

EEEB273 - Quiz 1 [Question Set 1]  
 SEMESTER 1, ACADEMIC YEAR 2010/2011  
 Date: 15 July 2010

**Question:**

Design a two-transistor current source given the following parameters:

The circuit parameters are:  $V^+ = 5\text{ V}$  and  $V^- = -5\text{ V}$ .

The transistor parameters are:  $\beta = 50$ ,  $V_{BE}(\text{on}) = 0.7\text{ V}$ ,  $V_A = 80\text{ V}$ , and  $r_{o2} = 81\text{ k}\Omega$ .

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

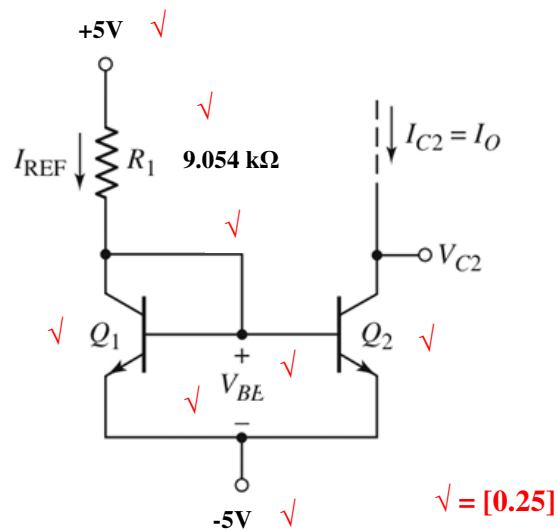
**Answer:**

$$r_{o2} = V_A / I_O$$

$$I_O = V_A / r_{o2} = 80 / 81\text{k} = 0.988\text{ mA}$$

$$I_{REF} = I_O (1 + 2/\beta) = (0.988\text{m})(1 + 2/50) = 1.027\text{ mA}$$

$$R_1 = (V^+ - V_{BE} - V^-) / I_{REF} = (5 - 0.7 - (-5)) / 1.027\text{m} = 9.054\text{ k}\Omega$$



EEEB273 - Quiz 1 [Question Set 2]  
SEMESTER 1, ACADEMIC YEAR 2010/2011  
Date: 15 July 2010

**Question:**

Design a two-transistor current source given the following parameters:

The circuit parameters are:  $V^+ = 10\text{ V}$  and  $V^- = 0\text{ V}$ .

The transistor parameters are:  $\beta = 50$ ,  $V_{BE}(\text{on}) = 0.7\text{ V}$ ,  $V_A = 90\text{ V}$ , and  $r_{o2} = 93\text{ k}\Omega$ .

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

**Answer:**

$$r_{o2} = V_A / I_O$$

$$I_O = V_A / r_{o2} = 90 / 93\text{k} = 0.968\text{ mA}$$

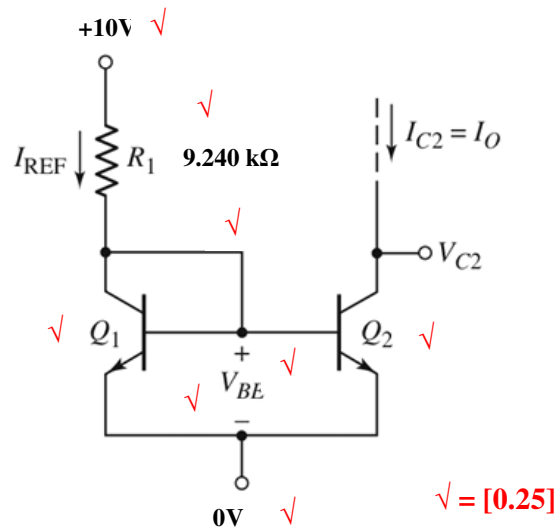
$$[1] \quad [0.5] \quad [0.5]$$

$$I_{REF} = I_O (1 + 2/\beta) = (0.968\text{m})(1 + 2/50) = 1.006\text{ mA}$$

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

$$R_1 = (V^+ - V_{BE} - V^-) / I_{REF} = (10 - 0.7 - 0) / 1.006\text{m} = 9.240\text{ k}\Omega$$

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



EEEB273 - Quiz 1 [Question Set 3]  
SEMESTER 1, ACADEMIC YEAR 2010/2011  
Date: 15 July 2010

**Question:**

Design a two-transistor current source given the following parameters:

The circuit parameters are:  $V^+ = 10\text{ V}$  and  $V^- = 0\text{ V}$ .

The transistor parameters are:  $\beta = 80$ ,  $V_{BE}(\text{on}) = 0.7\text{ V}$ ,  $V_A = 100\text{ V}$ , and  $r_{o2} = 93\text{ k}\Omega$ .

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

**Answer:**

$$r_{o2} = V_A / I_O$$

$$I_O = V_A / r_{o2} = 100 / 93\text{k} = 1.075\text{ mA}$$

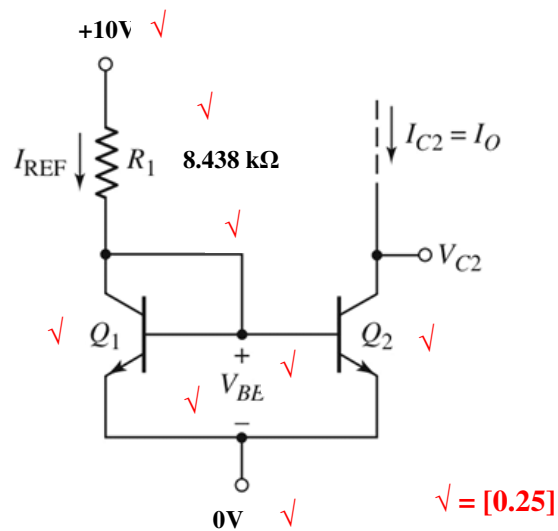
$$[1] \quad [0.5] \quad [0.5]$$

$$I_{REF} = I_O (1 + 2/\beta) = (1.075\text{m})(1 + 2/80) = 1.102\text{ mA}$$

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

$$R_1 = (V^+ - V_{BE} - V^-) / I_{REF} = (10 - 0.7 - 0) / 1.102\text{m} = 8.438\text{ k}\Omega$$

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



EEEB273 - Quiz 1 [Question Set 4]  
SEMESTER 1, ACADEMIC YEAR 2010/2011  
Date: 15 July 2010

**Question:**

Design a two-transistor current source given the following parameters:

The circuit parameters are:  $V^+ = 5\text{ V}$  and  $V^- = -5\text{ V}$ .

The transistor parameters are:  $\beta = 100$ ,  $V_{BE}(\text{on}) = 0.7\text{ V}$ ,  $V_A = 80\text{ V}$ , and  $r_{o2} = 83\text{ k}\Omega$ .

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

**Answer:**

$$r_{o2} = V_A / I_O$$

$$I_O = V_A / r_{o2} = 80 / 83\text{k} = 0.964\text{ mA}$$

$$I_{REF} = I_O (1 + 2/\beta) = (0.964\text{m})(1 + 2/100) = 0.983\text{ mA}$$

$$R_1 = (V^+ - V_{BE} - V^-) / I_{REF} = (5 - 0.7 - (-5)) / 0.983\text{m} = 9.460\text{ k}\Omega$$

