Name:	**Dr JBO – Model Answer**
Student ID Number:	
Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 1]
SEMESTER 1, ACADEMIC YEAR 2010/2011
Date: 18 August 2010

Question:

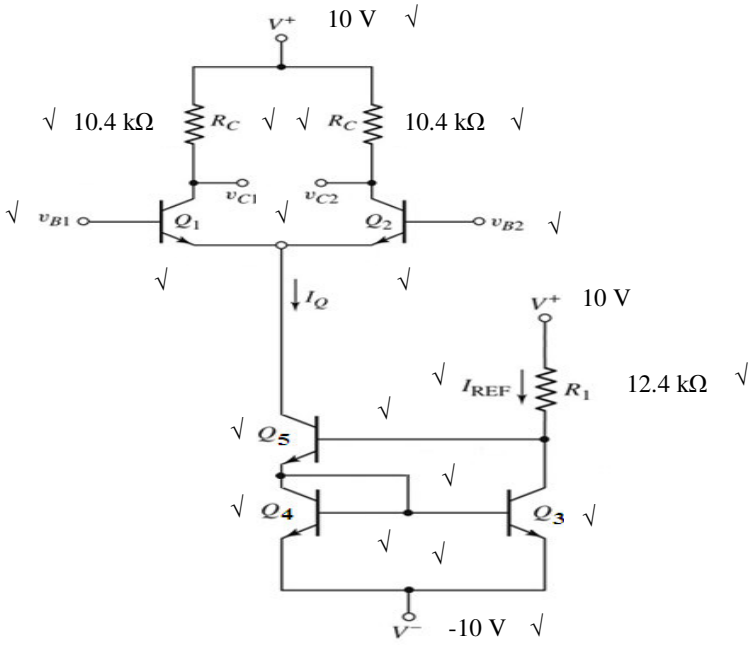
Draw and label clearly a complete circuit for a BJT differential amplifier that is biased with a Wilson current source at a constant current of **1.5 mA**. The BJT differential amplifier has a differential gain for the one-sided output (A_d) of 150. Power supplies for V^+ and V^- are +10 V and -10 V, respectively. Assume $\beta = 100$ and V_{BE} (on) = 0.7 V for all BJT in the circuit. [10 marks]

Hints: You are required to ***determine*** *the value for* R_1 *in the Wilson current source, and the value for* R_C *in the BJT differential amplifier.* [5 marks]

Answer:

$I_{REF} = (V^+ - V_{BE3} - V_{BE5} - V^-) / (R_1) \approx I_Q$ [1 mark]
$R_1 = (V^+ - V_{BE3} - V_{BE5} - V^-) / (I_Q)$ [1 mark]
$= (10\text{-}0.7\text{-}0.7\text{-}(-10)) / (1.5\text{m}) = 12.4\ \text{k}\Omega$ [1/2 mark]

$A_d = (g_m R_C)/2$
$R_C = (2 A_d)/ g_m$ [1 mark]
$g_m = I_Q / (2V_T) = (1.5\text{m})/(2\text{x}26\text{m}) = 28.846\ \text{mA/V}$ [1 mark]
$R_C = (2\text{x}150)/(28.846\text{m}) = 10.4\ \text{k}\Omega$ [1/2 mark]



√ = ½ mark

Name:	**Dr JBO – Model Answer**
Student ID Number:	
Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 2]
SEMESTER 1, ACADEMIC YEAR 2010/2011
Date: 18 August 2010

Question:

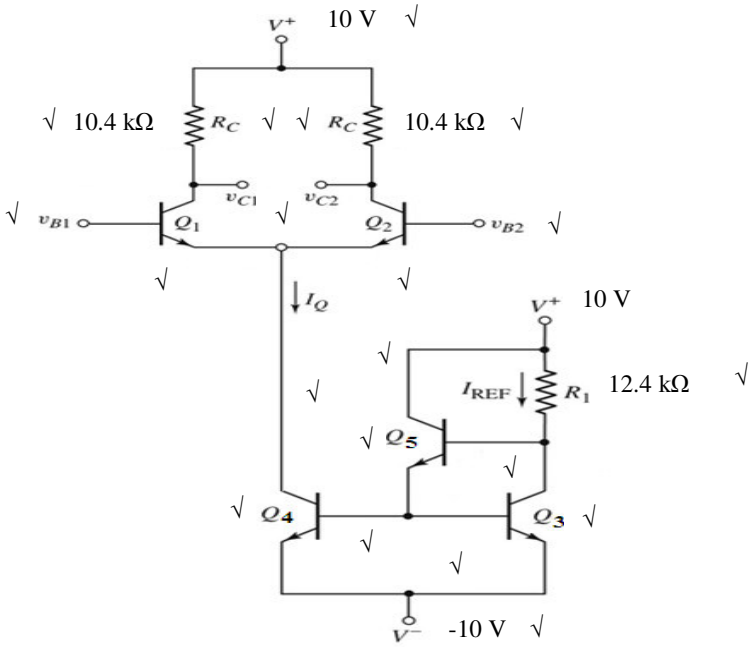
Draw and label clearly a complete circuit for a BJT differential amplifier that is biased with a basic 3-transistor current source at a constant current of **1.5 mA**. The BJT differential amplifier has a differential gain for the one-sided output (A_d) of 150. Power supplies for V^+ and V^- are +10 V and -10 V, respectively. Assume $\beta = 100$ and V_{BE} (on) = 0.7 V for all BJT in the circuit. [10 marks]

*Hints: You are required to **determine** the value for R_1 in the basic 3-transistor current source, and the value for R_C in the BJT differential amplifier.* [5 marks]

Answer:

$I_{REF} = (V^+ - V_{BE3} - V_{BE5} - V^-) / (R_1) \approx I_Q$ [1 mark]
$R_1 = (V^+ - V_{BE3} - V_{BE5} - V^-) / (I_Q)$ [1 mark]
$= (10\text{-}0.7\text{-}0.7\text{-}(-10)) / (1.5\text{m}) = 12.4\ \text{k}\Omega$ [1/2 mark]

$A_d = (g_m R_C)/2$
$R_C = (2 A_d)/ g_m$ [1 mark]
$g_m = I_Q / (2V_T) = (1.5\text{m})/(2\text{x}26\text{m}) = 28.846\ \text{mA/V}$ [1 mark]
$R_C = (2\text{x}150)/(28.846\text{m}) = 10.4\ \text{k}\Omega$ [1/2 mark]



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Student ID Number:	
Section:	05A / 05B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 1]
SEMESTER 1, ACADEMIC YEAR 2010/2011
Date: 18 August 2010

Question:

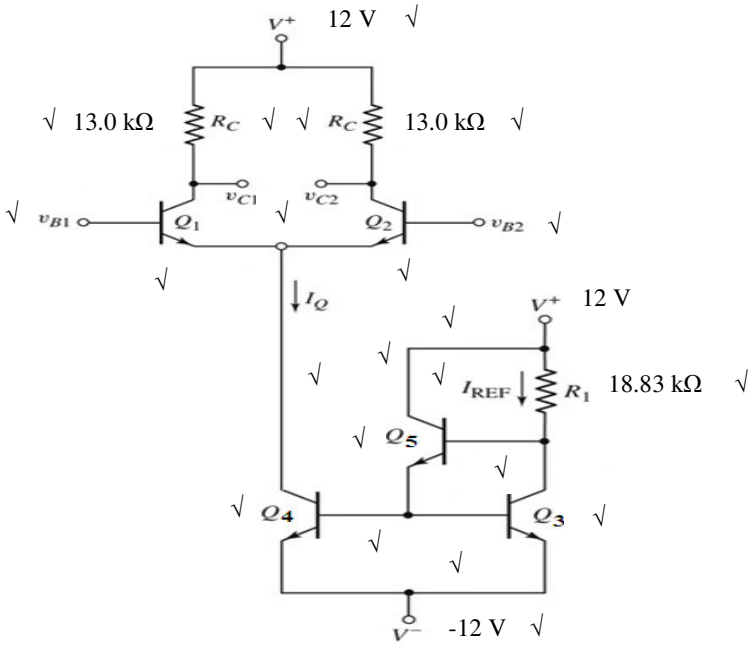
Draw and label clearly a complete circuit for a BJT differential amplifier that is biased with a basic 3-transistor current source at a constant current of **1.2 mA**. The BJT differential amplifier has a differential gain for the one-sided output (A_d) of 150. Power supplies for V^+ and V^- are +12 V and -12 V, respectively. Assume $\beta = 100$ and V_{BE} (on) = 0.7 V for all BJT in the circuit. [10 marks]

*Hints: You are required to **determine** the value for R_1 in the basic 3-transistor current source, and the value for R_C in the BJT differential amplifier.* [5 marks]

Answer:

$I_{REF} = (V^+ - V_{BE3} - V_{BE5} - V^-) / (R_1) \approx I_Q$ [1 mark]
$R_1 = (V^+ - V_{BE3} - V_{BE5} - V^-) / (I_Q)$ [1 mark]
$= (12\text{-}0.7\text{-}0.7\text{-}(-12)) / (1.2\text{m}) = 18.83\ \text{k}\Omega$ [1/2 mark]

$A_d = (g_m R_C)/2$
$R_C = (2 A_d)/ g_m$ [1 mark]
$g_m = I_Q / (2V_T) = (1.2\text{m})/(2\text{x}26\text{m}) = 23.077\ \text{mA/V}$ [1 mark]
$R_C = (2\text{x}150)/(23.077\text{m}) = 13.0\ \text{k}\Omega$ [1/2 mark]



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Name:	**Dr JBO – Model Answer**
Student ID Number:	
Section:	05A / 05B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 2]
SEMESTER 1, ACADEMIC YEAR 2010/2011
Date: 18 August 2010

Question:

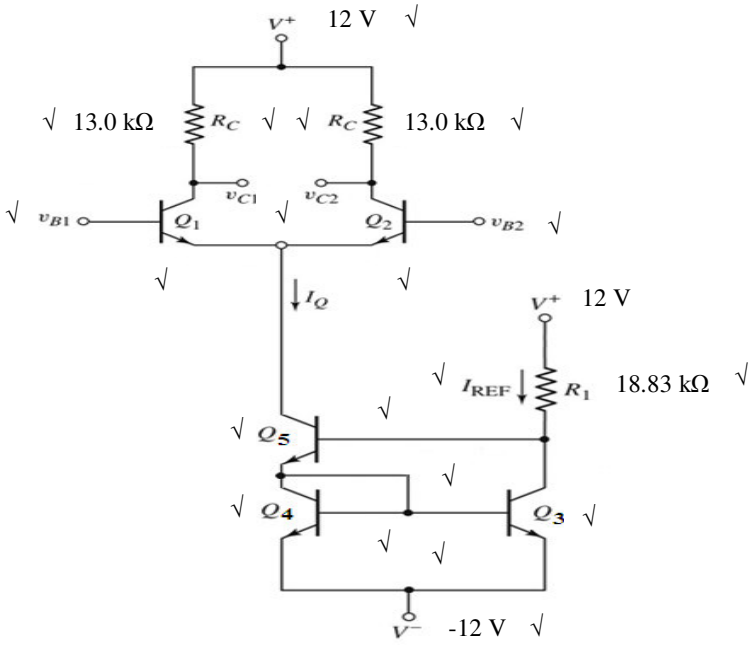
Draw and label clearly a complete circuit for a BJT differential amplifier that is biased with a Wilson current source at a constant current of **1.2 mA**. The BJT differential amplifier has a differential gain for the one-sided output (A_d) of 150. Power supplies for V^+ and V^- are +12 V and -12 V, respectively. Assume $\beta = 100$ and V_{BE} (on) = 0.7 V for all BJT in the circuit. [10 marks]

Hints: You are required to ***determine*** *the value for* R_1 *in the Wilson current source, and the value for* R_C *in the BJT differential amplifier.* [5 marks]

Answer:

$I_{REF} = (V^+ - V_{BE3} - V_{BE5} - V^-) / (R_1) \approx I_Q$ [1 mark]
$R_1 = (V^+ - V_{BE3} - V_{BE5} - V^-) / (I_Q)$ [1 mark]
$= (12\text{-}0.7\text{-}0.7\text{-}(-12)) / (1.2\text{m}) = 18.83\ \text{k}\Omega$ [1/2 mark]

$A_d = (g_m R_C)/2$
$R_C = (2 A_d)/ g_m$ [1 mark]
$g_m = I_Q / (2V_T) = (1.2\text{m})/(2\text{x}26\text{m}) = 23.077\ \text{mA/V}$ [1 mark]
$R_C = (2\text{x}150)/(23.077\text{m}) = 13.0\ \text{k}\Omega$ [1/2 mark]



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