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

EEEB273 - Quiz 4 [Question Set 1]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 28 March 2012

Question:

Referring to **Figure 1**, let $\boldsymbol{R_L = 1\ k\Omega}$, $\boldsymbol{V_{BB} = 1.40\ V}$, $\boldsymbol{V_{CC} = 6\ V}$ and the reverse saturation current for the transistors, $\boldsymbol{I_S = 2 \times 10^{-15}\ A}$. **Assume** $\boldsymbol{\beta >> 1}$.

For the case of the output voltage $\boldsymbol{v_O = -3\ V}$, **determine** $\boldsymbol{i_L}$, $\boldsymbol{i_{Cp}}$, and $\boldsymbol{i_{Cn}}$. [10 marks]

Answer:

$v_O = i_L R_L = -3V$ [1]
$i_L = v_O / R_L$ [1]
$= (-3V)/(1k\Omega) = -3\ mA$ [1]

Therefore, Q_p is conducting and Q_n is OFF.
$i_L \approx i_{Cp} = I_S \exp(V_{EBP}/V_T)$ [1]
$V_{EBP} = V_T \ln(i_{Cp}/I_S)$ [0.5]
$= 26m \ln(3m / 2x10^{-15})$
$= 0.7289\ V$ [0.5]

$V_{BEN} = V_{BB} - V_{EBP}$ [1]
$= 1.4 - 0.7289 = 0.6711\ V$ [0.5]
$i_{Cn} = I_S \exp(V_{BEN}/V_T)$ [1]
$= 2x10^{-15} \exp(0.6711/26m)$
$= 324.22\ \mu A$ [0.5]

$i_{Cn} = i_{Cp} + i_L$
Actual value of $i_{Cp} = i_{Cn} - i_L$ [1]
$i_{Cp} = 324.22\mu - (-3m)$
$= 3.324\ mA$ [1]

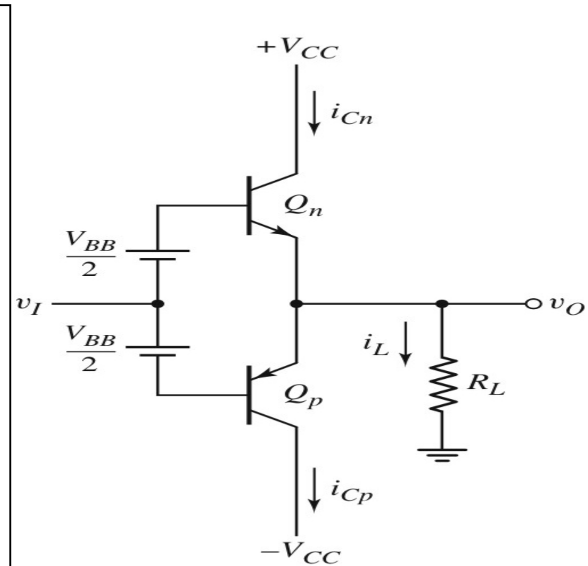

Figure 1

Name:	**Dr JBO**
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Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 4 [Question Set 2]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 28 March 2012

Question:

Referring to **Figure 1**, let R_L **= 1.2 kΩ,** V_{BB} **= 1.50 V,** V_{CC} **= 6 V** and the reverse saturation current for the transistors, $I_S = 2 \times 10^{-15}$ **A. Assume** $\beta >> 1$.

For the case of the output voltage $v_O = -3$ **V, determine** i_L, i_{Cp}, and i_{Cn}. [10 marks]

Answer:

$v_O = i_L R_L = -3\text{V}$ [1]
$i_L = v_O / R_L$ [1]
$= (-3\text{V})/(1.2\text{k}\Omega) = -2.5 \text{ mA}$ [1]

Therefore, Q_p is conducting and Q_n is OFF.
$i_L \approx i_{Cp} = I_S \exp(V_{EBP}/V_T)$ [1]
$V_{EBP} = V_T \ln(i_{Cp}/I_S)$ [0.5]
$= 26\text{m} \ln(2.5\text{m}/2\times10^{-15})$
$= 0.7242 \text{ V}$ [0.5]

$V_{BEN} = V_{BB} - V_{EBP}$ [1]
$= 1.5 - 0.7242 = 0.7758 \text{ V}$ [0.5]
$i_{Cn} = I_S \exp(V_{BEN}/V_T)$ [1]
$= 2\times10^{-15} \exp(0.7758/26\text{m})$
$= 18.184 \text{ mA}$ [0.5]

$i_{Cn} = i_{Cp} + i_L$
Actual value of $i_{Cp} = i_{Cn} - i_L$ [1]
$i_{Cp} = 18.184\text{m} - (-2.5\text{m})$
$= 20.684 \text{ mA}$ [1]

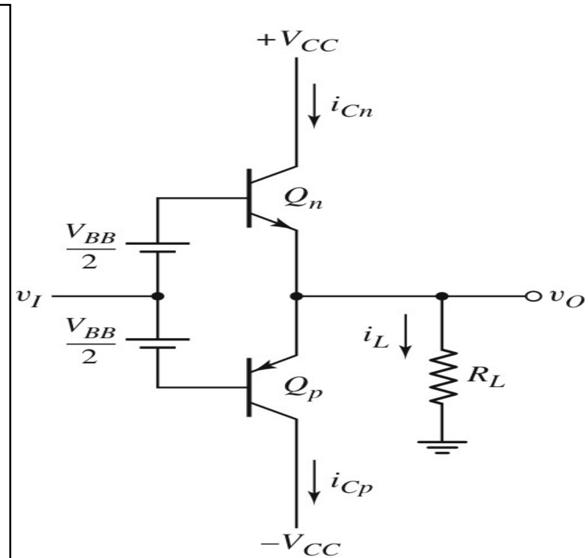

Figure 1

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

EEEB273 - Quiz 4 [Question Set 3]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 28 March 2012

Question:

Referring to **Figure 1**, let $R_L = 1\ \mathrm{k\Omega}$, $V_{BB} = 1.50$ V, $V_{CC} = 8$ V and the reverse saturation current for the transistors, $I_S = 2 \times 10^{-15}$ A. **Assume** $\beta \gg 1$.

For the case of the output voltage $v_O = -4$ V, **determine** i_L, i_{Cp}, and i_{Cn}. [10 marks]

Answer:

$v_O = i_L R_L = -4\text{V}$ [1]
$i_L = v_O / R_L$ [1]
$= (-4\text{V})/(1\text{k}\Omega) = -4\text{ mA}$ [1]

Therefore, Q_p is conducting and Q_n is OFF.
$i_L \approx i_{Cp} = I_S \exp(V_{EBP}/V_T)$ [1]
$V_{EBP} = V_T \ln(i_{Cp}/I_S)$ [0.5]
$= 26\text{m} \ln(4\text{m}/2\text{x}10^{-15})$
$= 0.7364\text{ V}$ [0.5]

$V_{BEN} = V_{BB} - V_{EBP}$ [1]
$= 1.5 - 0.7364 = 0.7636\text{ V}$ [0.5]
$i_{Cn} = I_S \exp(V_{BEN}/V_T)$ [1]
$= 2\text{x}10^{-15} \exp(0.7636/26\text{m})$
$= 11.374\text{ mA}$ [0.5]

$i_{Cn} = i_{Cp} + i_L$
Actual value of $i_{Cp} = i_{Cn} - i_L$ [1]
$i_{Cp} = 11.374\text{m} - (-4\text{m})$
$= 15.374\text{ mA}$ [1]

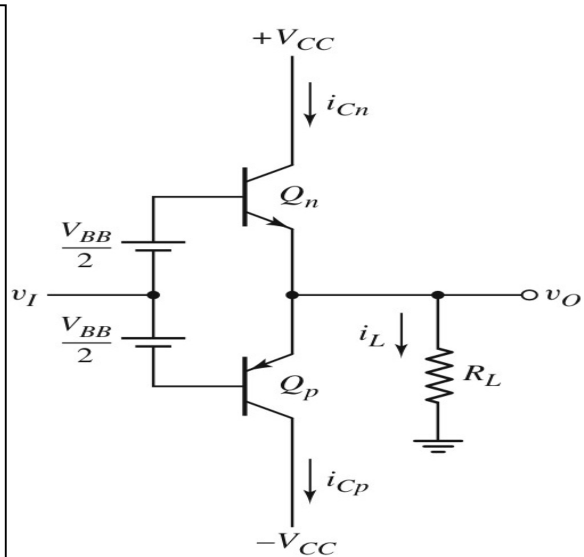

Figure 1

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

EEEB273 - Quiz 4 [Question Set 4]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 28 March 2012

Question:

Referring to **Figure 1**, let R_L **= 1.8 kΩ,** V_{BB} **= 1.40 V,** V_{CC} **= 8 V** and the reverse saturation current for the transistors, $I_S = 2 \times 10^{-15}$ **A. Assume $\beta >> 1$.**

For the case of the output voltage v_O **= -4.8 V, determine** i_L, i_{Cp}, and i_{Cn}. [10 marks]

Answer:

$v_O = i_L R_L = -4.8\text{V}$ [1]
$i_L = v_O / R_L$ [1]
$= (-4.8\text{V})/(1.8\text{k}\Omega) = -2.667\text{ mA}$ [1]

Therefore, Q_p is conducting and Q_n is OFF.
$i_L \approx i_{Cp} = I_S \exp(V_{EBP}/V_T)$ [1]
$V_{EBP} = V_T \ln(i_{Cp}/I_S)$ [0.5]
$= 26\text{m} \ln(2.667\text{m}/2\text{x}10^{-15})$
$= 0.7259\text{ V}$ [0.5]

$V_{BEN} = V_{BB} - V_{EBP}$ [1]
$= 1.4 - 0.7259 = 0.6741\text{ V}$ [0.5]
$i_{Cn} = I_S \exp(V_{BEN}/V_T)$ [1]
$= 2\text{x}10^{-15} \exp(0.6741/26\text{m})$
$= 363.87\ \mu\text{A}$ [0.5]

$i_{Cn} = i_{Cp} + i_L$
Actual value of $i_{Cp} = i_{Cn} - i_L$ [1]
$i_{Cp} = 363.87\mu - (-2.667\text{m})$
$= 3.030\text{ mA}$ [1]

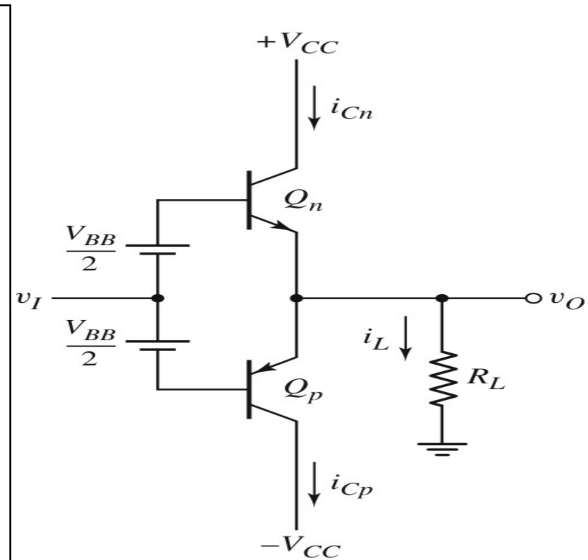

Figure 1