EE241 Laboratory Exercise
BJT Transistors: Introduction to Amplifiers

Instruments
2 Digital Multimeters
Protoboard
2 pairs of banana-to-clip cables

Components
Variable resistor box
Assorted resistors available in lab
2N2222 BJT Transistors

Pre-Lab

1) In this lab you will design, build, and test two amplifiers using BJT transistors. The first of these is to be a common-emitter amplifier. Its output is to be fed to the input of an emitter follower.

2) Using the rules of thumb given in the text on page 245, design a stable bias network for the common-emitter amplifier. Use a +15 V power supply and set the collector current to 5 mA. Simulate the circuit for $\beta = 50$, 100, and 200 using MultiSim, and confirm that the bias point is acceptable over this range of β. (Think about which electrical quantities your simulation needs to display in order to show that extreme values of β have not resulted in a non-functional circuit.) Paste your schematic drawing and your simulation outputs into your lab notebook, where all your planning should also be shown.

3) Design a stable bias network for the emitter follower. In addition to the rules of thumb on page 245 of the text, note on page 258 that some changes are needed for an emitter follower. Use the same power supply you used for your common-emitter amplifier and choose your network resistors so that the quiescent value of the emitter voltage is around 7.5 V. Simulate this circuit using MultiSim and include the results in your lab notebook.

4) Add a coupling capacitor at the input and a bypass capacitor at the output of the common-emitter amplifier design. Using a small-signal model, calculate the expected gain. Using Multisim, measure the gain at f = 1 kHz, 10 kHz, and 100 kHz. How do these values compare with the prediction you made using the small-signal model?

5) Calculate the gain of the emitter follower and measure it using Multisim. Why use an amplifier with this gain?

Lab

1) Build your common-emitter amplifier, minus the capacitors. Measure the collector current and compare it to the expected value.

2) Add the coupling and bypass capacitors and measure the gain at f = 1 kHz. Compare this to the value your prelab led you to expect.

3) Build your emitter-follower amplifier. Measure the gain and compare this to the value your prelab led you to expect.

4) Connect the output of the common-emitter amplifier to the input of the emitter-follower amplifier. Measure the voltage gain and the current gain at f = 1 kHz, 10 kHz, and 100 kHz. How do these values compare with those you obtained through simulation?