Serial # 0

-2 points for not writing your serial number

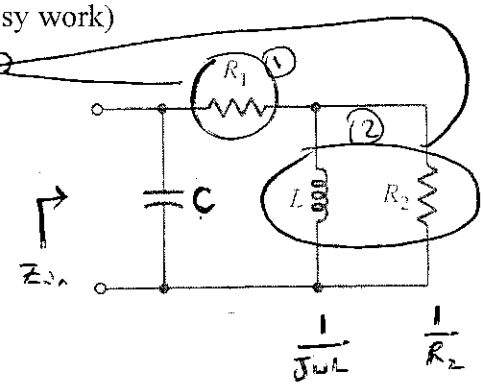
**King Fahd University of Petroleum & Minerals**
Electrical Engineering Department
EE205: Electric Circuits II (082)
Quiz 4: Resonance Frequency

Name: KEY ver 1 & Ver 2

For the shown circuit, design the value of $C$ to get a resonance frequency equals to 20 *k*Hz (30kHz)

Let $R_1$=3 Ohms, $L$=1 H, $R_2$=2 Ohms.

(Be clear and organized. No credit will be given for messy work)




$$Z_{in} = \frac{1}{j\omega C} \;//\; \left(R_1 + \frac{j\omega L R_2}{j\omega L + R_2}\right)$$

$$Z_{in} = \frac{1}{j\omega C} \;//\; \frac{R_1R_2 + j\omega L R_1 + j\omega L R_2}{j\omega L + R_2}$$

Substitute $R_1, R_2$ & $L$

$$Z_{in} = \frac{1}{j\omega C} \;//\; \frac{6 + j\omega 3 + j\omega 2}{j\omega + 2} \quad (2)$$

simplify

$$Z_{in} = \frac{1}{j\omega C} \;//\; \frac{6 + j\omega 5}{2 + j\omega}$$

multiply by conjugate

$$Y_{in} = j\omega C + \frac{2+j\omega}{6+j\omega 5} \cdot \frac{6 - j\omega 5}{6 - j\omega 5} \quad (1)$$

$$= j\omega C + \frac{12 - 4j\omega + 5\omega^2}{36 + 25\omega^2} \qquad \text{Imag}(Y_{in}) = 0 \quad (2)$$

$$\left(\omega_r C - \frac{4\omega_r}{36+25\omega_r^2}\right) = 0 \Rightarrow C = \frac{4}{36+25\omega_r^2} \quad (1)$$

for 20kHz $\Rightarrow \omega_r = (2\pi \times 20k) \Rightarrow C = 1.01 \times 10^{-11} = 10.1$ pF

for 30kHz $\Rightarrow \omega_r = (2\pi \times 30k) \Rightarrow C = 4.5$ pF (1)

Good Luck, **Dr. Ali Muqaibel**