Oscillations and Waves
Tutorial 3
Electromagnetic Oscillations

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Question A

Answer:

\[ T = 6.00 \, \mu s \]

\[ f = 1.67 \times 10^5 \, Hz \]

\[ t = 3.00 \, \mu s \]
In an oscillating LC circuit, \( L = 3.00 \text{ mH} \) and \( C = 3.9 \text{ \( \mu \)F}. \) At \( t = 0 \) the charge on the capacitor is zero and the current is 1.75 A. (a) What is the maximum charge that will appear on the capacitor? (b) At what earliest time \( t > 0 \) is the rate at which energy is stored in the capacitor greatest, and (c) what is that greatest rate?

**Answer:**

\[
Q = 1.89 \times 10^{-4} \text{ C}
\]

\[
t = 8.5 \times 10^{-5} \text{ s}
\]

\[
\left( \frac{dU_E}{dt} \right)_{\text{max}} = 42.3 \text{ W}
\]
Question C

An RLC circuit such as that of Fig. 31-7 has $R = 5.00 \, \Omega$, $C = 20.0 \, \mu F$, $L = 1.00 \, H$, and $\varepsilon_m = 30.0 \, V$. (a) At what angular frequency $\omega_d$ will the current amplitude have its maximum value, as in the resonance curves of Fig. 31-16? (b) What is this maximum value? At what (c) lower angular frequency $\omega_{d1}$ and (d) higher angular frequency $\omega_{d2}$ will the current amplitude be half this maximum value? (e) For the resonance curve for this circuit, what is the fractional half-width $(\omega_{d1} - \omega_{d2})/\omega$?

Answer:

$$\omega_d = 224 \, \text{rad/s}, \ I = 6.00 \, A$$

$$\omega_{d1} = 219 \, \text{rad/s}, \ \omega_{d2} = 228 \, \text{rad/s}$$

$$\frac{\omega_{d1} - \omega_{d1}}{\omega} = 0.040$$
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