North South University
Department of Electrical & Computer Engineering

LAB REPORT

Course Code: EEE - 141L

Course Title: Electrical Circuits Lab

Faculty: RQN

Experiment Number: 4

Experiment Name: 1

Delta Wye Conversion

Experiment Date: 26/2/25

Date of Submission: 5/3/25

Section: 19

Group Number: 2

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NORTH SOUTH UNIVERSITY

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

EEE41L/ETE141L

Instructor's Signature _____

Table 1:

Theoretical R	Measured R	% Error
15k	14.89 K	0.733 %
5k	5.12 K	2.4 %

Table 2:

Rt= 15 K

Rt= 15 K

Readings	Circuit 1		Circuit 2		% Error	
V_{AD}	10 V	9.97	10 V	9.97	0.3%	0.3%
V_{BD}	5 V	4.98	5 V	4.90	0.4%	2%
V_{CD}	5 V	4.98	5 V	4.89	0.4%	2.2%
V_{AB}	5 V	4.98	5 V	5.05	0.4%	1%
V_{BC}	0 V	10.6 mV	0 V	12.4 mV	M Error	M Error
V_{AC}	5 V	4.99	5 V	5.07	0.2%	1.4%

Koshfia Mahmood
26.2.2025
(1)

Report:

1. The resistors in Circuit 1 are in series or in parallel combination?
2. What technique would you use to find the equivalent resistance?
3. Perform Delta-Wye conversion for ΔABC $(upper\ portion)$ of circuit 1. Show all your steps to find the equivalent resistance R1, R2, R3 from Ra, Rb, Rc.
4. Redraw the equivalent the circuit after applying the Delta-Wye conversion for ΔABC. Is it same as circuit 2?
5. Calculate Req.
6. Calculate the voltage of R1, R2, R3.
7. Calculate V_{AB} , V_{BC}, V_{AC} and V_{AD} , V_{BD}, V_{CD}. Do your calculated values match the measured values for circuit 2? Find the % Error.
8. Using Table 2, analyze whether Circuit 2 is equivalent to Circuit 1? Was Delta-Wye conversion successful?

Experiment name:

Delta Wye Conversion

Objectives:

The objective of this experiment is to analyze the resistor network in two different circuit configurations. Then apply the Delta Wye conversion technique and verify whether circuit 2 is equivalent to circuit 1.

List of Equipment:

1. Trainer Board
2. DMM
3. 5 x 15 kΩ resistor
4. 3 x 5 kΩ resistor

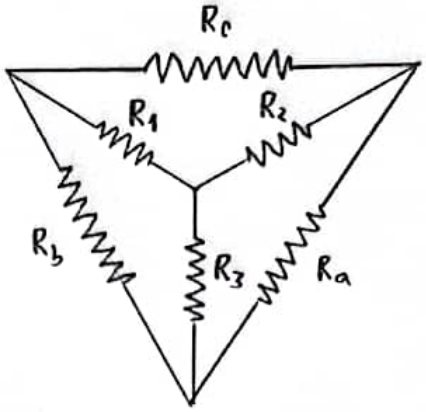
Theory:

Resistor networks can be analyzed using series parallel combinations and transformation techniques such as Delta Wye conversion. That is transformation is used to simplify complex resistor networks that are neither purely series nor parallel. The equivalent resistance of Δ Y transformation is calculated by:

$$R_1 = \frac{R_b R_c}{R_a + R_b + R_c}$$

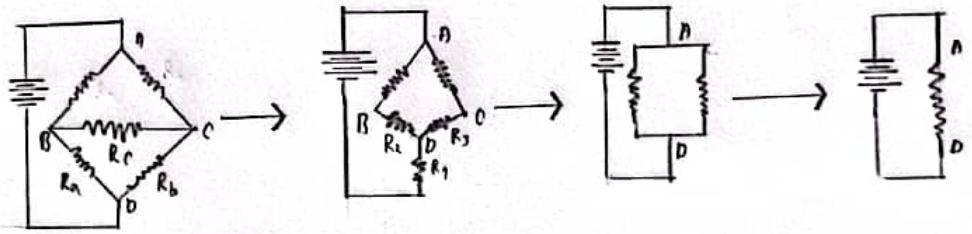
$$R_2 = \frac{R_a R_c}{R_a + R_b + R_c}$$

$$R_3 = \frac{R_a R_b}{R_a + R_b + R_c}$$

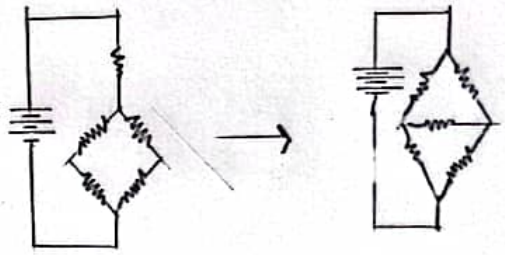


Where R_a, R_b, R_c are the resistances in the Δ configuration and R_1, R_2, R_3 are the transformed Y resistances.

Performing Δ - Y conversion on circuit 1



Performing Δ - Y conversion on circuit 2



Calculation:

For circuit 12

$R_{a1} = 15\ K\Omega$

$R_{b2} = 15\ K\Omega$

$R_{a3} = 15\ K\Omega$

$R_4 = 15\,K\Omega$

$R_5 = 15\,K\Omega$

R_2, R_4 and R_3, R_5 are in series,

$R_{S1} = R_2 + R_4$

$= 5 + 15$

$= 20\,K\Omega$

$R_{S2} = R_3 + R_5$

$= 5 + 15$

$= 20\,K\Omega$

R_{S1} and R_{S2} are in ~~pallel~~ parallel,

$$R_p = \left(\frac{1}{R_{S1}} + \frac{1}{R_{S2}}\right)^{-1}$$

$$= \left(\frac{1}{20} + \frac{1}{20}\right)^{-1}$$

$= 10\,K\Omega$

R_1 and R_p are in series,

$R_{eq} = R_1 + R_p$

$= 5 + 10$

$= 15\,K\Omega$

Calculating voltage of on R_1, R_2 and R_3

$$V_{R_1} = \frac{E.R_1}{R_{eq}}$$

$$= \frac{10 \times 5}{15}$$

$$= 3.33\ V$$

$$V_{R_2} = V_{AB} - V_{R_1}$$

$$= 5 - 3.33$$

$$= 1.67\ V$$

$$V_{R_3} = V_{R_2}$$

$$= 1.67\ V$$

Calculating V_{AB}, V_{BC}, V_{AC}, V_{AD}, V_{BD} and V_{CD}

$$V_A = E$$

$$= 10V$$

$$V_B = E - V_{R_1} - V_{R_2}$$

$$= 10 - 3.33 - 1.67$$

$$= 5\ V$$

$V_C = V_B$

$= 5V$

$V_D = E - I_T \times R_{eq}$

$= 10 - \frac{E}{R_{eq}} \times R_{eq}$

$= 10 - 10$

$= 0$

$\therefore V_{AB} = 10 - 5$

$= 5V$

$\therefore V_{BC} = 5 - 5$

$= 0V$

$\therefore V_{AC} = 10 - 5$

$= 5V$

$\therefore V_{AD} = 10 - 0$

$= 10V$

$\therefore V_{BD} = 5 - 0$

$= 5V$

$\therefore V_{CD} = 5 - 0$

$= 5V$

$$\% \text{ Error} = \left| \frac{\text{Experimental value} - \text{Theoretical value}}{\text{Theoretical value}} \right| \times 100$$

From table 2

$V_{AD} = 9.97V$

$V_{BD} = 4.90V$

$V_{CD} = 4.89V$

$V_{AB} = 5.05V$

$V_{BC} = 0.0124V$

$V_{AC} = 5.07V$

Now,

$$\% \text{ Error for } V_{AB} = \left| \frac{5.05 - 5}{5} \right| \times 100$$

$= 1\%$

$$\% \text{ Error for } V_{BC} = \left| \frac{0 - 0.0124}{0} \right| \times 100$$

= Measurement error

% Error For $V_{AC} = \left| \frac{5 - 5.07}{5} \right| \times 100$

$= 1.4\%$

% Error For $V_{AD} = \left| \frac{10 - 9.97}{10} \right| \times 100$

$= 0.3\%$

% Error For $V_{BD} = \left| \frac{5 - 4.9}{5} \right| \times 100$

$= 2\%$

% Error For $V_{CD} = \left| \frac{5 - 4.89}{5} \right| \times 100$

$= 2.2\%$

Using Table 2 we can say that circuit 2 is equivalent to circuit 1. We can also see that the % Error of both circuit is almost identical, which indicate that both the circuit has same amount of voltages running through them. So the Delta Wye conversion was successfull.

Discussion:

From this experiment we've learned the Delta - Wye conversion and Wye Delta conversion. Using this method we can calculate circuit. For example, in circuit 1 it wasn't clear if R_a, R_b and R_c were in series or parallel but after performing Delta Wye conversion we could easily calculate R_{eq} of the circuit. However this conversion method not only help us for this experiment but also it will help us in future. As a result we got slight error. Otherwise our Delta Wye conversion was successful.