

- 12.5** Consider the transistor described in Problem 12.3. (a) For a common-base current gain of $\alpha = 0.9850$, determine the common-emitter current gain [note: $\beta = \alpha / (1 - \alpha)$]. (b) Determine the emitter and base currents corresponding to the collector currents determined in Problem 12.3. (c) Repeats parts (a) and (b) for a common-base current gain of $\alpha = 0.9940$.

a) From section 12.3.3, $\beta = \frac{\alpha}{1-\alpha} = \frac{I_C}{I_B}$

$$\beta = \frac{0.994}{1-0.994} \Rightarrow \underline{\underline{\beta = 165.66}}$$

b) Use $\beta = \frac{I_C}{I_B}$ (12.6) & $\alpha = \frac{I_C}{I_E}$ (12.5)

(i) $i_c = 3.9948 \times 10^{-5} \text{ A}$ from prob 12.3

$$I_B = \frac{i_c}{\beta} = \frac{3.9948 \times 10^{-5}}{165.66} \Rightarrow \underline{\underline{I_B = 2.41135 \times 10^{-7} \text{ A}}}$$

$$I_E = \frac{i_c}{\alpha} = \frac{3.9948 \times 10^{-5}}{0.994} \Rightarrow \underline{\underline{I_E = 4.0189 \times 10^{-5} \text{ A}}}$$

(ii) $i_c = 5.9902 \times 10^{-4} \text{ A}$ from prob. 12.3

$$I_B = \frac{5.9902 \times 10^{-4}}{165.66} \Rightarrow \underline{\underline{I_B = 3.6158 \times 10^{-6} \text{ A}}}$$

$$I_E = \frac{5.9902 \times 10^{-4}}{0.994} \Rightarrow \underline{\underline{I_E = 6.0234 \times 10^{-4} \text{ A}}}$$

(iii) $i_c = 8.9824 \times 10^{-3} \text{ A}$ from prob 12.3

$$I_B = \frac{8.9824 \times 10^{-3}}{165.66} \Rightarrow \underline{\underline{I_B = 5.422 \times 10^{-5} \text{ A}}}$$

$$I_E = \frac{8.9824 \times 10^{-3}}{0.994} \Rightarrow \underline{\underline{I_E = 9.0366 \times 10^{-3} \text{ A}}}$$