Experiment #2 General DC Circuits

2.1 Introduction:

In most practical circuits, devices are neither connected in simple series nor simple parallel form. Practical devices are connected in various circuit configurations that generally consist of combinations of both series and parallel forms. Some of these circuit connections have standard forms that are identified by such names as **ladder, lattice, tee, pi, wye,** and **delta** networks, to mention but a few. In the process of designing an electrical system, circuit designers try various circuit configurations, evaluate their performances, and select the one that meets or exceeds the design objectives at minimum cost.

This experiment examines the behavior of a general dc circuit, and deals with the design and performance-evaluation of a simple voltage-divider circuit.

Reference: Text; chapter three.

2.2 Objectives:

- To investigate the performance of a general dc circuit.
- To become familiar with the concept of circuit (reference point) ground.
- To design, construct, and test the performance of a simple voltage-divider circuit.

2.3 Prelab Assignment:

1- Consider the general dc circuit shown in Fig (2.1). Through measurements, it is found that the voltage of node # **3** [w.r.t. circuit ground] is **+6V.** Find all the missing data in the following table.

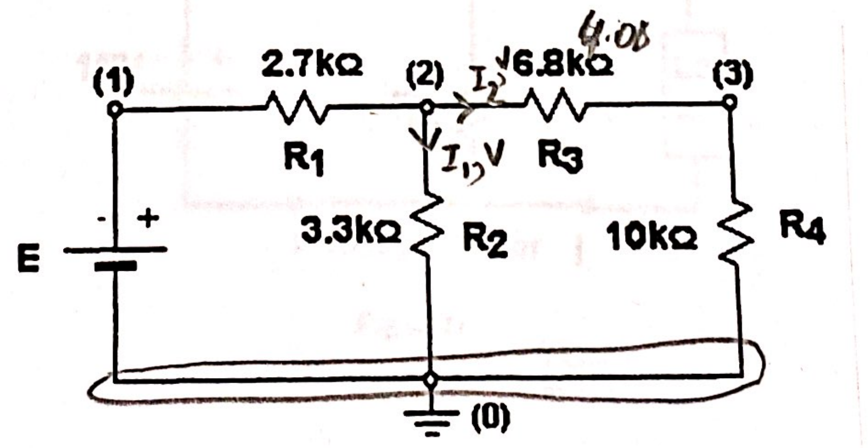


Fig (2.1)

	Device	Voltage across (V)	Current through (mA)	Absorbed Power (mW)
	Source	19.87	0.93	18.5
2.7KΩ	R_1	9.828	0.93	9.144
3.3KΩ	R_2	10.08	0.33	3.31
6.8KΩ	R_3	4.08	0.60	2.45
10KΩ	R_4	6.00	0.60	3.60

2- Given a circuit similar to that in Fig (2.1), but without any numerical values for its components. Use the symbols: "↑" for increase, "↓" for decrease, and "=" for no change, in the following table, to show the effects of an **increase in the value of R_2** on the voltage, current, and power of all devices.

Device	Voltage across	Current through	Absorbed Power
Source "="	=	=	=
R_1 "="	↓	=	↓
R_2 "↑"	↑	=	↑
R_3 "="	↑	=	↑
R_4 "="	↑	=	↑

3- Fig (2.2) shows a **simple voltage-divider** connecting a dc voltage source to a **variable** resistive load. Design the voltage divider to provide a voltage of **about 5V (± 10 %)** across the variable load. The load-current demand varies in the range of **0 to 5mA,** and the available dc-supply voltage is **15V.**

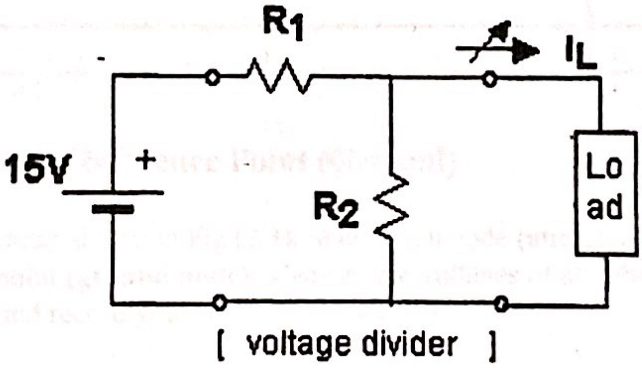


Fig (2.2)

Experiment 2

pre lab

$R_3 : R_4$

$6.8 : 10$

$: 6$

V at R_4: $\frac{6 \times 6.8}{10} = \boxed{4.08\ V}$

$\frac{1}{R_T} = \frac{1}{3.3} + \frac{1}{10+6.8}$

$\frac{1}{R_T} = \frac{335}{924}$ $\boxed{R_T = 2.758\ k\Omega}$

$R_1 : R_T$

$2.7 : 2.758$

$: 10.04$

V at R_1 = $\frac{10.04 \times 2.7}{2.758} = 9.828$ $\boxed{9.83\ V}$

Source = $9.83 + 10.04 = 19.87$

$P = VI$

$V = IR$

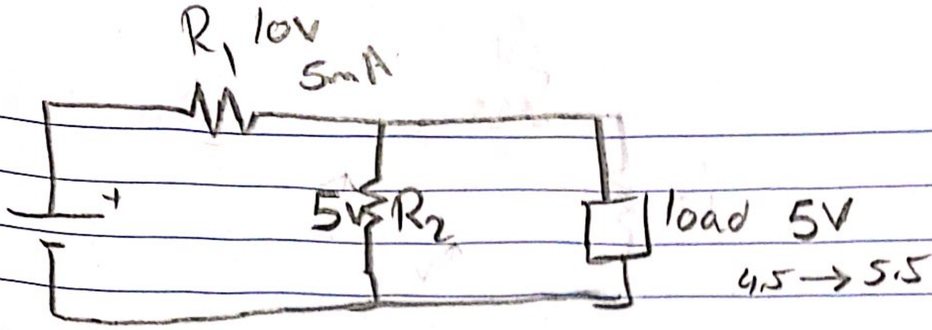
$V/R = I$

$\boxed{6/10 = 0.6\ mA}$

$\boxed{3.3/10.04 = 0.327\ mA}$

$\boxed{0.6 + 0.33 = 0.93\ mA}$

3-



$\uparrow V = IR \uparrow$

$$R_1 = \boxed{\frac{10}{5} = 2k\Omega}$$

R_2 any value