LAB 3a THE OSCILLOSCOPE

EXPERIMENTAL GOAL

Your goal in this lab are the following: to become proficient (1) in using an *oscilloscope* to display and analyze potential differences in a circuit that vary periodically in time, and (2) in using a *function generator* to generate such waveforms.

PROCEDURAL COMMENTS

So far in lab, we have dealt only with DC circuits in which currents and voltages are constant in time. In this lab, we will use the function generator and other sources to *generate* periodic potential-difference waveforms and the oscilloscope to *display* such waveforms. For the record, the **frequency** of such waveforms is the number of complete cycles that the waveform goes through per second: frequencies are expressed in Hz, where 1 Hz = 1 cycle per second. If the time required for a complete cycle of the wave is T, then the frequency is $1/T$, since the wave completes exactly one cycle in time T. The **amplitude** of the waveform is the maximum value of the absolute value of the potential difference between the two wires going into the scope input.

It may be daunting to figure out how both of these instruments work at the same time. We have therefore set up your function generator to produce a certain kind of periodic waveform. Without adjusting *anything* on the function generator, adjust the horizontal sweep (sec/div or msec/div) and vertical scale of the scope so that it displays a few cycles of this signal in full scale. From these values and the height and width of the displayed wave, you should be able determine the waveform's amplitude and period. Check with your helper that you have done this correctly before you go on.

The second periodic waveform is a signal generated by TV/computer monitors, which can be readily picked up by a coil. (A time-varying induced current flows in the coil because of the time-varying magnetic fields created in the monitor.) Use the scope to determine the frequency of this signal. You may also want to explore how the strength of the signal changes with the orientation and the shape of the coil.

Finally, charges that are moving through the electrical wiring in the room create fluctuating electric fields. A BNC cable with one end connected to the input of the scope and the other end unconnected can measure the time-dependent potential difference between the two banana leads at the unconnected end. Try moving this end around until you get a strong signal (you may find the signal to be particularly strong near electrical cords). What is the frequency and amplitude of the strongest signal you observe? Why do you think this signal has the frequency you found?

Now that you have become more comfortable with the scope, use it to explore how the function generator works. You may adjust the frequency knobs on the left side of the and the row of push buttons along the top. While you can also adjust the rightmost knob below the switches (the one labeled "AMPL") to change the "amplitude" (or voltage) of the signal the function generator produces, please do NOT adjust the three knobs to the left of the "AMPL" knob.

PREPARING FOR YOUR CHECKOUT INTERVIEW

For your exit interview, each member of your group should be able to generate and display any sine-, square-, or triangle-wave of any amplitude and frequency. Also, if your grader gives you an unknown periodic waveform from some source, you should be able to determine its amplitude and period using the oscilloscope.