Electronics Pre-Lab

Warning: This Pre-Lab requires you to come into the lab a day or two before the electronics class day, in order to become completely familiar with your test equipment. You will be given your own signal generator and oscilloscope.

Part 1: Preparation

Read *Chapter 3* from Melissinos (download from this web page), and *Pages from Student Manual for The Art Of Electronics* (preceding item on this Guide listing).

You need to come into Electronics lab completely familiar with your test equipment. Complete this Pre-Lab BEFORE coming to class! **Answer all questions in bold below**. Hand in at the beginning of class. This Pre-Lab will take you several hours. Your grade and success will depend on it. There will also be a quiz to test your familiarity with this measurement equipment and simple passive analog circuits.

Part 2: Understanding your test and measurement equipment

Watch the *Video Tutorial* and read the *On Oscilloscopes* file (Related Material).

Get a 2V peak-to-peak (P-P) sine wave at ~100Hz out of your signal generator, and displayed on the scope. Adjust P-P to exactly 2V (use Measure function). Alternately use CURSOR function. Also estimate using the graticule markings on the screen together with your V/division gain setting.
What is the difference between peak, p-p, and rms voltage?

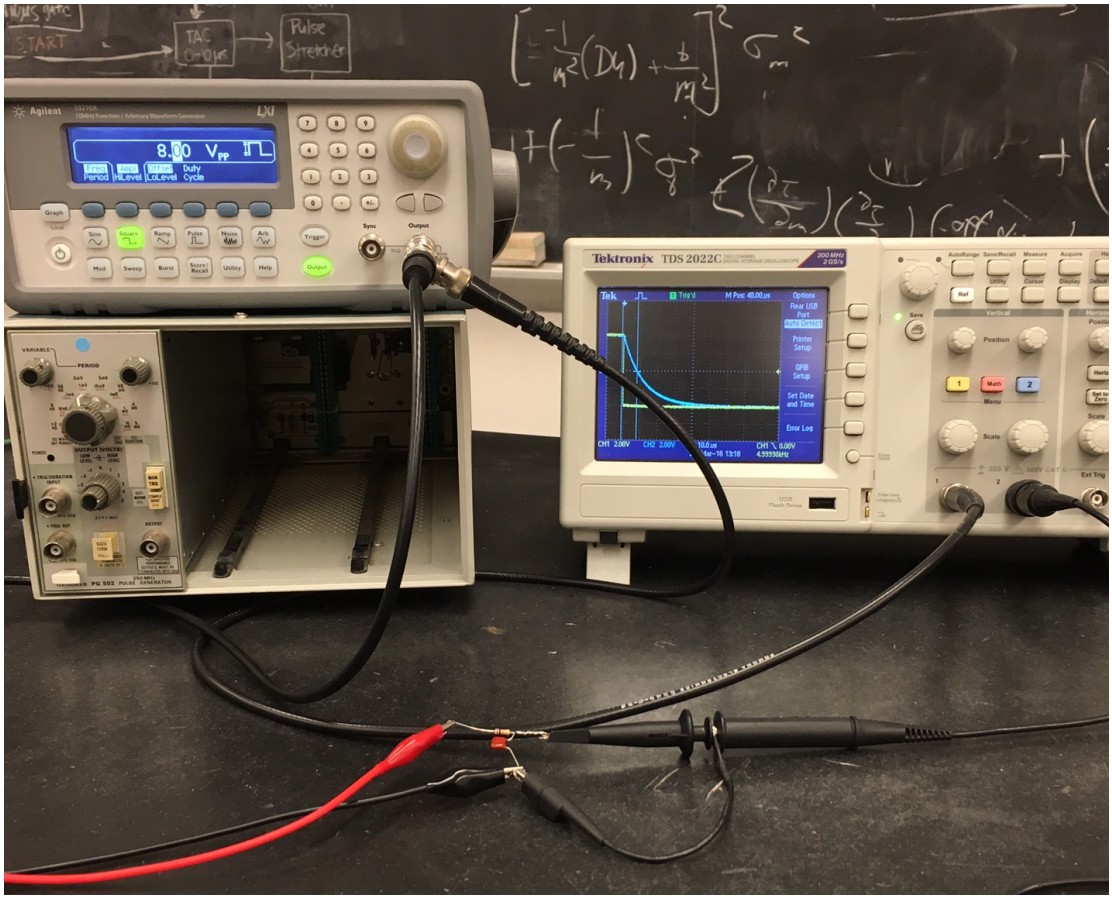
Familiarize yourself with the scope trigger, rising and falling. Explore 100mV to 1V p-p sine wave and square wave signals at ~1MHz, changing signal generator and scope settings. Move trigger threshold below, through, and above the waveform, for both rising and falling trigger.
Describe what you find.

Explore the channel gain (V/div) *vs.* signal generator amplitude tradeoff, keeping the p-p display on the scope the same size. As you decrease the signal generator output and increase the scope gain eventually at near zero signal generator output you will encounter scope preamp noise at ~10mV. Another lesson.
Explain what is happening.

Part 3: Simple analog filter

Imagine you have a problem with a noisy detector+preamp circuit (with most noise at 1 KHz and lower frequencies) and that your desired signal out of the detector is expected to be an AC signal at 1 MHz. Your detector is followed by a non-ideal (noisy) preamp with output impedance 50 ohms. Before digitizing, you would like to filter out the noise and keep your signal. Using complex impedance for capacitors and resistors, design a "high pass" filter using one resistor and one capacitor which passes your AC signal but suppresses AC noise below 100 KHz. Choose a value for R in your RC circuit much lager than your preamp output impedance of 50 ohm, say 1000 ohms.

Draw the circuit [2 input ports, 2 output ports], derive an analytic expression for the real component of the output voltage vs frequency, determine values for R and C based on your filter requirements, and plot its frequency response (log Volts- vs log frequency). Show your math, and component values.



An example of a setup using your test equipment.