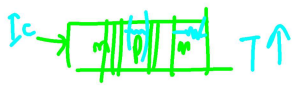
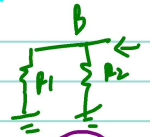
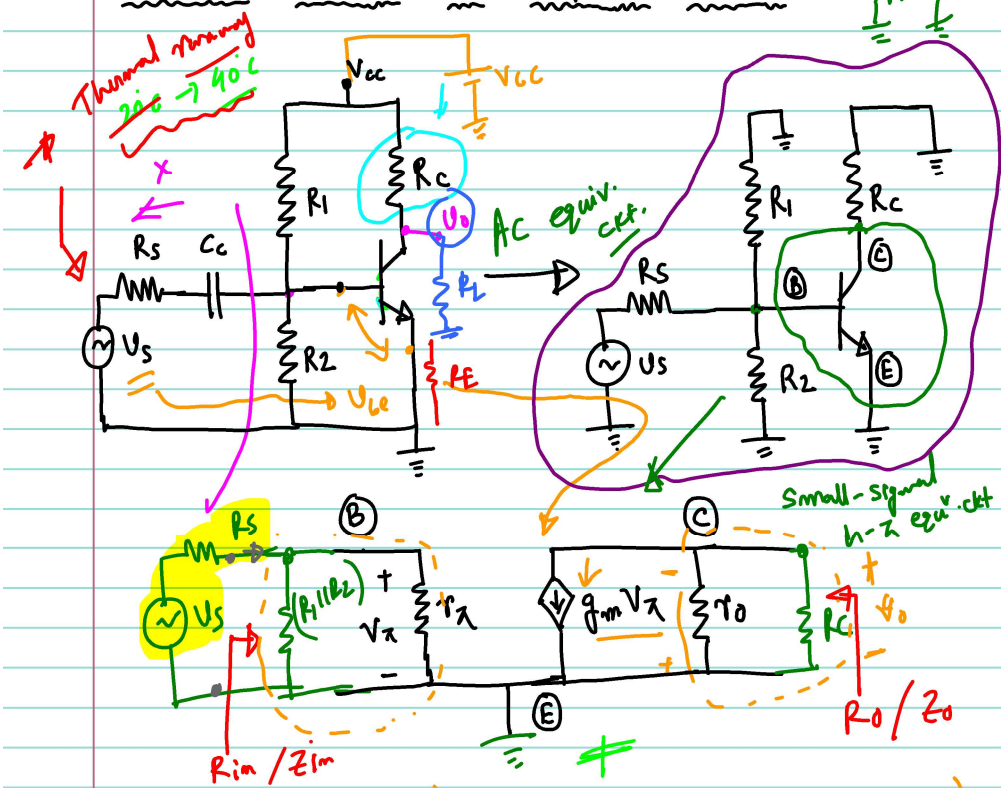


Common-Emitter (CE) Amplifier circuit:



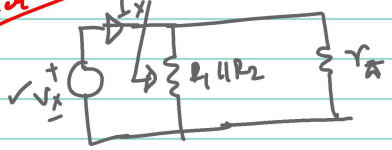


$$V_\pi = \frac{(R_1 \| R_2 \| r_\pi)}{R_s + (R_1 \| R_2 \| r_\pi)} \times V_s \; ; \; V_o = -g_m V_\pi \times (r_o \| R_c)$$

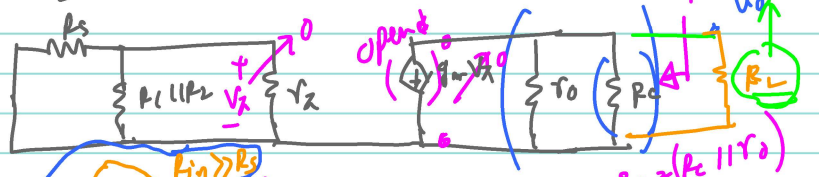
$$V_o = -g_m \cdot (r_o \| R_c) \times \frac{R_1 \| R_2 \| r_\pi}{R_1 \| R_2 \| r_\pi + R_s} \times V_s$$

Small-signal Gain $= \frac{V_o}{V_s} = -g_m (r_o \| R_c) \times \left(\frac{R_1 \| R_2 \| r_\pi}{R_1 \| R_2 \| r_\pi + R_s} \right)$

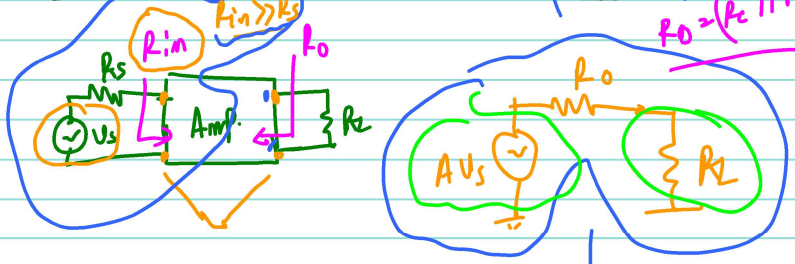
i/p and o/p impedance (resistance)



$$R_{in} = (R_1 \| R_2 \| r_\pi)$$



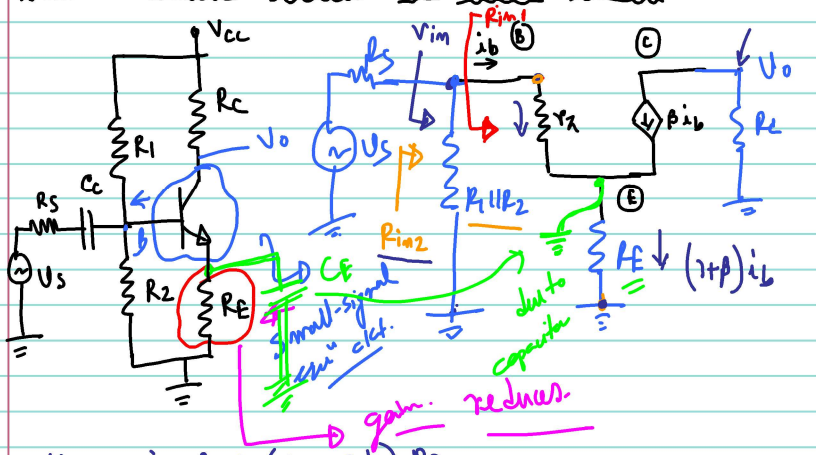
$R_o = (R_c \| r_o)$



$R_L \gg R_o$

$V_A \to \infty$ V_A high., $r_o \uparrow$

Common Emitter Amplifier with emitter resistor:



$$V_{in} = i_b \cdot r_\pi + (i_b + \beta i_b) R_E$$

$$V_{in} = i_b [r_\pi + (1+\beta) R_E]$$

$$R_{in_1} = \frac{V_{in}}{i_b} = r_\pi + (1+\beta) R_E$$

$$R_{in_2} = R_{in_1} \,||\, R_1 \,||\, R_2$$

$$V_{in} = \frac{R_{in2}}{R_{in2} + R_S} \cdot U_S$$

$$V_o = -\beta i_b \cdot R_C$$

$$V_o = -\beta R_C \cdot \frac{V_{in}}{r_\pi + (1+\beta) R_E}$$

$$V_o = -\beta R_C \cdot \frac{R_{in2}}{R_{in2} + R_S} \cdot U_S \times \frac{1}{r_\pi + (1+\beta) R_E}$$

gain

$$\frac{V_o}{U_S} = -\frac{\beta R_C}{r_\pi + (1+\beta) R_E} \times \frac{R_{in2}}{R_{in2} + R_S} \quad ; \quad R_{in2} \gg R_S$$

$$= -\frac{\beta R_C}{r_\pi + (1+\beta) R_E} \quad ; \quad (1+\beta) R_E \gg r_\pi$$

$1+\beta \simeq \beta$

$$\approx -\left(\frac{R_C}{R_E}\right)$$