

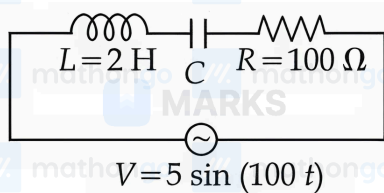
Q1. JEE Main 2026 (21 January Shift 2)

A capacitor C is first charged fully with potential difference of V_0 and disconnected from the battery. The charged capacitor is connected across an inductor having inductance L . In t s 25% of the initial energy in the capacitor is transferred to the inductor. The value of t is ____ s.

- (1) $\frac{\pi\sqrt{LC}}{3}$ (2) $\frac{\pi\sqrt{LC}}{6}$ (3) $\frac{\pi\sqrt{LC}}{2}$ (4) $\pi\sqrt{\frac{LC}{2}}$

Q2. JEE Main 2026 (23 January Shift 1)

Using a variable frequency a.c. voltage source the maximum current measured in the given LCR circuit is 50 mA for $V = 5 \sin(100t)$ The values of L and R are shown in the figure. The capacitance of the capacitor (C) used is ____ μF .



Q3. JEE Main 2026 (28 January Shift 2)

An inductor stores 16 J of magnetic field energy and dissipates 32 W of thermal energy due to its resistance when an a.c. current of 2 A (rms) and frequency 50 Hz flows through it. The ratio of inductive reactance to its resistance is _____. ($\pi = 3.14$)

Q4. JEE Main 2026 (28 January Shift 1)

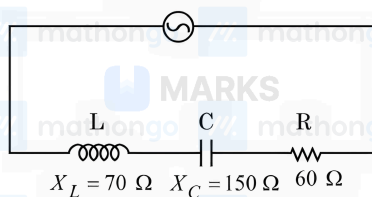
The electric current in the circuit is given as $i = i_0(t/T)$. The r.m.s current for the period $t = 0$ to $t = T$ is ____.

- (1) i_0 (2) $\frac{i_0}{\sqrt{6}}$ (3) $\frac{i_0}{\sqrt{3}}$ (4) $\frac{i_0}{\sqrt{2}}$

Q5. JEE Main 2026 (24 January Shift 1)

For the series LCR circuit connected with 220 V, 50 Hz a.c source as shown in the figure, the power factor is $\frac{\alpha}{10}$. The value of α is ____.

220 V, 50 Hz



- (1) 10 (2) 4 (3) 6 (4) 8

ANSWERS AND SOLUTIONS

1. (2) 2. 50 3. 314 4. (3) 5. (3)

1. (2) In an LC circuit, energy oscillates sinusoidally.

Initial energy in capacitor is $E_0 = \frac{1}{2}CV_0^2$.

When 25% is transferred to the inductor, 75% remains in the capacitor.

Since energy in capacitor varies as $E_C(t) = E_0 \cos^2(\omega t)$, we need $\cos^2(\omega t) = 0.75$.

This gives $\sin^2(\omega t) = 0.25$, so $\sin(\omega t) = 0.5$, yielding $\omega t = \frac{\pi}{6}$.

With $\omega = \frac{1}{\sqrt{LC}}$, we get $t = \frac{\pi\sqrt{LC}}{6}$ seconds.

2. (50) From $V = 5 \sin(100t)$, angular frequency $\omega = 100$ rad/s

At resonance in LCR circuit: $X_L = X_C$, so $\omega L = \frac{1}{\omega C}$

Maximum current occurs at resonance: $I_{max} = \frac{V_{rms}}{R}$

$$50 \times 10^{-3} = \frac{5/\sqrt{2}}{100} \text{ (verified at resonance)}$$

From resonance condition: $100 \times 2 = \frac{1}{100 \times C}$

$$200 = \frac{1}{100C}$$

$$C = \frac{1}{20000} = 5 \times 10^{-5} \text{ F} = 50 \text{ } \mu\text{F}$$

3. (314) Given: Magnetic field energy = 16 J, Thermal power dissipated = 32 W, $I_{rms} = 2$ A, $f = 50$ Hz.

From energy stored in inductor:

$$\frac{1}{2}LI_{rms}^2 = 16$$

$$\frac{1}{2} \cdot L \cdot 4 = 16$$

$$L = 8 \text{ H}$$

From thermal power dissipated:

$$I_{rms}^2 R = 32$$

$$4R = 32$$

$$R = 8 \text{ } \Omega$$

Inductive reactance:

$$X_L = \omega L = 2\pi fL = 2 \times 3.14 \times 50 \times 8 = 2512 \text{ } \Omega$$

$$\frac{X_L}{R} = \frac{2512}{8} = 314$$

4. (3) The RMS current is calculated using $I_{rms} = \sqrt{\frac{1}{T} \int_0^T i^2 dt}$.

Given $i = i_0(t/T)$:

$$I_{rms} = \sqrt{\frac{1}{T} \int_0^T i_0^2 \left(\frac{t}{T}\right)^2 dt} = \sqrt{\frac{i_0^2}{T^3} \int_0^T t^2 dt} = \sqrt{\frac{i_0^2}{T^3} \cdot \frac{T^3}{3}}$$

$$= \sqrt{\frac{i_0^2}{3}} = \frac{i_0}{\sqrt{3}}$$

5. (3) Net reactance: $X = X_C - X_L = 150 - 70 = 80\Omega$.

Impedance: $Z = \sqrt{R^2 + X^2} = \sqrt{60^2 + 80^2} = \sqrt{10000} = 100\Omega$.

Power factor: $\cos \phi = R/Z = 60/100 = 0.6$.

Since power factor is $\alpha/10$, we have $0.6 = \alpha/10$, so $\alpha = 6$