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**EE 210** **MID-SEM P2** **24.2.21**

All BJTs in the circuit shown are identical with ($\beta$, $V_A$) $\rightarrow \infty$ [*for parts a)-d)*].

a) Show that $I_0$ is a function only of $V_{CC}$ and $R_E$, if $R_1 = R_2$. **4**

b) If $I_0 = I_1$, how is $R_E$ related to $R_1$ (or $R_2$, since $R_1 = R_2$)? **2**

c) If $V_{CC} = 5$ V, determine $R_1$ (= $R_2$) and $R_E$ to give $I_0 = 1$ mA. **2**

d) What is $V_{0,min}$? Is the value acceptable to you? Comment. **2**

e) *Only for this part*, assuming $\beta = 100$, $V_A = 100$ V, $I_0$ and $I_1$ remain at 1 mA, and using the values of $R_1$ (= $R_2$) and $R_E$ calculated in part c), estimate the output resistance $R_0$. **5**