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

EEEB273 - Quiz 4 [Question Set 1]
SEMESTER 1, ACADEMIC YEAR 2011/2012
Date: 3 July 2011

Question:

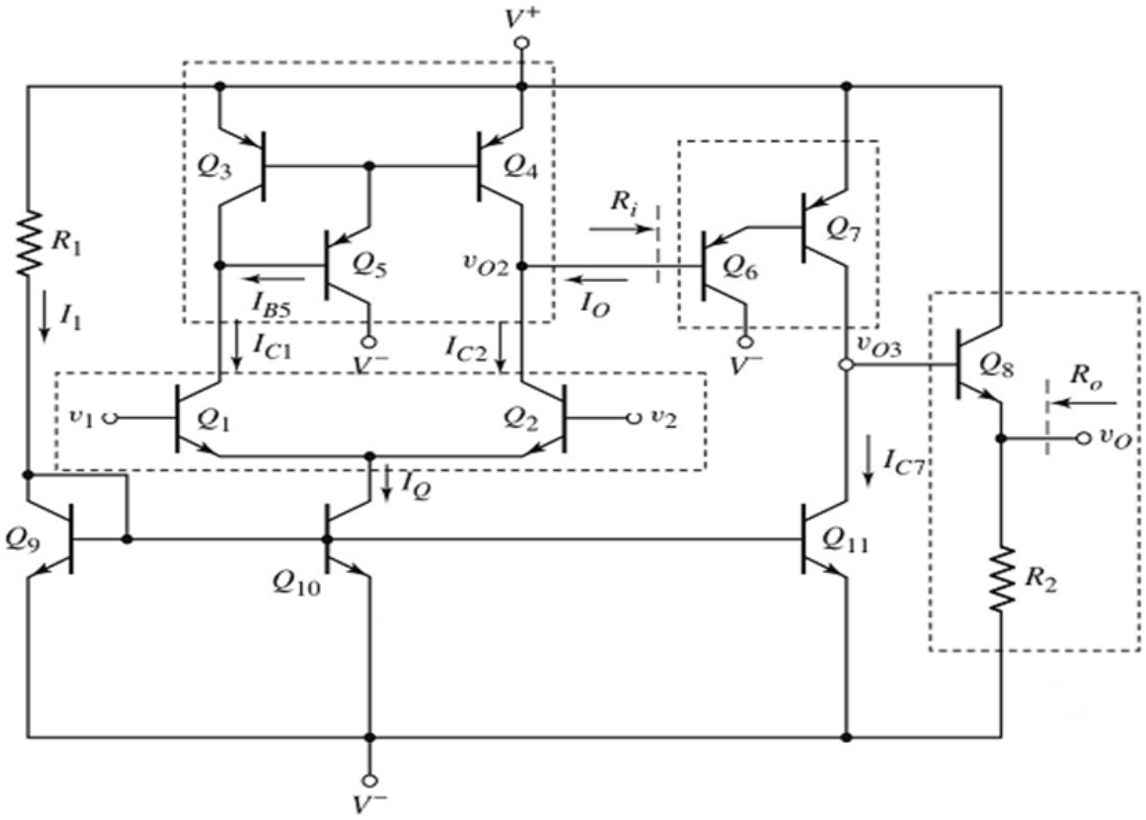

Figure 1

Consider the circuit shown in **Figure 1**, with parameters $I_{C7} = I_Q = 0.18$ **mA**, $I_{C8} = 1$ **mA,** and $R_2 = 10$ **kΩ**. Study the figure carefully. *Note that biasing for amplifiers in the circuit is provided by* ***two-transistor current mirrors***. Assume that $\beta = 100$ for all transistors, and the **Early voltage** for Q_{11} is **100 V**.

Calculate the input resistance and the small-signal voltage gain of the Darlington pair.

[10 marks]

Answer:

$$R_i = \frac{2(1+\beta)\beta V_T}{I_Q}$$ **[0.5]**

$$R_i = \frac{2(1+100)(100)(26m)}{0.18m} = 2917.78k\Omega = 2.917M\Omega$$ **[1.5]**

$$A_v = \left(\frac{I_Q}{2V_T}\right)R_{L7}$$ **[0.5]**

$\boldsymbol{R_{L7} = R_{c11} \| R_{b8}}$ **[0.5]**

$\boldsymbol{R_{c11} = r_{o11} = V_{A11} / I_Q}$ **= 100/0.18m = 555.56 kΩ** **[2]**

$\boldsymbol{R_{b8} = r_{\pi 8} + (1+\beta)R_2}$ **[0.5]**

$\boldsymbol{r_{\pi 8} = \beta V_T / I_{C8}}$ **= (100)(26m)/(1m) = 2.6 kΩ** **[1]**

$\boldsymbol{R_{b8} = r_{\pi 8} + (1+\beta)R_2}$ **= 2.6k + (1+100)(10k) = 1012.6 kΩ** **[1]**

$\boldsymbol{R_{L7}}$ **= (555.56k || 1012.6k) = 358.74 kΩ** **[1.5]**

$\boldsymbol{A_v}$ **= (0.18m x 358.74k)/(2 x 26m) = 1241.8** **[1]**

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Question:

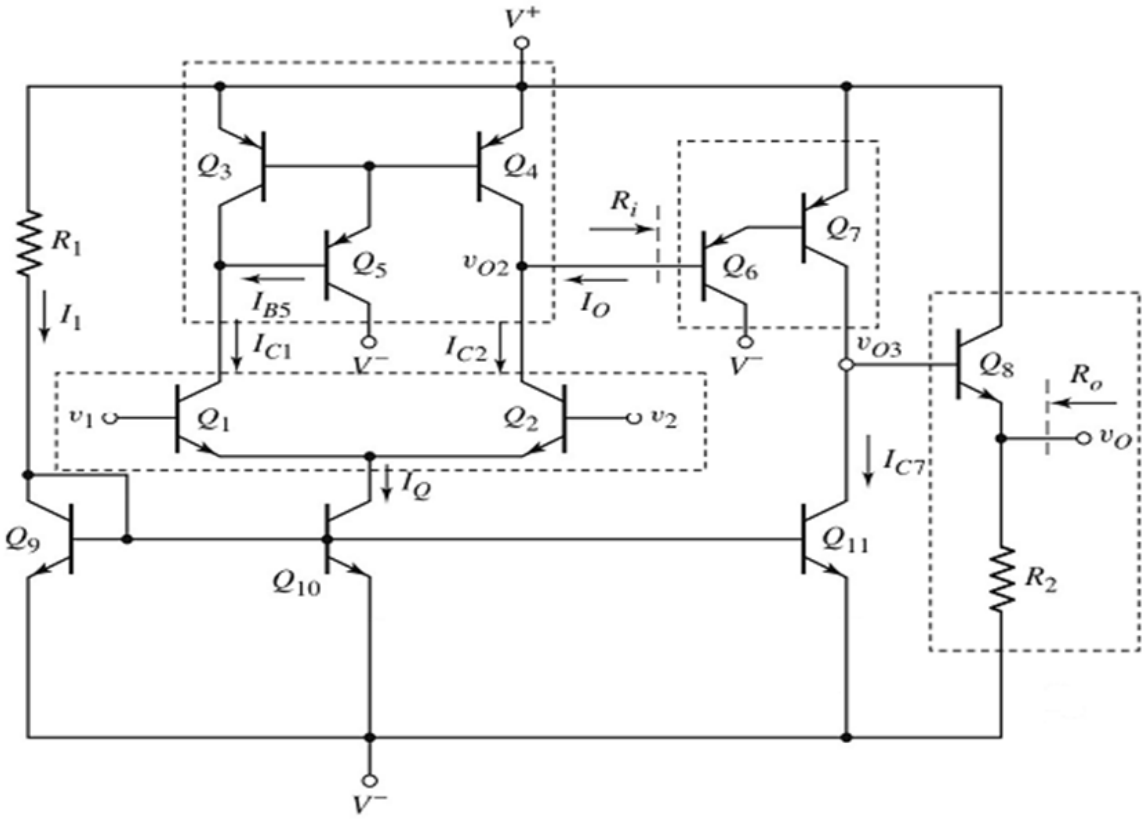

Figure 1

Consider the circuit shown in **Figure 1**, with parameters $I_{C7} = I_Q = 0.21$ **mA**, $I_{C8} = 1$ **mA,** and $R_2 = 12$ **kΩ**. Study the figure carefully. *Note that biasing for amplifiers in the circuit is provided by* ***two-transistor current mirrors***. Assume that $\beta = 120$ for all transistors, and the **Early voltage** for Q_{11} is **100 V**.

Calculate the input resistance and the small-signal voltage gain of the Darlington pair.

[10 marks]

Answer:

$$R_i = \frac{2(1+\beta)\beta V_T}{I_Q}$$ **[0.5]**

$$R_i = \frac{2(1+120)(120)(26m)}{0.21m} = 3595.428k\Omega = 3.595M\Omega$$ **[1.5]**

$$A_v = \left(\frac{I_Q}{2V_T}\right)R_{L7}$$ **[0.5]**

$R_{L7} = R_{c11} \| R_{b8}$ **[0.5]**

$R_{c11} = r_{o11} = V_{A11} / I_Q$ = 100/0.21m = 476.19 kΩ **[2]**

$R_{b8} = r_{\pi 8} + (1+\beta)R_2$ **[0.5]**

$r_{\pi 8} = \beta V_T / I_{C8}$ = (120)(26m)/(1m) = 3.12 kΩ **[1]**

$R_{b8} = r_{\pi 8} + (1+\beta)R_2$ = 3.12k + (1+120)(12k) = 1455.12 kΩ **[1]**

R_{L7} = (476.19k || 1455.12k) = 358.78 kΩ **[1.5]**

A_v = (0.21m x 358.78k)/(2 x 26m) = 1448.9 **[1]**

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EEEB273 - Quiz 4 [Question Set 2]
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Date: 3 July 2011

Question:

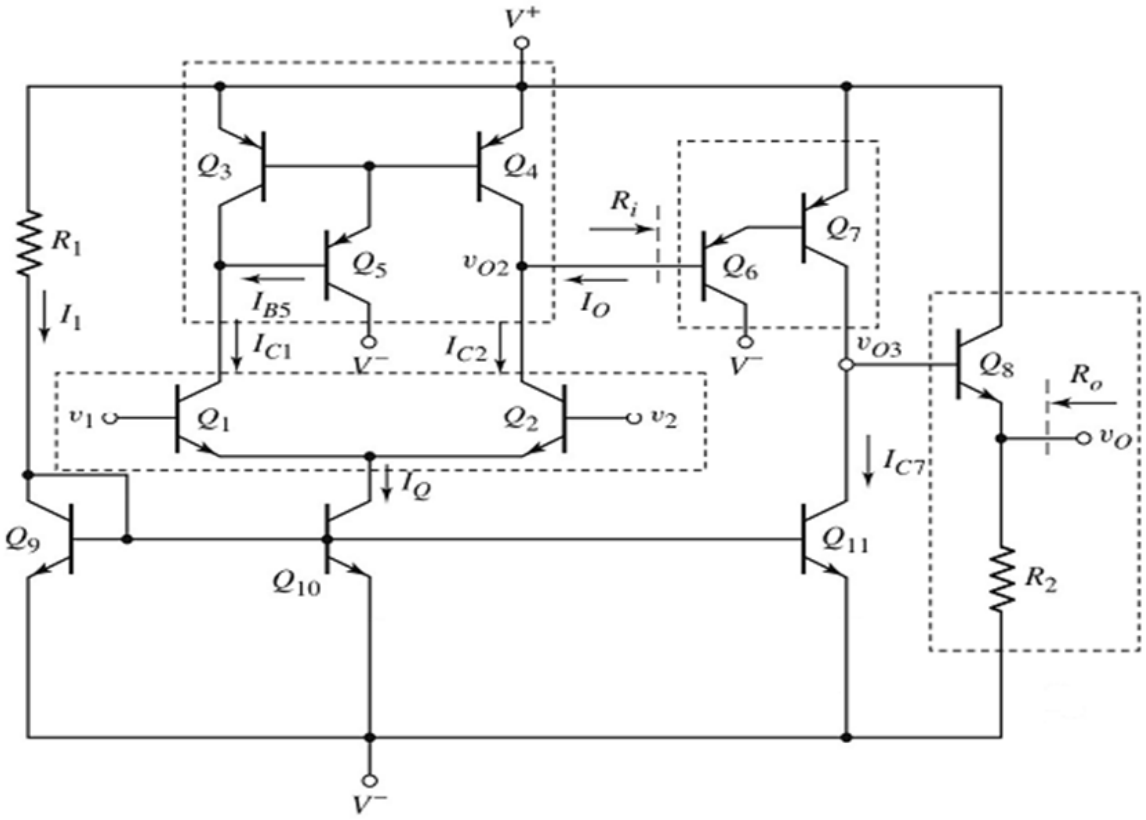

Figure 1

Consider the circuit shown in **Figure 1**, with parameters $I_{C7} = I_Q = 0.19$ **mA**, $I_{C8} = 1$ **mA,** and $R_2 = 12$ **kΩ**. Study the figure carefully. *Note that biasing for amplifiers in the circuit is provided by* ***two-transistor current mirrors***. Assume that $\beta = 100$ for all transistors, and the **Early voltage** for Q_{11} is **100 V**.

Calculate the input resistance and the small-signal voltage gain of the Darlington pair.

[10 marks]

Answer:

$$R_i = \frac{2(1+\beta)\beta V_T}{I_Q}$$ **[0.5]**

$$R_i = \frac{2(1+100)(100)(26m)}{0.19m} = 2764.21k\Omega = 2.764M\Omega$$ **[1.5]**

$$A_v = \left(\frac{I_Q}{2V_T}\right)R_{L7}$$ **[0.5]**

$\boldsymbol{R_{L7} = R_{c11} \| R_{b8}}$ **[0.5]**

$\boldsymbol{R_{c11} = r_{o11} = V_{A11} / I_Q}$ **= 100/0.19m = 526.32 kΩ** **[2]**

$\boldsymbol{R_{b8} = r_{\pi 8} + (1+\beta)R_2}$ **[0.5]**

$\boldsymbol{r_{\pi 8} = \beta V_T / I_{C8}}$ **= (100)(26m)/(1m) = 2.6 kΩ** **[1]**

$\boldsymbol{R_{b8} = r_{\pi 8} + (1+\beta)R_2}$ **= 2.6k + (1+100)(12k) = 1214.6 kΩ** **[1]**

$\boldsymbol{R_{L7}}$ **= (526.32k || 1214.6k) = 367.20 kΩ** **[1.5]**

$\boldsymbol{A_v}$ **= (0.19m x 367.20k)/(2 x 26m) = 1341.7** **[1]**