PE
9

Thevenin's Theorem and Max Power Transfer *(Updated 17SEP2008)*

A Practical Exercise Name:_____ Section: _____

I. Purpose.

1. Review the concept of Thevenin's Theorem for determining the Thevenin equivalent circuit of a DC series/parallel circuit from the standpoint of a two terminal load.
2. Review the use of nodal analysis to determine unknown voltages and branch currents in a DC series/parallel circuit.
3. Introduce the concept of the maximum power transfer theorem.

II. Equipment.

Agilent 34401A Digital Multimeter (DMM)
Agilent E3620A Dual DC Power Supply
Quad Board and Test Leads
Variable Ohm resistor
100 Ohm resistor
330 Ohm resistor
470 Ohm resistor
680 Ohm resistor
1000 Ohm resistor

III. Preparation.

Review procedures for measuring resistance, voltage, and current.

IV. Lab Procedure.

You must **read** and complete each step.

Step One: Circuit Analysis.

☐ Use any circuit analysis technique (preferably nodal analysis, etc.) determine $\boldsymbol{I_L}$, $\boldsymbol{V_{ab}}$, and $\boldsymbol{P_{load}}$ when $\boldsymbol{R_{load}}$ is 1000 Ω in this DC series parallel network (Figure 1).

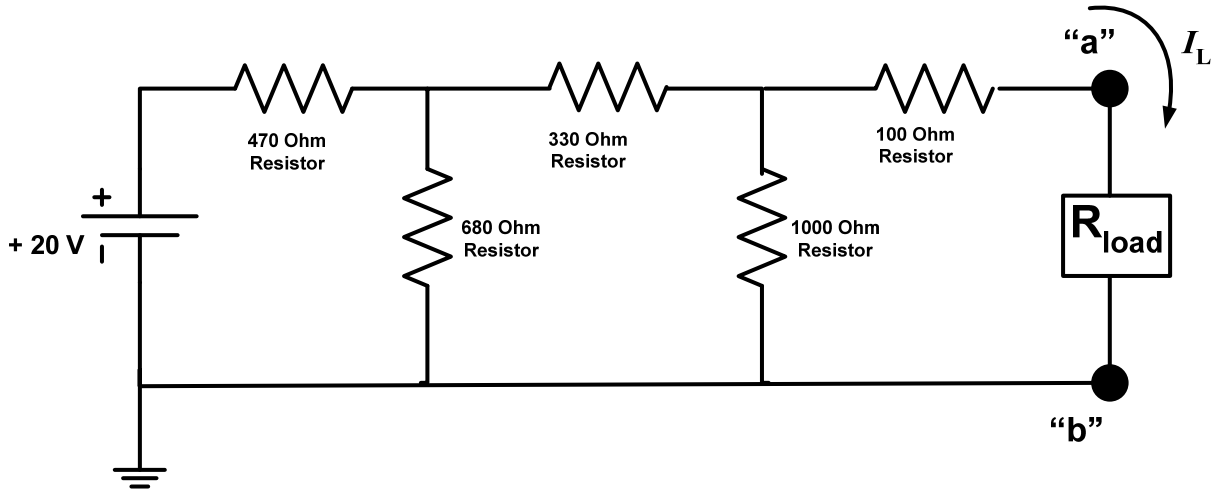

Figure 1

	Calculated values		Power dissipated by the load
I_L		P_{load}	
V_{ab}			

Step Two: Calculate $R_{Thevenin}$ (R_{th}).

☐ For the DC series-parallel circuit in Figure 1, calculate R_{th} as seen from terminals **"a"** and **"b"** of R_{load}.

$$R_{th} = \_\_\_\_\_$$

Step Three: Calculate $E_{Thevenin}$ (E_{th}).

☐ For the DC series-parallel circuit in Figure 1 calculate the open-circuit voltage (E_{th}) across terminals **"a"** and **"b"**.

$$E_{th} = \_\_\_\_\_$$

☐ Sketch the Thèvenin Equivalent circuit in the space provided below.

☐ Assume R_{load} is 1000 Ω and is connected to terminals **"a"** and **"b".** Use your Thevenin Equivalent circuit to calculate the DC current supplied to R_{load} and the total real power dissipated by R_{load}.

$$I_s = \_\_\_\_\_ \qquad P_{load} = \_\_\_\_\_$$

Is the total real power (directly above) calculated using the Thevenin Equivalent circuit the same as the total real power calculated in step one (series-parallel circuit)? _____

Why or Why not? _____

Is this circuit supplying the maximum power to $\mathbf{R_{load}}$? _____

Why or Why not? _____

_____

Step Four: Construct the DC series-parallel circuit.

☐ On a QUAD board construct the DC series-parallel circuit in Figure 2.

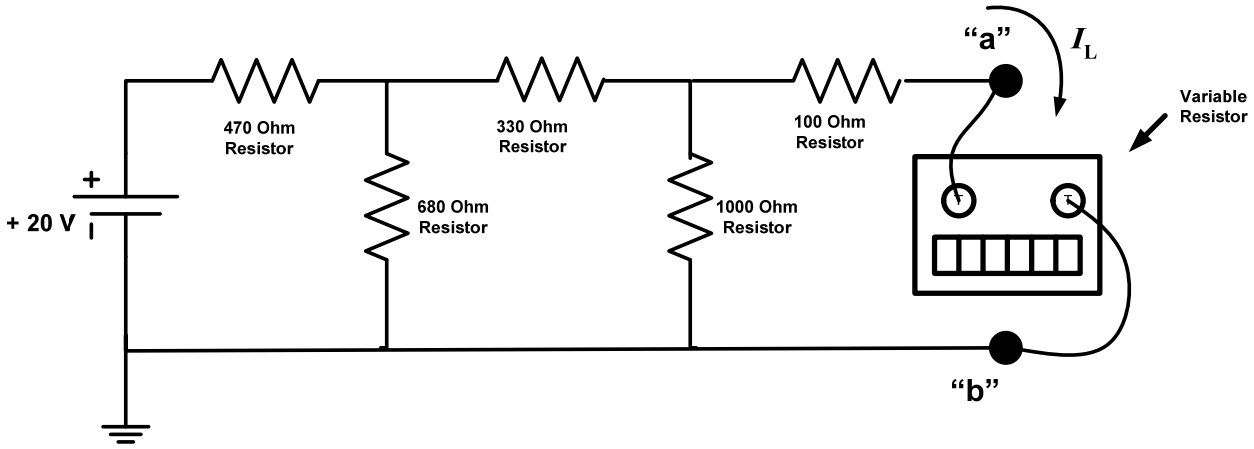

Figure 2

☐ Insert your DMM into your circuit such that it always displays the load current, $\boldsymbol{I_L}$.

☐ Set the variable resistor to 2500 Ω.

☐ Record $\boldsymbol{I_{L2500\Omega}}$

☐ Set the variable resistor to 200 Ω.

☐ Record $\boldsymbol{I_{L200\Omega}}$

☐ Set the variable resistor to $\mathbf{R_{th}}$.

☐ Record $\boldsymbol{I_{R(Thevenin)}}$

	Measured current		**Calculated power dissipated by the R_{load}**
$I_{L2500\Omega}$		$P_{L2500\Omega}$	
$I_{L200\Omega}$		$P_{L200\Omega}$	
$I_{R(Thevenin)}$		$P_{R(Thevenin)}$	

Do your power values verify the Maximum Power Transfer theorem? _____

Explain. _____

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