

# Electronics Laboratory Final Project

(Due May 10, 2006)

As a final examination for the Electronics Laboratory Course, each student will independently (without a partner) design and construct a circuit. Choose one of the following five projects.

The project will be evaluated in three stages: design, construction, and testing. The design rationale should be described, with a complete circuit diagram and the principle of operation. The construction of the circuit should be correct, compact and neat, for easy adjustment and repair if necessary. The test results should be reported and compared to the specifications of the project.

## 1. Siren sound

A siren sound will be generated. The frequency of the sound changes continuously from about 550 Hz to 650 Hz, then back to 550 Hz, with a period of about 4 seconds. This period is repeated indefinitely. There will be a switch available, and turning this switch changes the period to about 1 second.

*Possible components for the circuit:* Capacitors, resistors, microcontroller, op-amps, speaker.

*Specifications:* The frequencies should be accurate within 50 Hz, and the timing should be accurate within 5 %.

## 2. Optical Transmitter/Receiver

When a button is pressed, one microcontroller will send a serial message to a second microcontroller by optically pulsing an LED. The receiver circuit should correctly decode the message with the aid of a photoresistor, and display the message.

*Possible components for the circuit:* LED, photoresistor, microcontrollers, resistors.

*Specifications:* The entire message will be 8 bits. The sender and the receiver must be sync'd with some sort of a serial hand-shaking protocol.

### **3. Basketball shot clock**

A clock that counts down from 45, stops at 00, and turns a red light on when the time is up. There will be two push buttons. Pressing the first button displays 45 on the clock. Pressing the second button starts the clock, pressing it again stops it, and so on.

*Possible components for the circuit:* Capacitors, resistors, microcontroller, logic gates, binary-to-7-segment decoders, 7-segment displays, push buttons.

*Specifications:* Two digits and a red light. The timing should be accurate within 2%.

### **4. Battery tester.**

A simple device to test the voltage of a regular 1.5 volt battery cell. A red LED will turn on if the battery is low, a yellow LED if the battery is somewhat low, a green LED if the battery is good.

*Possible components for the circuit:* Comparators, resistors, LEDs, transistors.

*Specifications:* Green light if the voltage is above 1.4 v, yellow light if the voltage is below 1.4 v but above 1.2 v, red light if the voltage is below 1.2 v.

### **4. Period Counter**

A device to display the period of a sine wave. Ten LEDs will be used to indicate the period of the input sine wave (0 – 1023 millisecond).

*Possible components for the circuit:* Comparator, resistors, LEDs, flip-flops.

*Specifications:* The user must be able to reset the circuit to zero prior to measurement. The input sine wave can be between 10 Hz to 1 kHz. A second 1 kHz TTL square wave can be used as a clock. Additional DC voltages can be used as needed.