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Computer Engineering

Assignment  
EEE 322

1.  $R = 100 \text{ k}\Omega$   $L = 20 \text{ mH}$   $C = 5 \text{ nF}$  @  $\omega_0$

$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(20 \times 10^{-3})(5 \times 10^{-9})}}$$
$$= 10^5 = \underline{100 \text{ K rad/s}}$$

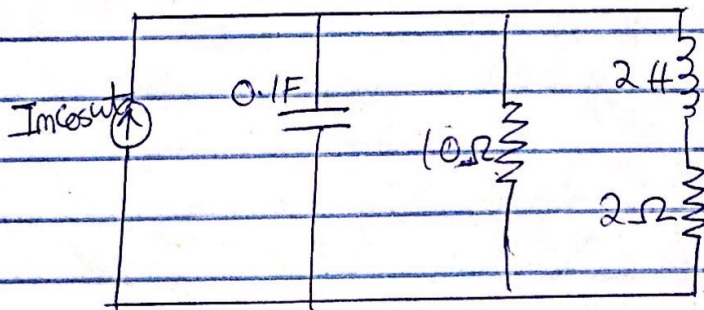
$$Q = \frac{R}{\omega_0 L} = \frac{100 \times 10^3}{(10^5)(20 \times 10^{-3})} = \underline{50}$$

$$B = \frac{\omega_0}{Q} = \frac{10^5}{50} = \underline{2 \text{ K rad/s}}$$

$$Q \geq 10 \text{ hence, } \omega_1 = \omega_0 - \frac{B}{2} = 100,000 - 1,000 = \underline{99 \text{ K rad/s}}$$

$$\omega_2 = \omega_0 + \frac{B}{2} = 100,000 + 1,000 = \underline{101 \text{ K rad/s}}$$

2. Determine the resonant frequency of the circuit below



The input impedance is

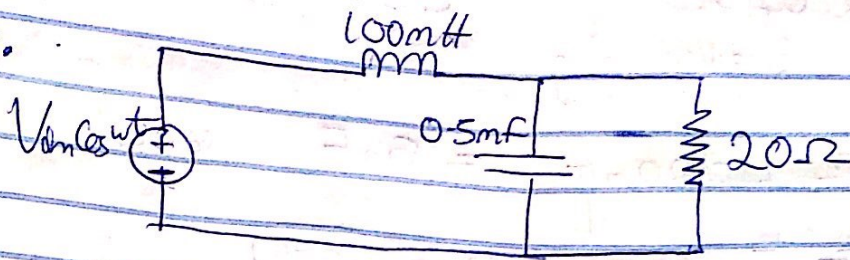
$$Y = j\omega \cdot 0.1 + \frac{1}{10} + \frac{1}{2 + j\omega 2} = 0.1 + j\omega \cdot 0.1 + \frac{2 - j\omega 2}{4 + 4\omega^2}$$

At resonance,  $\text{Im}(Y) = 0$

$$\omega_0 \cdot 0.1 - \frac{2\omega_0}{4 + 4\omega_0^2} = 0$$

$$\omega_0 = 2 \text{ rad/s}$$





$$Z = [j\omega(100 \times 10^{-3})] + \left[ 20 \parallel \frac{1}{j\omega 0.5 \times 10^{-3}} \right]$$

$$= [j\omega 0.1] + \left[ \frac{20}{\frac{j\omega 0.5 \times 10^{-3}}{20 + \frac{1}{j\omega 0.5 \times 10^{-3}}}} \right]$$

$$= j\omega 0.1 + \frac{20}{0.01j\omega + 1}$$

$$= \frac{-(0.1\omega)^2 + j0.01\omega + 20}{1 + 0.01j\omega}$$

$$= \frac{-(0.1\omega)^2 + j0.01\omega + 20}{1 + 0.01j\omega} \times \frac{1 - 0.01j\omega}{1 - 0.01j\omega}$$

$$= \frac{20 + j(0.01\omega + (0.01\omega)^3 - 0.2\omega)}{1 + (0.01\omega)^2}$$

$$= \frac{20 + j(0.01\omega + (0.01\omega)^3 - 0.2\omega)}{1 + (0.01\omega)^2}$$

$\text{Im}(Z) = 0$  at resonance

$$\frac{0.01\omega_0 + (0.01\omega_0)^3 - 0.2\omega_0}{1 + (0.01\omega_0)^2} = 0$$

$$(0.01\omega_0)^3 - 0.2\omega_0 = 0$$

$$0.01^3 \omega_0^2 = 0.1$$

$$\omega_0^2 = 0.1$$

$$(0.01)^3$$

$$\omega_0 = \sqrt{10^5}$$

$$\omega_0 = \underline{\underline{316.23 \text{ rad/s}}}$$