UNIVERSITY OF MIAMI
Department of Electrical and Computer Engineering
ECE 203

Name: _____
Section: _____
Date: _____

EXPERIMENT 1

VOLTAGE DIVISION

PURPOSE: The purpose of this lab is to introduce a new student to the basics of electric measurements through the use of a simple voltage divider circuit.

Equipment

1 Variable resistance box
1 Digital voltmeter (DVM)
1 D.C. power supply
1 Function generator
1 Oscilloscope

Preliminary Work

Fig. 1.1 shows a voltage divider circuit. For this circuit find:

a) The current I in terms of V_s, R_1, and R_L;
b) The voltage across R_L;
c) The DC power delivered to R_L, and
d) The power supplied by the source.
e) Request the instructor's help to gather information in order to answer discussion item (d).

Experimental Procedure

I. D.C. Measurements:

a) Set up the circuit shown in Fig. 1.1. Measure and record the actual value of R_1.

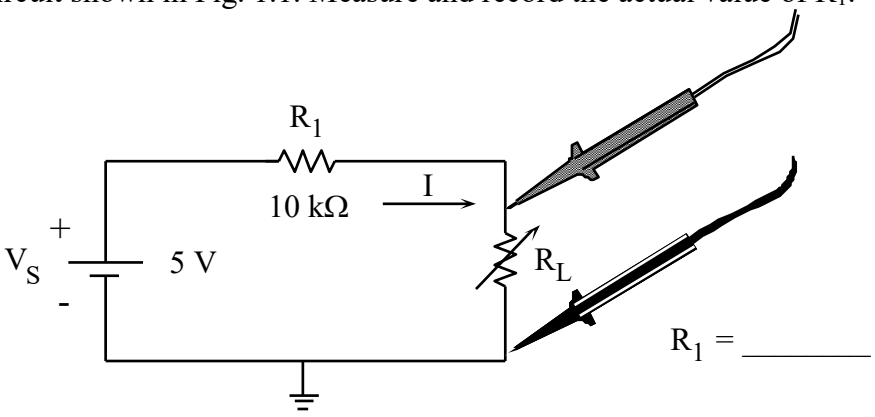

Figure 1.1 Simple voltage divider circuit with DVM probes shown.

b) Set the dc power supply to 5 V. Measure the voltages across R_1 and R_L using the DVM as shown in Fig. 1.1 (Set the DVM to measure DC). Vary the R_L to the values given in Table 1.1; measure the voltages at each point. Enter all the values in the table under the column labeled *"MEASURED"*.

c) Calculate the voltages across the resistors R_1 and R_L for all values of R_L shown in Table 1.1 using the formulas from your preliminary work. Enter the voltages in the table under the column labeled *"CALCULATED"*. Compare V_{RL} against the measured value by calculating the percentage error. Remember that the percentage error can be found from

$$\% \, Error = \left| \frac{Calculated\ value - Measured\ value}{Calculated\ value} \right| x\ 100\%.$$

Show a set of calculations for V_{R1}, V_{R2}, and %Error on V_{RL} in detail.

	Measured		**Calculated**		
R_L (KΩ)	**V_{R1} (V)**	**V_{RL} (V)**	**V_{R1} (V)**	**V_{RL} (V)**	**% Error (V_{RL})**
1					
5					
10					
15					
20					
40					

Measured value of V_s = _____ V

Table 1.1 Measured and calculated dc voltages using DVM

d) Repeat parts (a) - (c) but use the oscilloscope instead of the DVM (see Fig. 1.2). Record your values in Table 1.2. Measure and record the actual value of R_1. Note that the measurement has to be taken as $V_{R1}=VS-V_{RL}$.

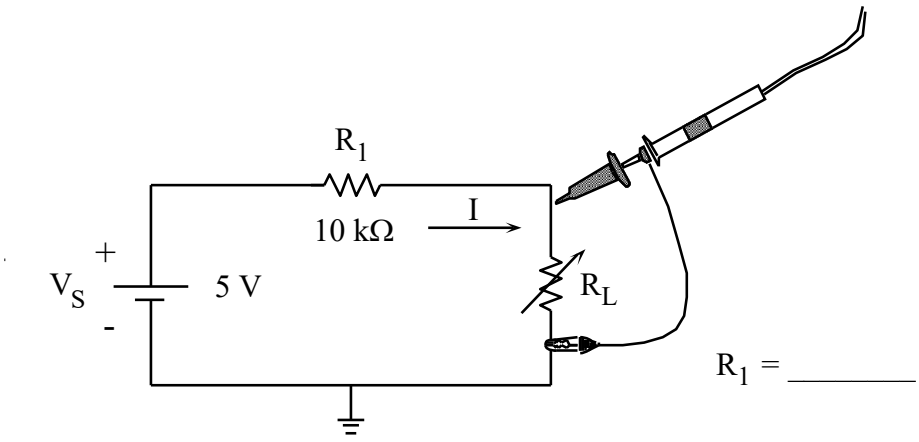

Figure 1.2 Simple voltage divider circuit with oscilloscope probes shown.

	Measured		Calculated		
R_L (KΩ)	**V_{R1} (V)**	**V_{RL} (V)**	**V_{R1} (V)**	**V_{RL} (V)**	**% Error (V_{RL})**
1					
5					
10					
15					
20					
40					

Measured value of V_s = _____ V

Table 1.2 Measured and calculated dc voltages using oscilloscope.

II. AC Measurements:

a) *DVM measurements:* Replace the dc power supply in Fig. 1.1 with the frequency (function) generator. Adjust the voltage to 5 V_{p-p} at 1 kHz. Repeat parts (a) - (c) of the dc measurements. Tabulate your data in Table 1.3. Note that the DVM should be in AC mode in order to measure AC rms. values.

	Measured		Calculated		
R_L (KΩ)	**V_{R1} (V)**	**V_{RL} (V)**	**V_{R1} (V)**	**V_{RL} (V)**	**% Error (V_{RL})**
1					
5					
10					
15					
20					
40					

Measured value of V_s = _____ V_{rms}

Table 1.3 Measured and calculated rms. AC voltages using DVM.

b) *Oscilloscope measurements:* Repeat part (a) of the ac measurements using the oscilloscope. Tabulate your data in Table 1.4.

	Measured		Calculated		
R_L (KΩ)	**V_{R1} (V)**	**V_{RL} (V)**	**V_{R1} (V)**	**V_{RL} (V)**	**% Error (V_{RL})**
1					
5					
10					
15					
20					
40					

Measured value of V_s = _____ $V_{p\text{-}p}$

Table 1.4 Measured and calculated peak-to-peak AC voltages using oscilloscope.

Discussion of Results

a) Comment on the benefits of using either the DVM or the SCOPE for particular situations.

b) Find the current in the circuit of Fig. 1.1 when $R_L = 50\ k\Omega$.

c) In the circuit of Fig. 1.3 R_1 is fixed. Derive the condition under which maximum power will be delivered to R_2. Why?

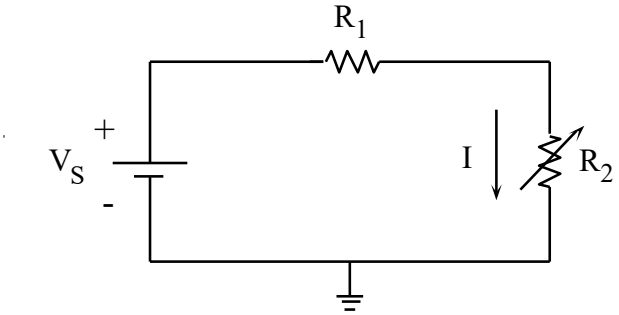

Figure 1.3 Simple voltage divider circuit.

d) Prepare a table indicating the possible measurements that can be carried out using each equipment you used during the experiment.

e) Write a conclusion.