MASSACHUSETTS INSTITUTE OF TECHNOLOGY

6.071 Introduction to Electronics, Signals and Measurement

Spring 2006

Laboratory 16: Diodes. Signal conditioning

Exercise 1.

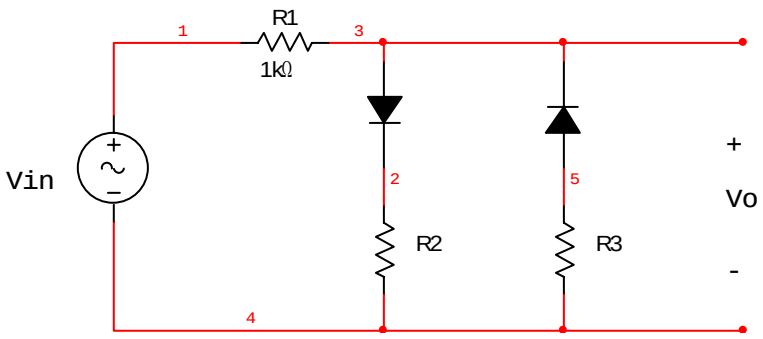
Use the *I-V* instrument to measure the *I-V* characteristics of a diode from your labkit. The zoom feature will give you the opportunity to investigate in detail all regions of the curve.

Exercise 2.

Build and test a **full wave rectifier** circuit. For input use the function generator to create a sinusoidal signal with an amplitude of 2.5 Volts and a frequency of 60 Hz. Increase the frequency to 1kHz, 10kHz, 50kHz and observe the resulting output.

Exercise 3.

Next let's built, analyze and test the following circuit

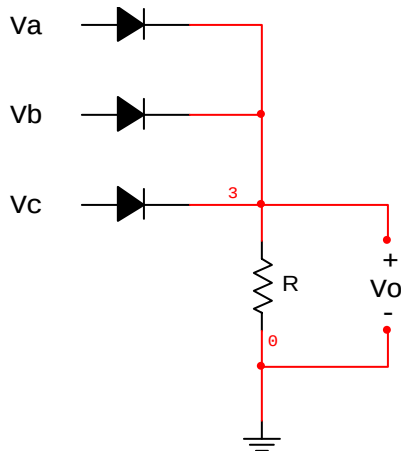


This circuit is called waveform clipper.
Resistor R1 is called the current limiting resistor since it limits the current through the diodes.
What is the role of resistors R2 and R3?

Use your function generator to create a triangular wave with an amplitude of 2.5 Volts. Measure the output voltage *Vo* with the oscilloscope and draw its form below. You may use a variable resistor in the place of R2 and R3 and observe the output as you trim the resistors.

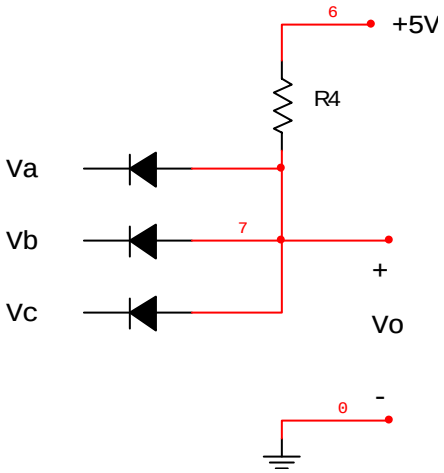
Exercise 4.

Diode logic gates.
Built and test the following circuits



Determine the output for the following values for the voltages Va, Vb and Vc. This circuit performs the logic operation OR

Va	Vb	Vc	Vo
5V	5V	5V	
5V	0V	5V	
0V	0V	5V	



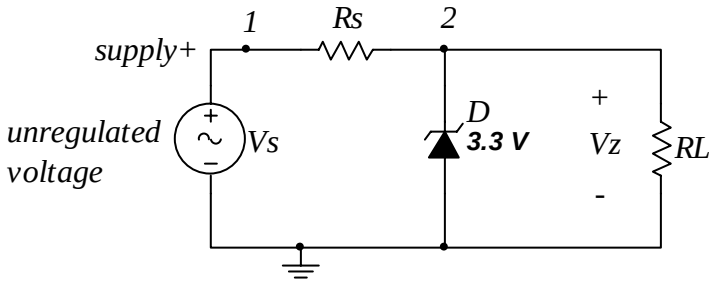
Determine the output for the following values for the voltages Va, Vb and Vc. This circuit performs the logic operation AND

Va	Vb	Vc	Vo
5V	5V	5V	
5V	0V	5V	
0V	0V	5V	

Voltage regulator

Start this experiment and complete the analysis for Monday.

The Zener diode with its well defined breakdown voltage may be used for building a very effective voltage regulator. In this exercise we will construct and test a voltage regulator circuit.



The supply is able to provide a maximum current of 1.5A, and the Zener diode has an effective resistance of 30Ω.

Using Rs ~ 500Ω and RL ~ 10kΩ build the above circuit. From the class web site download the instrument called **ZenerRegulator**. This instrument controls the variable power supply of your ELVIS unit. Make the following connections to your protoboard.

Node 1: Connected to ACH1 (measures the unregulated voltage Vs)
Node 2: Connected to ACH2 (measures the regulated voltage Vz)

Run your instrument and observe the response of the circuit (regulated voltage Vz) as the unregulated voltage Vs is varied. Try adding noise to Vs and observe Vz.

Note the loading effect of this voltage regulator circuit. As Vs gets larger what is the max Vz across the load?

Given the maximum Vz and the diode's effective resistance calculate the maximum current through the diode Iz. What is the maximum current Is?