

EEEE273 - Quiz 1 [Question Set 1]  
 SEMESTER 2, ACADEMIC YEAR 2010/2011  
 Date: 14 December 2010

**Question:**

Design a two-transistor current source, **using pnp transistors**, given the following parameters:

The transistor parameters are:  $\beta = 100$ ,  $V_{BE}(\text{on}) = 0.6\text{ V}$ , and  $V_A = 100\text{ V}$ .

The circuit parameters are:  $V^+ = 7.5\text{ V}$  and  $V^- = -7.5\text{ V}$ .

The output resistance of the two-transistor current source,  $R_O$ , is  $120\text{ k}\Omega$ .

Draw the final circuit for your design, showing all relevant signals including the power supply voltages.

**Answer:**

$$R_O = V_A / I_O$$

$$I_O = V_A / R_O = 100 / 120\text{k} = 0.833\text{ mA}$$

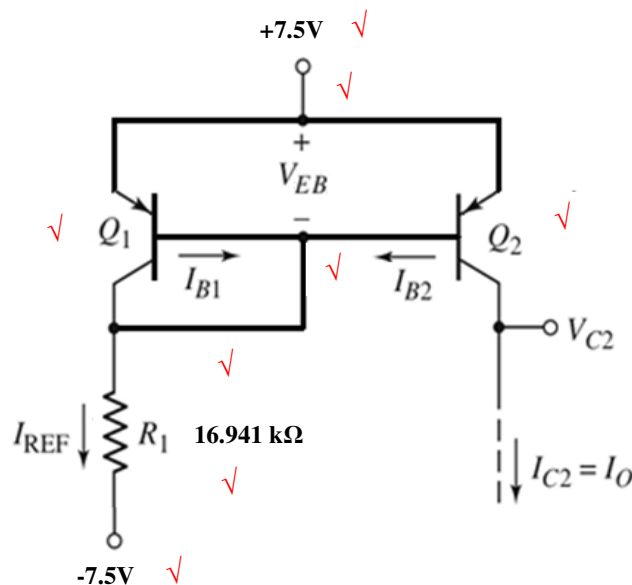
$$[1] \quad [0.5] \quad [0.5]$$

$$I_{REF} = I_O (1 + 2/\beta) = (0.833\text{m})(1 + 2/100) = 0.850\text{ mA}$$

$$[1] \quad [1] \quad [1]$$

$$R_I = (V^+ - V_{BE} - V^-) / I_{REF} = (7.5 - 0.6 - (-7.5)) / 0.850\text{m} = 16.941\text{ k}\Omega$$

$$[1] \quad [1] \quad [1]$$



$$\checkmark = [0.25]$$

EEEE273 - Quiz 1 [Question Set 2]  
 SEMESTER 2, ACADEMIC YEAR 2010/2011  
 Date: 14 December 2010

**Question:**

Design a two-transistor current source, **using pnp transistors**, given the following parameters:

The transistor parameters are:  $\beta = 80$ ,  $V_{BE}(\text{on}) = 0.6 \text{ V}$ , and  $V_A = 180 \text{ V}$ .

The circuit parameters are:  $V^+ = 10 \text{ V}$  and  $V^- = -10 \text{ V}$ .

The output resistance of the two-transistor current source,  $R_O$ , is  $98 \text{ k}\Omega$ .

Draw the final circuit for your design, showing all relevant signals including the power supply voltages.

**Answer:**

$$R_O = V_A / I_O$$

$$I_O = V_A / R_O = 180 / 98\text{k} = 1.837 \text{ mA}$$

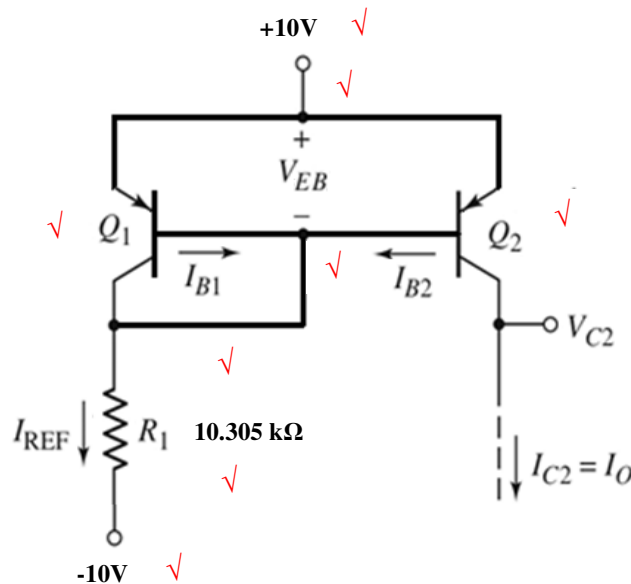
$$[1] \quad [0.5] \quad [0.5]$$

$$I_{REF} = I_O (1 + 2/\beta) = (1.837\text{m})(1 + 2/80) = 1.883 \text{ mA}$$

$$[1] \quad [1] \quad [1]$$

$$R_I = (V^+ - V_{BE} - V^-) / I_{REF} = (10 - 0.6 - (-10)) / 1.883\text{m} = 10.305 \text{ k}\Omega$$

$$[1] \quad [1] \quad [1]$$



$$\checkmark = [0.25]$$