



Alternating Current

Q.No.1: The current voltage relation of a diode is given by $I = (e^{1000V/T} - 1)$ mA, where the applied voltage V is in volts and the temperature T is in Kelvin. If a student makes an error measuring ± 0.01 V while measuring the current of 5 mA at 300 K, what will be the error in the value of current in mA?

- A. 0.5 mA
- B. 0.05 mA
- C. 0.2 mA
- D. 0.02 mA

Q.No.2: Time period of a simple pendulum is T inside a lift when the lift is stationary. If the lift moves upwards with an acceleration $g/2$, the time period of pendulum will be : **JEE 2021**

- A. $\sqrt{\frac{2}{3}}T$
- B. $\sqrt{3}T$
- C. $\sqrt{\frac{3}{2}}T$
- D. $\frac{T}{\sqrt{3}}$

Q.No.3:

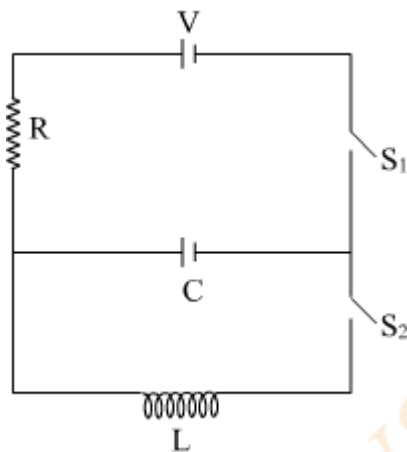
A diode detector is used to detect an amplitude modulated wave of 60% modulation by using a condenser of capacity 250 pico farad in parallel with a load resistance 100 kilo ohm. Find the maximum modulated frequency which could be detected by it.

JEE 2013

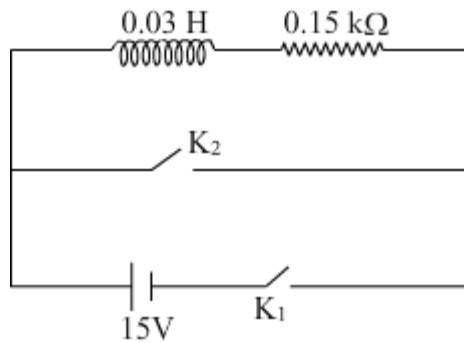
- A. 10.62 MHz
- B. 10.62 kHz
- C. 5.31 MHz
- D. 5.31 kHz

Q.No.4:

In an LCR circuit as shown below both switches are open initially. Now switch S_1 is closed, S_2 kept open. (q is charge on the capacitor and $\tau = RC$ is Capacitive time constant). Which of the following statement is correct?

**JEE 2013**

- A. Work done by the battery is half of the energy dissipated in the resistor
- B. At $t = \tau$, $q = CV/2$
- C. At $t = 2\tau$, $q = CV(1 - e^{-2})$
- D. At $t = \frac{\tau}{2}$, $q = CV(1 - e^{-1})$



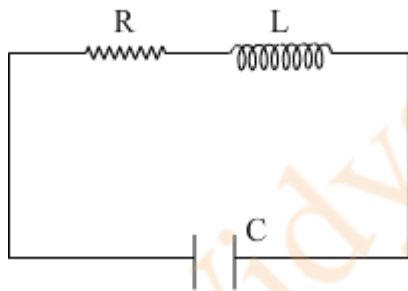
Q.No.5:

An inductor ($L = 0.03 \text{ H}$) and a resistor ($R = 0.15 \text{ k}\Omega$) are connected in series to a battery of 15 V EMF in a circuit shown below. The key K_1 has been kept closed for a long time. Then at $t = 0$, K_1 is opened and key K_2 is closed simultaneously. At $t = 1 \text{ ms}$, the current in the circuit will be : ($e^5 \cong 150$)

JEE 2015

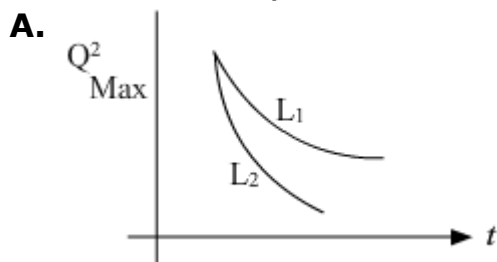
- A. 100 mA
- B. 67 mA
- C. 6.7 mA
- D. 0.67 mA

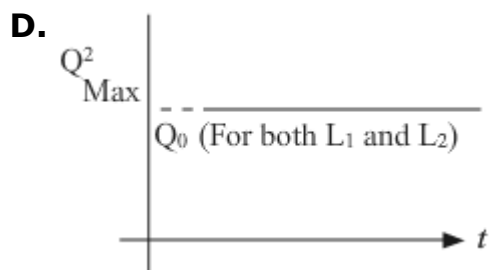
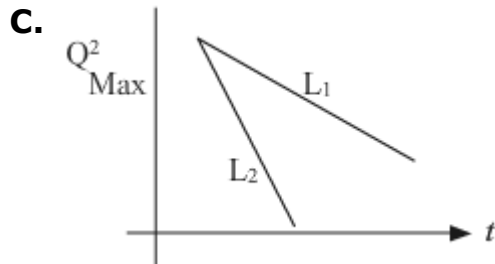
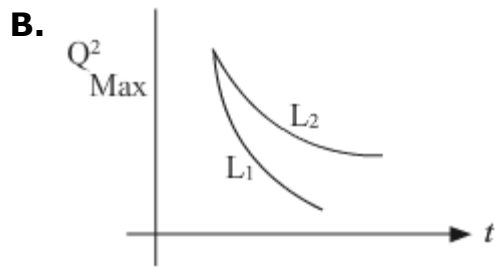
Q.No.6: An LCR circuit is equivalent to a damped pendulum. In an LCR circuit the capacitor is charged to Q_0 and then connected to the L and R as shown below :



If a student plots graphs of the square of maximum charge (Q_{Max}^2) on the capacitor with time (t) for two different values L_1 and L_2 ($L_1 > L_2$) of L then which of the following represents this graph correctly? (plots are schematic and not drawn to scale)

JEE 2015





Q.No.7: An arc lamp requires a direct current of 10 A at 80 V to function. If it is connected to a 220 V (rms), 50 Hz AC supply, the series inductor needed for it to work is close to : **JEE 2016**

- A. 0.08 H
- B. 0.044 H
- C. 0.065 H
- D. 80 H

Q.No.8: For an RLC circuit driven with voltage of amplitude v_m and frequency $\omega_0 = \frac{1}{\sqrt{LC}}$ the current exhibits resonance. The quality factor, Q is given by :

JEE 2018

- A. $\frac{R}{(\omega_0 C)}$
- B. $\frac{CR}{\omega_0}$
- C. $\frac{\omega_0 L}{R}$
- D. $\frac{\omega_0 R}{L}$

Q.No.9: In an a.c. circuit, the instantaneous e.m.f. and current are given by

$$e = 100 \sin 30 t$$

$$i = 20 \sin \left(30 t - \frac{\pi}{4} \right)$$

In one cycle of a.c., the average power consumed by the circuit and the watt-less current are, respectively:

JEE 2018

- A. $\frac{50}{\sqrt{2}}, 0$
- B. 50, 0
- C. 50, 10
- D. $\frac{1000}{\sqrt{2}}, 10$

Q.No.10: A power transmission line feeds input power at 2300 V to 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 5 A and its efficiency is 90%, the output current would be:

JEE 2019

- A. 50 A
- B. 45 A
- C. 35 A
- D. 25 A