University of Maryland Baltimore County
Department of Computer Science and Electrical Engineering

CMPE 212L, Principles of Digital Design Laboratory

Experiment #1 Friday 1/29/2016

Objective

In this laboratory, you will get introduced to lab equipment, and how to use the catalogues and guidelines.

Required Equipment

- Multi-meter: "An instrument that enables measuring voltage, current, and resistance*".
- Breadboard: "A configurable that facilitates the development of prototype electronic circuits*".
- Power Supply: "A device that supplies electrical energy to one or multiple circuits or equipment*".
- Oscilloscope:" An electronic test instrument that enable the visualization of signals. The signal variations over time is displayed as two-dimensional graph (x-axis is time)*".

Experiments:

1. Examine and find connected pins of the breadboard by the use of multi-meter (the inter pins impedance should be zero to be connected).
2. Turn on the dc power supply, change the dc voltage setting and measure the output voltage by the digital multi-meter (DMM). Change the output voltages and verify that you know how to use the dc power supply and the DMM.
3. Check the oscilloscope functionality and try to see the square wave:
    - Connect the oscilloscope power cable.
    - Turn on the oscilloscope. Wait for the confirmation that all self-tests have passed.
    - Connect the oscilloscope probe to channel #1. Attach the probe tip and reference lead to the PROBE COMP connectors.
    - Push the AUTOSET button. You should see a square wave in the display (approximately 5 V at 1 kHz).
4. Display some waveforms:
    - Connect the power supply to channel #1 probe.
    - Push the **AUTOSET** button.
    - The oscilloscope sets vertical, horizontal, and trigger controls automatically. You can manually adjust any of these controls if you need to optimize the display of waveform.
    - Push the **MEASURE** button to see the measurement menu.
    - Push the **CH1** button and then push the **Select Measurement** for CH1 screen button.
    - Select the **FREQUENCY** measurement.
    - Push the more screen button until you can select the **Pk-Pk** measurement.
    - Push the **MENU OFF** button.

- Repeat the experiment with other signals like sine and square. Generate a signal (for example, a sine wave) and observe the waveform from the scope. Change the amplitude and frequency, and observe that the trace on the scope changes accordingly.
- Generate a clock pulse by power generator. Show the waveform on the scope and try it with different voltage amplitudes and different pulse frequencies.

5. Make a circuit board:
   - Connect the 5V DC and GND lines from the power supplies to the respective horizontal line of the breadboard (Red: 5V, Blue: GND).
   - Using the color code table (Table 1, 2), read the resistors' value (Figure 1).
   - Make the circuit in Figure 2 on the breadboard to turn the LED on.
   - Repeat the experiment by replacing the V_{cc} with a square waveform with the same amplitude and different frequencies, find what happens to the LED and explain why.

Table 1 - Resistor Colour Pattern

Color	Significant Figures
Black	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Gray	8
White	9
Gold	-
Silver	-
None	-

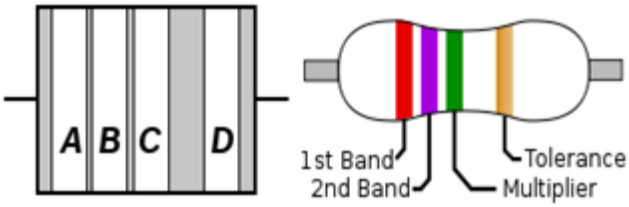

Figure 1 - A typical Resistor's Colour Schema

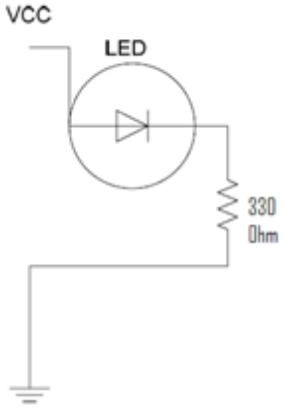

Figure 2 - Voltage Indicator Circuit

Table 2 - Resistor Tolerance Rating

Tolerance Rating	Red=2%	Gold=5%	Silver=10%	No Band=20%

- Definitions obtained from Wikipedia.