

EEEE273 - Quiz 1 [Question Set 1]
 SEMESTER 1, ACADEMIC YEAR 2011/2012
 Date: 23 May 2011

Question:

Refer to **Figure 1**. All transistors are matched.

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

The transistor parameters are: $\beta = 100$, $V_{BE}(\text{on}) = 0.6 \text{ V}$, and $V_A = 150 \text{ V}$.

Given $I_{B2} = 8 \mu\text{A}$.

- (a) Design a two-transistor current source using all the parameters given above. [8 marks]
 (b) Find the output resistance (R_O) of the two-transistor current source. [2 marks]

Show clearly all calculations as marks are given according to this.

Answer:

$I_O = I_{C2}$	$= \beta I_{B2}$	[1]
	$= (100)(8\mu)$	[1]
	$= 0.8 \text{ mA}$	[0.5]
I_{REF}	$= I_O (1 + 2/\beta)$	[1]
	$= (0.8\text{m})(1 + 2/100)$	[1]
	$= 0.816 \text{ mA}$	[0.5]
R_I	$= (V^+ - V_{BE} - V^-) / I_{REF}$	[1.5]
	$= (7.5 - 0.6 - (-7.5)) / (0.816\text{m})$	[1]
	$= 17.647 \text{ k}\Omega$	[0.5]
R_O	$= V_A / I_O$	[1]
	$= (150) / (0.8\text{m})$	[0.5]
	$= 187.5 \text{ k}\Omega$	[0.5]

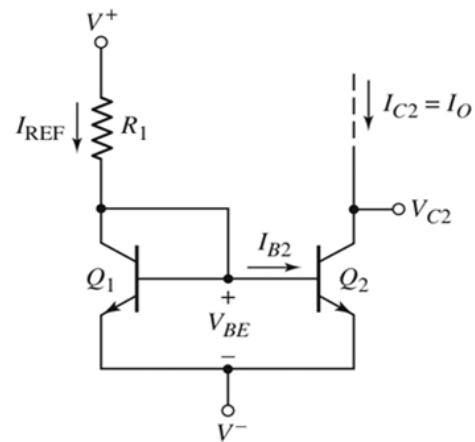


Figure 1

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Refer to **Figure 1**. All transistors are matched.

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

The transistor parameters are: $\beta = 120$, $V_{BE}(\text{on}) = 0.6\text{ V}$, and $V_A = 100\text{ V}$.

Given $I_{B2} = 8\text{ }\mu\text{A}$.

(c) Design a two-transistor current source using all the parameters given above. [8 marks]

(d) Find the output resistance (R_O) of the two-transistor current source. [2 marks]

Show clearly all calculations as marks are given according to this.

Answer:

$I_O = I_{C2}$	$= \beta I_{B2}$	[1]
	$= (120)(8\mu)$	[1]
	$= 0.96\text{ mA}$	[0.5]
I_{REF}	$= I_O (1 + 2/\beta)$	[1]
	$= (0.96\text{m})(1 + 2/120)$	[1]
	$= 0.976\text{ mA}$	[0.5]
R_I	$= (V^+ - V_{BE} - V^-) / I_{REF}$	[1.5]
	$= (10 - 0.6 - (-10)) / (0.976\text{m})$	[1]
	$= 19.877\text{ k}\Omega$	[0.5]
R_O	$= V_A / I_O$	[1]
	$= (100) / (0.96\text{m})$	[0.5]
	$= 104.167\text{ k}\Omega$	[0.5]

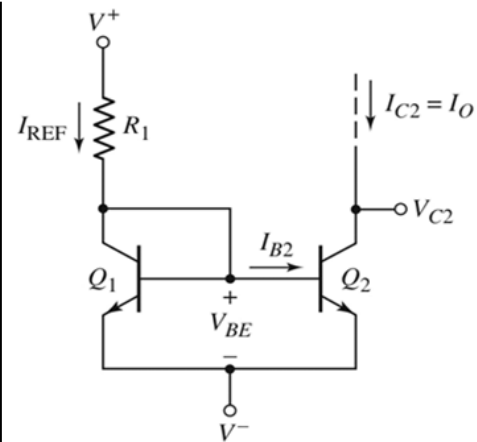


Figure 1

EEEB273 - Quiz 1 [Question Set 2]
 SEMESTER 1, ACADEMIC YEAR 2011/2012
 Date: 23 May 2011

Question:

Refer to **Figure 1**. All transistors are matched.

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

The transistor parameters are: $\beta = 100$, $V_{BE}(\text{on}) = 0.6 \text{ V}$, and $V_A = 120 \text{ V}$.

Given $I_{B2} = 10 \mu\text{A}$.

(e) Design a two-transistor current source using all the parameters given above. [8 marks]

(f) Find the output resistance (R_O) of the two-transistor current source. [2 marks]

Show clearly all calculations as marks are given according to this.

Answer:

$I_O = I_{C2}$	$= \beta I_{B2}$	[1]
	$= (100)(10\mu)$	[1]
	$= 1.0 \text{ mA}$	[0.5]
I_{REF}	$= I_O (1 + 2/\beta)$	[1]
	$= (1.0\text{m})(1 + 2/100)$	[1]
	$= 1.02 \text{ mA}$	[0.5]
R_I	$= (V^+ - V_{BE} - V^-) / I_{REF}$	[1.5]
	$= (7.5 - 0.6 - (-7.5)) / (1.02\text{m})$	[1]
	$= 14.118 \text{ k}\Omega$	[0.5]
R_O	$= V_A / I_O$	[1]
	$= (120) / (1.0\text{m})$	[0.5]
	$= 120.0 \text{ k}\Omega$	[0.5]

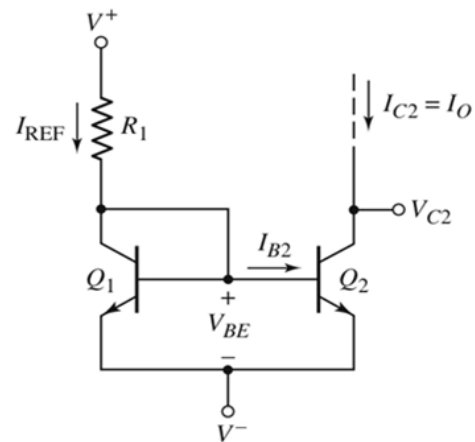


Figure 1