PURDUE UNIVERSITY NORTH CENTRAL

Electrical & Computer Engineering Technology Department

ECET 15700 (Prof. C. Smith) **Spring, 2010**

Lab 4 - Op Amp Circuits

OVERVIEW: In this lab, you will apply what you learned about op amps to design some simple op amp circuits using the 741 op amp. The first part of the lab will involve studying and verifying

OBJECTIVES: The objectives of this lab are to:
(1) Measure some of the characteristics of the 741 op amp.
(2) Build and test an inverting amplifier circuit.
(3) Build and test a non-inverting amplifier circuit.
(4) Build and test a summing amplifier circuit.
(5) Build and test a voltage follower circuit.

PART 1 - Measure Vio:

Measure V_{IO} of a 741 op amp. To do this, ground both the (+) and the (-) inputs. Use ±15 volts for the power supply voltages, V_{CC} and V_{EE}. Then, measure the output voltage with a voltmeter.

If the trainer does not reach 15 volts, get as close to 15 as possible. Record the exact +/- supply voltages that you used.

For your write-up, how does your measurement compare to the spec sheet on Page 211 of your text? What could account for any errors between the spec sheet and your measured values?

PART 2 - Inverting Amplifier Circuit:

Construct an inverting amplifier with a gain of 10. Again use ±15 for the supply voltages, or as close to ±15 as you can get.

For the input use a 1 Vpk sine wave. Display both the input and the output on the oscilloscope. You may either sketch the display or take a photo with your phone or camera.

For your write-up, discuss the error between your calculated output and the actual output.

PART 3 - Summing Amplifier Circuit (aka, "Summer"):

Construct a summing amplifier circuit with the following characteristics:

- One input is a 1 Vpk sine wave and has a gain of 10. (Note that you already have this from Part 2.)
- The other input is a -1 Vdc and has a gain of 5.

Display both the sinusoidal input and the output on the oscilloscope. You may either sketch the display or take a photo with your phone or camera.

For your write-up, discuss the error between your calculated output and the actual output.

PART 4 - Non-Inverting Amplifier Circuit:

Construct a non-inverting amplifier with a gain of 10. Again use ±15 for the supply voltages, or as close to ±15 as you can get.

For the input use a 1 Vpk sine wave. Display both the input and the output on the oscilloscope. You may either sketch the display or take a photo with your phone or camera.

For your write-up, discuss the error between your calculated output and the actual output.

PART 5 - Voltage Follower Circuit:

Construct a voltage follower circuit. Once again, use ±15 for the supply voltages, or as close to ±15 as you can get.

For the input use a 1 Vpk sine wave. Display both the input and the output on the oscilloscope. You may either sketch the display or take a photo with your phone or camera.

For your write-up, discuss the error between your calculated output and the actual output.

WRITE-UP:

Draw a schematic for each circuit, including Part 1, where you measured V_{IO}. For each part, calculate the percent error between measured values and expected values. Remember the formula for this:

$$\textbf{\textit{Percent Error}} = \frac{|\,\textbf{\textit{Expected Value}} - \textbf{\textit{Measured Value}}\,|}{\textbf{\textit{Expected Value}}} \times \mathbf{100}\%$$

Note that the numerator is the absolute value - - i.e., it is always positive.

Draw or include a photo of the oscilloscope display for each circuit, except for Part 1.

For each error, explain everything that might have caused the error. **HINT:** Look at *each* part of the circuit and *every* piece of the circuit - - every component, every source, every meter. Tell what the tolerance (i.e., maximum possible error) of each piece is and to what degree it may have contributed toward your error.