KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Electrical Engineering Department

EE 208 ELECTRICAL SYSTEMS

Experiment # 2 SERIES & PARALLEL CIRCUITS RELATIONSHIPS

OBJECTIVE:

The objective of this experiment is to study the relation between the current, the voltage, and the resistance of the entire combination to that of the separate parts of the **series circuit** and the **parallel circuit**.

APPARATUS: AC Power Supply
Ohmmeter, 2 - AC Voltmeter and AC Ammeter
3 - 120 Lamps (40, 60 and 100 watts)
1 – Double switch

INTRODUCTION:

- **Kirchhoff's Voltage Law (KVL):**
  The algebraic sum of all voltages around any closed path is equal to zero.

- **Kirchhoff's current Law (KCL):**
  The algebraic sum of all currents at a junction point is equal to zero.

Appling the two lows to a **series-connected** elements result in:

1. The current passing through the elements is the **same**.
2. The total voltage across the elements is equal to the **summation** of the voltages across the individual elements.
3. If the elements are resistors, the equivalent resistance is the **summation** of the individual resistances.

$$I_L = I_1 = I_2 = I_3 \qquad (1)$$

$$V_L = V_1 + V_2 + V_3 \qquad (2)$$

$$R_{eq} = R_1 + R_2 + R_3 \qquad (3)$$

Appling the two lows to a **parallel-connected** elements result in:

1. The voltage across all the elements is the **same**.
2. The total current passing through elements is equal to the **summation** of the current passing through the individual elements.
3. If the elements are resistors, the equivalent conductance is the **summation** of the individual conductance.

$$I_L = I_1 + I_2 + I_3 \qquad (4)$$

$$V_L = V_1 = V_2 = V_3 \qquad (5)$$

$$G_{eq} = G_1 + G_2 + G_3 \qquad (6)$$

PROCEDURE:

Part I SERIES CIRCUIT

1. Connect the circuit shown in **figure 1**.

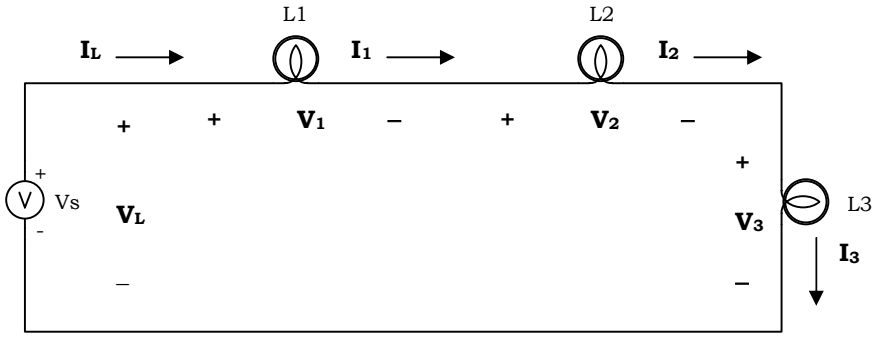

Figure 1

2. Connect a **voltmeter** in parallel and an **ammeter** in series with the voltage source to measure its voltage and its current.
3. Have the **instructor** check the circuit before energizing it.
4. **Close** the main switch and **set** the voltage of the source ($V_s = V_L$) to **100** V.
5. With the source **unchanged** measure voltage $\mathbf{V_L}$ and current $\mathbf{I_L}$ and record your results in Table 1.
6. **Open** the main switch.
7. Connect a **voltmeter** and an **ammeter** to the first lamp to measure its voltage and current. (Use **another** voltmeter and keep the first voltmeter connected to the source.)
8. **Close** the main switch.
9. With the source **unchanged** measure voltage $\mathbf{V_1}$ and current $\mathbf{I_1}$ and record your results in Table 1.
10. **Repeat** steps 6 through 9 **for remaining** lamps and record your results in Table 1.

Part II PARALLEL CIRCUIT

1. Connect the circuit shown in **figure 2**.

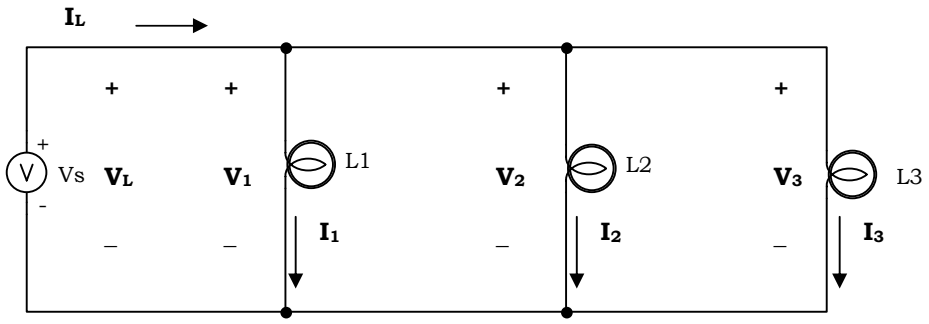

Figure 2

2. Connect a **voltmeter** in parallel and an **ammeter** in series with the voltage source to measure its voltage and its current.
3. Have the **instructor** check the circuit before energizing it.
4. **Close** the main switch and **set** the voltage of the source ($V_s = V_L$) to **100** V.
5. With the source **unchanged** measure voltage $\mathbf{V_L}$ and current $\mathbf{I_L}$ and record your results in Table 2.
6. **Open** the main switch.
7. Connect a **voltmeter** and an **ammeter** to the first lamp to measure its voltage and current. (Use **another** voltmeter and keep the first voltmeter connected to the source.)
8. **Close** the main switch.
9. With the source **unchanged** measure voltage $\mathbf{V_1}$ and current $\mathbf{I_1}$ and record your results in Table 2.
10. **Repeat** steps 6 through 9 for **remaining lamps** and record your results in Table 2.

REPORT:

1. Using Ohm's Law and the data in Table 1 find the **resistance** of each element of the circuit given in Figure 1 and record your results in Table 3.
2. Using Ohm's Law and the data in Table 2 find the **conductance** of each element of the circuit given in Figure 2 and record your results in Table 4.
3. **Fill** in what is left in Tables 3 and 4.
4. Using the data measured in Tables 1 & 3 **show** that **equations** 1 through 3 are **verify** the experimentally.
5. Using the data measured in Tables 2 & 4 **show** that **equations** 4 through 6 are **verify** the experimentally.

QUESTIONS:

1. What is the relation between the line current and the current through each element in a series circuit?
2. What is the relation between the total voltage and the voltage across the individual element in a parallel-circuit?
3. What is the relation between total resistance and individual resistance in a parallel-circuit?
4. What would happen if one of the elements in a series-connected circuit burned out? What about in a parallel-connected circuit?
5. Which lamp is brighter in the series circuit: the low-resistance lamp or the high resistance lamp?
6. Which lamp is **brighter** in the **parallel** circuit: the low-resistance lamp or the high-resistance lamp?

EXPERIMENT # 2 Laboratory Report

Name: ..... **I.D.** ..... **Lab. Section:** .....

TABLE 1

V_L	V_1	V_2	V_3	I_L	I_1	I_2	I_3

TABLE 2

V_L	V_1	V_2	V_3	I_L	I_1	I_2	I_3

TABLE 3

R_1	R_2	R_3	R_L	$R_{eq}= R_1+ R_2+R_3$	% Error in R_{eq}

TABLE 4

G_1	G_2	G_3	G_L	$G_{eq}= G_1+ G_2+G_3$	% Error in G_{eq}