Lab 2 Thevenin’s Theorem and Impedance

Hand in your attempt of Homework 2 to your professor.

Simple Trouble shooting

1. Use a DMM to measure the resistances of the 4 different resistors in *Homework 2 Problem i-a*. Fill the table. Replace the resistor if it falls out of tolerance.

Parts used	Nominal value	Measured Value	Within tolerance?
R1			
R2			
R3			
R4			

2. Build this circuit on the breadboard and fill the following table. How do your measured actual values compare to your calculation and simulation? Explain and discuss the differences.

	Calculated keep 4 significant figures		Measured Multisim		Measured Actual	
Trouble	VA	VB	VA	VB	VA	VB
circuit OK						
R1 Open						
R2 Open						
R3 Open						
R4 Open						
R1 Shorted						
R2 Shorted						
R3 Shorted						
R4 Shorted						

Thevenin’s Theorem

1. Gather resistors needed for *Homework 2 problem ii*. Measure and record the value of each of the resistors used here. *Make a table like our first exercise of this lab in your lab book. In the future, you will be making all tables on your own.*
2. Build the circuit of *Homework 2 problem ii*, leaving out R_L. Measure V_{th}.
3. Figure out a way to measure R_{th}.

4. Recover to your original circuit and connect a 1kΩ resistor between A and B. Measure and record the new load voltage. Replace the load with a 4.7kΩ resistor and repeat. Leave your circuit on the breadboard for the next step.

Impedance match

1. Find R_{th} by the matched-load method; that is, use the potentiometer as a variable resistance between the AB terminals. Vary resistance until … well, we discussed this in our lecture. Record your measured load resistance. Does the value agree with R_{th} found in step 3 of last exercise? Hint: use a 10kΩ pot. Consult your TA/professor if you don't know how to connect a potentiometer to a circuit.
2. We can measure the output impedance (R_s) of our function generator with a few of load resistors. First, directly connect the output of the function generator to Ch1 of oscilloscope, pick a not-too-fast frequency*(sine wave, less than 50kHz, so we know R_s is not changing with frequency.)* and a voltage of your own choice, record the peak to peak voltage and this is your open load source voltage V_s as a reference. Measure load voltage V_L at 10 different load resistance. Pick the 10 different resistors from 10Ω to 250Ω. Draw the Thevenin-equivalent circuit for the generator. Record your data and plot the function (that you did in your *Homework 2 Problem iii c*) and find the output impedance by doing a linear fitting of your function. Show your work. *(With this method, you wouldn't know R_s until you do the fitting or a manual calculation.)*
   - You may do the fitting with anything you know: Python, MATLAB, Mathematica, Google Sheets, Excel, …
   - Include the code that you used for your fitting with your plot.
3. You can also measure the output impedance of our function generator with a potentiometer(pot). Design your output impedance measurement circuit with a pot (hint: very simple circuit). We have various pots range from 100 Ω to 100k Ω. Which pot will work for your design? Write down your design, draw the circuit and record your measurements and results. *(With this method, you can instantly measure the output impedance R_s. The downside is that you need to play it around a little bit if you don't know the range of R_s in the first place.)*