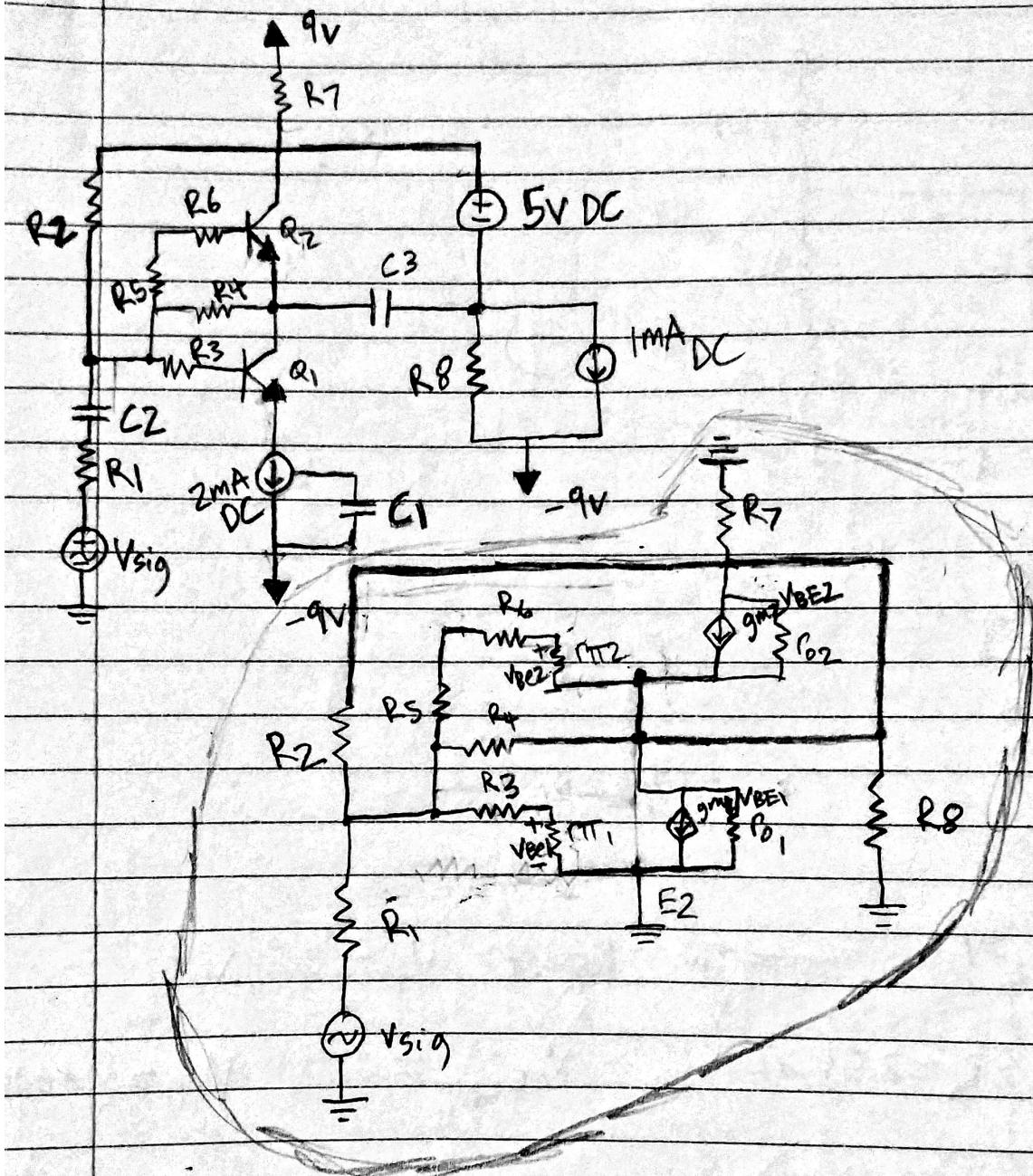
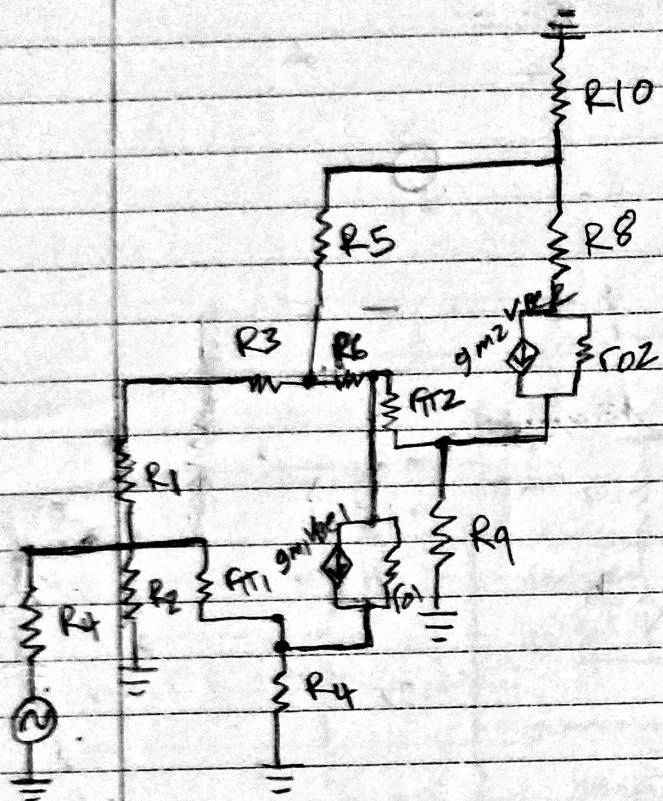


Nathan Donaldson
ECE 2280

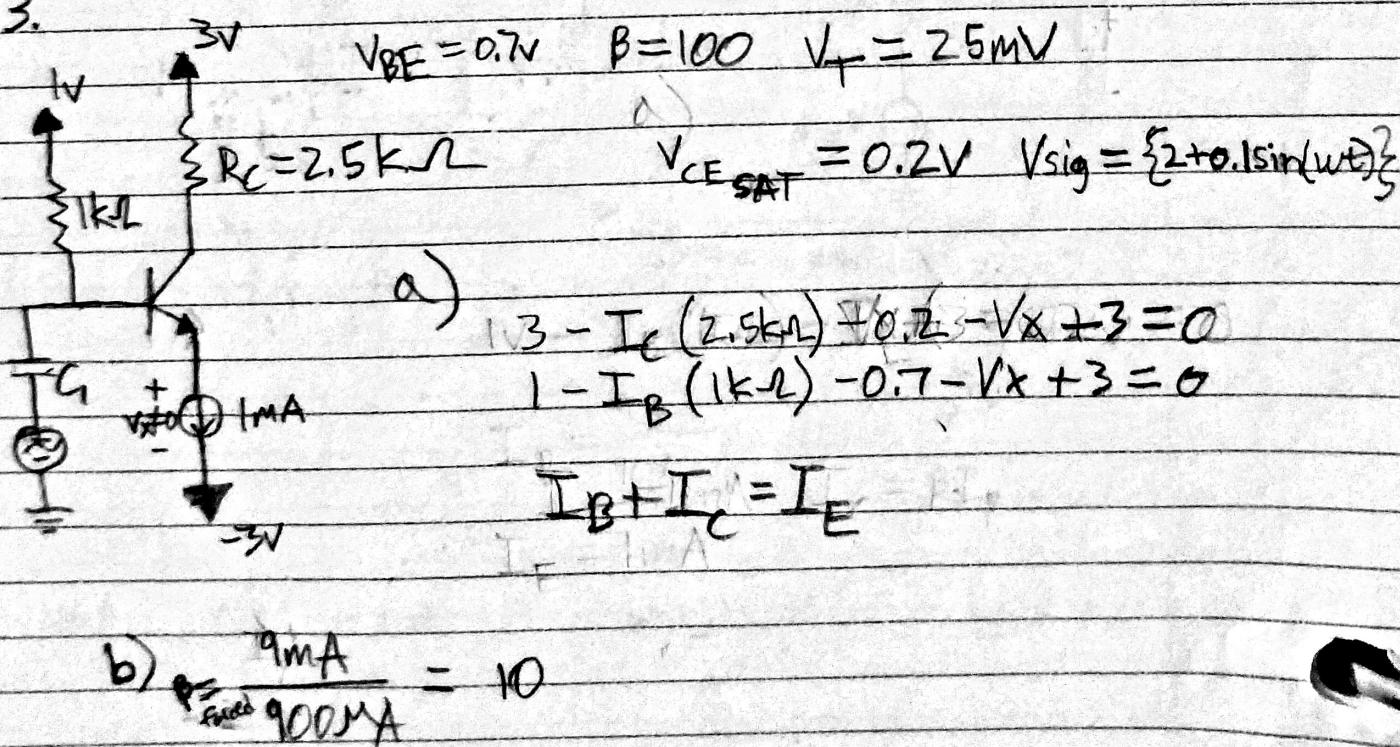
Homework #5



2.



3.



c)

$$V_C \geq V_B > V_E$$

$$I_B = \frac{1 \text{ mA}}{101}$$

$$V_B = 1V - 1k\Omega(10mA) = 990 \text{ mV}$$

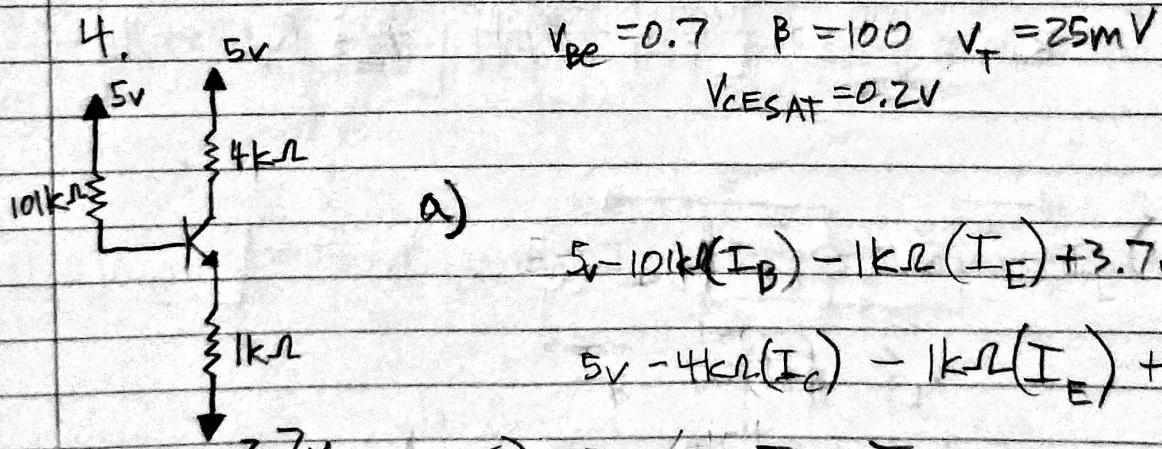
$$V_C = 3V - 2.5k\Omega(1 \text{ mA}) = .5V \quad I_C = 100 \cdot 10^{-6} \text{ A} = 1 \text{ mA}$$

$$V_E = 9.9 - .7 = 0.29 = 290 \text{ mV}$$

$$3V : R (1 \text{ mA}) = 990 \text{ mV}$$

$$R = 2030 \Omega$$

$$\star R_C \geq 2030 \Omega$$



$$5V - 10k\Omega(I_B) - 1k\Omega(I_E) + 3.7V - 0.7 = 0$$

$$5V - 4k\Omega(I_C) - 1k\Omega(I_E) + 3.7 - 0.2 = 0$$

$$5V - 10k\Omega(I_B) = \frac{8.5 - 4k\Omega(I_E)}{5k} + 3.7V - 0.2V \quad I_B + I_C = I_E$$

$$I_B(-10k - 4m) = 6.3A \quad 5V - 4kI_E + 4kI_B - 1k(I_E) + 3.7 - 0.2 = 0$$

$$b) \quad I_E = 5A \quad I_B(-4k - 1k) = -8.5 - 4kI_E$$

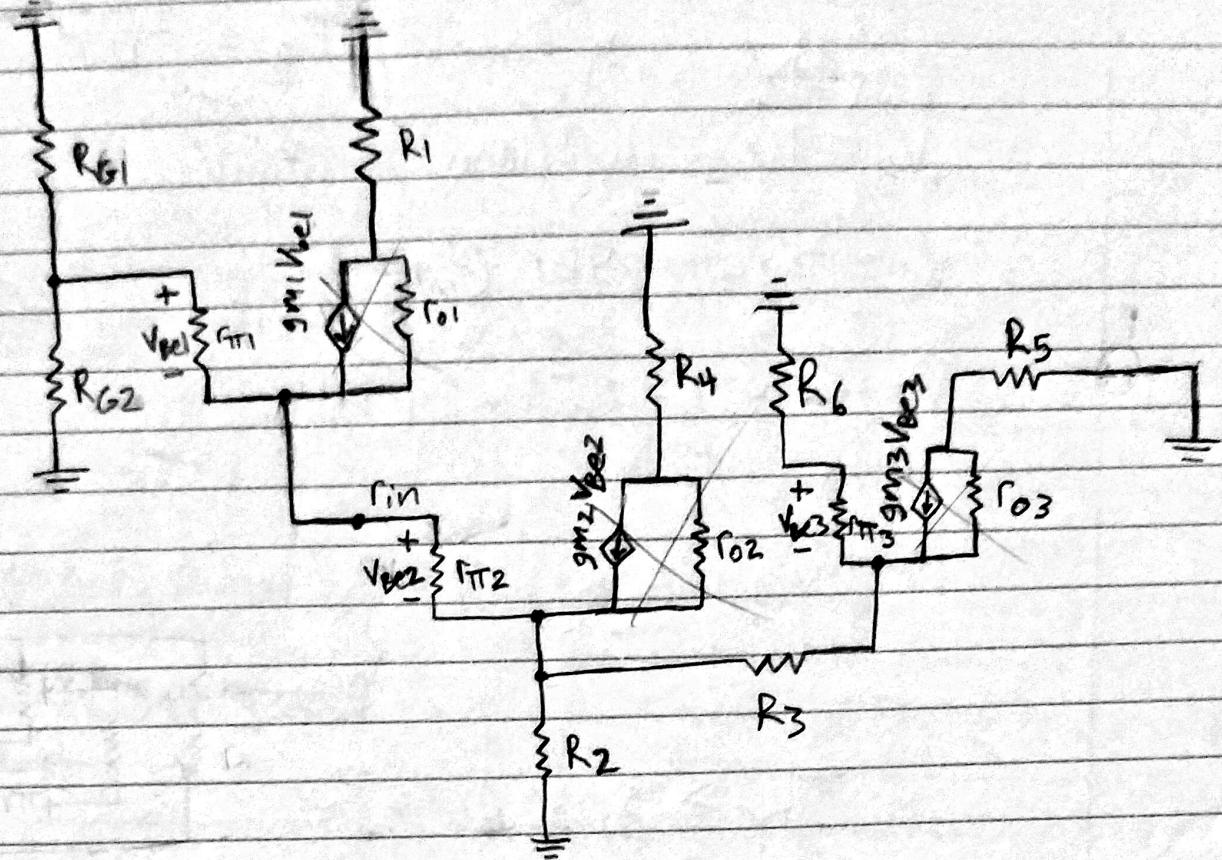
$$I_B \text{ forced} = 27.3$$

$$I_C = 171 \text{ mA}$$

$$I_E = \frac{8.5 + 4kI_B}{5k}$$

5.

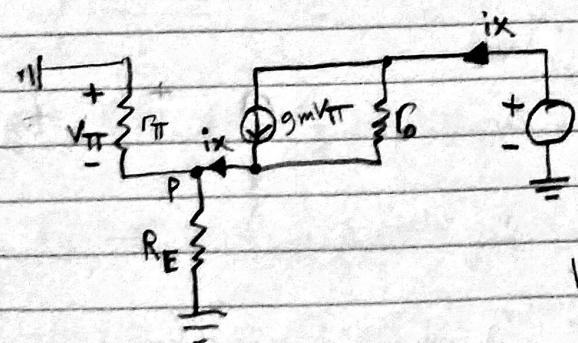
a)



b)

$$R_{in} = \left[\frac{r_{\pi 1}}{\beta + 1} + \frac{R_{G1} || R_{G2}}{\beta + 1} \right] || \left[r_{\pi 2} + R_2 (\beta + 1) \right] \left[\frac{(r_{\pi 3} + R_6)(\beta + 1)}{\beta + 1} \right]$$

6.



$$Vx = 1V$$

$$-ix - gm v_{\pi} - \frac{1}{ro} + \frac{-v_{\pi}}{r_{\pi}} + \frac{1}{RE} = 0$$

$$ix = -gm v_{\pi} - \frac{1}{ro} + \frac{1}{r_{\pi}^2} + \frac{1}{RE} = 0$$

$$R_{Th} = \frac{1}{ix} = \frac{1}{gm v_{\pi}} - ro + r_{\pi}^2 + RE$$

$$v_{\pi} = -\frac{1}{r_{\pi}}$$