EE101 Laboratory 9 (FL03)	**Name ______________________________**
Date ______________________	**Partner's name ______________________________**

Instructional Objectives (at the end of this lab you should be able to:)

- Solder some components of the sound-activated circuit onto the small printed circuit board in your lab kit.
- Follow a wiring diagram and printed circuit board markings to properly construct the circuit containing two operational amplifiers used in the previous lab.
- Use a voltage divider circuit to provide the input signal to the soldered circuit.
- Measure circuit signals and follow the signal through the circuit by displaying signals on the oscilloscope to verify solder joints and circuit operation.

Description and Background

This week and next week you will be assembling the sound-activated project kit. By the end of next week (Lab 10), each of you are required to demonstrate that your circuit is functioning properly. Because quality assembly and soldering of the circuit is essential for proper operation of the circuit, you may need to spend time outside of lab to complete the assignment. <u>Please feel free to arrange for additional time in the laboratory as needed to complete the procedures</u>.

This lab assignment is to solder components of the sound-activated circuit onto the small printed circuit board in your lab kit. The schematic diagram is shown in the booklet that came with your sound-activated project kit.

Upon completion of soldering, you will repeat procedures similar to what you did in Lab 8: test the 2-amplifier circuit and verify that it is working as expected.

Equipment

Your own circuit prototype board, your own lab kit containing the microphone, resistors, capacitors, and the LM358 operational amplifier, your own resistor color code chart, alligator clips from your lab kit. The lab power supply and oscilloscope, meter cables, soldering gun and solder furnished in the lab.

Procedures

P1. Very Important – Read and follow:

BEFORE starting assembly, please note the following special instructions:

- If you don't know where a particular component should go, leave it out until you seek assistance from the instructor or lab assistant.
- <u>Socket:</u> Solder the socket for the LM358 operational amplifier onto the printed board, and <u>do not</u> solder the op amp itself onto the board. By not soldering the op amp directly to the printed board, you will be able to easily replace the op amp if it becomes damaged.
- <u>Microphone</u>: *Do not* connect the microphone to the board yet. You will first want to test the amplifier circuit with the signal generator. Save the microphone for next week.

- Capacitor C3: For now, *do not* connect the capacitor marked C3. Leaving this out will allow for tests to be run in the next lab session to investigate portions of the circuit and to verify proper performance prior to soldering in capacitor C3.
- Terminals A&B, C&D, and E&F: It is recommended that you solder wires (4" long) to the labeled holes on the printed circuit board (PCB), rather than the stud pins supplied in the kit. The wires will allow you to connect the PCB easily to your breadboard and to the power supply while you are testing the circuit.
- Use care in soldering components. It is difficult to remove soldered components, and removal greatly increases the risk of damage to the circuit board.

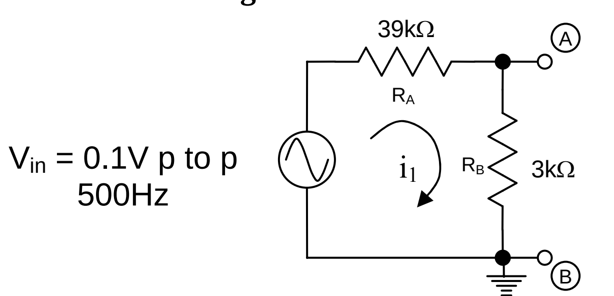
P2. Once the PCB circuit is assembled (*except* for C3 and the microphone):

→ Assemble the simple circuit of Figure 1 on your prototype board. This is the same input circuit you used last week in Lab 8. Set the function generator to the proper frequency and amplitude by observing the generator signal with the oscilloscope.

→ Next, set the DC power supply to +9 volts (using the DMM to monitor the voltage) and attach the +9 volts to the power supply wires on your PCB (terminal wires C & D). Make sure the polarity is correct!

→ Attach the input terminal wires (A&B) to the corresponding A and B nodes of the Figure 1 input circuit. Note that this is where the microphone circuit will be attached later.

Figure 1: Input Circuit: Voltage Divider Network



$|i_1| = |V_{in}| / (R_A + R_B)$

$|V_{AB}| = |i_1| \cdot R_B$

($R_{Thevenin}$= 2.79kΩ, $V_{Thevenin}$= 7.14mV)

P3. → Measure the peak-to-peak output (pin 1) of the 1st stage amplifier, using AC coupling with the scope. The *voltage gain* (v_o/v_{in}) of the 1st stage alone is the ratio of the output voltage (pin 1) to the input voltage (function generator). Calculate the 1st stage gain using your measured values.

V peak to peak at pin 1 (1st stage output): _______________

1st stage gain ($V_{pin\ 1}$ / $V_{func\ gen}$): __________________

P4. Measure the peak-to-peak output voltage of the 2nd stage amplifier (pin 7).

→ Using the measured voltages, calculate the gain of stage 2, from the 2nd stage input (pin 1) to the 2nd stage output (pin 7)

2nd stage gain ($V_{pin\ 7}$ / $V_{pin\ 1}$): ____________

P5. Determine the overall gain of the 2-stage amplifier, from the signal generator to the 2nd stage output (pin 7).

Overall gain ($V_{pin\ 7}$ / $V_{func\ gen}$): _________________