ROBOTICS AND COMMUNICATIONS SYSTEMS ENGINEERING TECHNOLGY
SWITCHING TRANSISTORS & MULTIVIBRATORS LAB
3RD SEMESTER, SR. INSTRUCTOR TIM LEISHMAN

General Objective:

Upon completion of this lab, the student will be able to:

A. Calculate switch mode transistor voltage and current values.
B. Measure and record switch mode transistor values.
C. Calculate astable & monostable multivibrator transistor circuits
D. Measure astable & monostable multivibrator transistor circuits

References:

- Theory notes
- First Year Text & Lab books
- LM555 Datasheet
- 74121 Datasheet
- 2N3904
- BU4538B

Check-Off Sheet:

- Check-Off Sheet

Specific Objectives:

1. Define: delay time, rise time, turn on time, turn off time, storage time, and fall time. Describe with drawings. **(Instructor Check)**

2. Record in your lab book the specifications for a 2N3904 transistors delay time, rise time, storage time, fall time, turn on time, turn off time.
    a. Calculate and design a switching circuit using a 2N3904 transistor, predict and annotate waveforms and all switching times
    b. Measure all switching times and compare them to the specs. **(Instructor Check)**
    c. Commutating Capacitor - For the circuit in part a, redesign using a commutating capacitor. Measure all switching times and compare to previous measurements and the specifications. **(Instructor Check)**

3. Design and calculate an astable multivibrator to produce a PRF of _____and duty cycle of 50%. Annotate the predicted waveforms with properly label voltages and times.
    a. Build and measure the astable you designed.
    b. Annotate measured waveforms, properly label voltages and times. (If needed, one potentiometer may be used.) **(Instructor Check)**
    c. Use a diode to improve the rise time of the astable. Annotate the circuit schematic and waveform calculations for the pulse width and pulse spacing.
    d. Assemble, measure, and annotate the output waveforms. **(Instructor Check)**
    e. Set your bench generator to the same frequency as your astable multivibrator circuit and sync/genlock them together. **(Instructor Check)**

4. Disconnect the generator, and differentiate the output of your astable circuit to create a spike waveform for triggering purposes. Design and calculate a monostable circuit, draw the waveforms showing the output of your astable, the output of your differentiator, and the output of your monostable including all voltages and times. Design your monostable multivibrator to produce a pulse width of _____ for every input trigger. **(Instructor Check)**
    a. Construct, measure and annotate the astable waveform, the differentiated waveform, and the monostable waveform. Verify your working circuit with your instructor. **(Instructor Check)**

5. Design and build an astable multivibrator using a Schmitt Trigger Inverter to produce a 5hz output waveform. **(Instructor Check)**

6. Calculate an astable multivibrator using a 555 timer, to produce a _____Khz signal at _____% duty cycle. Calculate and draw the predicted Vc voltage waveform compared or referenced to the output signal. **(Instructor Check)**
    a. Construct the circuit, measure and annotate the waveforms. **(Instructor Check)**

7. Calculate and construct a monostable multivibrator using a 555 timer, to produce a 5us pulse for every trigger. Use the output of the astable you made in step 5 to produce the trigger for this circuit. **(Instructor Check)**

8. Using the datasheet, investigate and document how a 74121 IC chip works. Design a circuit using the 74121 IC to produce a _____us pulse for every trigger.

    a. Construct, measure and annotate the waveforms. Verify your working circuit with your instructor. **(Instructor Check)**

9. Complete Conclusion and submit completed Check-Off sheet and Lab writeup in Moodle.