Basics of circuitry

A.Y. 2023/2024 – II Semester

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Part I: Electronic laboratory equipment and basic components

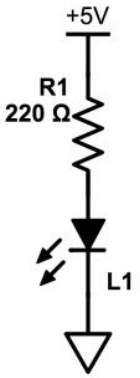
1. Power Supply
2. Bench Multimeter
3. Portable Multimeter
4. Passive components (resistor, capacitance, diode)
5. Breadboard

Part II: Experimental circuits on breadboard using the lab equipment

1. Power on LED

Build on the breadboard the circuit whose schematic is presented in the Figure aside. Use the power supply as a power source, setting as output voltage 5 V.

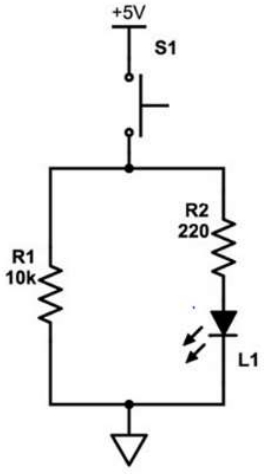
a. What is the maximum current level that can be reached before the LED burns out? (The answer to this question is to be found on the LED datasheet, not actually causing the LED to burn out)
b. What is the minimum voltage level that can be set to make the LED illuminate?
c. How much current is flowing in our circuit?



2. LED switching on by button.

Build the circuit shown in the Figure aside on the breadboard. Through this circuit, the LED turns on only when the button is pressed, while it is off when the button is released.

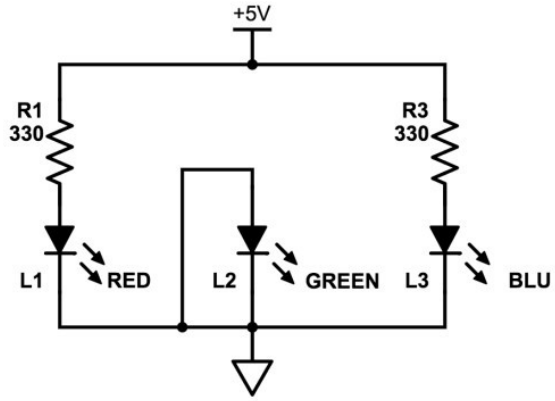
a. What kind of configuration are we using the button in?
b. What other kind of configuration can it be used to activate the LED?
c. How is it possible to reverse the operation of the circuit (LED lit when the button is released)?



3. RGB LED control

Build the circuit shown in the Figure aside on the breadboard, which provides for the lighting of a magenta RGB LED.

a. What kind of configuration is implemented for the RGB LED?
b. How many colors can be generated with the RGB LED using only a power supply and 3 resistors?
c. How many colors can be generated with the RGB LED using 3 pulse width modulators and 3 resistors? In addition to this, create a circuit which, by means of the selective pressure of 3 buttons, allows to generate up to 8 colors



Demonstrative session #2:

- Function generator
- Oscilloscope

4. Flashing LED

Using the function generator, you build a drive the power line of the breadboard with a sinusoidal waveform featuring the following parameters:

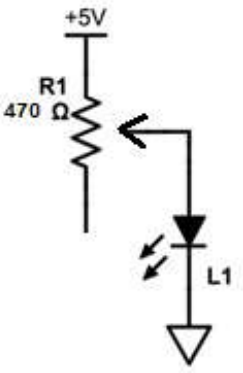
- Baseline voltage V_{PP} = 5 V
- Offset voltage V_{offset} = 2.5 V
- Starting driving frequency f = 1 Hz

Using the circuit of exercise 3, test the effect of switching the frequency from 1 Hz to 10 Hz , 100 Hz up and 1 kHz and verify the behavior of the circuit.

5. LED intensity modulation

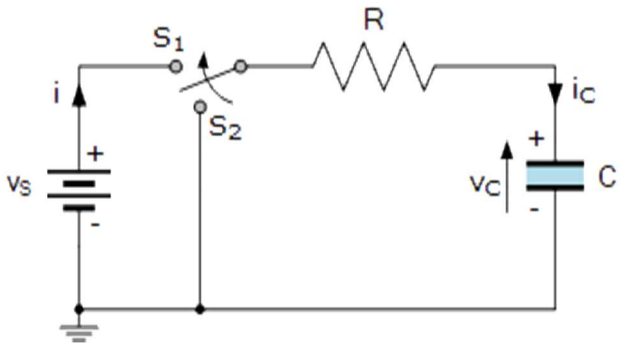
Build a circuit on the breadboard that modulates the LED intensity throughout a variable resistance using a trimmer. Consider the use of an additional resistance properly placed in the circuit to avoid possible LED failure (why??).

a. Using the trimmer, you want to decrease the intensity as you clock-wise turn the handle.
b. Using the trimmer, you want to increase the intensity as you touch the sensor.



6. Capacitive circuit

You may assemble an RC circuit, with two different combinations of resistors and capacitance, e.g. (1M Ω, 100 nF) and (1k Ω, 100 nF), with a pushbutton (normally open) included.



a. You use the power supply to power *vs* a voltage of 5 V. You monitor the voltage *vc* through the oscilloscope as soon as you active the pushbutton and release it in both configurations.

b. Instead of the power supply, you use the function generator to produce a 100Hz sine wave. You monitor the voltage *vc* through the oscilloscope as soon as you active the pushbutton and release it in both configurations. What is the difference between the two condition.

7. Analog filtering

You may use the function generator to generate a 1kHz sine wave. Check with the oscilloscope that the signal is correctly generated. Build the circuits shown in the Figure on the breadboard.

a. What is the expected processing of these circuits? Check the behavior of these circuits by connecting the sinusoid generated by the function generator to the circuit at the input, and displaying the output of our circuits with the oscilloscope.

b. are the two circuits be cascaded?