EC244 **Experiment #2** **Spring 2012**

Pre-Lab

Comparators

1. Look up the datasheet for the LM311 comparator to determine the chip connection diagram, maximum ratings, and find a typical application diagram for configuring the comparator to produce an output square-wave.
2. Notice that this particular comparator provides an output connection to the collector terminal of an internal BJT (a device we will soon study – that in this situation is functioning as a switch). This output configuration is termed an open-collector output. Conduct some web-based research to learn more about this configuration – be sure to learn about a pull-up resistor and how to properly size a pull-up resistor for a particular open-collector output.
3. Design and simulate the square-wave output comparator circuit for and adjust the circuit components to yield an output frequency of 2 kHz.

Sallen-Key Filters

4. Research the Sallen-Key filter topology and learn how to use this circuit as a low-pass filter.
5. Design a Sallen-Key low-pass filter using the LM741 operational amplifier (introduced in Laboratory Experiment #1) with unity gain and a cutoff frequency of 3 kHz.
6. Simulate your design in Multisim to confirm its operation.

Laboratory Work

1. Build the comparator square-wave circuit that you designed and simulated in pre-lab step 3. Verify the correct operation of the circuit using the oscilloscope and function generator.
2. Build the Sallen-Key filter circuit that you designed and simulated in pre-lab step 5 and 6. Measure and record at least ten input/output data points. Generate a plot of the circuit gain as a function of frequency (Hz).
3. Now, use the square-wave circuit from step 1 as input to the filter circuit from step 2. Verify circuit operation using the oscilloscope.
4. If time permits, configure an LM386 operational audio amplifier in a non-inverting circuit with the output of the Sallen-Key filter as input and connect the amplifier output to a loudspeaker. Adjust the gain of the LM386 to make the output audible but not obnoxiously loud.