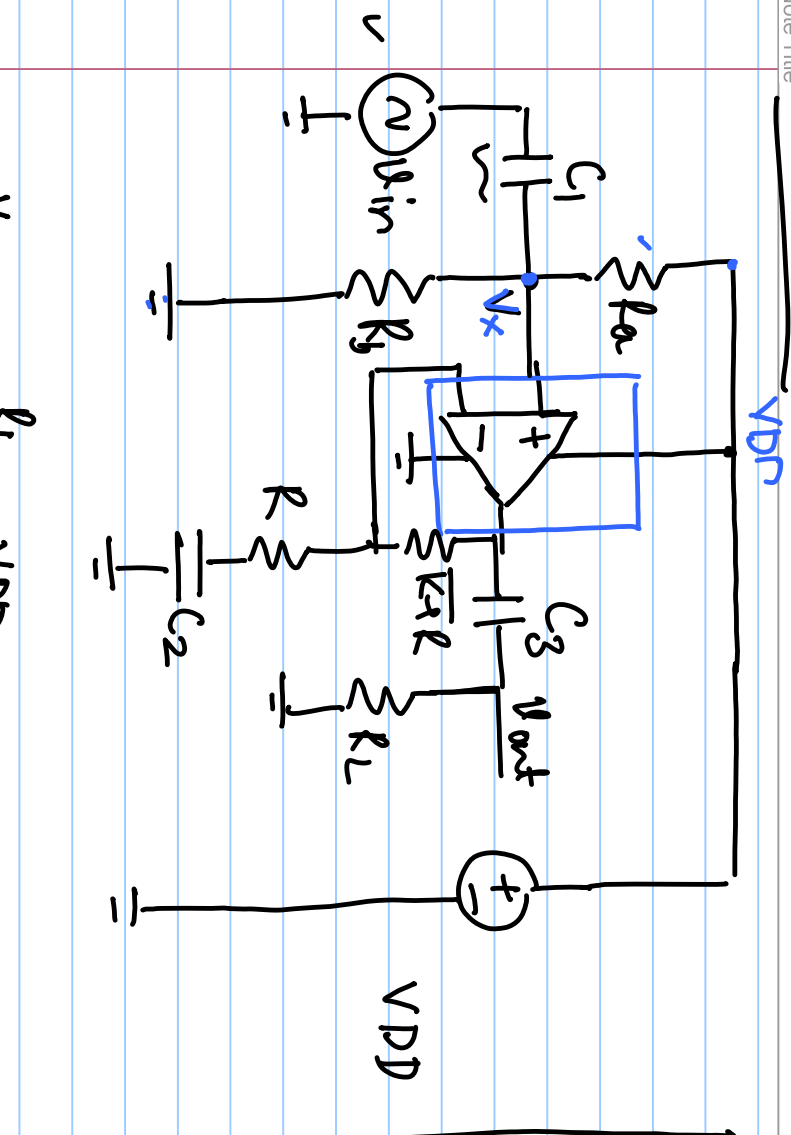


# Lecture # 13



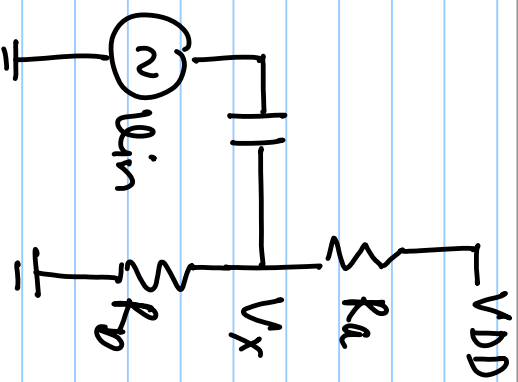
$$V_x = \frac{R_b}{R_b + R_a} V_{DD}$$

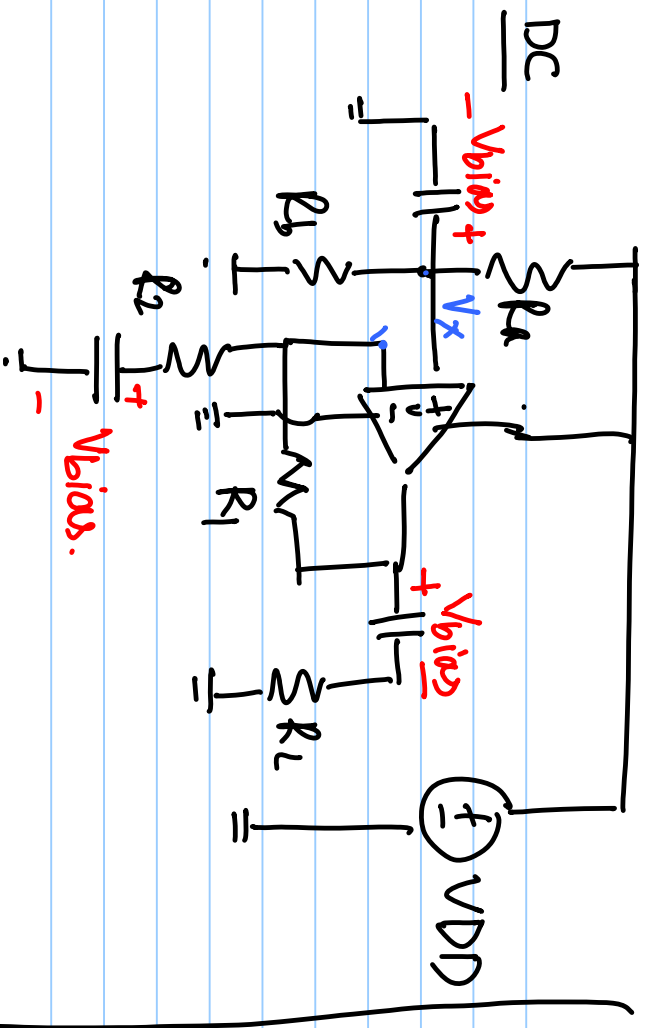
$$V_x(s) = \frac{(R_b \parallel \frac{1}{sC_1})}{R_a + (R_b \parallel \frac{1}{sC_1})} \underbrace{V_{DD}(s)} +$$

$$\frac{(R_a \parallel R_b)}{(R_a \parallel R_b) + \frac{1}{sC_1}} V_{in}(s)$$

$$V_x = V_{DD} + \frac{sC_1(R_a \parallel R_b)}{1 + sC_1(R_a \parallel R_b)} V_{in}(s)$$

$\underbrace{\hspace{10em}}_{sC_1(R_a \parallel R_b) \gg 1}$



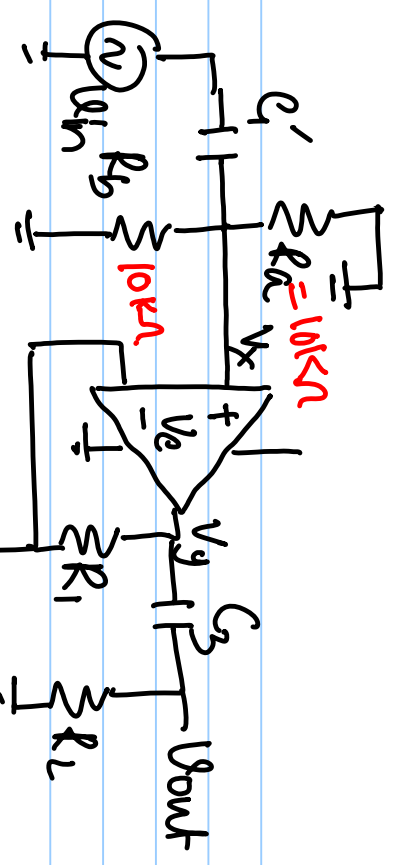


$$V_x = \frac{R_b}{R_b + R_a} V_{DD} = V_{bias}$$

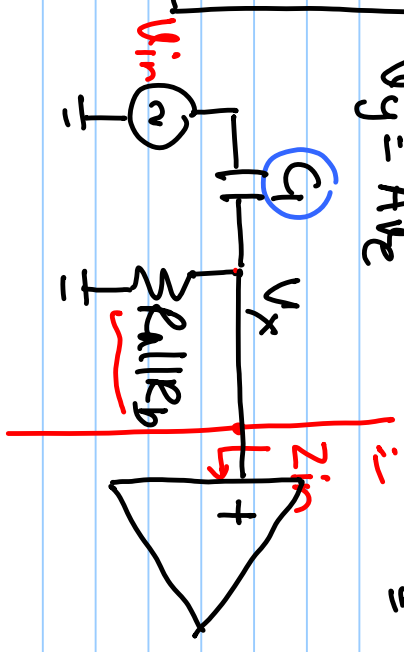
$$V_x = V_{in} \frac{s(R_{a||R_b})C_1}{(1 + s(R_{a||R_b})C_1)}$$

$$V_x \approx V_{in}$$

$$10 \text{ krad/s} \ll \omega_0(R_{a||R_b})C_1 \gg 1 \Rightarrow C_1 \gg \frac{1}{10 \times 10^3 \times 5 \times 10^3} = 10^{-8} \text{ s} = 10 \text{ nF}$$



$$V_y = A V_x$$



$$C_1 = \frac{10}{\omega_0(R_{a||R_b})}$$

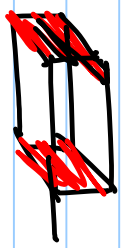
$$C = \frac{\epsilon A}{d}$$

$C = 10nF$

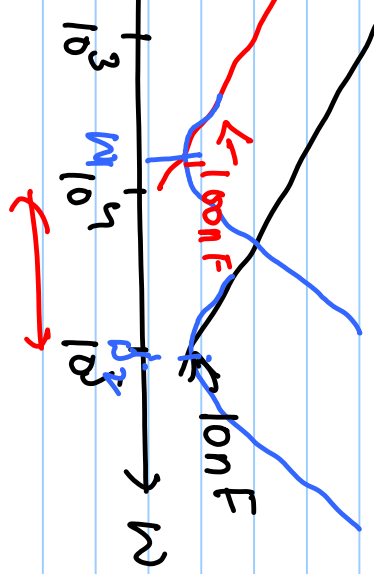


$$Z_c = \frac{1}{sC}$$

$$|Z_c| = \left| \frac{1}{\omega C} \right|$$



$|Z_c|$

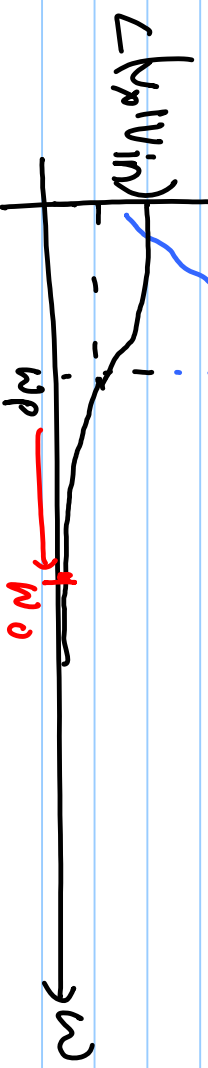


$$\omega_0 = \frac{1}{\sqrt{LC}}$$

$$V_x = V_{in} \frac{sRC}{1 + sRC}$$

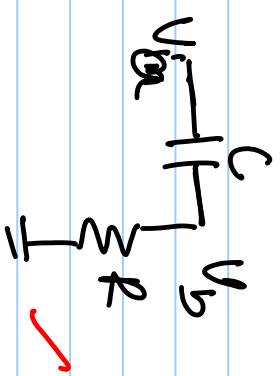
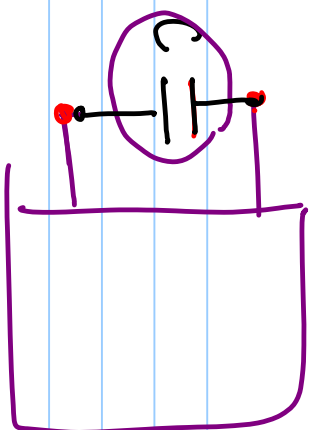
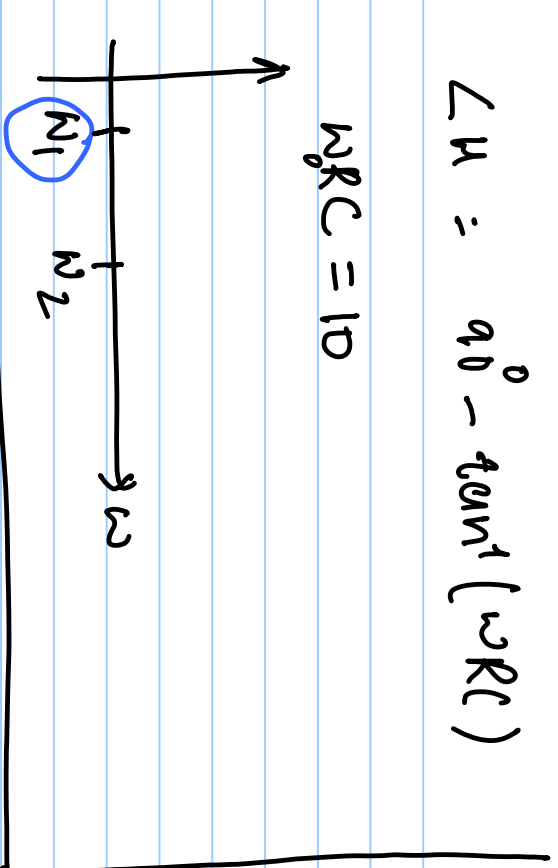
$$|V_x| = |V_{in}| \frac{\omega RC}{\sqrt{1 + (\omega RC)^2}}$$

$$H(s) = \frac{V_x}{V_{in}} = \frac{j\omega RC}{1 + j\omega RC}$$

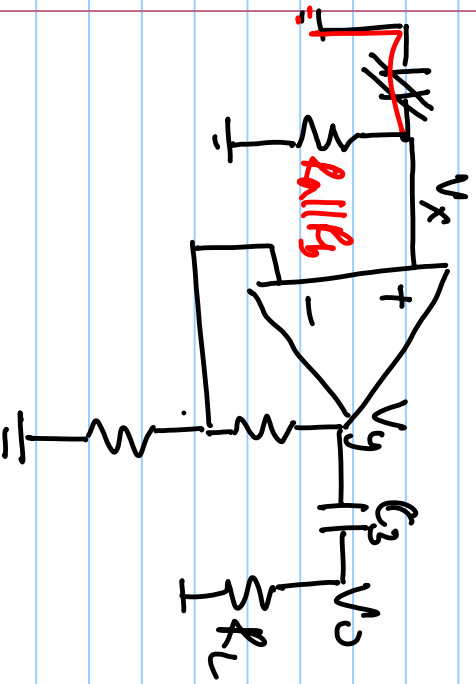
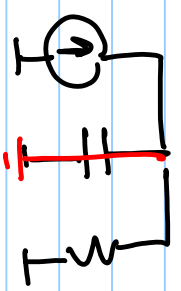


$$\angle H = 90^\circ - \tan^{-1}(\omega RC)$$

$$\omega RC = 10$$



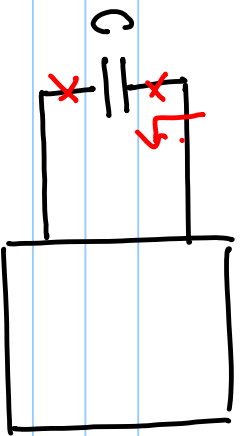
$$V_o \approx V_a$$



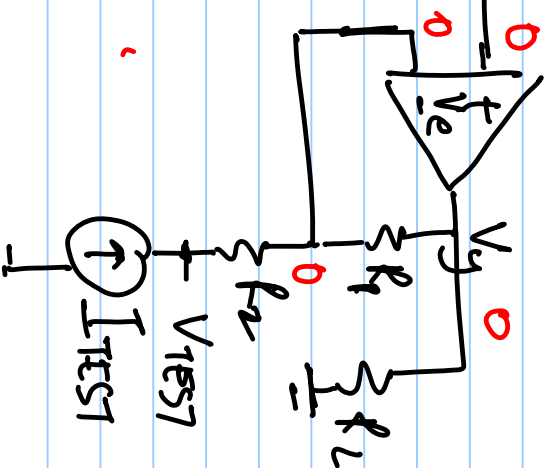
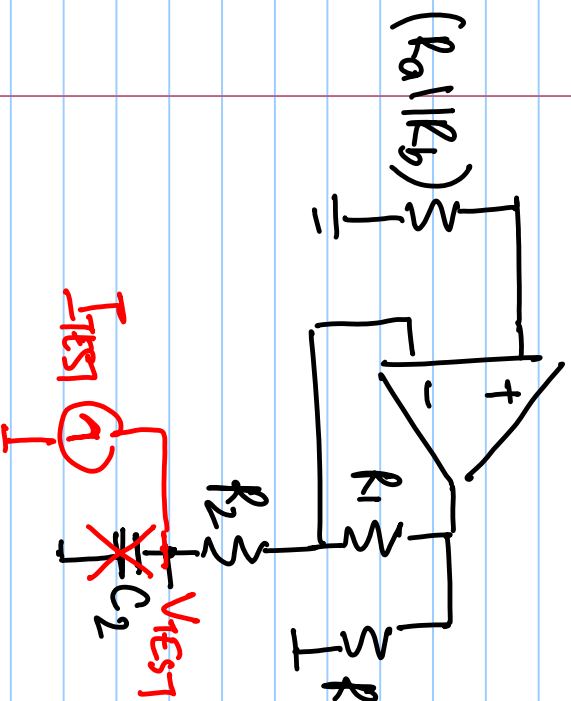
$$\frac{V_o}{V_y} = \frac{R_L}{R_L + \frac{1}{sC_3}} = \frac{sC_3 R_L}{1 + sC_3 R_L}$$

$$\omega_0 C_3 R_L \gg 1$$

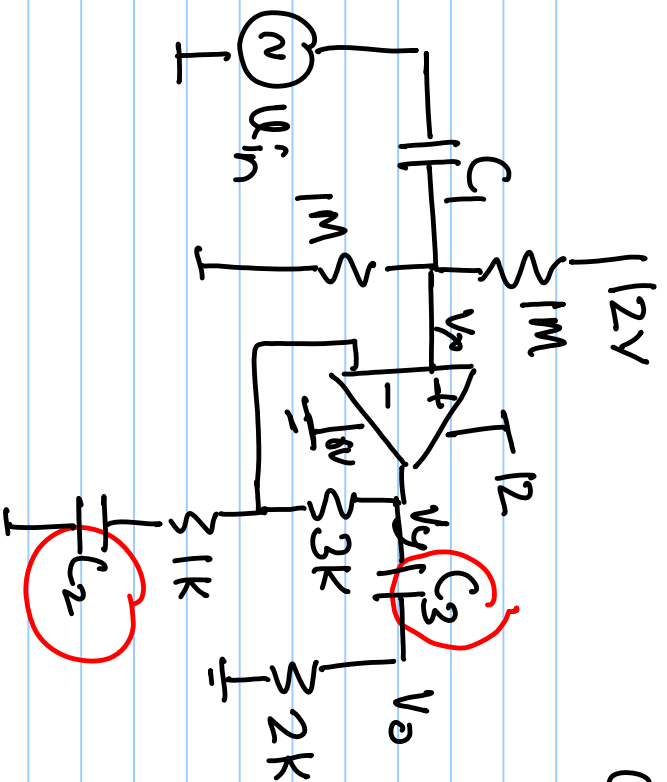
$$\omega_0 C_3 R_L = 10$$



$$C = \frac{L_3}{R_2}$$



$$\omega_0 R_2 C_2 \gg 1$$



$$C_1: \text{Min. } C_1 \times (0.5 \text{M}) \rightarrow 1$$

$$C_1 = 0.2 \text{nF}$$

$$C_2: \text{Min. } C_2 \cdot 1\text{K} = 10$$

$$C_2 = \frac{10}{100 \times 10^3 \times 10^3} = 100 \text{nF}$$

$$C_3: \text{Min. } C_3 \cdot 2\text{K} = 10$$

$$100 \text{Krad/s} \text{ Min } \leq 10 \text{Mrad/s}$$

$$\text{MRC} \rightarrow 1$$

$$C_{\text{min}}$$

