CSE 231 - HW 5

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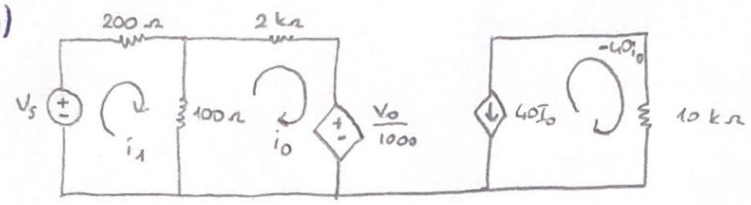
3.68) $V_1 = V_S \cdot \frac{300}{2000+300} \Rightarrow V_1 = \frac{V_S}{5}$

$V_0 = -60V_1 \cdot \frac{400}{200+400} \Rightarrow V_0 = -40V_1$

$V_0 = -40 \left(\frac{V_S}{5}\right) \Rightarrow \frac{V_0}{V_S} = -8$

3.69)



① $-V_S + 200 \cdot i_1 + 100(i_1 - i_0) = 0$

$i_1 = \frac{100 i_0 + V_S}{300}$

② $100(i_0 - i_1) + 2000\, i_0 + \frac{V_0}{1000} = 0$

③ $V_0 = 10000 \cdot -40\, i_0$

$i_0 = \frac{-V_0}{400000}$

put eq 1 and eq 3 in eq 2

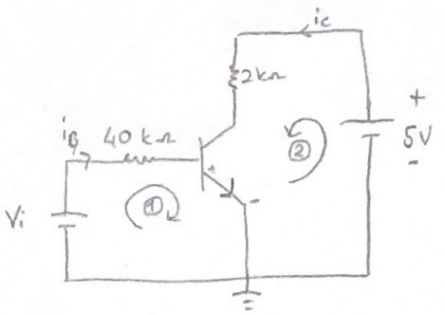
$100 \cdot \left(\frac{-V_0}{400000} - \frac{100 i_0 + V_S}{300}\right) + 2000 \cdot \frac{-V_0}{400000} + \frac{V_0}{1000} = 0$

$\frac{-V_0}{400000}$

Then

$\frac{V_0}{V_S} = -80$

3.70)



$i_C = 75 . i_B$

① $-V_i + i_B . 40000 + 0,7 = 0$

$V_i = 40000\, i_B + 0,7$

② $-5 + 75\, i_B . 2000 + V_{CE} = 0$, $V_{CE} = 2V$

$i_B = \frac{3}{75 . 2000}$

Then,

$V_i = 40000 . \frac{3}{75 . 2000} + 0,7 = 1,5\ V$

3.71)

$i_E = i_B + i_C$, $i_C = 150\, i_B$

$i_E = 151\, i_B$

$i_E = \frac{V_o}{500} = \frac{4}{500} = 8\ mA \Rightarrow i_B = \frac{i_E}{151} = \frac{8}{151}\ mA$

$-V_S + 10 . 10^3 . i_B + V_{BE} + V_o = 0$

$V_S = 10 . 10^3 . \frac{8}{151} . 10^{-3} + 0,7 + 4 = 0$

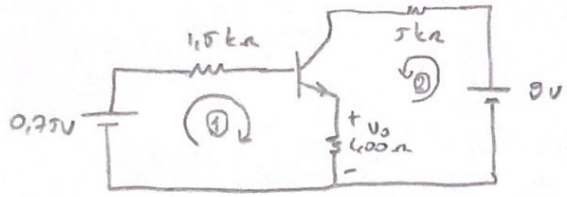
$V_S = 5,23\ V$

3.72) Some source transformation

$\frac{3\ V}{6\ k\Omega} = 0{,}5\ mV$

$6 \parallel 2 = 1{,}5\ k\Omega$

$0{,}5\ mV \cdot 1{,}5\ k\Omega = 0{,}75\ V$



$i_E = i_B + i_C$, $i_C = 200\, i_B$

$i_E = 201\, i_B$

Loop 1:

$-0{,}75 + 1500 \cdot i_B + 0{,}7 + 400 \cdot 201\, i_B = 0$

$i_B = 0{,}61\ \mu A$

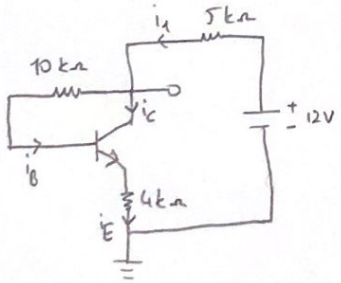
Loop 2:

$-9 + 5000 \cdot 200 \cdot 0{,}61 \cdot 10^{-6} + V_{CE} + 400 \cdot 201 \cdot 0{,}61 \cdot 10^{-6} = 0$

$V_{CE} = 8{,}641\ V$

$V_o = 400 \cdot 201 \cdot 0{,}61 \cdot 10^{-6} = 0{,}049\ V = 49\ mV$

3.73)



$i_1 = i_B + i_C = (1+\beta)\, i_B$, $i_E = i_B + i_C = i_1$

KVL for outer loop:

$4k \cdot i_E + V_{BE} + 10k\, i_B + 5k\, i_1 = 12$

$i_B = 12{,}296\ \mu A$

$12 = 5k\, i_1 + V_C \Rightarrow V_C = 12 - 5k(101) i_B = 5{,}791\ V$