Ex:

When driven by a square-wave generator feeding a diode and resistor in series and connected to the top of the capacitor, the above acts as an analog TV jamming circuit.

a) Find the value of C that will make the circuit oscillate at 26 MHz, (old channel 2). Remember to convert Hz to rad/s.

b) Find the value of the damping factor, \( \alpha \).

**SOL’N:**

a) First, we calculate the frequency, which will be the damping frequency, \( \omega_d \), in Hz:

\[
\omega_d = 26 \text{ MHz} \cdot 2\pi \approx 163 \text{ Mr/s}
\]

The formula for the damping frequency, in terms of damping factor, \( \alpha \), and resonant frequency, \( \omega_o \), is the same for both series and parallel RLC circuits:

\[
\omega_d = \sqrt{\omega_o^2 - \alpha^2} = 163 \text{ Mr/s}
\]

For a series RLC circuit, \( \alpha \) is one-half the inverse of the L/R time constant:

\[
\alpha = \frac{R}{2L} = \frac{8 \text{ m\Omega}}{2 \cdot 4\text{nH}} = 1 \text{ M/s}
\]

Now we can solve for C:

\[
\omega_d = 163 \text{ Mr/s} = \sqrt{\omega_o^2 - \alpha^2} = \sqrt{\omega_o^2 - 1 \text{ (M/s)}^2}
\]

or
\[ \omega_d^2 = 163^2 \text{ (Mr/s)}^2 = \omega_0^2 - 1 \text{ (Mr/s)}^2 \]

or

\[ \omega_0^2 = (163^2 + 1) \text{ (Mr/s)}^2 \]

The "+1" from \( \alpha^2 \) is negligible, and we have the following approximation:

\[ \omega_0^2 = 163^2 \text{ (Mr/s)}^2 = \frac{1}{LC} \]

or

\[ C = \frac{1}{L \omega_0^2} = \frac{1}{4 \text{nH} \cdot 163^2 \text{ (Mr/s)}^2} = \frac{1}{4 \cdot 163^2 \text{ kF}} \]

or

\[ C = 9.41 \text{ nF} \]

**Sol'n:** b) The value of \( \alpha \) was found in the solution to part (a):

\[ \alpha = \frac{R}{2L} = \frac{8 \text{ m\Omega}}{2 \cdot 4 \text{nH}} = 1 \text{ M/s} \]