KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

Electrical Engineering Department

EE 208 ELECTRICAL SYSTEMS

Experiment # 3 SERIES & PARALLEL CONNECTIONS, CDR & VDR

OBJECTIVE:

1 - To **study** series and parallel connections of electrical elements experimentally.
2 - To experimentally **verify** the current divider rule (**CDR**) for parallel circuits and the voltage divider rule (**VDR**) for series circuits.

APPARATUS: DC Power Supply
Ohmmeter, DC Voltmeter and DC Ammeter
Carbon Resistors: 100 Ω, 150 Ω, 220 Ω and 330 Ω.

THEORY:

- **Series Conditions:**

By definition, a series connection between any two electrical elements is such that the **same current passes through both elements**. For example element e1, e2, and e3 in Figure 1 are in series since the same current I1 passes through them.

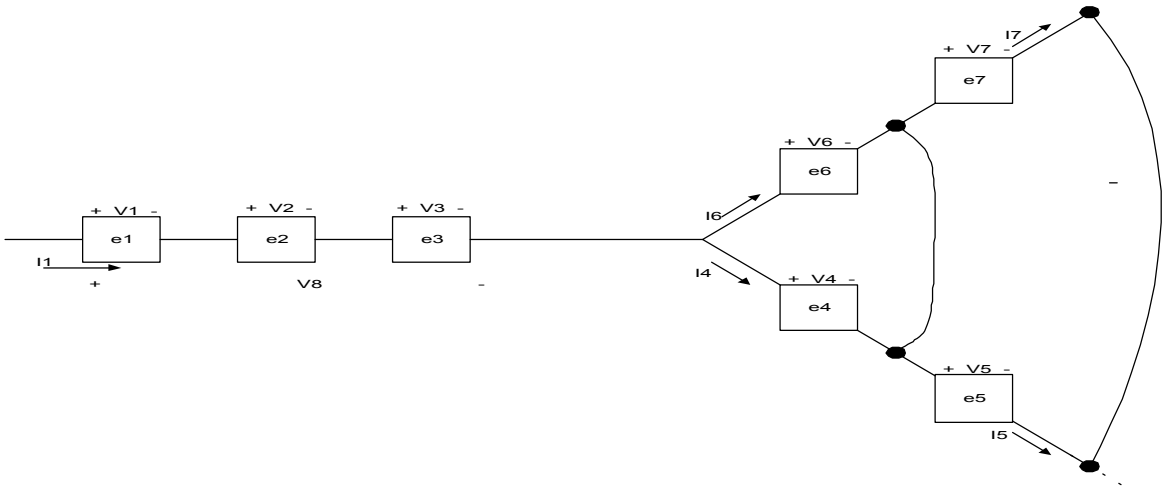

Figure 1

- **Parallel Connections:**

By definition, a parallel connection between any two electrical elements is such that **the voltage is the same across both the elements**. For example, elements e4 and e6 in Figure 1 are in parallel, since the same voltage ($V_4 = V_6$) is across both of them. Also, element e5 and e7 are in parallel for a similar reason.

- **Voltage Divider Rule (VDR):**

For a discussion of VDR, refer to your textbook. As an example of VDR, in Figure 1, if e1 = R_1, e2 = R_2, and e3 = R_3, then:

$$V_1 = \frac{R_1}{R_1 + R_2 + R_3} V_8 \quad (1)$$

$$V_2 = \frac{R_2}{R_1 + R_2 + R_3} V_8 \quad (2)$$

- **Current Divider Rule (CDR):**

For a discussion of CDR, refer to your textbook. As an example of CDR in Figure 1, If e4= R_4 and e6 = R_6, then:

$$I_4 = \frac{R_6}{R_4 + R_6} I_1 \quad (3)$$

For I_5 and I_7, CDR can be applied as

$$I_5 = \frac{R_7}{R_5 + R_7} (I_4 + I_6) \quad (4)$$

$$I_7 = \frac{R_5}{R_5 + R_7} (I_4 + I_6) \quad (5)$$

This is valid, since I_4 + I_6 is the total current passing though the parallel combination in this case.

PROCEDURE:

1- **Check the values** of resistors used in the circuit of Figure 2, using the Ohmmeter. Record the values in Table 1.

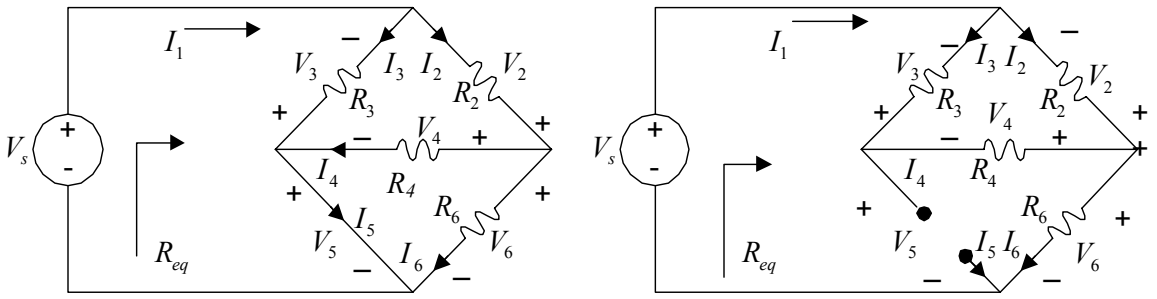

Figure 2

2- **Connect** the circuit of **Figure 2a** and adjust the supply **voltage Vs to 10** V, using the DC voltmeter.

3- **Measure the entire unknown voltages and currents shown**. Record their values in Table 2.

4- **Measure Req** using an Ohmmeter and record its values in Table 2.

5- **Connect** the circuit of **Figure 2b** and adjust the supply voltage **Vs to 10 V**, using the DC voltmeter.

6- **Measure the entire unknown voltages and currents shown**. Record their values in Table3 (*recall that when measuring current by an ammeter, the ammeter should be placed in series with the element in which the current passes. Keep this fact in mind when measuring* I_5.)

7- **Measure Req.** and record its value in Table 3.

REPORT:

1- For the circuit shown in **Figure 2a and Figure 2b**, calculate: the **unknown voltages** and **currents** shown and the **equivalent resistance** seen by V_s. Record your results in Table 1 and Table 2.

2- **Compare** the theoretical and experimental values of voltages and currents and the equivalent resistance of **both circuits**. **Calculate the percent errors**.

QUESTIONS:

- Referring to the circuit of **Figure 2a:**

1. Are R_4 and R_6 in parallel or in series?
2. Are R_3 and R_4 in parallel or in series?
3. Are Vs and R_3 in parallel or in series?
4. Are Vs and R_6 in series or in parallel?
5. Are Vs and R_{eq} in parallel or in series?
6. Is VDR applicable for applicable for R_3 and R_4?
7. Is CDR applicable for R_4 and R_6?
8. Is the parallel combination of R_4 and R_6 in series or in parallel with R_2?

Justify your answer in each case by referring to the experimental results.

- Referring to circuit of **Figure 2b:**

Questions 9-15: **Answer** questions 1-7 respectively for the circuit of Figure **2b**.

16. Is the series combination of R_3 and R_4 in series or in parallel with R_2?

Justify your answer in each case by referring to the experimental results.

EXPERIMENT # 3 Laboratory Report

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

TABLE 1

Resistor Values:

Resistor	R_2	R_3	R_4	R_6
Nominal Value (Ohm)	100	220	150	330
Ohmmeter reading				

TABLE 2

Circuit of Figure 2a:

Unknown	I_1	I_2	I_3	I_4	I_5	I_6	V_2	V_3	V_4	V_5	V_6	R_{eq}
Theory												
Experiment												
% Error												

TABLE 3

Circuit of Figure 2b

Unknown	I_1	I_2	I_3	I_4	I_5	I_6	V_2	V_3	V_4	V_5	V_6	R_{eq}
Theoretical												
Experimental												
% Error												