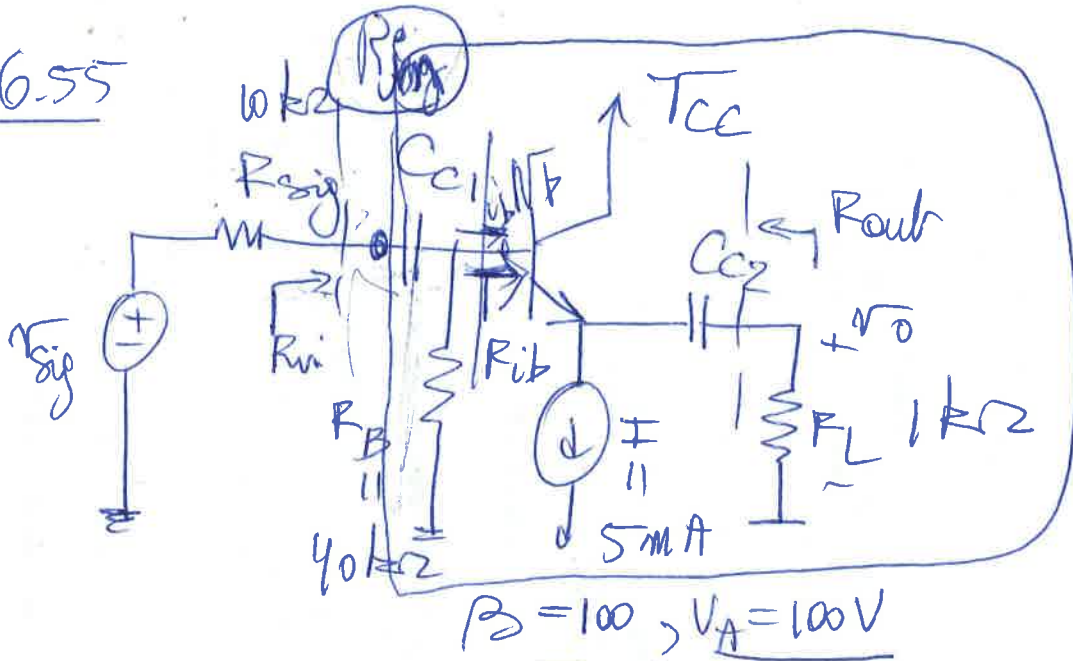


Ex 6.55

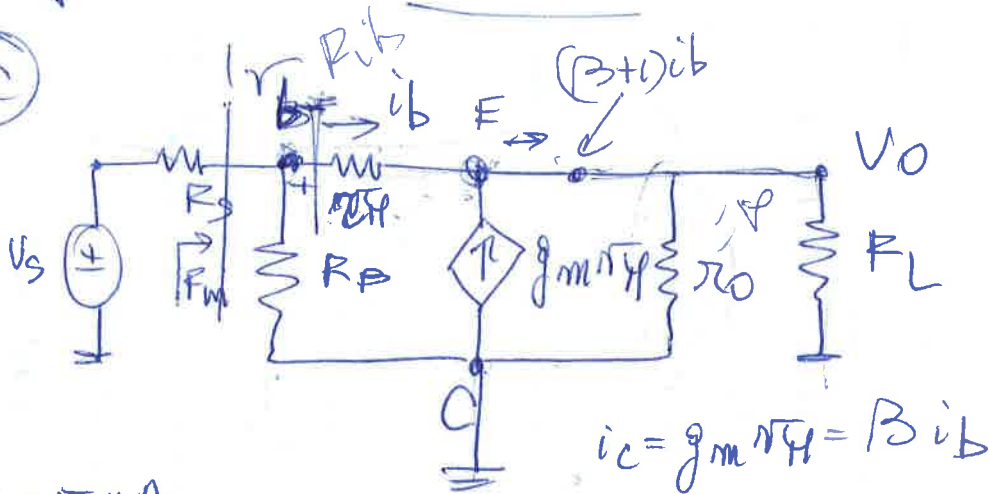


$$G_v = \frac{v_o}{v_{sig}} \quad G_{v0} = \frac{v_o}{v_{sig}} \quad (R_L = \infty)$$

The limited to 10mV peak $\rightarrow v_o$ ampl?

G_{v0} if $R_L = 2k\Omega \rightarrow 500\Omega$

(AC)



$I_C = 5mA$

$r_{\pi} = \frac{\beta V_T}{I_C} = 500\Omega$

$r_o = \frac{V_A}{I_C} = 20k\Omega$

$i_b = \frac{v_b - v_o}{r_{\pi}}$



$\rightarrow i_b = \frac{v_b}{r_{\pi}}$

$v_o = (i_b + g_m v_{\pi})(r_o \parallel R_L) = (\beta + 1) i_b (r_o \parallel R_L) = \frac{(\beta + 1) i_b (r_o \parallel R_L)}{r_{\pi}}$

$$R_{ib} = \frac{v_b}{i_b} = r_{\pi} + (\beta+1)(r_o \parallel R_L) = 0.5 + (101)(20 \parallel 1) = 96.7 \text{ k}\Omega$$

$$R_{ib} = 96.7 \text{ k}\Omega \leftarrow$$

$$R_{in} = (R_{ib} \parallel R_D) = 28.3 \text{ k}\Omega$$

$$G_m = \frac{v_o}{v_s} = \left(\frac{v_o}{v_b} \right) \left(\frac{v_b}{v_s} \right)$$

$$i_b = \frac{v_b - v_o}{r_{\pi}}$$

~~$$v_b = r_{\pi} i_b + v_o$$~~

$$v_b = r_{\pi} i_b + v_o$$

~~$$\frac{v_o}{v_b} = \frac{v_b - (\beta+1) i_b (r_o \parallel R_L)}{v_b}$$~~

$$i_b = \frac{v_b - (\beta+1) i_b (r_o \parallel R_L)}{r_{\pi}}$$

$$\frac{v_b}{v_o} = 1 + r_{\pi} \frac{i_b}{v_o} = 1 + \frac{r_{\pi}}{(\beta+1)(r_o \parallel R_L)}$$

$$\frac{v_b}{v_o} = \frac{(\beta+1)(r_o \parallel R_L) + (\beta+1) r_{\pi}}{(\beta+1)(r_o \parallel R_L)}$$

$$\left(\frac{v_o}{v_b} \right) = \frac{(r_o \parallel R_L)}{r_{\pi} + (r_o \parallel R_L)}$$

$$\frac{v_b}{v_s} = \frac{R_{in}}{R_s + R_{in}}$$

$$\frac{v_o}{v_s} = \left(\frac{R_{in}}{R_s + R_{in}} \right) \left[\frac{(r_o \parallel R_L)}{r_{\pi} + (r_o \parallel R_L)} \right]$$

$$V_o = (\beta + 1) i_b (r_o \parallel R_L)$$

$$\frac{V_o}{V_{in}} = (\beta + 1) \frac{i_b}{V_{in}} (r_o \parallel R_L)$$

~~V_{in}~~

$$V_o = (\beta + 1) \frac{(r_o \parallel R_L)}{r_{in}} V_{in}$$

$V_{in} = 10 \text{ mV}$

$$r_{in} = r_{in} i_b$$

$$r_o = \infty$$

$$V_o = (101) \frac{(20 \text{ k} \parallel 1 \text{ k})}{500} V_{in} = \frac{101}{500} (2 \text{ k}) 10 \text{ mV}$$

$$\therefore V_o \approx 2 \text{ V}$$