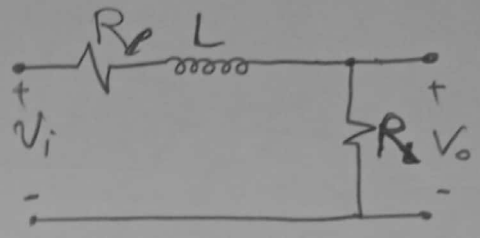
(Handwritten Assignment #3)

Q1



@ $\frac{V_o}{V_i} = ?$ $\boxed{Z_L = SL}$

$$V_o(S) = \frac{R}{R + R_L + SL} V_i(S)$$

$$\therefore H(S) = \frac{V_o(S)}{V_i(S)} = \frac{R\|L}{S + R\|L + R_L/L} = \boxed{\frac{R\|L}{S + (R+R_L)/L}} \quad \#@$$

(b) $|H(jw)| = max$ @ $f = ?$

$$H(jw) = \frac{R\|L}{jw + (R+R_L)/L} \Rightarrow |H(jw)| = \frac{(R\|L)}{\sqrt{w^2 + [(R+R_L)/L]^2}}$$

$|H(jw)|_{max}$ occurs @ $\boxed{w=0}$ $\boxed{f=0}$ $\#(b)$

(c) $|H(jw)|_{max} = \frac{R\|L}{(R+R_L)/L} = \boxed{\frac{R}{R+R_L}}$ $\#(c)$

(d) $w = ?$ when $|H(jw)| = \frac{1}{\sqrt{2}} H_{max} \Rightarrow (w_c) = ?$

$$|H(jw_c)| = \frac{R}{\sqrt{2}(R+R_L)} = \frac{R\|L}{\sqrt{w_c^2 + [(R+R_L)/L]^2}}$$

$$\therefore w_c^2 = \frac{(R+R_L)^2}{L^2} \quad \boxed{\therefore w_c = \frac{R+R_L}{L}} \quad \#(d)$$

(e) $R = 300\Omega$, $L = 50mH$ Find w_c, $H(j0)$, $H(w_c)$, $H(0.2jw_c)$, $H(5jw_c)$

$R = 1200\Omega$

$$w_c = \frac{R+R_L}{L} = \frac{1200+300}{0.05} = \boxed{30{,}000 \text{ rad/sec}}$$

$R\|L = 1200 \| 0.05 = \boxed{24{,}000}$

$$H(jw) = \boxed{\frac{24{,}000}{30{,}000 + jw}} \quad \#$$

$$H(0j) = \frac{24{,}000}{30{,}000} = \boxed{0.8} \quad \#$$

$$H(\underbrace{30{,}000}_{w_c} j) = \frac{24{,}000}{30{,}000 + 30{,}000j} = \frac{0.8}{1+j} = \boxed{0.4 - 0.4j} = \boxed{0.5657 \angle -45^\circ} \quad \#$$

$$H(6000j) = \frac{24{,}000}{30{,}000 + 6{,}000j} = \boxed{\frac{10}{13} - \frac{2}{13}j} = \boxed{0.7845 \angle -11.31^\circ} \quad \#$$

$$H(150{,}000j) = \frac{24{,}000}{30{,}000 + 150{,}000j} = \boxed{\frac{2}{65} - \frac{2}{13}j} = \boxed{0.1569 \angle -78.69^\circ} \quad \#(e)$$

Q2 band pass, $\omega_0 = 50K$ rad/sec, $Q = 4$

Find $\beta = ?$, $\omega_{c_{upper}} = ?$, $\omega_{c_{lower}} = ?$. Express all in KHz

$$\beta = \frac{\omega_0}{Q} = \frac{50,000}{4} = \boxed{12.5K \text{ rad/s}} \#$$

$$\beta = \frac{12,500}{2\pi} = \boxed{1.99 \text{ KHz}} \#$$

$$\beta = \omega_{c_2} - \omega_{c_1} \Rightarrow \omega_{c_2} - \omega_{c_1} = 12500$$

$$\omega_0^2 = \omega_{c_1} \cdot \omega_{c_2} \Rightarrow \omega_{c_1} = \frac{(50,000)^2}{\omega_{c_2}}$$

$$\therefore \omega_{c_2} - \frac{(50,000)^2}{\omega_{c_2}} = 12500 \quad (*\omega_{c_2}) \Rightarrow \omega_{c_2}^2 - (50,000)^2 = 12500\,\omega_c$$

$$\therefore \omega_{c_2}^2 - 12500\,\omega_c - (50,000)^2 = 0$$

$$\omega_{c_2} = 56639.11 \text{ rad/sec} = \boxed{56.639K \text{ rad/s}} \#$$

$$\therefore f_{c_2} = \frac{56.639 * 10^3}{2\pi} = \boxed{9.015 \text{ KHz}} \#$$

$$\therefore \omega_{c_{upper}} = 56.639K \text{ rad/s}$$

$$f_{c_{upper}} = 9.015 \text{ KHz} \#$$

$$\therefore \omega_{c_1} = \frac{(50,000)^2}{56639.11} = \boxed{44.139K \text{ rad/s}} \rightarrow f_{c_{lower}} = \frac{44.139 * 10^3}{2\pi} = \boxed{7.02 \text{ KHz}}$$

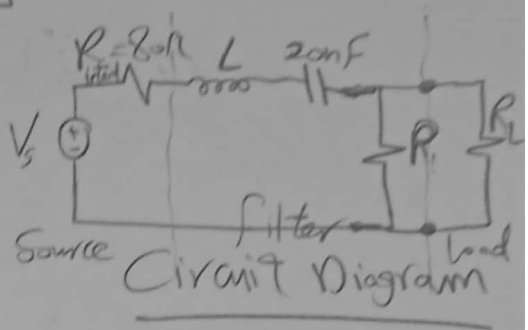
$$\therefore \omega_{c_{lower}} = 44.14K \text{ rad/s} \#$$

$$f_{c_{lower}} = 7.02 \text{ KHz} \#$$

Q3 Sinu-Soidal Voltage Src & RLC series band pass filter

internal impedance is $80+0j$ $Z_{load} = 48+0j$ $C = 20nF$, $\omega_c = 5k rad/s$

$Q = 6.25$



Circuit Diagram

(a) Dorel

(b) $\omega_0 = \frac{1}{\sqrt{LC}}$

$L = \frac{1}{\omega_0^2 C} = \frac{1}{(50*10^3)(20*10^{-9})} = 20mH$ #

$R = \frac{\omega_0 L}{Q}$ as $Q = \frac{\omega_0}{\beta} = \frac{\omega_0}{R/L} = \frac{L\omega_0}{R}$

$R = \frac{\omega_0 L}{Q} = \frac{(50,000)(20*10^{-3})}{6.25} = 160\Omega$ #

(c) $Q_{interconnected\ sys} = ?$

$R_{eq} = (160 \| 480) + 80 = 200\Omega$

$\therefore Q = \frac{\omega_0 L}{R_{eq}} = \frac{(50,000)(20*10^{-3})}{200} = 5$ #

(d) $\beta_{sys} = \frac{\omega_0}{Q_{sys}} = \frac{50,000}{5} = 10 k rad/s$

$\beta_{sys}(hz) = \frac{10*10^3}{2\pi} = 1591.55 Hz$ #

:)

I hope not to forget Something this time

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11/10/2023

Thankyou