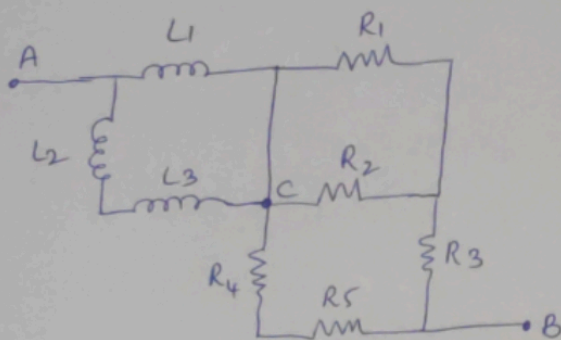


EECE105L- Quiz-5

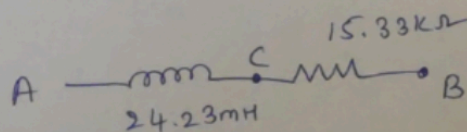
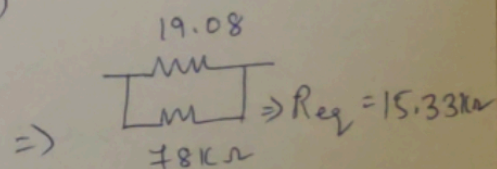
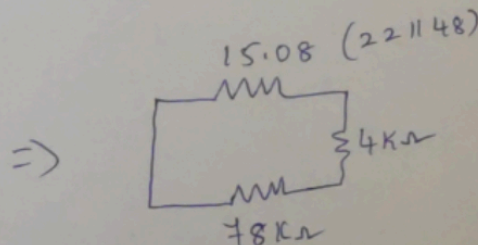
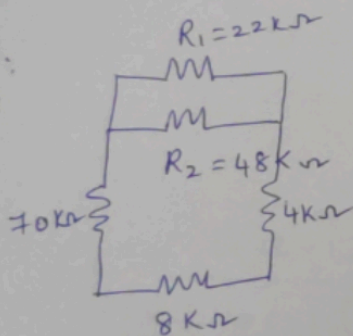
①



$$R_1 = 22\text{K}\Omega, R_2 = 48\text{K}\Omega, R_3 = 4\text{K}\Omega, \\ R_4 = 70\text{K}\Omega, R_5 = 8\text{K}\Omega, L_1 = 47\text{mH}, \\ L_2 = 38\text{mH}, L_3 = 12\text{mH}.$$

$$\frac{1}{L_{eq}} = \frac{1}{L_1} + \frac{1}{(L_2 + L_3)} = \frac{1}{47\text{mH}} + \frac{1}{50\text{mH}} = 24.23\text{mH}$$

Req:



$$H(\omega) = \frac{R}{j\omega L + R} \Rightarrow |H(\omega)| = \frac{1}{\sqrt{1 + \left(\frac{L}{R}\right)^2 \omega^2}} = \frac{1}{\sqrt{1 + (2.498 \times 10^{-12}) \omega^2}}$$

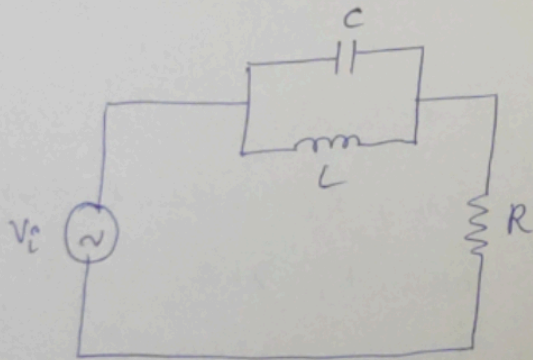
$$\text{as } \omega \rightarrow 0 \quad |H(\omega)| \rightarrow 1$$

$$\text{as } \omega \rightarrow \infty \quad |H(\omega)| \rightarrow 0$$

It is a low pass filter

$$f_c = \frac{1}{2\pi \sqrt{2.498 \times 10^{-12}}} = \underline{\underline{100.69\text{KHz}}}$$

2



$$\underline{Z}_{eq} = a + jb$$

$$V_c = V_m \sin \omega t$$

$$V_m = 10.6 \text{ V}$$

$$\omega = 1552 \text{ rad/sec}$$

$$R = 101 \Omega, C = 10 \mu\text{F}, L = 2 \text{ mH}$$

$$\underline{Z}_{eq} = (X_C \parallel X_L) + R$$

$$\text{where } X_C = \frac{1}{j\omega C}, X_L = j\omega L$$

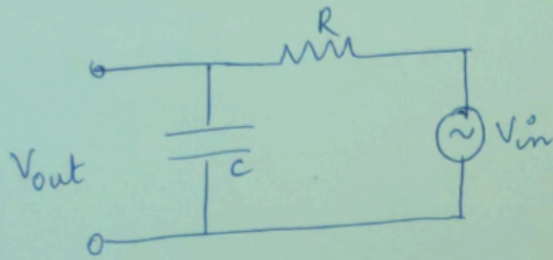
$$X_C \parallel X_L \Rightarrow \frac{X_C X_L}{X_C + X_L} = \frac{\frac{1}{j\omega C} \times j\omega L}{\frac{1}{j\omega C} + j\omega L} = \frac{L/C}{\frac{1 - \omega^2 LC}{j\omega C}} = \frac{j\omega L}{1 - \omega^2 LC}$$

$$\therefore \underline{Z}_{eq} = R + j \frac{\omega L}{1 - \omega^2 LC}$$

$$\therefore \underline{a} = R = 101 \Omega, \quad b = \frac{\omega L}{1 - \omega^2 LC} = \frac{1552 \times 2 \times 10^{-3}}{1 - [1552 \times 1552 \times 2 \times 10^{-3} \times 10 \times 10^{-6}]}$$

$$\underline{b = 3.26 \Omega}$$

③



$$R = 61 \text{ K}\Omega, \quad C = 20 \text{ nF}$$

$$H(\omega) = \frac{V_c}{V_R + V_c}$$

$$|H(\omega)| = \frac{1}{\sqrt{1 + (\omega RC)^2}}$$

$$= \frac{1/j\omega C}{R + 1/j\omega C}$$

$$\omega = 0 \Rightarrow |H(\omega)| = 1$$

$$\omega = \infty \Rightarrow |H(\omega)| = 0$$

$$H(\omega) = \frac{1}{1 + j\omega RC}$$

This circuit represents a
Low pass filter

$$f_c = \frac{1}{2\pi RC} = \frac{1}{2 \times 3.141 \times 61 \times 10^3 \times 20 \times 10^{-9}}$$

$$\underline{f_c = 130.52 \text{ Hz}}$$