Laboratory 4

Series and Parallel Circuits and the Node Voltage Method

Objectives

Students will:

- Familiarize with breadboards by constructing more complex circuits
- Analyze series-connected and parallel-connected circuits
- Study and verify node-voltage methods

Equipment and Components

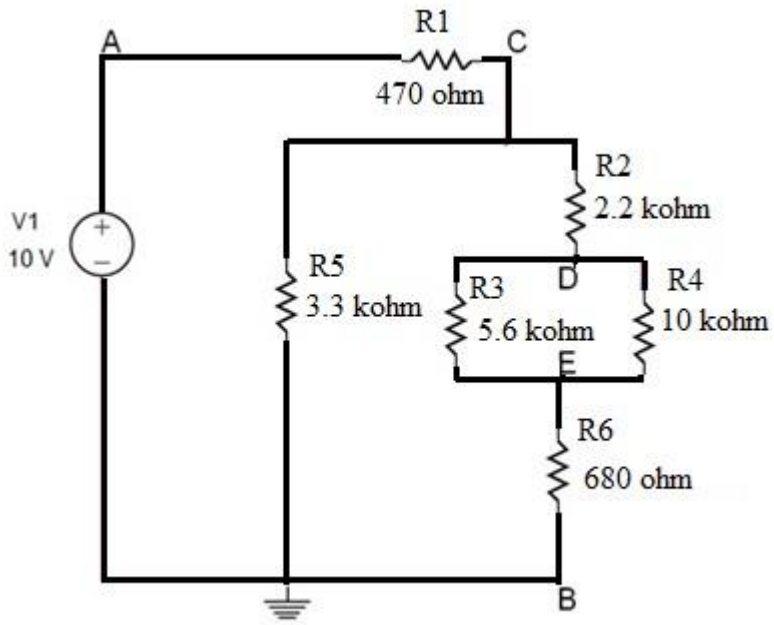
- 2x Digital multimeters
- 2x Power supplies
- 1 Breadboard
- Cables and connecting wires as needed
- Resistors: 100 Ω, 270 Ω, 470 Ω, 680 Ω, 1 kΩ, 2.2 kΩ, 3.3 kΩ, 5.6 kΩ, 10 kΩ, 100 kΩ, 4.7 MΩ, 10 MΩ.

Preliminary Work

- Read Section 2.5, 2.6,3.1, 3.2, 3.2 of the textbook.
- **Fill out the tables (theoretical values) for the given circuits**. Clearly indicate units for your solutions. Show your results to your instructor before starting the lab.

Procedures

1. A) construct the following circuit without the power supply on the breadboard.



B) Measure the equivalent resistance seen by the source. What is the % error of the measured and calculated values of this equivalent resistance?

	Theoretical Value*	Measured Value	% Error
Equivalent resistance			

2. Apply 10 V to the circuit and measure the following currents and voltages shown in the table below. **Note:**
    - **to measure V_{XY}, the red lead of the DMM (Digital Multimeter) should be at point X and the black lead at point Y of the circuit. For example, to measure V_{AC}, the red lead of the DMM should be at point A and the black lead at point C of the circuit**
    - **to measure V_X, the red lead of the DMM should be at point X and the black lead at Ground (point B in the above circuit.)**

Variable	Theoretical Value*	Measured Value
I_{R1}		
I_{R2}		
I_{R3}		
I_{R4}		
I_{R5}		
I_{R6}		

Variable	Theoretical Value*	Measured Value
V_A		
V_B		
V_C		
V_D		
V_E		

Variable	Theoretical Value*	Measured Value
V_{AC}		
V_{CD}		
V_{DE}		
V_{EB}		
V_{CE}		

3. If R_1 is removed from the circuit, what would be the value of V_D? Explain.

Variable	Theoretical Value*	Measured Value
V_D		

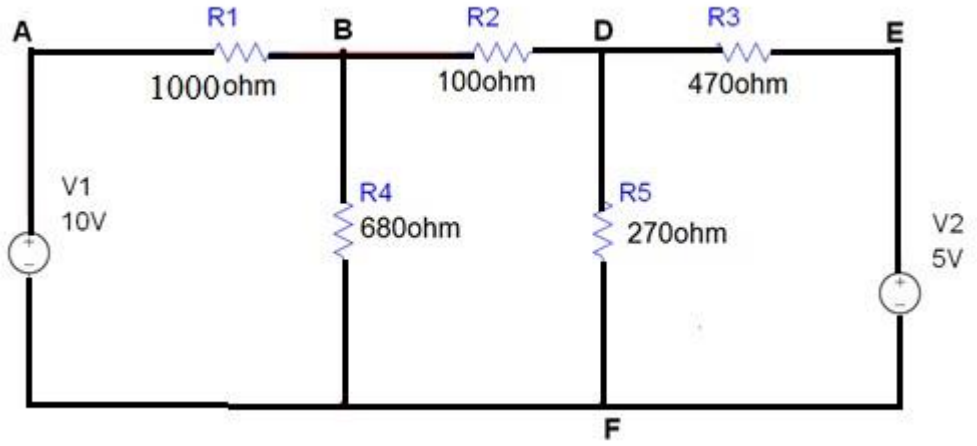
4. If R_6 is removed from the circuit, what would be the value of V_D? Explain.

Variable	Theoretical Value*	Measured Value
V_D		

5. If R_5 is removed from the circuit, would the current in R_1 increase or decrease?

_____

6. Construct the circuit shown below on the breadboard. Use the DC power supply to provide the two voltage sources as shown in the circuit. **Node F is the reference node.**



7. Measure and fill out the voltages in the table below. Verify the KVL for each loop in the circuit.

Variable	Theoretical Value*	Measured Value
V_{AB}		
V_{BD}		
V_{DE}		
V_{EF}		
V_{AF}		
V_{BF}		
V_{DF}		

Questions and conclusions

- Summarize your findings and explanations in response to the questions posed in this lab.

Note: **Please, <u>clean up and put everything in their original places before leaving labs!</u>**