Quiz for Lesson 14,15

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Electronic Circuits 1
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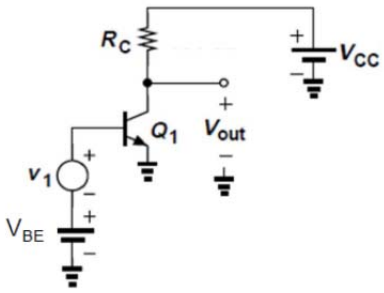
Prob. 1

For the circuit shown below, we are interested only in the small-signal changes in the circuit due to small v_1. Redraw the circuit using small-signal models for all circuit elements. Assume Q_1 is biased in the forward active region and the Early effect can be ignored.



Prob. 2

Determine numerical values for the circuit parameters used in your small signal model for Q_1 in Prob. 1 at room temperature. Q_1 has collector saturation current of 1×10^{-16}A, $\beta = 100$. $V_{BE} = 750$mV. Approximate exp(30) as 1.0×10^{13}.

Prob. 3

Using the small-signal circuit model determined in Prob. 1 and parameter values determined in Prob. 2, determine the numerical value for the small-signal voltage gain, $A_v = v_{out}/v_1$. Use $R_C = 1k\Omega$ and ignore the Early effect.

Prob. 4

An NPN transistor has the collector saturation current of $1x10^{-16}$A, β = 100 and, V_A, the Early voltage, of 20V. Plot I_c vs V_{CE} when V_{BE} = 750mV at room temperature. Assume $V_{CE,sat}$ (the saturation voltage or the value of V_{CE} below which the transistor is not in forward active region) is very small compared to V_A.

Prob. 5

The transistor described in Prob. 4 is used in the circuit shown in Prob. 1. What is V_{out} at room temperature when v_1 = 0, R_C = 1kΩ, and V_{CC} = 3V?

Prob. 6

Draw the small-signal circuit for the transistor described in Prob. 4 and Prob. 5. Give the numerical values for all small-signal circuit parameters.