EECS 100 **Fall 1999** **Midterm # 1**

NAME:

ID #:

# 1	# 2	# 3	# 4	# 5	# 6	TOTAL
8	8	14	15	15	30	90

Instructions:

1 Write your name and student ID number.

2 Read the questions carefully.

3 Write your solution clearly.

4 This exam has 6 questions worth 90 points, so you should proceed at approximately 1 point per minute.

Problem # 1 $(4 * 2 = 8$ points)

Circle the most approriate answers. **Incorrect answers receive -2 points.** No explanantions are necessary.

The internal resistance of a current source is in **series/parallel** with the source. For a well-designed circuit with a current source, this internal resistance should be much **larger/smaller** than the load resistance.

A circuit element that requires an external power supply is called **active/passive**.

We **can/cannot** find the Thevenin equivalent of a circuit containg diodes.

Problem # 2 $(4 + 4 = 8$ points)

(a) You have two resistors R_1 and R_2. Using these in vaious combinations you can make resistances of $4, 6, 12$, and 18ω. Find R_1, R_2.

(b) Draw the $i - v$ characteristic of a Zener diode. What is a Zener diode useful for?

Problem # 3 $(5+5+2+2=14$ points)

A 10 volt battery with internal resistance R_1 is connected to a resistive load R_L. The voltage across the load is measured with a voltmeter whose internal resistance is R_2.

(a) Draw a circuit diagram for this problem.

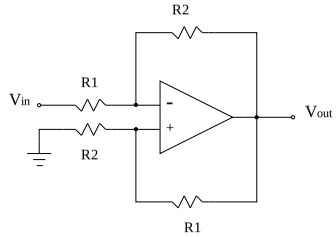
(b) Find an expression for the voltage recorded by the voltmeter in terms of R_1, R_2, R_L.

(c) Ideally, what are the values of R_1 and R_2?

(d) In the ideal case, what would the voltmeter read?

Problem # 4 $(5+5+5=15$ points)

Consider the op-amp circuit shown below. Use the ideal op-amp method to find the output voltage V_{out} in terms of the input voltage V_{in} and the resistances R_1, R_2.



Problem # 5 (5+5+5 = 15 points)

Consider the op-amp circuit shown below. Both diodes have current-voltage characteristic

$$i = c \cdot \exp(dv)$$

where c and d are some constants. The sign convention for this $i = v$ characteristic is shown above. Find an expression for the output voltage V_{out}. You may use the ideal op-amp method.

Hint: Consider the two diodes together as a single nonlinear circuit element. Your final algebra will simplify if you recognize that

$$\sinh(x) = \frac{\exp(x) - \exp(-x)}{2}$$