

i, A parallel resonant circuit has $R = 100 \text{ k}\Omega$, $L = 20 \text{ mH}$ & $C = 5 \text{ nF}$
 Calculate ω_0 , ω_1 , ω_2 , Q & B

$$\rightarrow \omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(20 \times 10^{-3}) \times (5 \times 10^{-9})}}$$

$$= 100 \text{ krad s}^{-1}$$

$$\rightarrow B = \frac{\omega_0}{Q} = \frac{1}{RC} = \frac{1}{100 \times (5 \times 10^{-9})}$$

$$= 2 \text{ krad s}^{-1}$$

From above, $\omega_0 = 100 \text{ krad s}^{-1}$ & $B = 2 \text{ krad s}^{-1}$

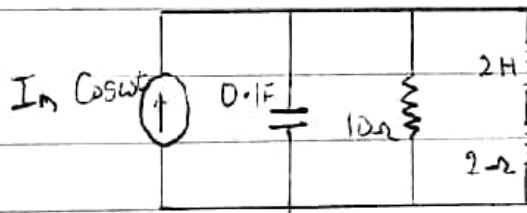
$$\therefore Q = \frac{\omega_0}{B} = \frac{100 \times 10^3}{2 \times 10^3} = 50$$

Since $Q \geq 10$

$$\rightarrow \omega_1 = \omega_0 - \frac{B}{2} = 100 \times 10^3 - \frac{2 \times 10^3}{2} = 99 \text{ krad s}^{-1}$$

$$\rightarrow \omega_2 = \omega_0 + \frac{B}{2} = 100 \times 10^3 + \frac{2 \times 10^3}{2} = 101 \text{ krad s}^{-1}$$

ii, Determine the resonant frequency of the circuit below



The input admittance is; $Y = j\omega 0.1 + \frac{1}{10} + \frac{1}{2 + j\omega 2}$

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

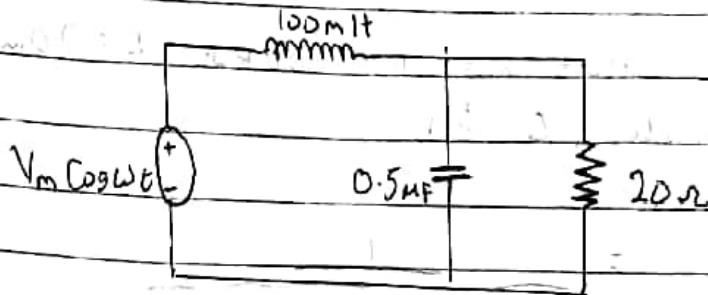
At Resonance

$$\text{Im}(Y) = 0$$

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

$$\omega_0 = 2 \text{ rad s}^{-1}$$

iii, Calculate the resonant frequency of the circuit below



$$\frac{20 + \frac{2000}{j\omega}}{20 + \frac{2000}{j\omega}} = \frac{40000}{20j\omega + 2000} = \frac{40000}{20j\omega + 2000} + \frac{(20j\omega - 2000)}{(20j\omega - 2000)}$$

$$= \frac{80000j\omega - 80000000}{-400j\omega - 4000000} + 100 \text{ mH}$$

At resonance of the imaginary part of $\omega = 0$

$$\frac{80,000j\omega}{-400j\omega - 4,000,000} + \frac{j\omega(100 \times 10^{-3})}{-400j\omega - 4,000,000}$$

$$= \frac{80,000j\omega}{-400j\omega - 4,000,000}$$

$$= \frac{80,000j\omega + [-40\omega^2] - 4,000,000}{-400j\omega - 4,000,000}$$

$$= \frac{40,000j\omega - 40\omega^2 - 4,000,000}{-400j\omega - 4,000,000}$$

$$-40\omega^2 = -4,000,000$$

$$\omega^2 = \frac{-4,000,000}{-40}$$

$$= 100,000$$

$$\omega = \sqrt{100,000} = 100 \text{ rad s}^{-1}$$