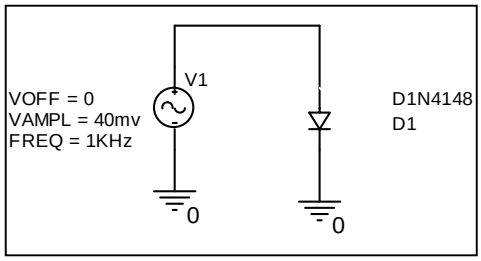
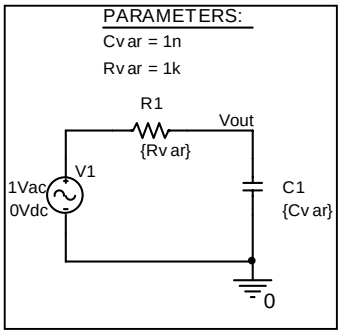
EE503 Problem Set 1

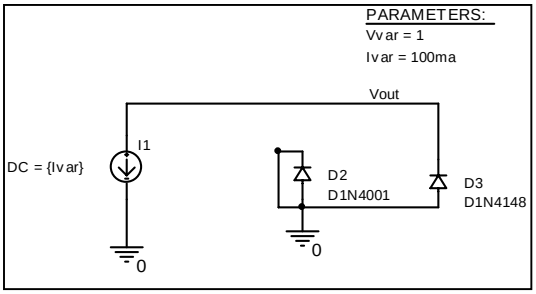
(Additional information for problem 4 may be found in the "distortion" notes on the class web page.)



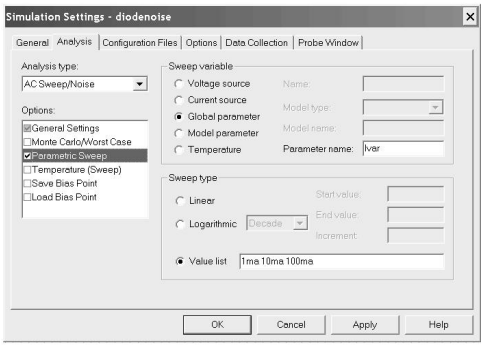
1. In p-spice, set up a Vsin source with an amplitude of 40 mV, and a frequency of 1 KHz across a 1N4148 diode. Suggested time settings are duration 100us to capture 100 cycles. Monitor the diode current.
   a. For the output FFT plot, measure the current amplitude of the fundamental, 2nd and 3rd harmonics and calculate the a1, a2, a3 coefficients from the notes. Estimate what they should be from theory. (you will have to estimate Idss, or extract it from the p-spice model.
   b. Use two Vsin sources (40 mV each) in series with one frequency at 9.5 KHz and the second at a frequency of 10.5 KHz. Measure the third order products at calculate the 3rd order intercept.



2. It can be shown that the total rms noise voltage of a RC lowpass filter is only dependent on the value of the C and is independent R. Find the theoretical rms noise voltage developed at the output of the filter in terms of R and C. Verify your answer in pspice with a 1k resistor, 1nF cap, and a 10 nF cap.



3. Calculate the noise density in A/Hz you would expect to see from a diode with 1mA, 10 mA, and 100 mA of DC current flowing through it. (Ignore Rs)
   a. Set up a p-spice simulation using IDC, and a 1N4148 diode. Adjust the VDC levels to get 1mA, 10 mA, and 100 mA. Compare the diode noise current with your calculations.
   b. Repeat a) using a 1N4001



4. An amplifier stage has the following parameters:

   G= 10dB
   B=100 KHz
   NF= 6 dB
   OIPT3= 20 dBm

   a. What is the total noise power at the output of the amplifier in dBm? In Watts?
   b. Cascade two of the amplifiers. What is the total noise figure? What is the total output third order intercept point, OIPT3?