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LAB-4

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Spring 2022 EEE/ETE 141L Electrical Circuits-I Lab(Sec-10) Faculty : Md. Abu Obaidah (AbO) Instructor: Farhana Atuyar Saleh
Lab No.: 04

Date of Performance : 09/03/2022 Date of Submission : 16/03/2022	**Name:** 1. **Bushra Hossain** 2. **Md. Ishtiaq Ahamed Fahim** 3. **Tajrian Al Israq** **ID:** 1. **2031346642** 2. **2012518642** 3. **2021536643**

Lab 4 : Delta-Wye Conversion

Objectives :

① We have to perform Delta-wye Conversion.

② We have to verify the resyts with measured data.

③ We have to solve a complex circuit using Delta-wye Conversion.

List of Equipment :

① Trainer Board

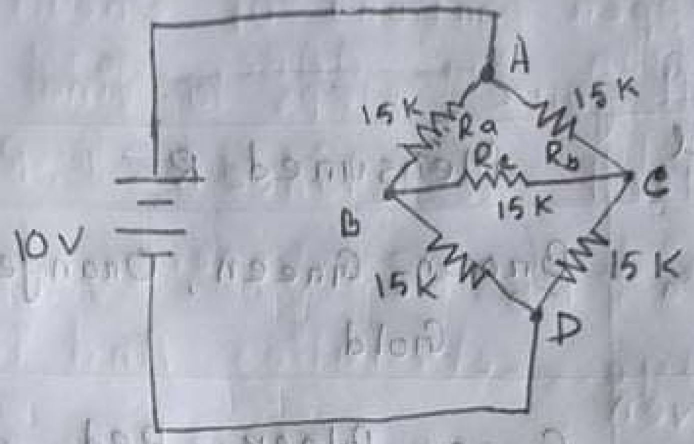
② DMM

③ 5 × 15 Ω resistor

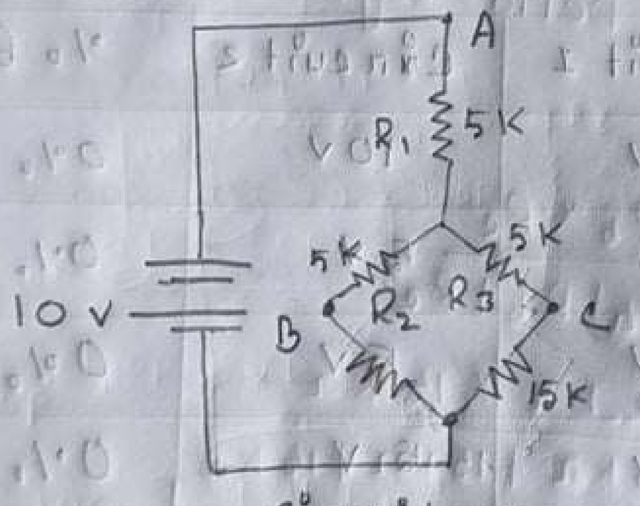
④ 3 × 5 Ω resistor

⑤ Multisim .

Circuit Diagram :



Circuit : 1



Circuit - 2

Data Table :

Table 1 :

Theoretical R	Measured R	% Error
15 K	Brown, Green, Orange, Gold	0%
5 K	Green, Black, Red, Gold	0%

Table 2 :

Readings	Circuit 1	Circuit 2	% Error
V_{AD}	10V	10 V	0%
V_{BD}	5 V	5 V	0%
V_{CD}	5 V	5 V	0%
V_{AB}	5 V	5 V	0%
V_{BC}	0 V	0 V	0%
V_{AC}	5 V	5 V	0%

Question / Answer :

① The resistors in circuit-1 are in series or in parallel combination?

Ans : The resistors in circuit-1 are neither in series nor in parallel combination.

The resistors are in a complex combination.

② What techniques would you use to find the equivalent resistance?

Ans : I would use Delta-Wye conversion techniques 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 $R1, R_2, R_3$ from R_a, R_b, R_c.

Ans: Given,

$$R_a = 15\ K\Omega,\ R_b = 15\ K\Omega,\ R_c = 15\ K\Omega$$

According to Delta-wye conversion formula,

$$R1 = \frac{R_b \times R_c}{R_a + R_b + R_c}$$

$$= \frac{15\ K\Omega \times 15\ K\Omega}{15\ K\Omega + 15\ K\Omega + 15\ K\Omega}$$

$$= 5\ K\Omega$$

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

$$= \left(\frac{15 \times 15}{15 + 15 + 15}\right) K\Omega$$

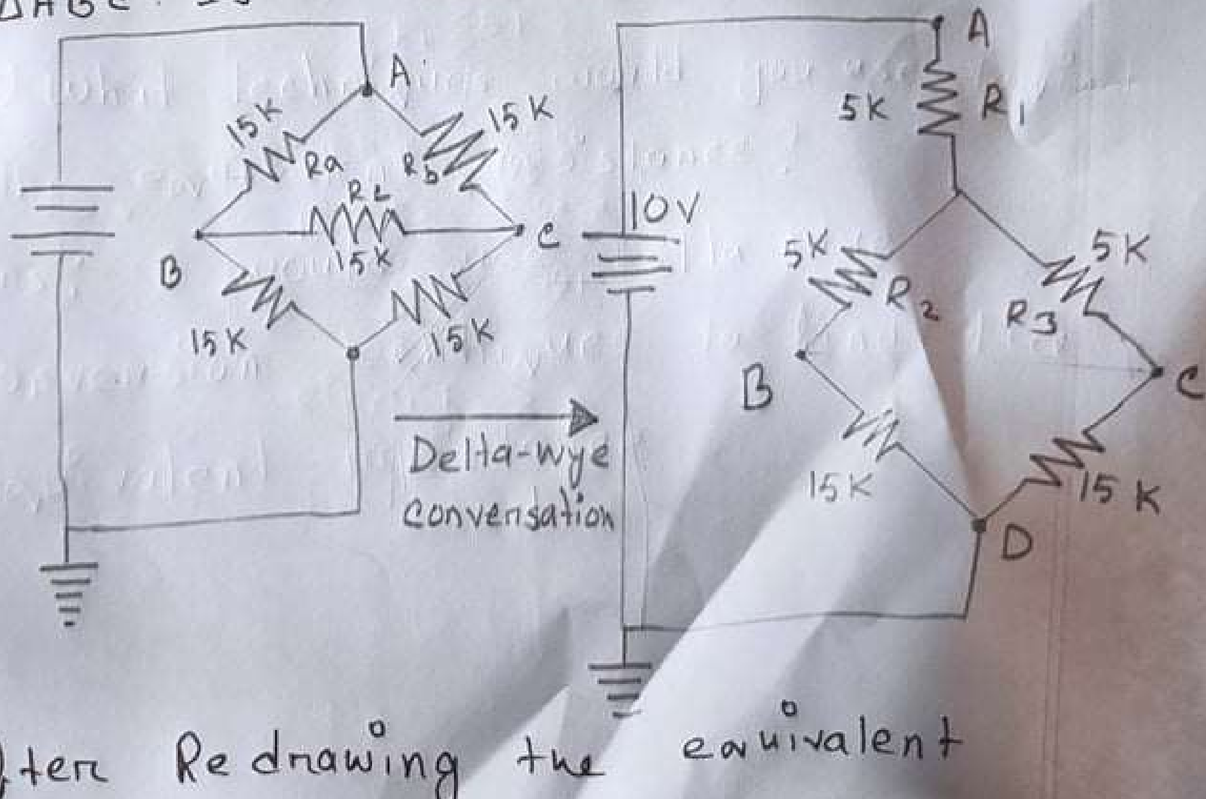
$$= 5\,K\Omega$$

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

$$= \frac{15\,K\Omega \times 15\,\Omega}{15\,K\Omega + 15\,K\Omega + 15\,K\Omega}$$

$$= 5\,K\Omega$$

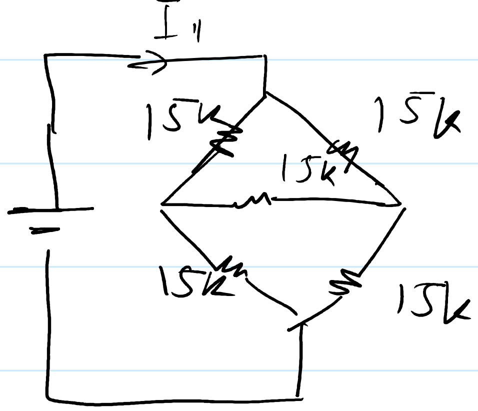
(4) Redraw the equivalent the circuit after applying the Delta-Wye conversation for ΔABC. Is it same as circuit-2?

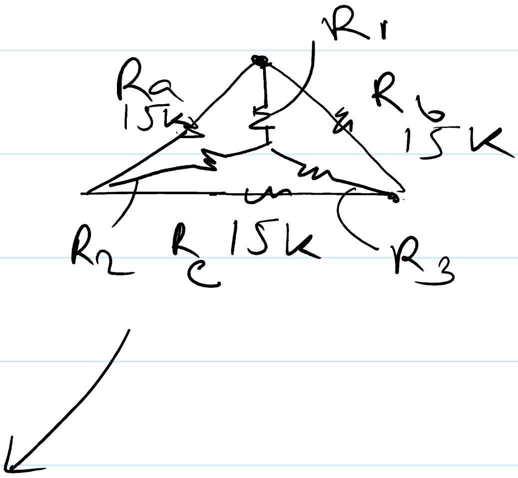


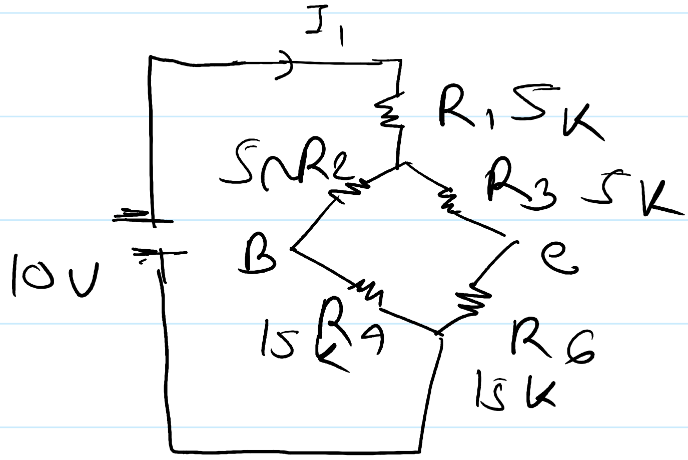
After Redrawing the equivalent

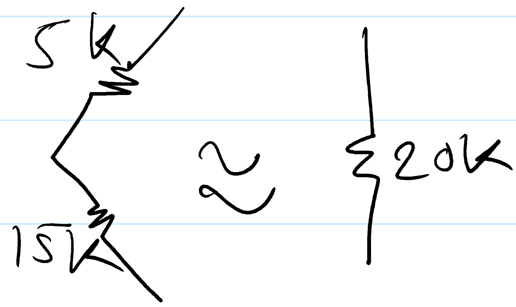
circuit after applying the Delta-Wye conversation for ΔABC everything is exactly same except the values of individual resistances of the Delta-Wye schematics. And it is same as circuit-2.

5. Calculate Req.

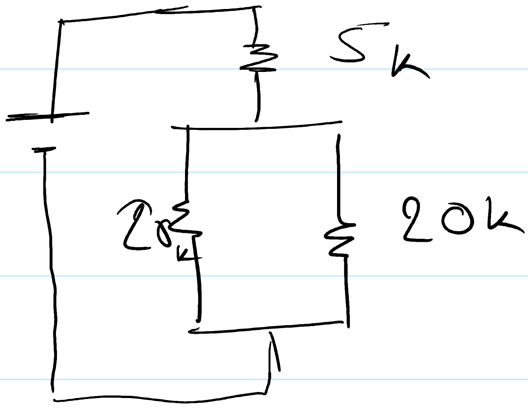


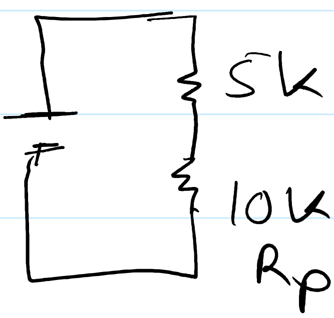


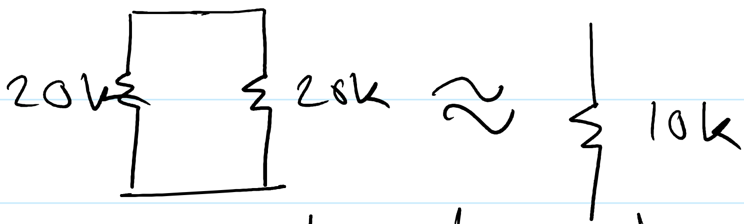




$$R_S = 5 + 15$$
$$= 20K$$







$$\frac{1}{R_P} = \frac{1}{R_S} + \frac{1}{R_S}$$

$$\frac{1}{R_p} = \frac{1}{20} + \frac{1}{20}$$

$$\frac{1}{R_p} = \frac{2}{20}$$

$$R_p = 10k$$

$$R_{eq} = R_1 + R_p$$

$$= (5 + 10)\,k$$

$$= 15k$$

(Ans)

6. Calculate the voltage of R1, R2, R3

$$R_{eq} = 15\,k$$

$$E = 10V$$

$$I_1 = \frac{E}{R} = \frac{10}{15} = \frac{2}{3} = 0.67 \text{ A}$$

$$V_{R_1} = I_1 R_1 = 0.67 \times 5 = 3.35\ V$$

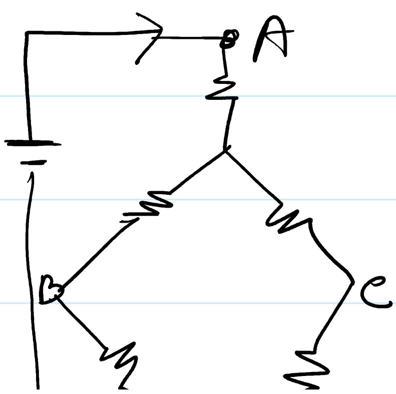
$$V_{R_2} = (10 - 3.35)\frac{R_2}{R_2 + 15}$$

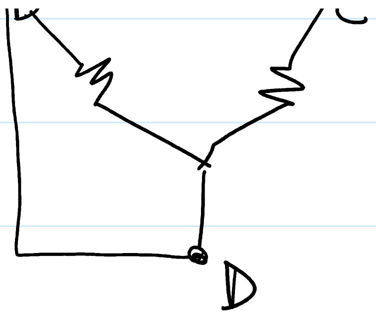
$$= 6.65 \times \frac{5}{5+15} = 1.675\ V$$

$$V_{R_3} = (10 - 3.35)\frac{R_3}{R_3 + 15}$$

$$= 6.65 \times \frac{5}{5+15} = 1.675\ V$$

7. Calculate VAB , VBC , VAC and VAD , VBD , VCD . Do your calculated values match the
measured values for circuit 2? Find the % Error





$$V_{AB} = V_{R_1} + V_{R_2} = 1.67\ \text{V} + 3.33\ \text{V}$$
$$= 5.00\ \text{V}$$

$$V_{BC} = V_{R_2} - V_{R_3} \quad [\text{using KVL}]$$
$$= (1.67 - 1.67)$$
$$= 0\ \text{V}$$

$$V_{AC} = V_{R_1} + V_{R_3}$$
$$= (1.67 - 3.33)\ \text{V}$$

$$V_{BD} = E - V_{R_1} - V_{R_2}$$
$$= 10 - 3.3 - 1.67$$
$$= 10 - 5$$
$$= 5\ \text{V}$$

$$V_{AD} = V_{AB} + V_{BC} + V_{RBD}$$

$$= (3.33 + 1.67 + 5)V$$

$$= 10V$$

$$V_{CD} = E - VR_1 - VR_3$$

$$= 10 - 3.3 - 1.67$$

$$= 10 - 5$$

$$= 5V$$

we know

$$\%Error = \frac{Theoratical - Experimital}{Theoratical} \times 100\%$$

circuit -2

Reading	Theoratiel	Experminatal	% Error
VAB	5 V	5 V	$\frac{5-5}{5} \times 100\% = 0\%$
VBC	0V	0V	$\frac{0-0}{0} \times 100\% = 0\%$
VAC	5V	5V	$\frac{5-5}{5} \times 100\% = 0\%$
VAD	10V	10V	$\frac{10-10}{10} \times 100\% = 0\%$
VBD	5V	5V	$\frac{5-5}{5} \times 100\% = 0\%$
VCD	5V	5V	$\frac{5-5}{5} \times 100\% = 0\%$

8. Using Table 2, analyze whether Circuit 2 is equivalent to Circuit 1? Was Delta-Wye
conversion successful?

table-2

Reading	circuit-1	circuit-2	% Error	was Delta wye succesful?
V_{AD}	10 V	10 V	0%	Yes, extrimly Accurate
V_{BD}	5V	5V	0%	Yes, extrimly Accurate
V_{CD}	5V	5V	0%	Yes extrimily Accur
V_{AB}	5V	5 V	0%	Yes Extrimily Accur
V_{Be}	0V	0V	0%	Yes, Extrimily Accurate
V_{Ae}	5V	5 V	0%	Yes, Extrimlly Accur

As wye Delta convartion yielded the same circuit as circit 2. And science circit 1 and 2 are totally equivalent we can say for sure wye delta was succefull.

Discussion:

Form this lab we can learn wye Delta convention that helps us solve for circuit which can not be said serise or parrall and to calculate its equivalent value circuit and to calculate it.

As its lab on multisim software There is no error that might have been arrised.

Both multisim and load effect has the same result. As its software Based lab we don't have flaws That might have arrived form accurray problem lose connection human error, or on DMM, cables, breadboard connection etc.