NCERT Physics 12.7 Q6

EE23BTECH11212 - SWATHI DEEPIKA*

Question: Obtain the resonant frequency of a series LCR circuit with $L = 2.0\,H$, $C = 32\,\mu F$, and $R = 10\,\Omega$. What is the Q-value of the circuit.

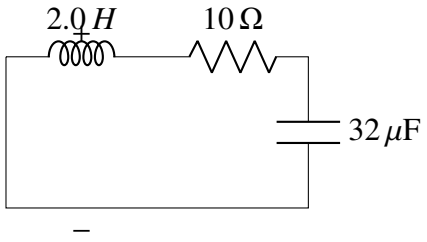

Fig. 1. LCR Circuit

Solution: In Figure Fig. 1 the following information is provided:

Symbol	Value	Description
L	2.0 H	Inductance
C	$32\,\mu$F	Capacitance
R	$10\,\Omega$	Resistance
Q	$\frac{1}{R}\sqrt{\frac{L}{C}}$	Quality Factor

TABLE I
PARAMETERS

Given: $L = 2\,\text{H}$, $C = 32 \times 10^{-6}\,\text{F}$, $R = 10\,\Omega$

RESONANT FREQUENCY (f_r):

$$f_r = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{2 \times 32 \times 10^{-6}}} \approx 19.9\,\text{Hz}$$

QUALITY FACTOR (Q):

$$Q = \frac{1}{R}\sqrt{\frac{L}{C}} = \frac{1}{10}\sqrt{\frac{2}{32 \times 10^{-6}}} \approx 25$$

Conclusion: The resonant frequency is approximately 19.9 Hz, and the quality factor is approximately 25.