North South University

Department of Electrical & Computer Engineering

LAB REPORT- 04

Course Code: **EEE141L**

Course Title: **Electrical Circuits Lab**

Section: **07**

Lab Number: **04**

Experiment Name:

Delta-Wye Conversion

Experiment Date: **28th March, 2024**

Date of Submission: **4th April, 2024**

Submitted by Group Number: **02**

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Objective:

① To Perform Delta-Wye conversion.

② To verify the results with measured Data.

③ Solve the complex circuit using Delta-wye conversion.

Equipment:

① Trainer Board

② Software

③ DMM

④ 5 X (15 k-Ω)

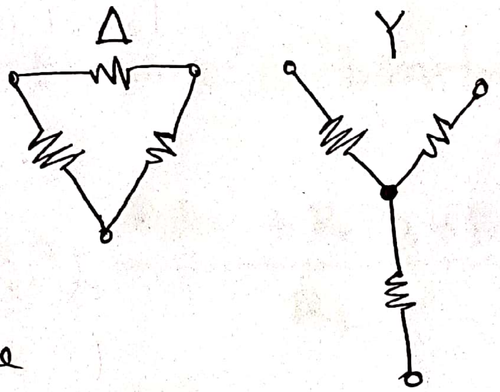
⑤ 3 X (5 k-Ω)

Theory:

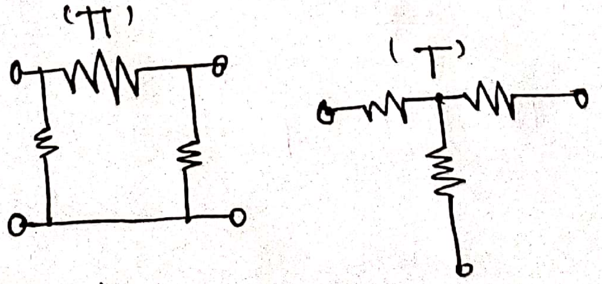
In many circuits, the components of resistors are connected to a certain way that looks like the "delta" (∇) and "Y" format that is known as Delta-Wye.

[P.T.O]

Sometimes it is hard to identify the resistors connections if those were connected parallel or series. At that time, we use delta_wye conversion to calculate the total resistor in an easier way. With this conversion, we can change the Δ for Y as vice-varsa. This is also called Pi-T transformation when the connection of resistor looks like Pi or T.



Here in the drawing, we can see the formation of both Δ and Y. The difference between these two formations is one has three and othe has Four nodes.



These resistor connection look like π and T, is called π-T configuration. But that is same as Δ-Y configuration.

To convert a Delta (Δ) to a Wye(Y):

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

$$R_B = \frac{R_A R_c}{R_a + R_b + R_c}$$

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

To convert $Y \rightarrow \Delta$ transformation:

$$R_a = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_1}$$

$$R_b = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_2}$$

$$R_c = \frac{R_1 R_2 + R_2 R_3 + R_3 R_1}{R_3}$$

Procedure :

① Measure the resistor values with DMM and noted down in table 1.

② Then setup the circuit as shown in the circuit 1.

③ After that we measure Votage to AD, BD and CD, and noted down table 2

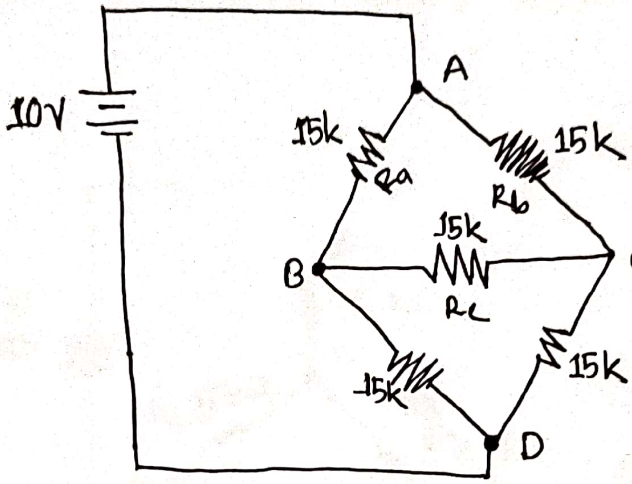
④ Then, measure V_{AB}, V_{BC} and V_{AC} and note down table 2.

⑤ Then we setup circuit 2

⑥ After that, the voltage V_{AD}, V_{BD} and V_{CD} (D is the reference node) and note down in table 2)

⑦ Measure the voltage V_{AB}, V_{BC}, V_{AC} and note down in table 2.

① Solution:



Circuit: 01

The resistors in circuit 1 are in vague to identify that it's in series or parallel combination.

② Solution:

Here we used Delta-wye conversion to find the equivalent resistance.

③ Solution:

Circuit_1 is in ∇ form. Ra, Rb, Rc all these resistors values are 15kΩ. From ∇ to Y conversion -

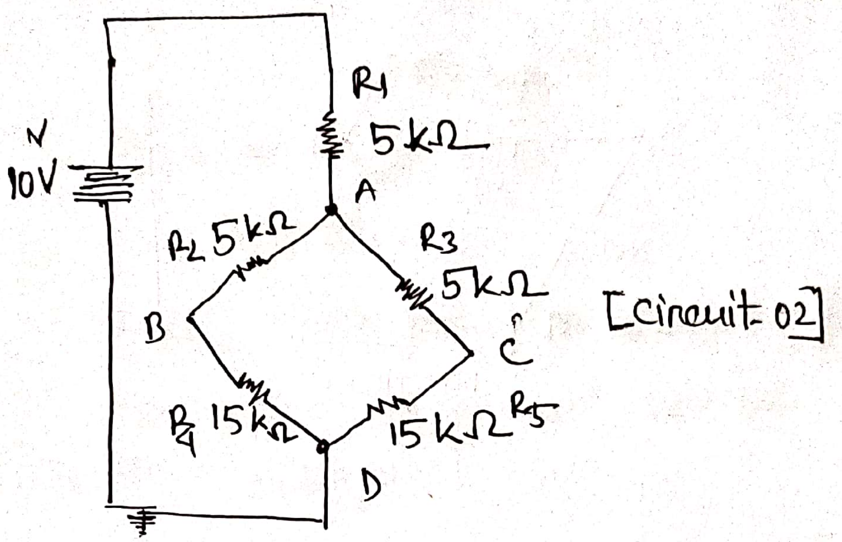
$$R_1 = R_2 = R_3 = R_b \times R_c / R_a + R_b + R_c$$

$$= 15 \times 15/45$$

$$= 5 k\Omega$$

④ <u>Solution:</u>

The equivalent circuit after delta- wye conversion



Yes, ΔABC is the same as circuit2 Because circuit 2 itself Y formatted circuit.

⑤ Calculating Req.

- from circuit 2

R_2 series R_4 $= (5+15) = 20\,k\Omega$

R_3 series $R_5 = (5+15) = 20\,k\Omega$

Now, these are connected parallel $R_P = (20 \parallel 20)$

$= 10\,k\Omega$

Therefore,

Req is $= 5 + R_P$

$= 5 + 10$

$= 15\,k\Omega$

⑥ calculating the voltage of R_1, R_2, R_3

= From Q5, the req. is 15 kΩ

Therefore, $I = 10/15$

$= \cdot 67$ mA

$V_{R_1} = 5 \times \cdot 67$

$= 3 \cdot 35$ V

$R_2 + R_4 \parallel R_3 + R_5$ with equal resistors in both side of parallel connection. So, current will be equally divided in this node.

$V_{R_2} = 5 \times \cdot 335$

$= 1 \cdot 67$ V

$V_{R_3} = 5 \times \cdot 335$

$= 1 \cdot 67$ V

⑦

From circuit2,

$V_{ae} = V_{ab} = V_{R_1} + V_{R_2}$

$= 3 \cdot 35 + 1 \cdot 67$

$= 5 \cdot 02$ V

ERROR $= (|5 - 5 \cdot 02| / 5 \cdot 02) \times 100$

$= \cdot 398\%$

Discussion :

In this lab session we focused on Delta-Wye transformation, the fundamental technique used in analyzing electrical circuits. In this lab, we have explored the concept, conversion formula's and its practical application. We got right data similar to experimental and theoritical data. We came to a conclusion that, Delta-wye conversion is a valueable tool for simplifying and analyzing electrical circuits, that allows a impactful technique in various complex circuits.

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Group: 02
SECTION: 07

NORTH SOUTH UNIVERSITY

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

EEE41L/ETE141L

Instructor's Signature 02

For, 15k : $\frac{14.92 + 14.98 + 14.94 + 14.81 + 14.87}{5} \times 100$

$= 14.904$

Masud
28/03/2024

Table 1:

Theoretical R	Measured R	% Error
15k	14.92 kΩ, 14.098, 14.94, 14.81, 14.17	0.64 %
5k	4.85 kΩ, 5.14 kΩ, 4.95 kΩ	0.4 %

For, 5k : $\frac{4.85 + 5.14 + 4.95}{3} \times 100$ $= 4.98$

Table 2:

Rt= 15 K Rt= 15 K

Readings	Circuit 1		Circuit 2		% Error
V_{AD}	10 V	10.09 v	10 V	10.09 v	0 %
V_{BD}	5 V	5.05 v	5 V	5.11 v	1.19 %
V_{CD}	5 V	5.05 V	5 V	5.06 v	0.19 %
V_{AB}	5 V	5.03 v	5 V	4.98 v	0.99 %
V_{BC}	0 V	0.110 v	0 V	0.113 v	2.73 %
V_{AC}	5 V	5.03 v	5 V	5.02 v	0.198 %

* MD Tamim

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?