Name_____

EET 251 Lab #5
Multivibrators

OBJECTIVES:

1. To design and test a one-shot (monostable multivibrator) using a 555 IC.
2. To design and test a clock (astable multivibrator) using a 555 IC.
3. To simulate a 555 circuit using *Multisim.*

EQUIPMENT REQUIRED:

- Integrated Circuit: 555.
- Assorted capacitors and resistors
- Digital-Analog Trainer
- Digital Storage Oscilloscope with printing capability

PART A:

- According to your textbook or notes, what is the formula for computing a 555 monostable multivibrator's (one-shot) pulse width?

  t_w =

- Design a 555 monostable multivibrator with a pulse width of 2 seconds. Use the formulas above to calculate the required component values.
  - Show your calculations below, and fill in the blanks with your component values:

R1 = _____ C1 = _____

- Draw the circuit diagram below, including pin numbers on the 555:

- Build the circuit on the breadboard, using a potentiometer if needed.
- Connect the 555's output to an LED.
- Trigger the one-shot using the complemented output of one of the trainer's pulse switches. Observe the output pulse.
- Disconnect the output from the LED and connect it to Channel 1 of the oscilloscope.
- Trigger the one-shot and obtain the pulse on the scope.
- Use the oscilloscope's cursors to measure the exact pulse-width.
- Get a printout showing the pulse-width reading and **turn it in** with this lab.

PART B:

- According to your textbook or notes, what is the formula for computing a 555 astable multivibrator's frequency?

  f =

- What is the formula for computing a 555 astable multivibrator's duty cycle?

  Duty cycle =

- Design a 555 astable multivibrator to generate a 10 kHz waveform with 60% duty cycle. Use the formulas above to calculate the required component values. I recommend choosing C1 = 10 nF or greater, and using resistors in the kilohm range (between 1 kΩ and 100 kΩ).
  - Show your calculations below, and fill in the blanks with your component values:

R1 = _____ R2 = _____

C1 = _____

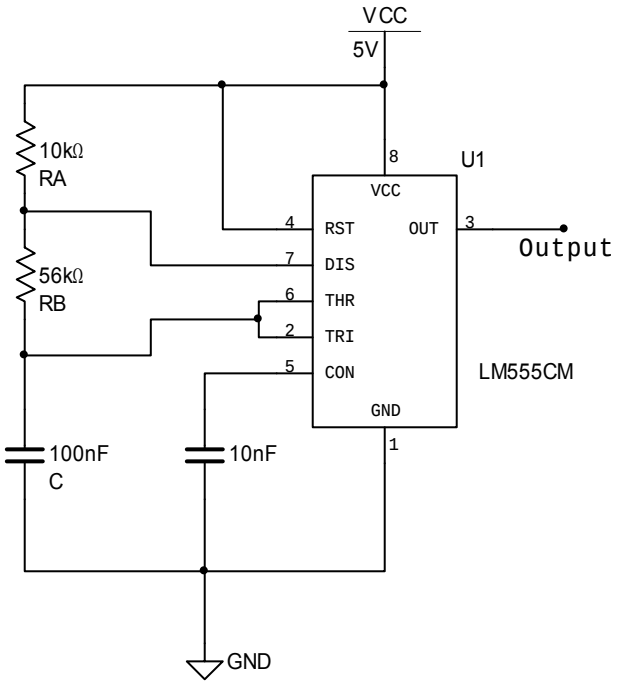
- Draw the circuit diagram below, including pin numbers on the 555:

- Build the circuit on the breadboard, and display the output waveform on the oscilloscope.

- Use the oscilloscope's MEASURE menus to display the waveform's frequency, positive pulse width, and period. Obtain a printout showing these values and **turn it in** with this lab.

PART C:

Consider the circuit shown below.



What type of circuit is this? _____

1. Using equations from your textbook, calculate values for the quantities listed in Data Table A below. Record your calculated values, rounded to three significant digits and using engineering notation with metric prefixes.

2. Then draw the circuit in Multisim. Display the output waveform on Multisim's Tektronix oscilloscope, which is almost identical to the real oscilloscopes we have in our lab room. Using Multisim's oscilloscope, measure the values listed. Record your measured values, rounded to three significant digits and using engineering notation with metric prefixes.

DATA TABLE A: Circuit with R_A = 10 kΩ, R_B = 56 kΩ, and C = 100 nF

Quantity	Calculated Value	Measured Value (from Multisim)
Frequency		
Time high		
Time low		
Duty cycle		

3. When you have completed Data Table A, ask me to check your work. _____

4. Change R_B to 22 kΩ, and repeat Steps 1 and 2 above, recording your values in Data Table B.

DATA TABLE B: Circuit with R_A = 10 kΩ, R_B = 22 kΩ, and C = 100 nF

Quantity	Calculated Value	Measured Value (from Multisim)
Frequency		
Time high		
Time low		
Duty cycle		

5. Change R_B back to 56 kΩ, and change C = 10 nF. Repeat Steps 1 and 2, recording your values in Data Table C.

DATA TABLE C: Circuit with R_A = 10 kΩ, R_B = 56 kΩ, and C = 10 nF

Quantity	Calculated Value	Measured Value (from Multisim)
Frequency		
Time high		
Time low		
Duty cycle		

Questions:

1. On the basis of your observations in Part C, explain what are the effects of reducing the value of resistor R_B.

2. On the basis of your observations in Part C, explain what are the effects of reducing the value of capacitor C.

3. Suggest applications for the circuits of Part A, Part B, and Part C.

4. List the things you have learned from each part of this lab activity.