Incorrect: -1

24 The core of any transformer is laminated so as to

reduce the energy loss due to eddy currents

make it light weight

make it robust and strong

increase the secondary voltage

Correct: +4 · Incorrect: -1

25 In a transformer number of turns in the primary coil are 140 and that in the secondary coil are 280. If current in primary coil is 4A, then that in the secondary coil is

4A

2A

6A

10A

Correct: +4 · Incorrect: -1

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ANSWERS

SECTIONS

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1 11

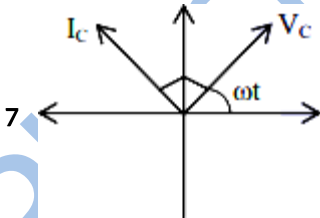
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4 Average value of current for complete cycle is zero

5 1

6 $4 \mu\text{F}$



8 3

9 The bandwidth of resonance circuit will increase

10 900

11 2A

12 $1.1 \times 10^{-2} \text{H}$

13 $2 \ln 2$

14 RL circuit with $R = 1 \text{ k}\Omega$ and $L = 10 \mu\text{H}$

15 $0.52 \cos 314 t$

16 $\frac{\omega_0 L}{R}$

17 $NAB\omega$

18 R, L

19 0V (zero)

20 $L/2$

21 Step up transformer

22 440

23 45A

24 reduce the energy loss due to eddy currents

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