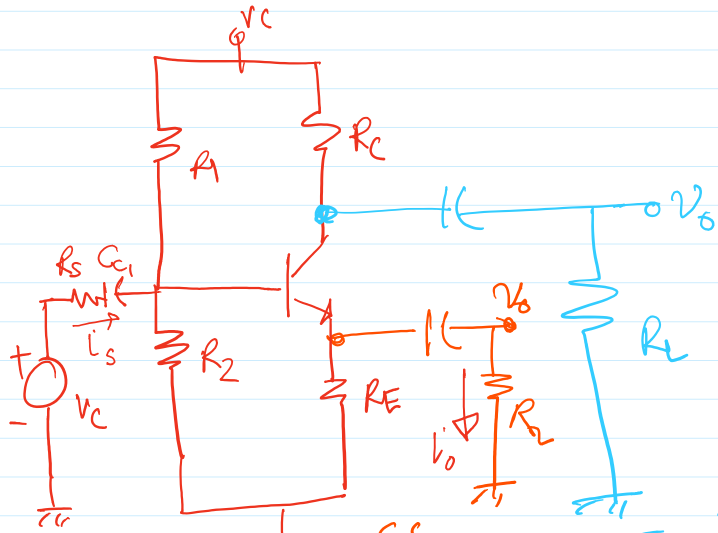
Common Collector Amplifier

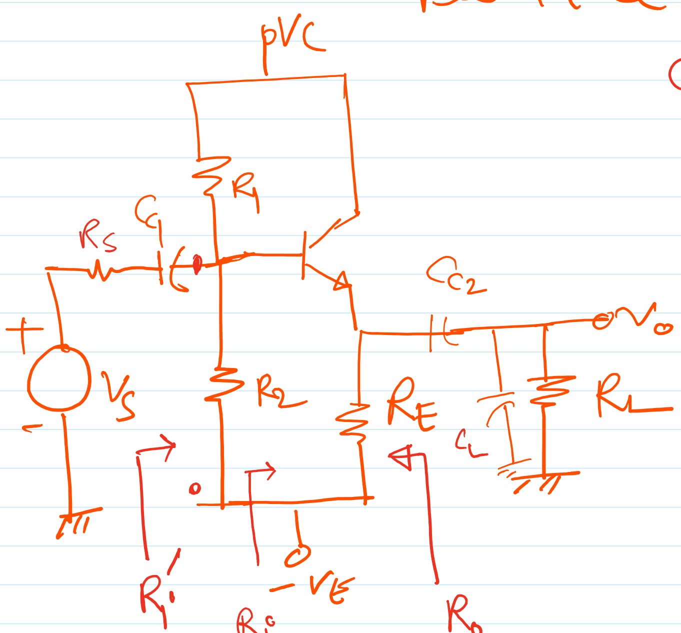
Monday, October 9, 2017 8:17 AM



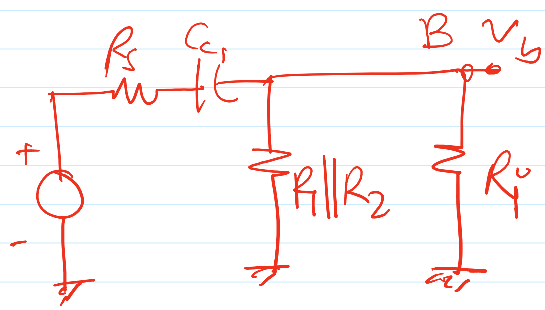
C.C with Collector resistance

CE with emitter resistance

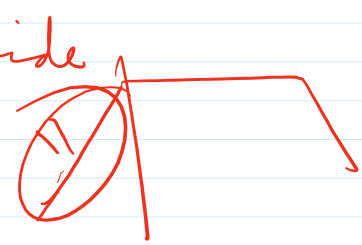
$$A_i = \left.\frac{i_o}{i_s}\right|_{midband}$$

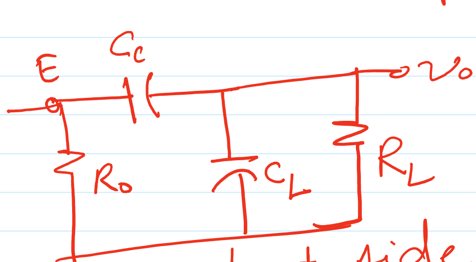


$$C_{c_1} \Rightarrow A_v = A_{vA} \times \frac{R_i'}{R_i' + R_s + 1/sC_{c_1}}$$

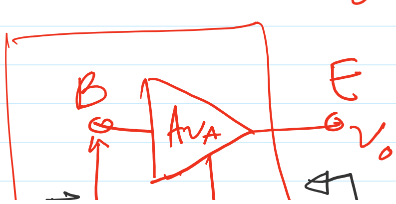


Input side

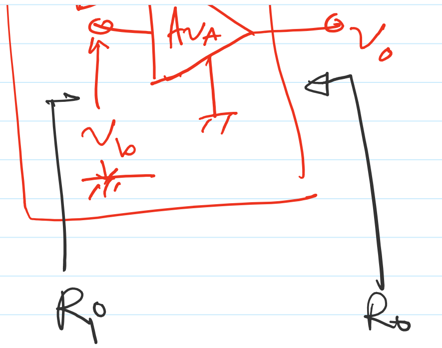




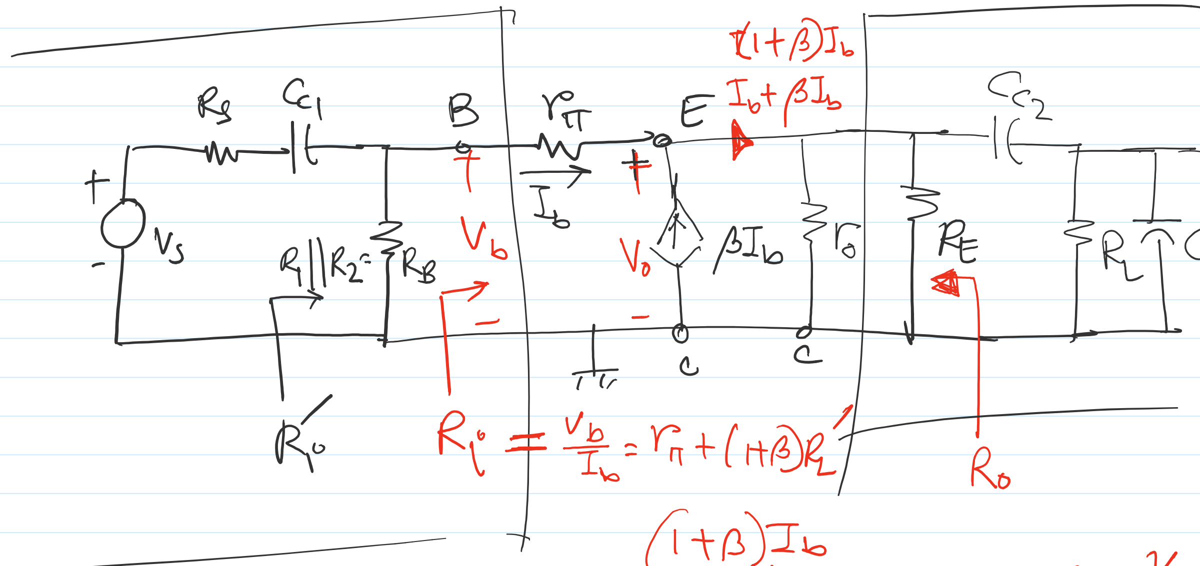
output side.



$$A_{vA} = \frac{v_o}{v_b}$$

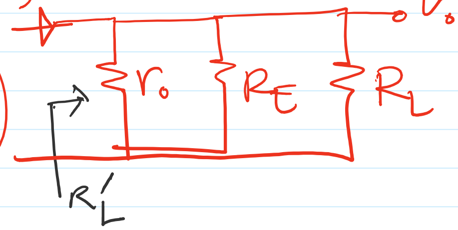


$$A_{vA} = \frac{\quad}{v_b}$$

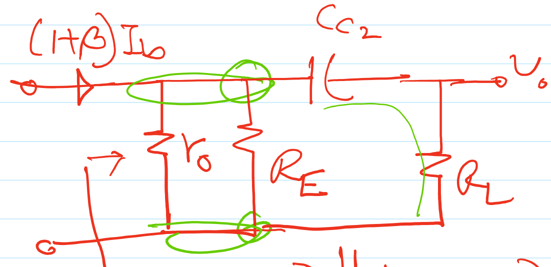


$$R_i = \frac{v_b}{I_b} = r_\pi + (1+\beta)R_L'$$

$$v_o\Big|_{midband} = (1+\beta)I_b\,(r_o \| R_E \| R_L)$$

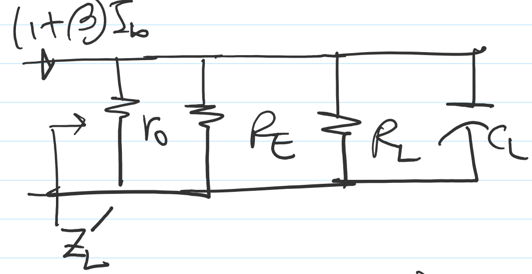


$$v_o\Big|_{Low freq} = (1+\beta)\, I_b \times Z_L$$



$$Z_L = (r_o \| R_E) \,\Big\|\, \left(\frac{1}{sC_{c2}} + R_L\right)$$

$$v_o\Big|_{High freq} = (1+\beta)\, I_b\, Z_L'$$



$$= r_o \| R_E \| R_L \| \left(\frac{1}{\ldots}\right)$$

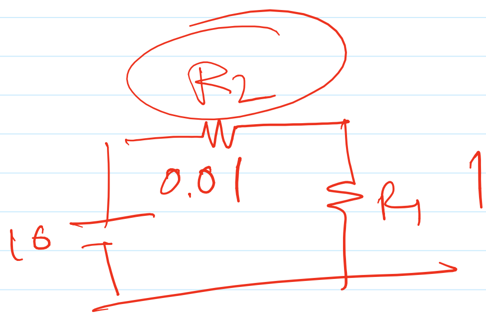
Z_L'

$Z_L' = r_o \| R_E \| R_L \| \left(\frac{1}{sC_L}\right)$

$A_{v_A} = \frac{v_o}{v_b}$

$v_b \big|_{\text{mid freq}} = r_\pi I_b + (1+\beta) I_b R_L'$

$V_b \big| = r_\pi I_b + v_o$



$v_o = \frac{R_1}{R_1 + R_2}$

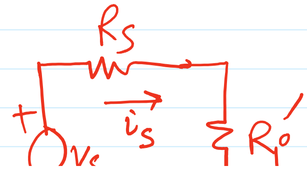
$R_2 \Rightarrow \cancel{\infty}$

$\frac{1}{\omega C} = \infty$

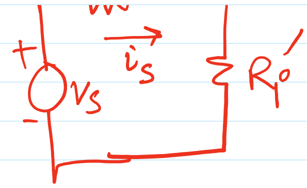
$A_{v_A} = \frac{v_o}{v_b} = \frac{(1+\beta) I_b R_L'}{r_\pi I_b + (1+\beta) R_L'}$

$= \frac{(1+\beta) R_L'}{r_\pi + (1+\beta) R_L'}$

$i_o = \frac{v_o}{R_L}$



$$i_o = \frac{v_o}{R_L}$$



$$i_s = \frac{v_s}{R_s + R_i'}$$

$$\frac{i_o}{i_s} = \frac{\frac{v_o}{R_L}}{\frac{v_s}{R_s + R_i'}} = \frac{v_o}{v_s} \cdot \frac{R_s + R_i'}{R_L}$$

$$= A_v \frac{R_s + R_i'}{R_L}$$

$$= A_{vA} \times \frac{R_i'}{R_s + R_i'} \times \frac{R_s + R_i'}{R_L}$$

$$= A_{vA} \frac{R_i'}{R_L}$$

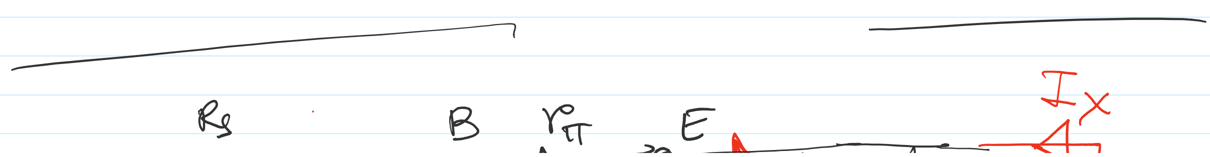
$$= \frac{(1+\beta) R_L'}{r_\pi + (1+\beta) R_L'} \times \frac{R_i'}{R_L}$$

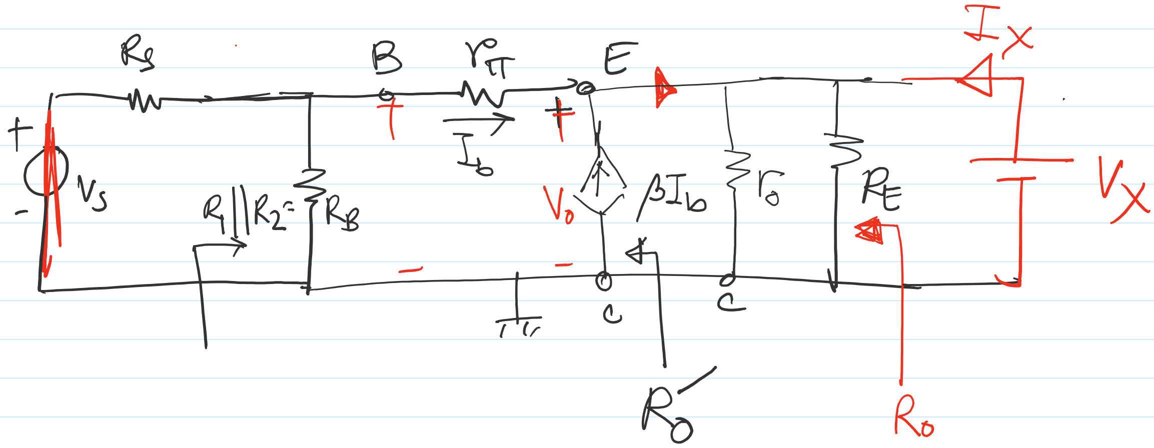
$$\simeq \frac{R_i'}{R_L}$$

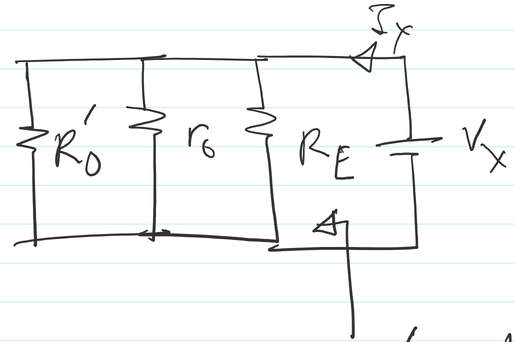
$$f_{LC_{C_1}} = \frac{1}{2\pi C_{C_1}(R_s + R_i')}$$

$$f_{LC_{C_2}} = \frac{1}{2\pi C_{C_2}(R_o + R_L)}$$

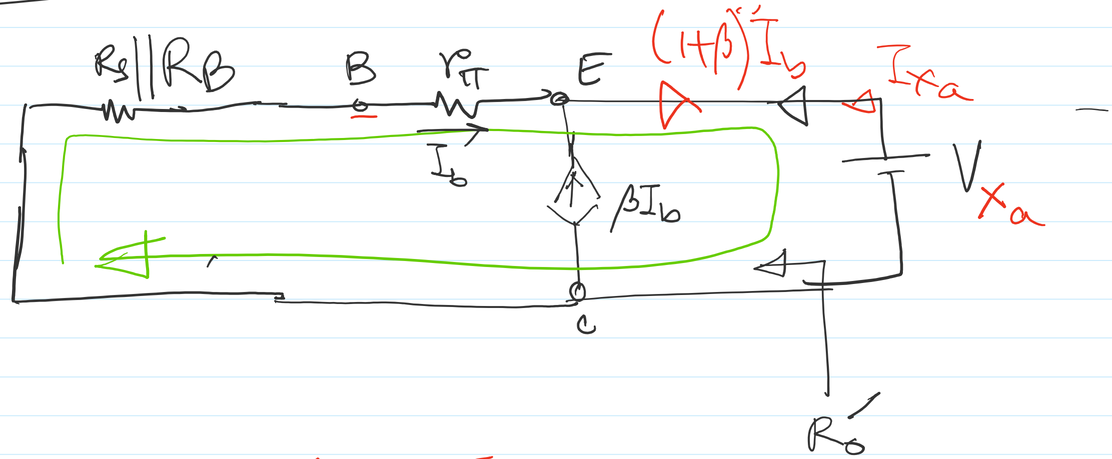
$$f_{HC_L} = \frac{1}{2\pi C_L R_o \| R_L}$$







$$R_o = R_o' || r_o || R_E$$



$$I_{xa} = -(1+\beta) I_b$$

$$R_o' = \frac{V_{xa}}{I_{xa}}$$

$$R_S || R_B I_b + r_\pi I_b + V_{xa} = 0$$

$$I_b = \frac{-V_{xa}}{(R_S || R_B + r_\pi)}$$

$$\therefore\ I_{xa} = -(1+\beta)\left(-\frac{V_{xa}}{R_S \| R_B + r_\pi}\right)$$

$$R_o' = \frac{V_{xa}}{I_{xa}} = \frac{R_S \| R_B + r_\pi}{(1+\beta)}$$

$$R_o = R_o' \,\|\, R_E \,\|\, r_o$$