Physics 334, Winter Quarter 2013
Electric Circuits Laboratory I
Homework Assignment 7
(sloppy work will not be graded)

1. Consider the “bad op-amp circuits”, text book Fig. 4.95, pp. 258-261. In 10 words or less each:
a) Explain why circuit D is “bad”; draw the corrected circuit.
b) Explain why circuit K is “bad”; draw a corrected circuit.
c) Explain why circuit M is “bad”; draw a non-lethal version of this circuit.

2. Digital-to-analog converter. (a) Exercise 4.5, page 185, in the textbook. Make a careful sketch of your circuit, showing voltages and component values. (b) If you design the circuit strictly according to the problem instructions, there’s a problem when the input is at full-scale: what’s this problem?

3. “Optional inverters”. Exercise 4.3 , page 183, with this change: With the input at V_{in}; what’s the output in each of the two switch positions (grounded versus not-grounded) when the right-most resistor in each figure is replaced by one with value 20kΩ?

The following problems are optional. They’re classic problems that are somewhat challenging but very enjoyable.

4. (optional) The classic Howland Current Source, problem 4.2 in the textbook. This is now rarely used.

5. (optional) Negative impedance converter part 1. Additional Exercise 6, page 251, in the textbook. Notice how device completes the quartet of resistor, capacitor, inductor, and now negative-impedance. Negative impedance devices are not just theoretical curiosities: tunnel diodes are one such realization.

6. (optional) Negative impedance converter part 2. The first part of Additional Exercise 7 (page 251) in the textbook (“Show how to make a dc amplifier with gain -10.”). Hint: Think about what would happen if you put negative impedance into a voltage divider? Such amplifiers in the form of tunnel diodes were used before transistors took off.

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