ECE 351 Lab 3
Amplifier Design

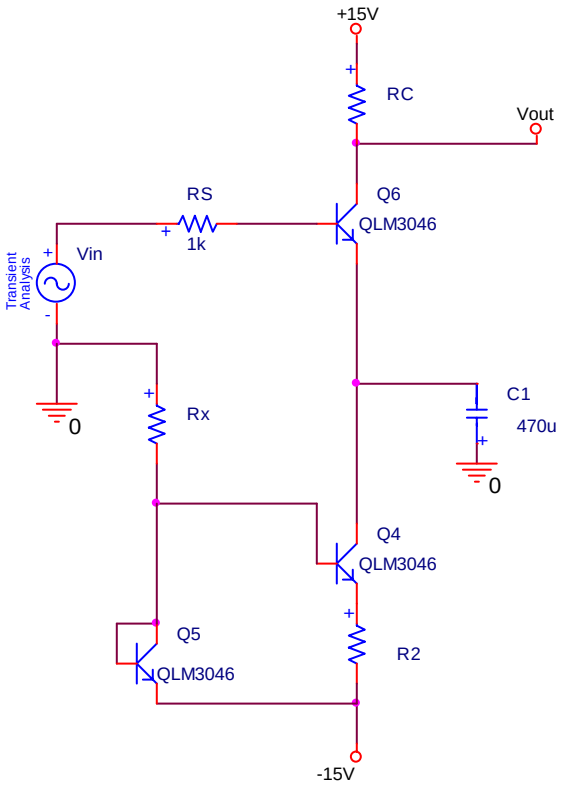
In this lab you will design, simulate, build, and test a common-emitter amplifier.

3.A. Pre-Lab Calculations

1. Design the common emitter amplifier shown below to achieve a minimum gain of 100 (in magnitude) and a minimum voltage swing at the output of ± 4V for $50 \le \beta \le 350$. For your design, calculate the bias (min and max I_C and V_{CE}), voltage swing, and minimum and maximum gain. Include all design calculations in your notebook as part of the pre-lab. Include the Early effect (the effects of r_o) in your analysis and design (this affects both the current source and voltage gain). Remember that $r_o = VA/I_{CQ}$. (To reduce the impact of r_o, you may want to keep I_{CQ} below 100 μA.) Calculate the min and max gain and bias values assuming tolerance in resistors, tolerance in the current source current, and tolerance in β.
2. Simulate your design with PSpice to verify your bias, minimum and maximum gain, and voltage swing.

3.B. Laboratory Procedure

Build your circuit and measure the bias, voltage gain, and maximum voltage swing at the output. Support all measurements with oscilloscope traces. All gain and voltage swing measurements should fall within your minimum and maximum calculations. If not, you must explain why not. Place all data in an easy to read form so that calculations can be compared to simulated and measured results.



Remember that pin 13 has to be at the most negative voltage in the circuit.

Some guidelines to remember:

- For all laboratory measurements you will need scope traces for documentation. For any measured number I see an a table, I will want to see the associated scope trace in your notebook with cursors or quick measure numbers displayed on the scope trace.

- You cannot measure maximum voltage swing and gain at the same time. Gain is a small signal measurement while swing is a large signal measurement. Measure gain with a small output and no visible distortion in the sine wave output (a 2 $V_{p\text{-}p}$ waveform or less at the output is a good estimate).

- You may want to use a 100 to 1 voltage divider on the input to make the input signal small enough for the gain measurement.

- Create a table to compare calculated, PSpice, and measured values of the gain and bias values. Make sure that all measured and PSpice values are between your calculated min and max values. If values are not within your min and max ranges, explain why.

- Document your results with scope traces. You should have a scope trace with numerical values displayed on the plot for each measured AC result in your table.