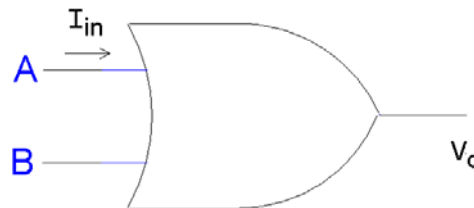
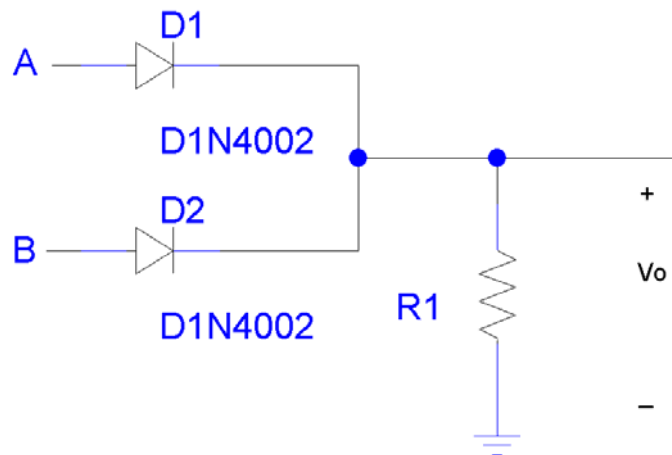


**EE 2274**  
**PRE-LAB EXPERIMENT 5**  
**DIODE OR GATE & CLIPPING CIRCUIT**  
**COMPLETE PRIOR TO COMING TO LAB**

Part I:

1. Design a diode, Figure 1 OR gate in which the maximum input current,  $|I_{in}|$ , is less than 5mA. Show all work.
  - a. Use two D1N4002 diodes.
  - b. Verify your design using Pspice.
  - c. Plot the voltage transfer function by varying the input voltage on Pin A while holding the voltage at Pin B to 0V. Assume the A is = to 5V and .7 voltage drop across D1.
  - d. Verify that the maximum current is within specification.

FIGURE 1



2. Simulate the circuit again after substituting two D1N914 diodes for the D1N4002 diodes.
  - a. Plot the voltage transfer function by varying the input voltage on Pin A while holding the voltage at Pin B to 0V.
  - b. Determine the maximum input current.
3. Determine the differences between the diodes.

- a. Click on D1N4002 in the PSpice simulation, causing the part to be highlighted in red.
- b. Select EDIT/MODEL
- c. In the pop-up window that opens, select EDIT INSTANCE MODEL (Text).
- d. Scroll through the parameter listed to find RS, the series resistance of the diode, IS, the reverse saturation current, and VJ, the turn-on voltage (or Von) of the diode.
- e. Repeat these steps with D1N914 to determine RS, IS, and VJ for this diode.

## Part II : CLIPPING CIRCUIT

Given the circuit in Figure 2 below, sketch the input  $v_i$  and output  $v_o$  signals expected if

1.  $v_i = 8 V_{pp}$ , 1 kHz sine + 2 V DC.  
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \geq 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $-0.7V < v_i < 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \leq -0.7V$
2. Repeat part 2 with  $v_i = 8 V_{pp}$ , 1 kHz sine – 2 V DC.  
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \geq 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $-0.7V < v_i < 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \leq -0.7V$
3. Repeat part 2 with  $v_i = 8 V_{pp}$ , 1 kHz sine + 2 V DC, reversing the diode, Figure 3.  
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \geq 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $-0.7V < v_i < 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \leq -0.7V$
4. Repeat part 4 with  $v_i = 8 V_{pp}$ , 1 kHz sine – 2 V DC.  
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \geq 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $-0.7V < v_i < 0.7V$   
 $v_o = \underline{\hspace{2cm}}$  when  $v_i \leq -0.7V$

Verify your sketch with PSpice. Turn in with Pre-Lab.

9/16/2008

FIGURE 2

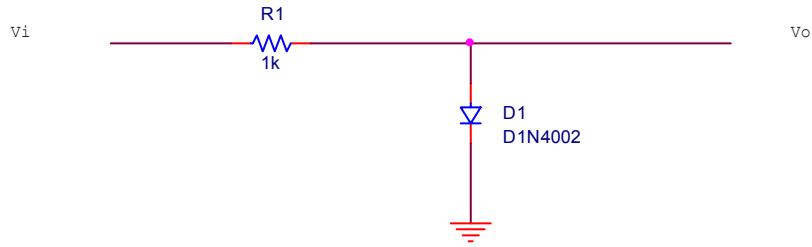
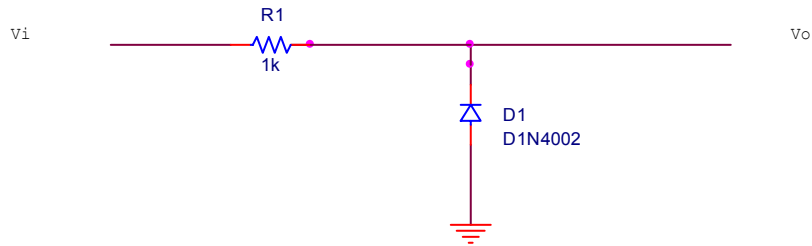
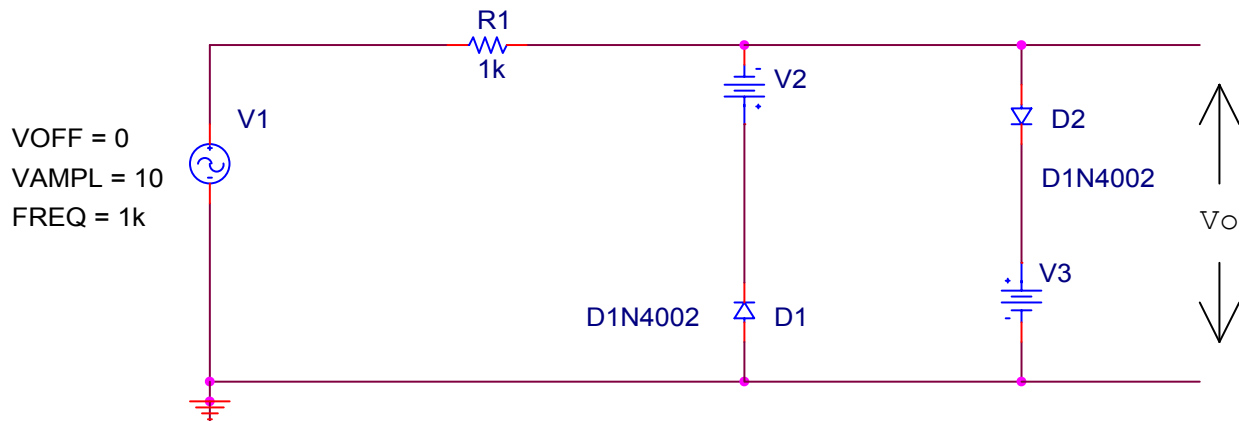


FIGURE 3



6. Design a clipping circuit as shown below, Figure 4 , so that the waveform will be clipped at +3V and -6V. Show all work. Verify your design using PSpice.

FIGURE 4



1. Print out the waveform. Why might the circuit not clip at exactly -6V and +3V?

**LAB EXERCISE  
EXPERIMENT #5  
DIODE GATE AND CLIPPING CIRCUIT**

**Part I. Diode OR GATE:**

1. Build an OR gate using D1N4001 (D1N400) same as D1N4002 except for peak reverse voltage).
  - a. Use the lab workbench software and the DC sweep to plot the voltage transfer function. Sweep from 0-5V in 200mv increments. (Label your graph to be turned in).
  - b. Same as above except plot the output current. Compare the maximum value for the output current with that obtained from your simulation.
  - c. Using the curve tracer to produce the forward-biased characteristic of your 1N004. From the graph and the 5mA current requirement determine  $V_D$ . Then use the digital multimeter to measure  $V_D$ . Compare your results. Turn in your graph.

**Part II. Clipping Circuits:**

1. Build the clipping circuit Figure 2 of the pre-lab. Do a scope capture of input ( $v_i$ ) and output ( $v_o$ ) waveforms.
2. Change the offset of the  $v_i$  to -2v.
3. Change the direction of the diode Figure 3.
4. Repeat 1.
5. Repeat 2.
  
6. Build your design for the clipping circuit in Figure 4. Place a probe in order to view  $V_o$ , the waveform produced. Capture the waveform and print out the waveform to be turned in.
  - a. Does the circuit clip at exactly -6V and +3V? Does it clip at the same values from your PSpice simulation? If not, why would there be differences between the PSpice simulation results and the real life results?

- b. Now that you know the voltage drop across the diodes you are using in lab, design your circuit so that the source is a 20V pp square wave that after clipping is approximately a 0 to 5V square wave. Build your circuit, capture the waveform and save it to disk to print later. Draw your design schematic on your answer sheet.

**DATA SHEET  
EXPERIMENT 5  
DIODE GATE & CLIPPING CIRCUIT**

**PART I.**

:

- a. Print out DC sweep and turn in with data sheet.
- b. Same as a.
- c. Print out forward-bias characteristics curve for the 1N004 diode.

$V_D$  (graph) = \_\_\_\_\_

$V_D$  (measured) = \_\_\_\_\_

Any difference? Why?

**PART II. Clipping Circuits**

1. Explain the circuit behavior, include scope capture of input ( $v_i$ ) and output ( $v_o$ ) to turn in with lab.
2. Same as 1
3. Same as 1
4. Same as 1
6. Turn in waveform.
  - a. Does the circuit clip at exactly  $-6V$  and  $+3V$ ? \_\_\_\_\_
  - b. Turn in waveform.