

## EET-210 Lab

## Op-Amp Experiments #2

This week you will need the homework assignment *Op-Amp Lab and Practice Problems.pdf* posted in the Week #9 Forums for EET-210 Lecture. Based upon the op-amp Lab & Practice Problems sheets construct each of the circuits for the following problems.pdf

The data sheet for the 741 op-amp and a pdf of this assignment are also available in the Week #9 Forum.

**Step #1:** Fig. P3-4 is the circuit for problems 3-5 through 3-8. Calculate and verify by building each circuit and comparing your measured output to your expected (calculated) output. For Problem 8, increase your input signal to the maximum. If the op-amp does not go into saturation, reduce your power supply voltages until the op-amp saturates on both the positive and negative output swings. For each problem, grab screenshots of  $V_{in}$  &  $V_{out}$  vs. time and  $V_{in}$  vs.  $V_{out}$  (XY Mode) with relevant measurements and your name on the display. Post these on the Week #10 Forum.

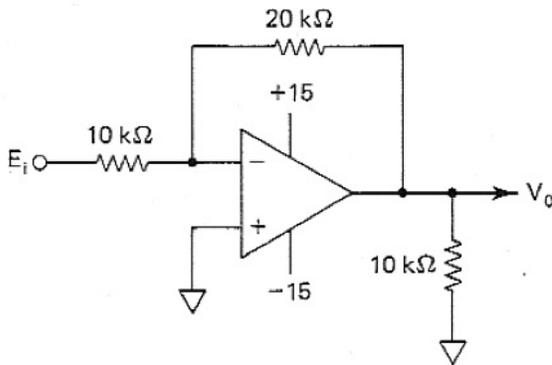


Figure P3-4

- 3-5. Calculate  $V_o$  and the op amp's output current in Fig. P3-4 if  $E_i$  equals (a) +5 V; (b) -2 V. For each situation, state if the op amp sources or sinks current.
- 3-6. Calculate  $E_i$  in Fig. P3-4 if  $V_o$  equals (a) +5 V; (b) -2 V.
- 3-7. Let  $E_i$  be a triangle wave with a frequency of 100 Hz and a peak value of 5 V in Fig. P3-4. (a) Plot  $E_i$  and  $V_o$  vs. time; (b)  $V_o$  vs.  $E_i$ .
- 3-8. Repeat problem 3-7 but let  $E_i$  be increased in amplitude to 8 V. (Assume that  $\pm V_{sat} = \pm 15$  V for ease of plotting.)

**Step #2:** Build and verify a circuit which implements plot B. Is this an inverting or non-inverting amplifier? Take screenshots of  $V_{in}$  &  $V_{out}$  vs. time and  $V_{in}$  vs.  $V_{out}$  (XY Mode).

- 3-13. Input-output characteristics are shown for three different circuits in Fig. P3-13. Design circuits to recreate plots A, B, and C.

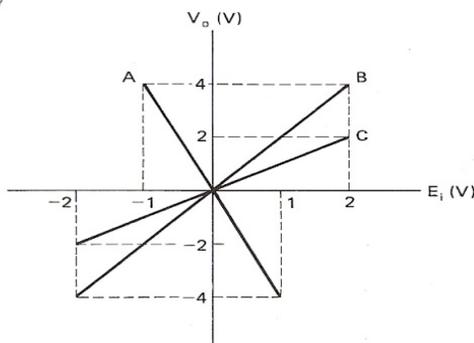


Figure P3-13

**Step #3:** Build and verify this circuit. (You'll need 2 741 IC's. Make all resistors the same value but they DO NOT have to be 10K, you can use any value between 2.2k - 47k as available.)

3-14. The circuit of Fig. P3-14 is called a "subtractor." Is  $E_1$  subtracted from  $E_2$  or vice versa?

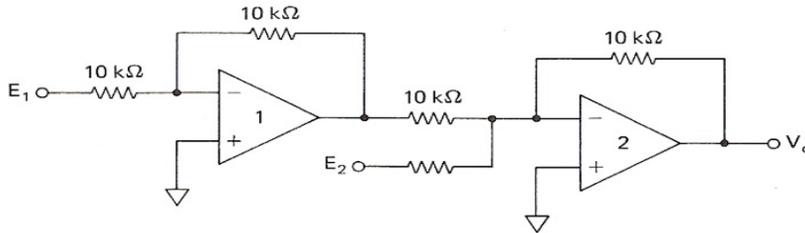


Figure P3-14

**Step #4:** Draw the schematic diagram, then build and verify the circuit in problem 3-17. Use the Superposition Principle (put a signal to each input individually while the other inputs are "off" (shorted)) and see if the summed output equals the output with all three source "on" simultaneously. For convenience, you can have all three sources be the same (e.g. 0.5V or 0.75V)

3-17. Design a three-channel inverting amplifier. Gains are to be  $-1$  for channel 1,  $-3$  for channel 2, and  $-5$  for channel 3 (refer to Section 3-3.2).

Have your instructor initial this sheet as your receipt that you completed the assignment. Then post your relevant screenshots on the EET-200 Lab Forum for this assignment.

Instructor Initial \_\_\_\_\_