Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	
Lecturer:	Dr. Jamaludin Bin Omar

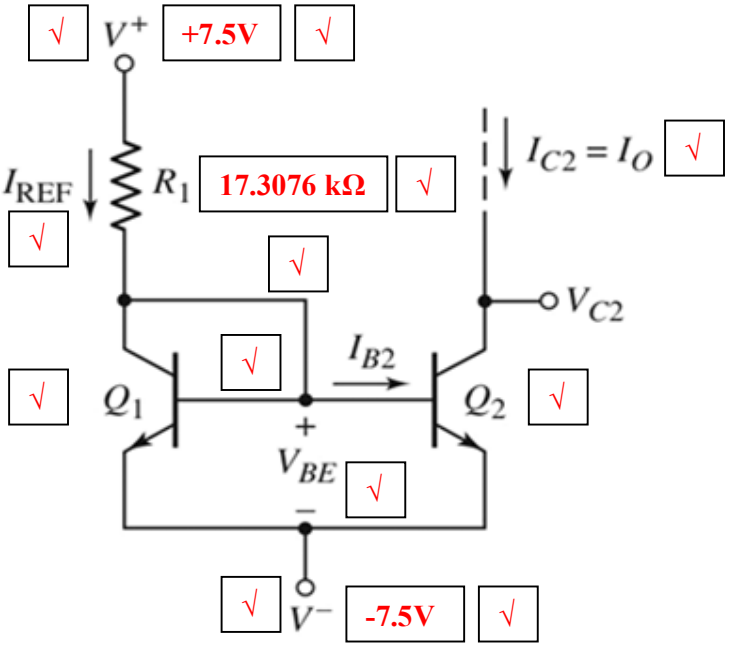
EEEB273 - Quiz 1
SEMESTER 2, ACADEMIC YEAR 2015/2016
Date: 2 Nov 2015 Time: 15 minutes .

Question:

DESIGN a two-transistor BJT current source using **NPN** transistors so that **its output current (I_O)** is **0.8 mA**. All transistors are matched. The transistor parameters are V_{BE} **(on) = 0.6 V**, $V_A = \infty$, and $\beta = 50$. The circuit parameters are $V^+ = 7.5$ **V** and $V^- = -7.5$ **V**. [7 marks]
Draw the circuit diagram of your design. [3 marks]
Show clearly all calculations as marks are given according to this.

Answer:

I_{REF}	$= I_O\,(1 + 2/\beta)$	[2]
	$= (0.8\text{m})(1 + 2/50)$	[1]
	$= 0.832$ mA	[0.5]
R_1	$= (V^+ - V_{BE} - V^-) / I_{REF}$	[2]
	$= (7.5 - 0.6 - (-7.5)) / (0.832\text{m})$	[1]
	$= 17.3076$ kΩ	[0.5]



√ = 0.25 marks

$$i_C = I_S e^{v_{BE}/V_T}\ ;\text{npn}$$

$$i_C = I_S e^{v_{EB}/V_T}\ ;\text{pnp}$$

$$i_C = \alpha i_E = \beta i_B$$

$$i_E = i_B + i_C$$

$$\alpha = \frac{\beta}{\beta + 1}$$

;Small signal

$$\beta = g_m r_\pi$$

$$r_\pi = \frac{\beta V_T}{I_{CQ}}$$

$$g_m = \frac{I_{CQ}}{V_T}$$

$$r_o = \frac{V_A}{I_{CQ}}$$

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Date: 2 Nov 2015 Time: 15 minutes

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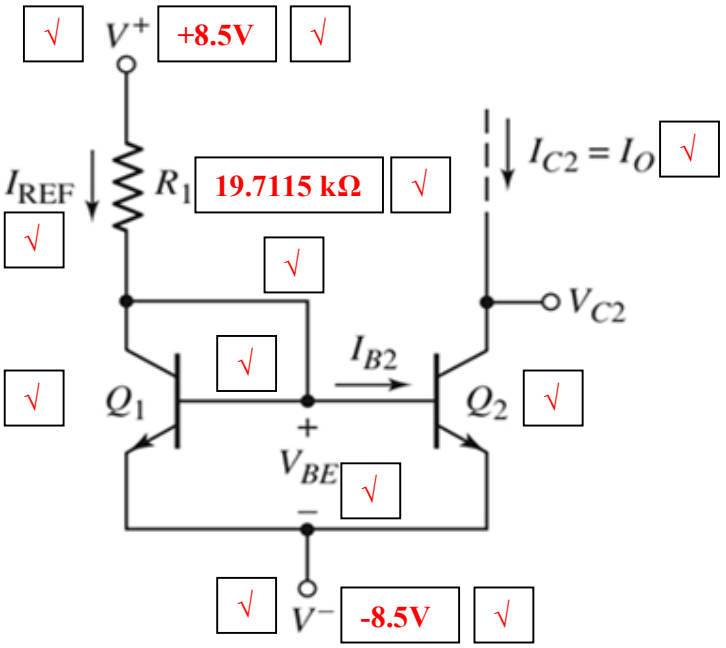
Question:

DESIGN a two-transistor BJT current source using NPN transistors so that **its output current (I_O)** is **0.8 mA**. All transistors are matched. The transistor parameters are V_{BE} **(on) = 0.6 V**, $V_A = \infty$, and $\beta = 50$. The circuit parameters are $V^+ = 8.5$ **V** and $V^- = -8.5$ **V**. [7 marks]
Draw the circuit diagram of your design. [3 marks]
Show clearly all calculations as marks are given according to this.

Answer:

I_{REF}	$= I_O (1 + 2/\beta)$	[2]
	$= (0.8m)(1 + 2/50)$	[1]
	$= 0.832$ mA	[0.5]
R_1	$= (V^+ - V_{BE} - V^-) / I_{REF}$	[2]
	$= (8.5 - 0.6 - (-8.5)) / (0.832m)$	[1]
	$= 19.7115$ kΩ	[0.5]



√ = 0.25 marks

$$i_C = I_S e^{v_{BE}/V_T}\ ;\text{npn}$$

$$i_C = I_S e^{v_{EB}/V_T}\ ;\text{pnp}$$

$$i_C = \alpha i_E = \beta i_B$$

$$i_E = i_B + i_C$$

$$\alpha = \frac{\beta}{\beta + 1}$$

;Small signal

$$\beta = g_m r_\pi$$

$$r_\pi = \frac{\beta V_T}{I_{CQ}}$$

$$g_m = \frac{I_{CQ}}{V_T}$$

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EEEB273 - Quiz 1
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Date: 2 Nov 2015 Time: 15 minutes ..

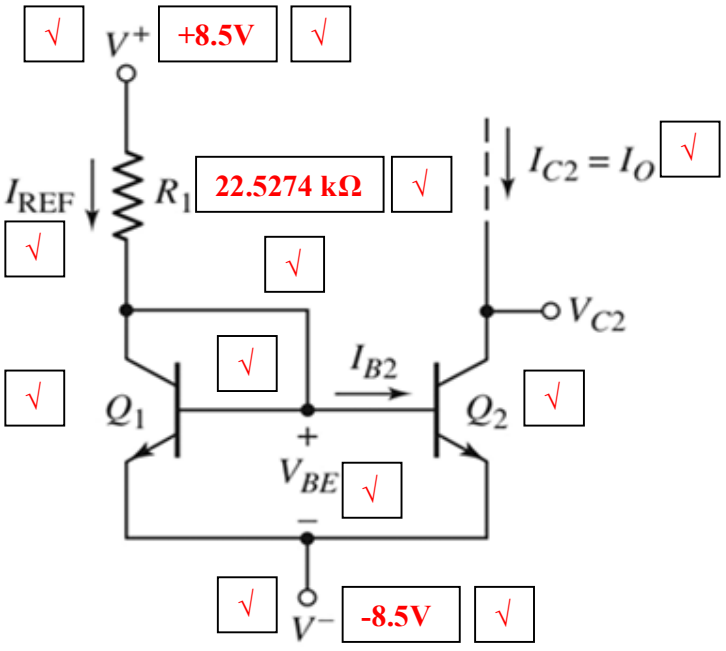
Question:

DESIGN a two-transistor BJT current source using NPN transistors so that **its output current (I_O)** is **0.7 mA**. All transistors are matched. The transistor parameters are V_{BE} **(on) = 0.6 V**, $V_A = \infty$, and $\beta = 50$. The circuit parameters are $V^+ = 8.5$ **V** and $V^- = -8.5$ **V**. [7 marks]
Draw the circuit diagram of your design. [3 marks]
Show clearly all calculations as marks are given according to this.

Answer:

I_{REF} $= I_O\,(1 + 2/\beta)$ **[2]**
$= (0.7\text{m})(1 + 2/50)$ **[1]**
$= 0.728$ **mA** **[0.5]**

R_1 $= (V^+ - V_{BE} - V^-) / I_{REF}$ **[2]**
$= (8.5 - 0.6 - (-8.5)) / (0.728\text{m})$ **[1]**
$= 22.5274$ **kΩ** **[0.5]**



√ = 0.25 marks

$$i_C = I_S e^{v_{BE}/V_T}\ ;\text{npn}$$

$$i_C = I_S e^{v_{EB}/V_T}\ ;\text{pnp}$$

$$i_C = \alpha i_E = \beta i_B$$

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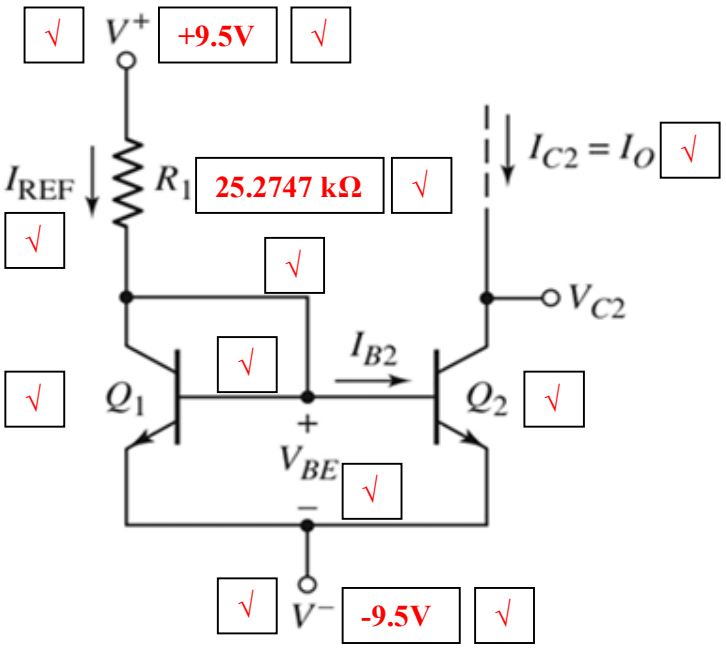
Question:

DESIGN a two-transistor BJT current source using NPN transistors so that **its output current (I_O)** is **0.7 mA**. All transistors are matched. The transistor parameters are V_{BE} **(on) = 0.6 V**, $V_A = \infty$, and $\beta = 50$. The circuit parameters are $V^+ = 9.5$ **V** and $V^- = -9.5$ **V**. [7 marks]
Draw the circuit diagram of your design. [3 marks]
Show clearly all calculations as marks are given according to this.

Answer:

I_{REF} $= I_O\,(1 + 2/\beta)$ **[2]**
$= (0.7\text{m})(1 + 2/50)$ **[1]**
$= 0.728$ **mA** **[0.5]**

R_1 $= (V^+ - V_{BE} - V^-) / I_{REF}$ **[2]**
$= (9.5 - 0.6 - (-9.5)) / (0.728\text{m})$ **[1]**
$= 25.2747$ **kΩ** **[0.5]**



√ = 0.25 marks

$$i_C = I_S e^{v_{BE}/V_T}\text{; npn}$$

$$i_C = I_S e^{v_{EB}/V_T}\text{; pnp}$$

$$i_C = \alpha i_E = \beta i_B$$

$$i_E = i_B + i_C$$

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;Small signal

$$\beta = g_m r_\pi$$

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