Lab 2: KCL, Current Divider Rule with Parallel and Ladder Circuit.

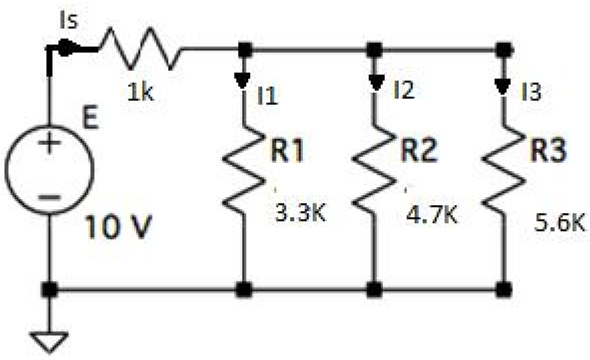
Objectives

- Learn how to connect a parallel circuit on a breadboard.
- Validate the current divider rules.
- Verify Kirchhoff's current law.
- Verify KCL and KVL in ladder circuit.

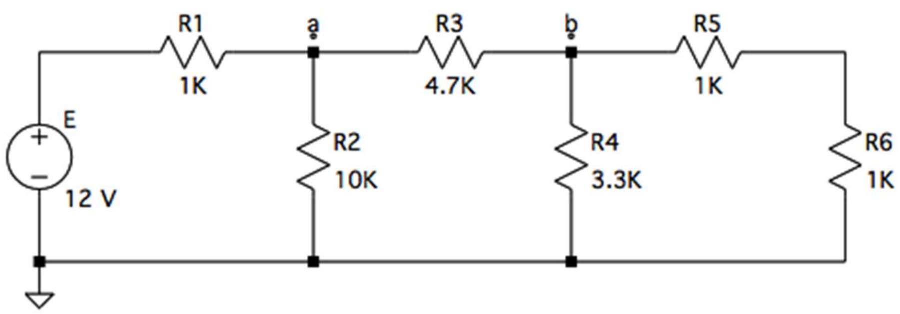
List of Components:

I. Trainer board
II. Resistors (1K, 3.3 KΩ, 4.7 KΩ, 5.6K, 10K)
III. Digital Multimeter (DMM)
IV. Connecting Wire

Circuit Diagram:



Circuit 1



Circuit 2

Procedure:

1. Identify all the given resistors using color coding and fill in the required columns in Table 1.
2. Measure the resistances of the resistors using the DMM and fill in the required column in Table 1.
3. Calculate the percentage error of the resistance values.

   Percentage Error = |(Practical value – Theoretical value)| / Theoretical value

1. Build the circuit 1
2. Using the DMM, measure the currents I_s, I_1, I_2, and I_3. Record the readings in Table 2.
3. Fill in Table 3.
4. Now, disconnect the voltage source from the circuit and measure the total load resistance, Req of the circuit using DMM. Note down values in Table 4.
5. Construct Circuit 2.
6. Using a DMM, measure the potential differences across all the resistors in circuit 2. Record all the readings in Table 5

7. Using a DMM, measure the current through all the resistors and record in Table 5.

Table 1:

Resistance using colour coding					Resistance using DMM	% Error
Band 1	Band 2	Band 3	Band 4	Resistance ± tol		

Table 2:

Experimental readings				Theoretical values			
I_S	I_{R1}	I_{R2}	I_{R3}	I_S	I_{R1}	I_{R2}	I_{R3}

% Error			
I_S	I_{R1}	I_{R2}	I_{R3}

Table 3:

I_S		**Is Total Current equal to sum individual current?**
Sum of individual Current ($I_{R1} + I_{R1} + I_{R3}$)		

Table 4:

Experimental Req	Theoretical Req	% Error

Table 5:

Component	Voltage	Current
E		
R1		

R2		
R3		
R4		
R5		
R6		

Report

1. State the current division rule.
2. State the Kirchhoff's current law (KCL)
3. Showing all steps, calculate the theoretical values in Table 2. Compare theoretical values to your experimental values and explain whether your circuit follows KCL or not.
4. Does your circuit follow current division rule?
5. Showing all the steps, theoretically calculate Req. Compare with the experimental value.
6. Calculate all the theoretical values for Table 5. Show all steps.
7. Verify Kirchhoff's voltage law within each independent closed loop of the circuit from the experimental data.
8. Verify Kirchhoff's current law at nodes *a* and *b* of the circuit from the experimental data.

Useful Formula:

Current Divider Rule : $I_X = Is\ R_T / R_X$

% Error = (Theoretical value – Experimental Value) / Theoretical Value