Spring 2023

EEE/ETE 141L

Electrical Circuits-I Lab (Sec-19)

Faculty: Mr. Saif Ahmed (SfA)

Instructor: Md. Rabiul Karim Khan

Lab Report 04: Delta-Wye Conversion

Date of Performance:
19 March, 2023

Date of Submission:
02 April, 2023

Group no.: 05

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Experiment Name: Delta-Wye Conversion.

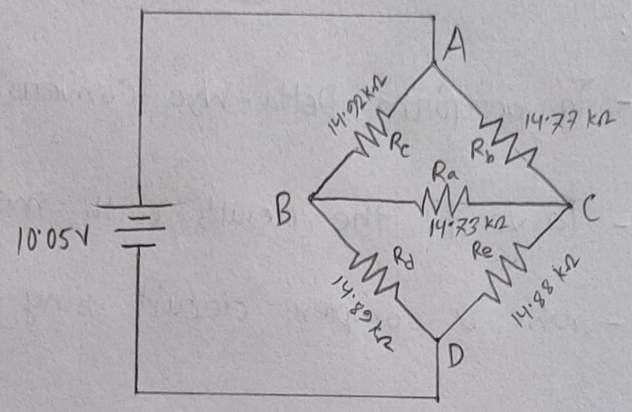
Objective:

- To perform Delta-Wye Conversion.
- To verify the results with measured data.
- Solve a complex circuit using Delta-Wye Conversion.

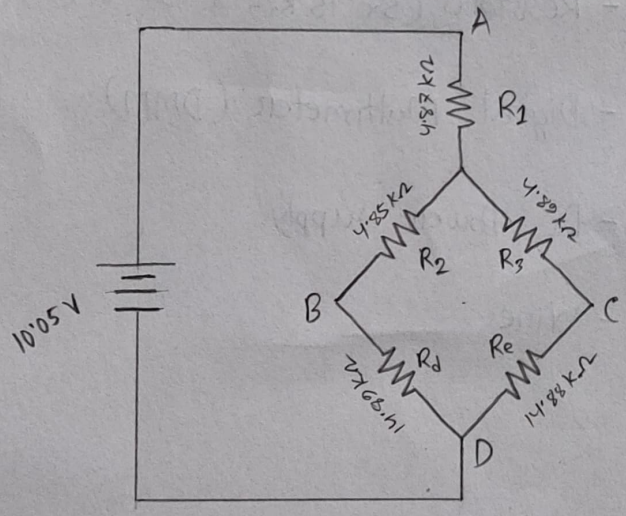
Apparatus:

- Breadboard
- Resistors (5x 15 kΩ & 3x 5 kΩ)
- Digital Multimeter (DMM)
- DC Power Supply
- Wires

Circuit Diagram:



Circuit-1



Circuit-2

Data Table:

Readings	Circuit-1 (V)	Circuit-2 (Practical) (V)	Circuit-2 (Theoretical) (V)	% Error
V_{AB}	4.99	4.96	4.96	0
V_{BC}	0.004	0.012	0.01	20
V_{AC}	5.00	4.97	4.97	0
V_{AD}	10.05	10.03	10.05	0.20
V_{BD}	5.04	5.026	5.09	0.59
V_{CD}	5.04	5.025	5.08	0.59

Here,

$$V_s = 10.05\ V$$

Theoretical value of Circuit-2:

$$R_T = R_1 + \left((R_2 + R_d) \parallel (R_3 + R_e) \right)$$

$$= R_1 + \left((4.85 + 14.89) \parallel (4.89 + 14.88) \right)$$

$$= R_1 + \left(19.74 \parallel 19.77 \right)$$

$$= R_1 + \left(\left(\frac{1}{19.74} + \frac{1}{19.77} \right)^{-1} \right)$$

$$= R_1 + 9.87$$

$$= 4.87 + 9.87$$

$$= 14.74\ k\Omega$$

$$\therefore I_s = \frac{V_s}{R_T} = \frac{10.05\ V}{14.74\ k\Omega} = 0.68\ mA$$

$\therefore I_{R1} = I_s = 0.68\,mA$

$\therefore V_{R1} = (0.68 \times 4.87) = 3.31\,V$

$\therefore I_{R2} = \frac{0.68 \times 9.87}{19.74} = 0.34\,mA$

$\therefore V_{R2} = (0.34 \times 4.85) = 1.65\,V$

$\therefore I_{R3} = \frac{0.68 \times 9.87}{19.77} = 0.34\,mA$

$\therefore V_{R3} = (0.34 \times 4.89) = 1.66\,V$

$\therefore I_{Rd} = I_{R2} = 0.34\,mA$

$\therefore V_{Rd} = (0.34 \times 14.89) = 5.06\,V$

$\therefore I_{Re} = I_{R3} = 0.34\,mA$

$\therefore V_{Re} = (0.34 \times 14.88) = 5.06\,V$

Now,

$V_A = 10.05\,V$

$V_B = (10.05 - 3.31 - 1.65) = 5.09\,V$

$V_c = (10.05 - 3.31 - 1.66) = 5.08\,V$

$V_D = 0\,V$

$\therefore V_{AB} = (10.05 - 5.09) = 4.96\ V$

$\therefore V_{BC} = (5.09 - 5.08) = 0.01\ V$

$\therefore V_{AC} = (10.05 - 5.08) = 4.97\ V$

$\therefore V_{AD} = (10.05 - 0) = 10.05\ V$

$\therefore V_{BD} = (5.09 - 0) = 5.09\ V$

$\therefore V_{CD} = (5.08 - 0) = 5.08\ V$

Error Calculation:

For,

$$V_{BC} = \left| \frac{0.01 - 0.012}{0.01} \right| \times 100\% = 20\%$$

$$V_{AD} = \left| \frac{10.05 - 10.03}{10.05} \right| \times 100\% = 0.20\%$$

$$V_{BD} = \left| \frac{5.09 - 5.06}{5.09} \right| \times 100\% = 0.59\%$$

$$V_{CD} = \left| \frac{5.08 - 5.05}{5.08} \right| \times 100\% = 0.59\%$$

Graph: N/A

Result Analysis:

After completing this experiment, we found that the voltage of each point of the two circuits is approximately the same. That means we successfully convert the delta circuit into a wye circuit.

Questions and Answers:

01. Already showed in Data Table section.

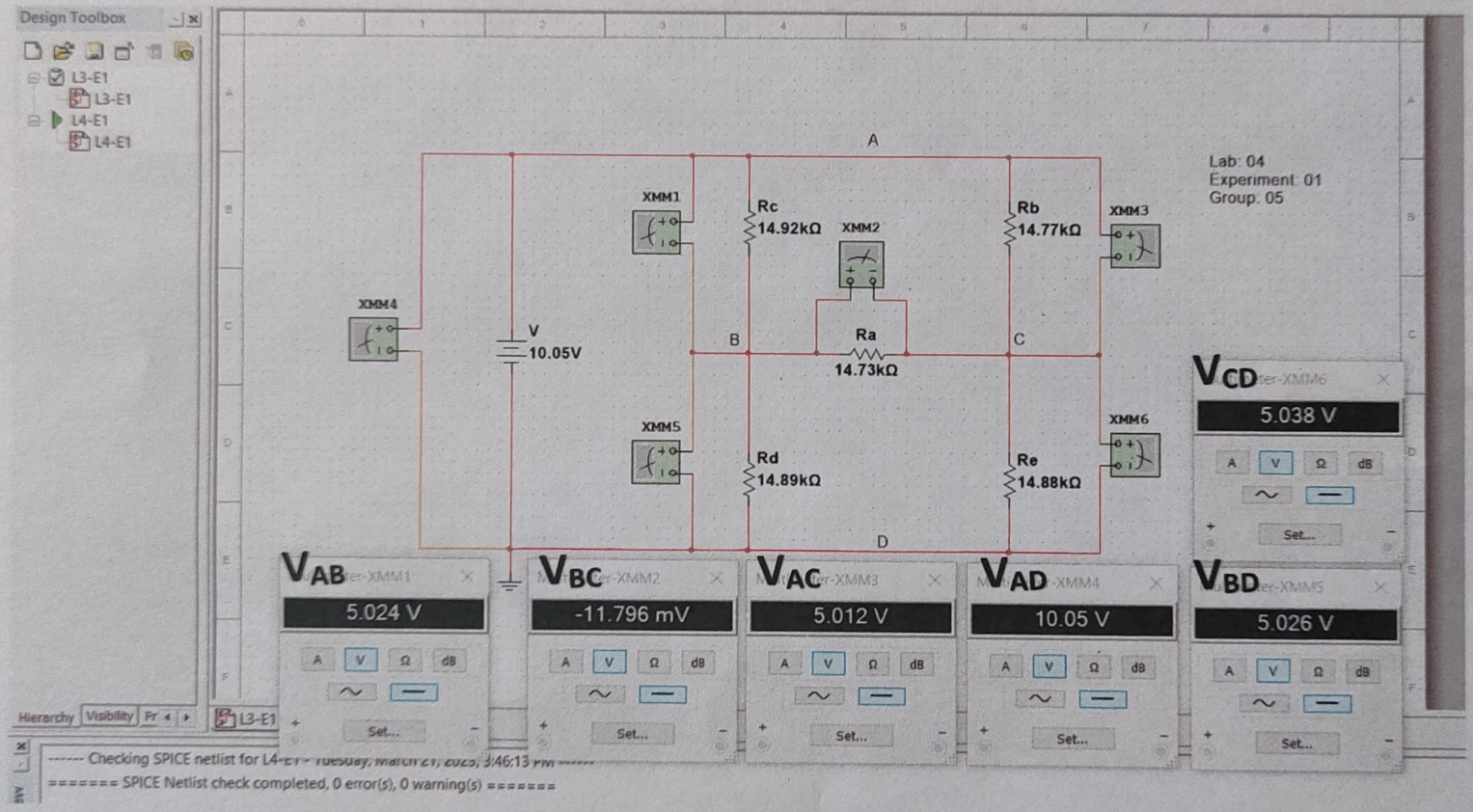
Discussion:

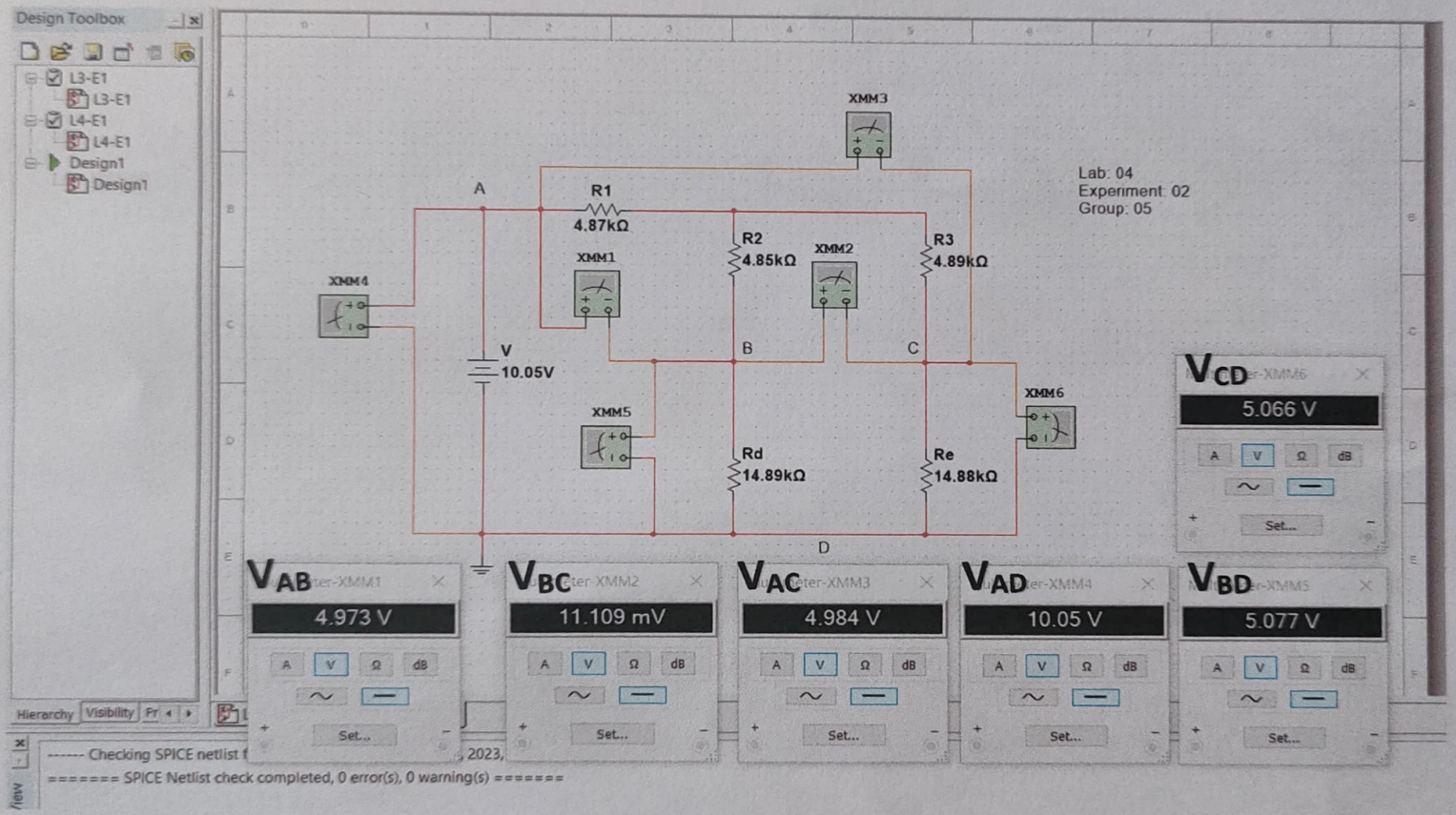
After this experiment, we learn about converting a delta circuit to a wye circuit. Now we can analyze a complex circuit using Delta-Wye conversion. The theoretical value and the measured value are approximately the same. That means our two circuits support the Delta-Wye conversion. In this experiment, we don't face any problems. Everything works perfectly. We complete this experiment within a short time.

Attachment:

01. Signed Data Table.

02. Simulation using Multisim.


Design Toolbox
L3-E1
L3-E1
L4-E1
L4-E1
Hierarchy
Visibility
Pr
L3-E1
A
B
C
D
Lab: 04
Experiment: 01
Group: 05
XMM1
XMM2
XMM3
XMM4
XMM5
XMM6
Rc
14.92kΩ
Rb
14.77kΩ
Ra
14.73kΩ
Rd
14.89kΩ
Re
14.88kΩ
V
10.05V
VAB
5.024 V
VBC
-11.796 mV
VAC
5.012 V
VAD
10.05 V
VCD
5.038 V
VBD
5.026 V
A
V
Ω
dB
Set...
------ Checking SPICE netlist for L4-E1 - Tuesday, March 21, 2023, 3:46:13 PM ------
======= SPICE Netlist check completed, 0 error(s), 0 warning(s) =======


Design Toolbox
L3-E1
L3-E1
L4-E1
L4-E1
Design1
Design1
Hierarchy
Visibility
XMM3
XMM1
XMM2
XMM4
XMM5
XMM6
R1
4.87kΩ
R2
4.85kΩ
R3
4.89kΩ
Rd
14.89kΩ
Re
14.88kΩ
V
10.05V
A
B
C
D
Lab: 04
Experiment: 02
Group: 05
VAB
4.973 V
VBC
11.109 mV
VAC
4.984 V
VAD
10.05 V
VBD
5.077 V
VCD
5.066 V
A
V
Ω
dB
Set...
------ Checking SPICE netlist f
2023,
======= SPICE Netlist check completed, 0 error(s), 0 warning(s) =======

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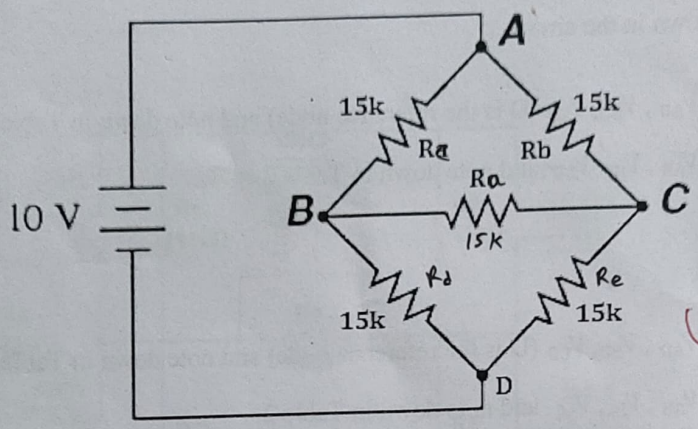
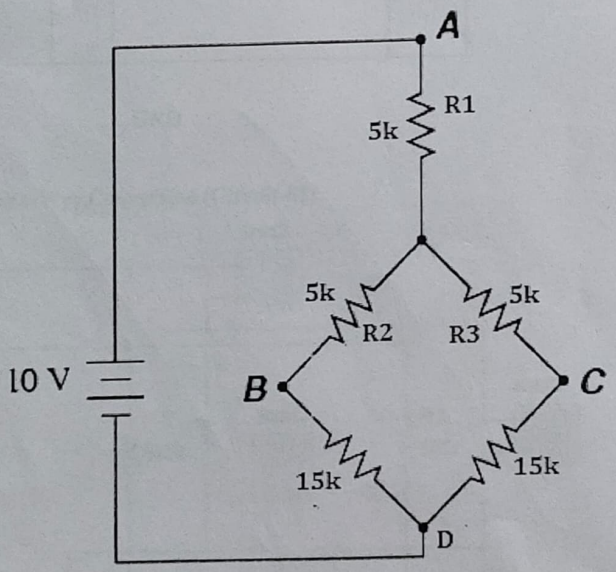
Electrical Circuit I Lab

Circuit Diagram:



$R_a = 14.73k\Omega$
$R_b = 14.77k\Omega$
$R_c = 14.92k\Omega$
$R_d = 14.89k\Omega$
$R_e = 14.88k\Omega$

Circuit 1



$R_1 = 4.87k\Omega$
$R_2 = 4.85k\Omega$
$R_3 = 4.89k\Omega$

Circuit 2

List of Equipment

- Trainer Board
- DMM
- 5 x 15kΩ resistor
- 3 x 5 kΩ resistor

0.888 fv=0.000000000000000888 v

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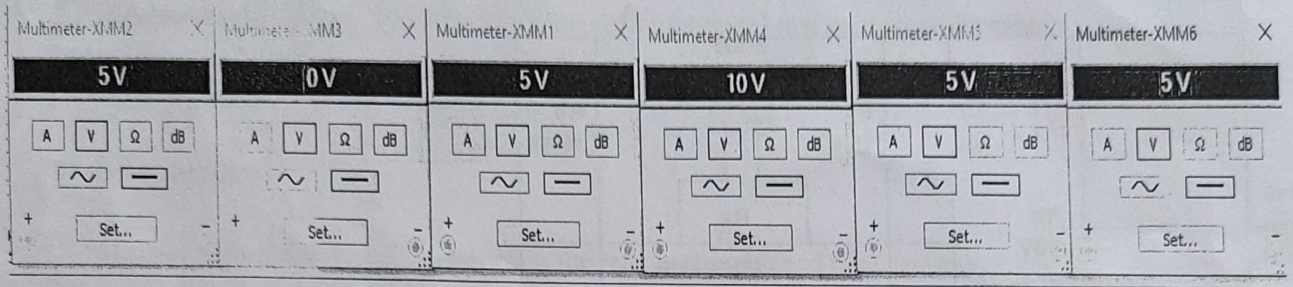
Electrical Circuit I Lab

Delta-Wye Conversion (Circuit-01)

V_{AB} V_{BC} V_{AC} V_{AD} V_{BD} V_{CD}



Wye- Delta Conversion (Circuit-02)

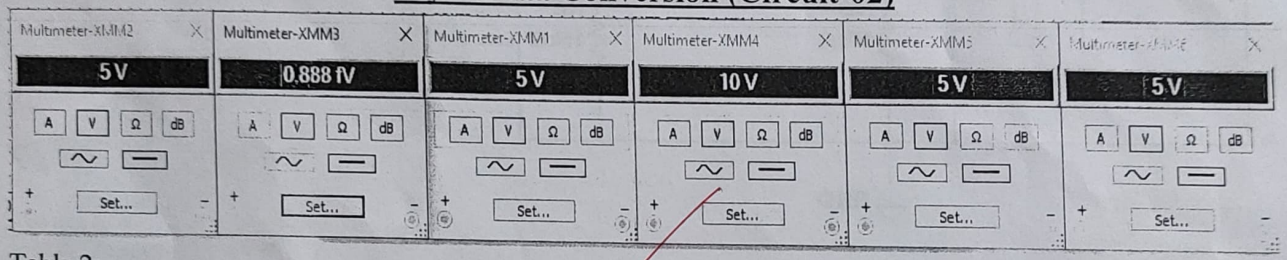


Table 2:

Readings	Circuit 1	Circuit 2(Practical)	% Error
V_{AB}	4.99	4.96	
V_{BC}	0.004	0.012	
V_{AC}	5.00	4.97	
V_{AD}	10.05	10.03	
V_{BD}	5.04	5.06	
V_{CD}	5.04	5.05	

$V_S = 10.05$

1. Calculate input current, I_S from circuit-2.

Discussion:

Robin
19/03/23