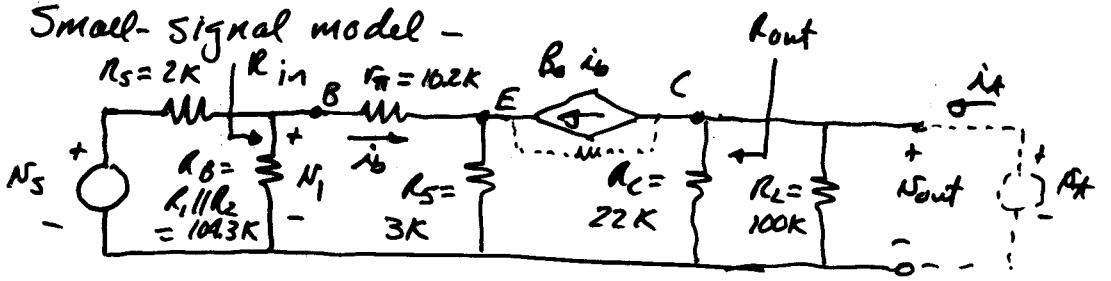
Common Emitter Amplifier with Emitter Degeneration – Cont'd

Small-signal model –



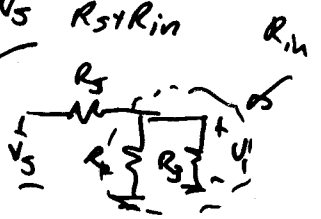
$$R_{in} = R_B \| [r_\pi + (1+\beta_o)R_E] = 104.3K \| [10.2K + (101)3K] = 104.3K \| 313.2K$$

$$= \underline{\underline{78.3K\Omega}}$$

$$R_{out} = R_C = \underline{\underline{22K}}$$

$$\frac{v_{out}}{v_S} = \left(\frac{v_{out}}{i_b}\right)\left(\frac{i_b}{v_S}\right) = \left[-\beta_o \times (R_C \| R_L)\right]\left(\frac{i_b}{v_1}\right)\left(\frac{v_1}{v_S}\right)$$

$$\therefore \frac{i_b}{v_1} = \frac{1}{r_\pi + (1+\beta_o)R_E} = \frac{1}{313.2K}, \quad \frac{v_1}{v_S} = \frac{R_{in}}{R_S + R_{in}}$$

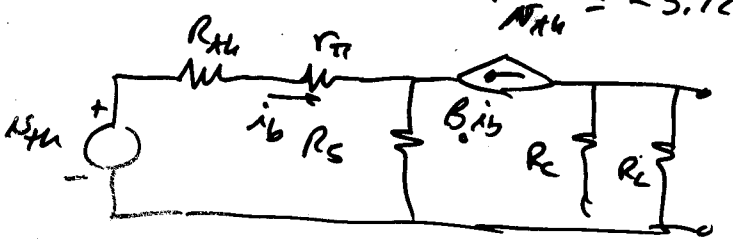


$$\frac{v_1}{v_S} = \frac{R_B \| [r_\pi + (1+\beta_o)R_E]}{R_S + R_B \| [r_\pi + (1+\beta_o)R_E]}$$

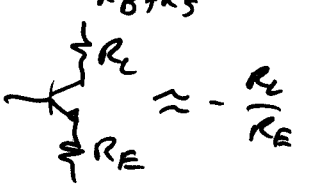
$$\frac{v_{out}}{v_S} = [-100(18.03K)]\left(\frac{1}{313.2K}\right)\left(\frac{78.3K}{2+78.3K}\right) = -5.61\ V/V$$

$$\frac{i_b}{v_S} = ? \qquad i_b = \frac{v_S}{R_S + R_{in}} \times \frac{R_B}{R_B + r_\pi + (1+\beta_o)R_E}$$

Text calculates $\frac{v_{out}}{v_{th}} = -5.72\ V/V$



$$v_{th} = \frac{R_B}{R_B + R_S} v_S$$



$$\approx -\frac{R_C}{R_E}$$

Q5 –

Next Example – Common Drain Amplifier

~~CE & CS~~

CC & CD

CB & CG

Common nothing – Last example

(Source degeneration or emitter degeneration)