ELEC 152 - Circuit Theory I

Module 7 Lab: Maximum Power Transfer Theorem.

The purpose of this lab is to explore the application of the Thevenin Equivalent model to the Maximum Power Transfer Theorem.

1. Thevenin and Norton Equivalent Circuits

1.1 Consider the circuit shown in Figure 1.

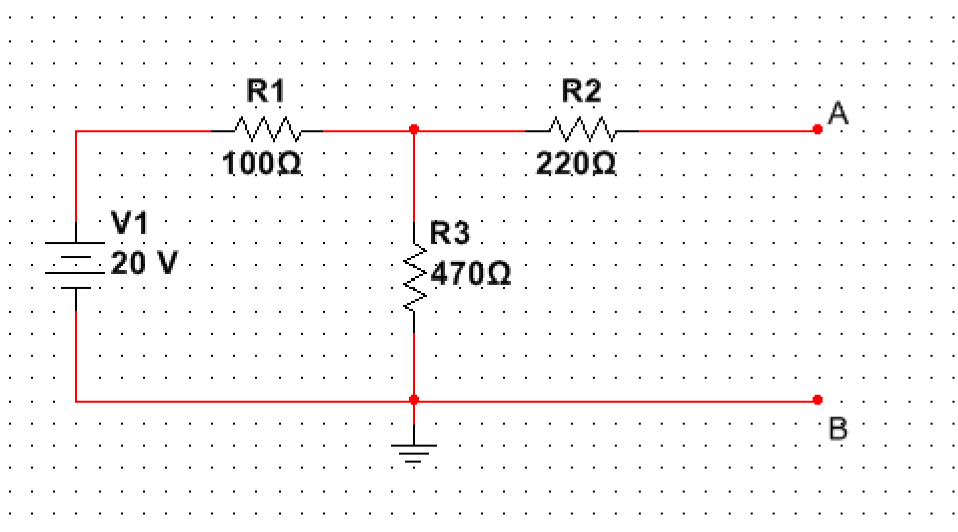

Figure 1: Circuit for Thevenin and Norton Equivalents

1.2 Analyze the circuit from Figure 1 and calculate the values of its Thevenin model and complete the table below:

Thevenin Model	
Vth	
Rth	

1.3 Analyze the circuit again, this time calculating the values of its Norton model and complete the table below:

Norton Model	
I_N	
R_N	

1.4 Verify the equivalency between the parameters of both models.

1.5 Using Multisim, Measure Vth, Rth and $I_{N.}$ Make sure that you show the experimental setup for each parameter in your lab report. Complete the table below.

Thevenin Model	
Vth	
Rth (or R_N)	
I_N	

1.6 Compare the calculated with the measured values. Explain any differences.

2. Maximum Power Transfer

2.1 In order to evaluate the power transferred to a load, we will connect a variable resistor (or a potentiometer) to terminals A-B. We will then vary the value of the load while we measure the power transferred to the load.

We will start by connecting a 500 Ω potentiometer to the terminals A-B: Figure 2 shows the location of potentiometers in Multisim (Basic → Potentiometer → Value). Note that if Multisim does not contain the value of the potentiometer that you need for your experiment, you can change its value by double clicking on the device.

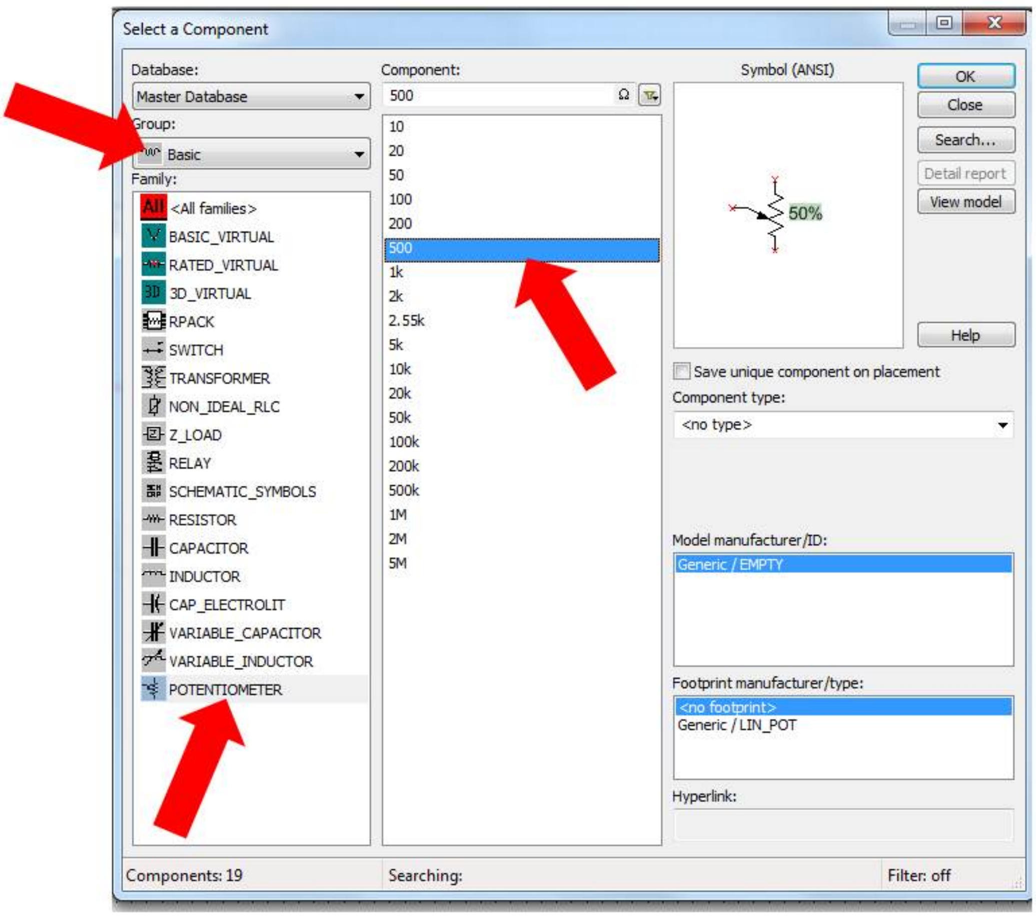

Figure 2: Location of potentiometer

2.2 Connect the potentiometer to the terminals A-B as shown in Figure 3.

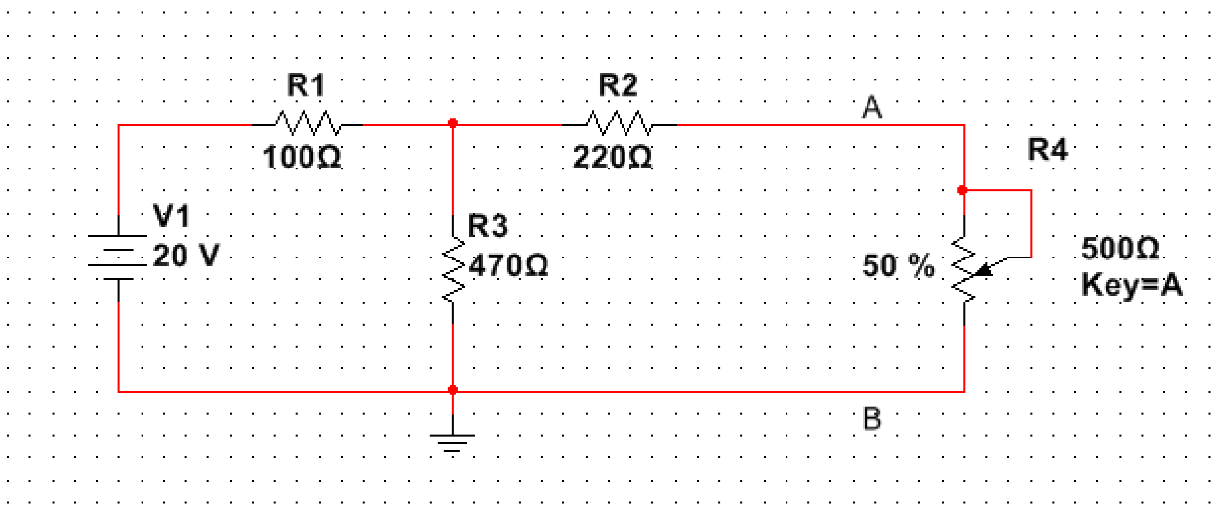

Figure 3: Connection of potentiometer

By default, potentiometers in Multisim are placed with 50% of their nominal value. This means, in this case, that the value of this potentiometer is 250 Ω. The value of the potentiometer can be changed by typing the Key associated with the potentiometer, in this case A. Typing A (capital A) increases the value of its resistance, while typing a (lowercase a) decreases it. This allows the user to easily change the value between 0 and its nominal resistance (500 Ω in this example).

2.3 Measure the power transferred to the load when the value of the potentiometer is 50%. You can use the Wattmeter described in Lab 6, or you can measure voltage and current and multiply both values. At this point, you should be able to set up the instruments on your own.

Power (50% or 250 Ω) =

2.4 We will now vary the value of the potentiometer between 0% and 100%. Complete the table below by calculating the value of the resistance in each case and measuring the power transferred to the load.

% pot	0%	10%	20 %	30 %	40 %	50%	60%	70 %	100%
R									
Power									

2.5 What is the value of the potentiometer that results in the maximum transfer of power? How does this value relate to the Thevenin resistance of the circuit?

3. Laboratory Report

Create a laboratory report using Word or another word processing software that contains at least these elements:

- Introduction: What is the purpose of this laboratory experiment?

- Results for each section: Measured and calculated values, calculations, etc., following the outline. Include screenshots for the circuits and waveforms as necessary -- You can press Alt + Print_Screen inside Multisim or if using Windows 7, you can use the "Snipping tool." Either way, you can paste these figures into your Word processor. Also include here the charts and graphs that you have created with the data you have collected.

- Conclusion: What area(s) you had difficulties with in the lab; what you learned in this experiment; how it applies to your coursework and any other comments.