Oyedeji Al'amin Oyedapo
15/ENG04/050
Electrical/Electronic Engr.

Assignment Solution

1) $R = 100k\Omega = 100 \times 10^3$

$L = 20mH = 20 \times 10^{-3} H$

$C = 5\mu F = 5 \times 10^{-9} F$

$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$= \frac{1}{\sqrt{20 \times 10^{-3} \times 5 \times 10^{-9}}} = 100000$$

$= 100 k rad/s$

$$Q = \frac{R}{\omega_0 L} = \frac{100 \times 10^3}{100 \times 10^3 \times 20 \times 10^{-3}}$$

$= 50$

$$B = \frac{\omega_0}{Q} = \frac{100 \times 10^3}{50}$$

$= 2 k rad/s$

$$\omega_1 = \omega_0 - \frac{B}{2} = 100 \times 10^3 - \frac{2 \times 10^3}{2}$$

$= 99 k rad/s$

$$\omega_2 = \omega_0 + B/2 = 100 \times 10^3 + \frac{2 \times 10^3}{2}$$

$= 101 k rad/s$

(2) $\dfrac{20 + \frac{2000}{j\omega}}{20 + \frac{2000}{j\omega}} = \dfrac{4000}{20j\omega + 2000} \quad \dfrac{40000}{20j\omega + 2000} \quad \dfrac{(20j\omega - 2000)}{(20j\omega - 2000)}$

$$= \frac{80,000j\omega - 80000000 + 100mH}{-400j\omega - 4000000}$$

At resonance imaginary part at $\omega = 0$

$$\frac{800000 j\omega}{-400j\omega - 4000000} + j\omega(800 \times 10^{-3})$$

$$\frac{800000}{-400w - 4000000} + [w30 \times 10^{-3}]w$$

$$\Rightarrow 800000w + [-40w^2] - 400000w$$

$$\Rightarrow 400000 - 40w^2 = 0$$

$$-40w^2 = -400000w$$

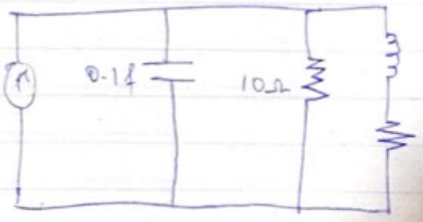
$$w^2 = \frac{400000}{40}$$

$$w^2 = 10000$$

$$w = \sqrt{10000}$$

$$w = 100 \text{ rad/s}$$

3)



The input admittance is

$$Y = j\omega 0.1 + \frac{1}{10} + \frac{1}{2+j\omega 2}$$

$$\frac{-0.1 + j\omega 0.1 + 2 - j\omega 2}{4 + 4\omega^2}$$

At resonance

$$\text{Im}[Y] = 0$$

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

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