

## Electrical Circuits LAB 3 - Voltage and Current Dividers

### Objectives

Understand and apply resistor simplification, voltage and current divider concepts to analysis of Electrical circuit.

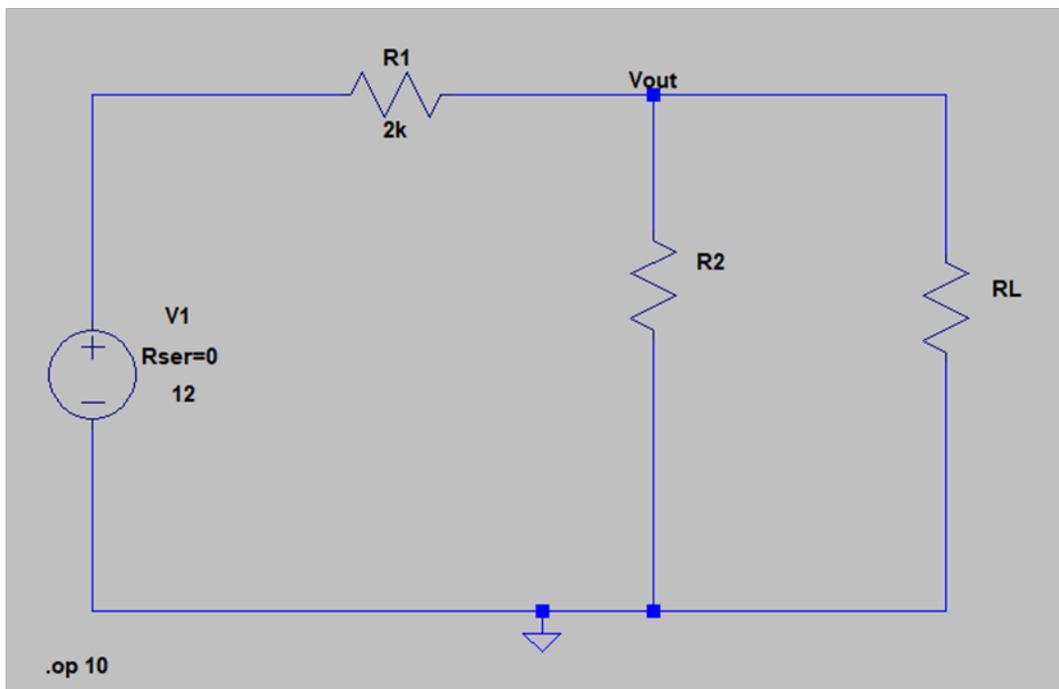
### Preparation

Complete the following steps before starting to work on the experiments in this lab:

- 1) Complete Lab 2 and associated report
- 2) Read textbook, watch lecture videos, and complete homework in Chapter 3 “Analysis of Resistive Circuits”.
- 3) Review the video on STEP Command and Waveform Charting at <https://youtu.be/86aXOFw7YQk>.

### Experiment 1

Use LTspice to determine the value of R2 in the following voltage divider circuit where Vout is 4V in an unloaded configuration ( $R_L = \infty \Omega$ ).



## Experiment 2

Use LTspice STEP function to explore the effect of changing  $R_L$  from  $100\ \Omega$  to  $10\text{k}\ \Omega$  in  $100\ \Omega$  steps on the value of  $V_{out}$ . Plot and describe the effect of  $R_L$  value changes on the  $V_{out}$  value.

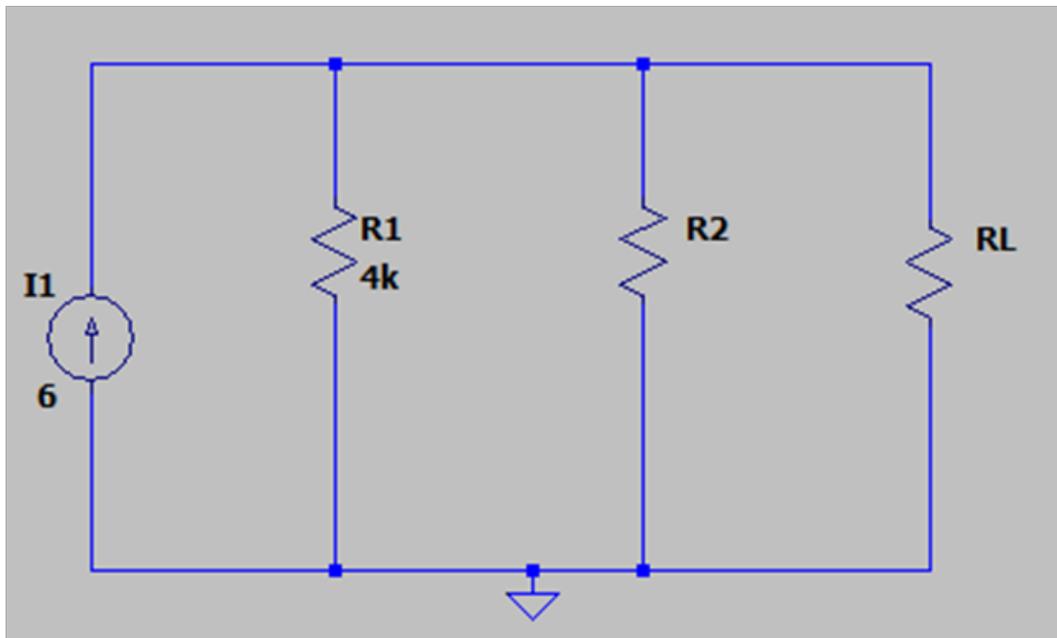
Note:

- 1) Set value of  $R_L$  to  $\{x\}$  and click on icon  to add the SPICE directive  
`.STEP PARAM x 100 10k 100`
- 2) Right click on the chart, left click on "Add Traces" from drop down menu, and left click on  $V(vout)$  to add  $vout$  trace to the chart. To display value of a point on the graph, left click on  $V(vout)$  to active the cursor then left click and hold to drag the cursor to point of interest on the trace.

Describe effect of change (increase or decrease) in values of  $R_1$  and  $R_2$  on reducing  $V_{out}$ 's sensitivity to  $R_L$  value change. Select a value of  $R_1$  and  $R_2$  that reduces sensitivity based on your understanding and use LTspice to support your selection.

## Experiment 3

Use LTspice to determine the value of  $R_2$  in the following voltage divider circuit where the current through  $R_2$  is  $4.8\text{ A}$  in unloaded configuration ( $R_L = \infty\ \Omega$ ).



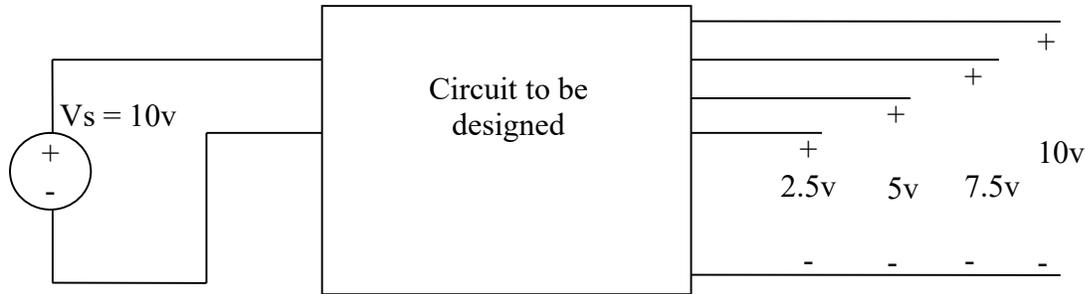
## Experiment 4

Use LTspice STEP function to explore the effect of changing  $R_L$  from  $100\ \Omega$  to  $10\text{ k}\Omega$  in  $100\ \Omega$  steps on the current through  $R_2$ . Plot and describe the effect of  $R_L$  change on current through  $R_2$ .

Describe effect of change (increase or decrease) in values of  $R_1$  and  $R_2$  on reducing  $R_2$  current's sensitivity to  $R_L$  value change. Select a value of  $R_1$  and  $R_2$  that reduces sensitivity based on your understanding and use LTspice to support your selection.

## **Experiment 5**

a) Design a voltage driver that accepts a 10 V supply and produces 4 outputs: 2.5v, 5v, 7.5v and 10v .



Use LTspice to measure the outputs when your circuit's actual output.

- b) Add a 1 k $\Omega$  load to each of the output ports. Calculate the percent difference between the voltages of each output in part a (unloaded) with corresponding output voltages in part b.
- c) Describe the best way to reduce the percentage of output voltage changes from unloaded circuit in part a to the loaded circuit in part b.

## **Report Requirements**

This lab and associated report must be completed individually. All reports must be computer printed (Formulas and Diagrams may be hand drawn) and at minimum:

### **For each experiment include:**

- Clear problem statement in your words.
- Answer to any specific experiment questions (if any)
- Identify the theory or process and associated calculations
- Documents resulting circuit schematics from LTspice, simulation output and additional tables, timing diagram or chart required by the experiment.

### **For the whole report include:**

- A Cover page with your name, class, lab and completion date.
- A Lessons Learned section which summarizes your learning from this lab in 5 sentences or more.
- A New Experiment section that has description of a new experiment and the experiment's results. Experiment should be related to material covered in class but not simply variation of the existing lab experiments.