Shri Vile Parle Kelavani Mandal's
DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING
(Autonomous College Affiliated to the University of Mumbai)
NAAC Accredited with "A" Grade (CGPA : 3.18)

First Year (Semester I) B.Tech.

Basic Electrical and Electronics Engineering

Experiment No. : 04
Thevenins and Nortons Theorem

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Date of performance : 27/03/2021

Signature of teacher-in-charge : ______________________

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Aim:	To determine resistor, voltage and current value in a circuit.
Apparatus:	Online simulation tools (Suggested Tinkercad)

Theortical Analysis:

Thevenins Theorem

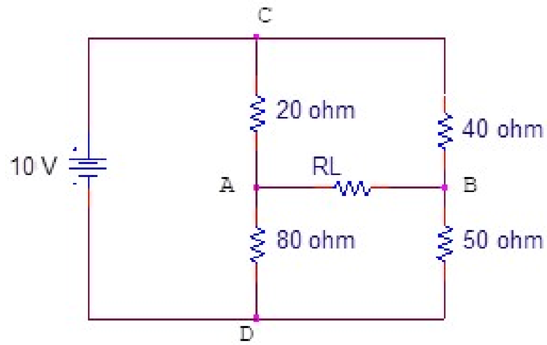
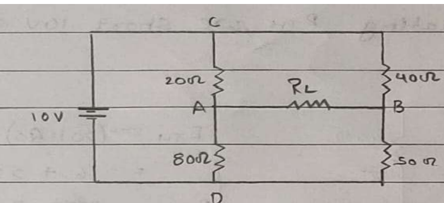
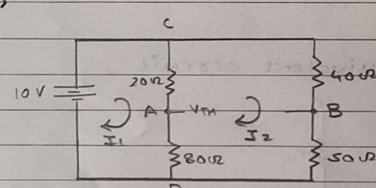


Fig. 1(a) Voltage acorss Rl load resistor value 10ohm, 20ohm, 30ohm

<u>Theoretical Calculations:</u>



For V_{TH},



KVL in loop 1,

$-100 I_1 + 100 I_2 + 10 = 0$

$\therefore 10 I_1 - 10 I_2 = 1$ —(i)

KVL in loop 2,

$-190 I_2 + 100 I_1 = 0$

$\therefore 10 I_1 - 19 I_2 = 0$ — (2)

On solving (i) and (ii)

$I_1 = 0.211A$ $\quad I_2 = 0.111A$

$\therefore$ KVL to find V_{TH},

$V_A + 20(I_1 - I_2) - 40 I_2 - V_B = 0$

$V_A - V_B = 2.44$

$\therefore \boxed{V_{TH} = V_{AB} = 2.44\ V}$

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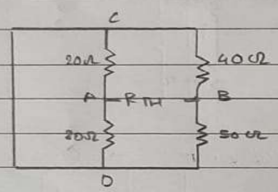
Now, for calculating R_{TH}, we short 10V source.

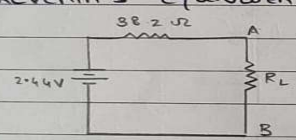


$\therefore R_{TH} = (20 \| 80) + (40 \| 50)$

$= 16 + 22.2$

$\boxed{R_{TH} = 38.2\ \Omega}$

∴ Thevenin's equivalent circuit,



when $R_L = 10\ \Omega$

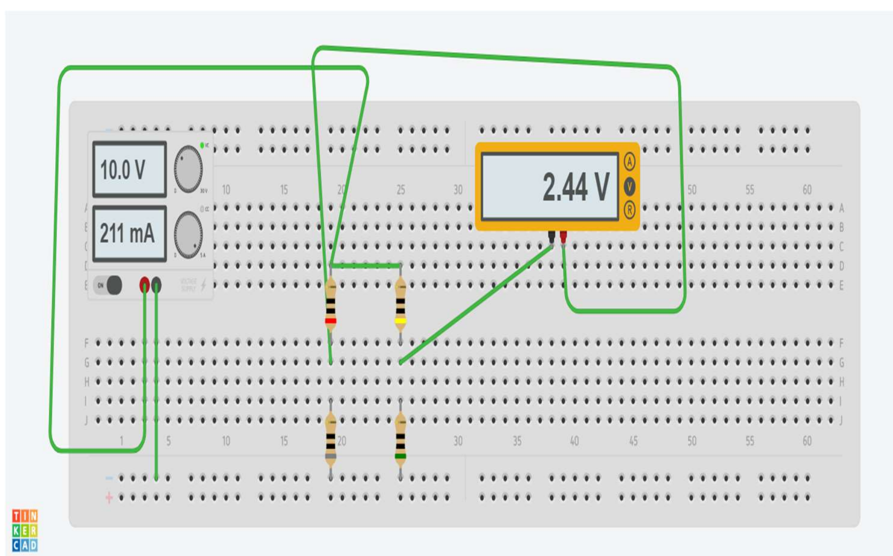
$\therefore V_{10\Omega} = \frac{2.44 \times 10}{48.2} = 0.507\ V = 507\ mV$

when $R_L = 20\ \Omega$,

$V_{20\Omega} = \frac{2.44 \times 20}{58.2} = 0.838\ V = 838\ mV$

when $R_L = 30\ \Omega$,

$V_{30\Omega} = \frac{2.44 \times 30}{68.2} = 1.07\ V$



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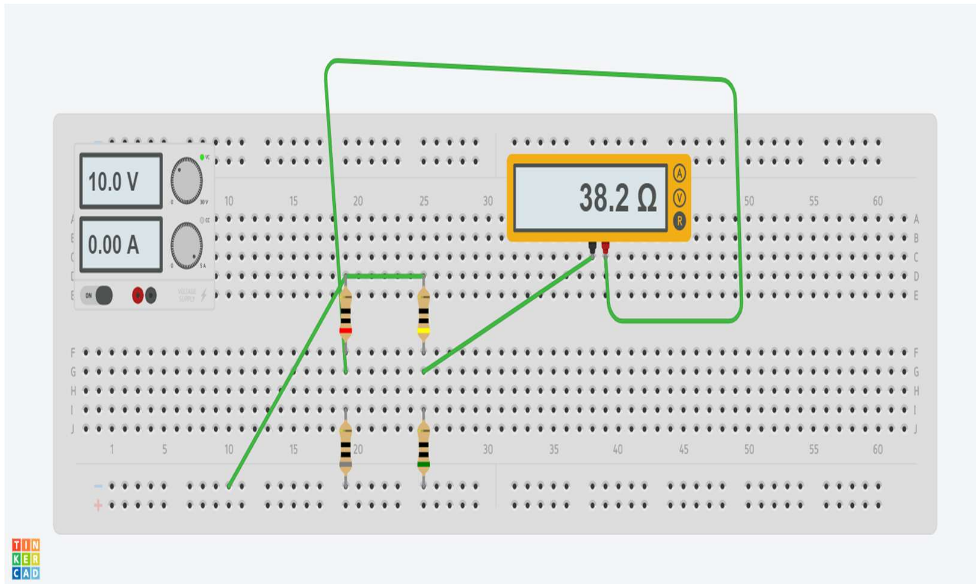

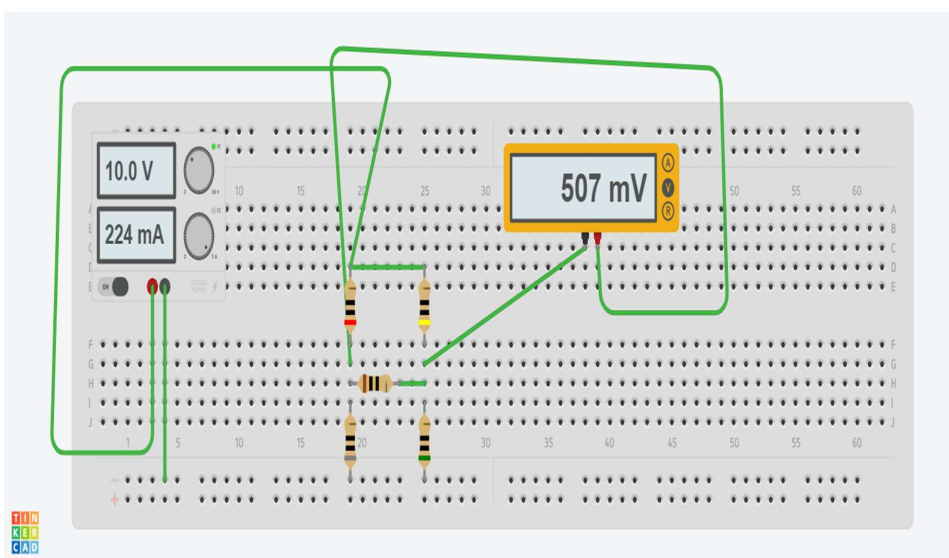

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Nortons Theorem

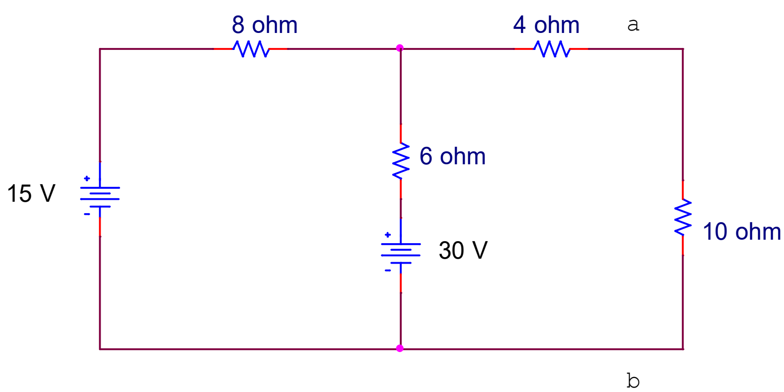
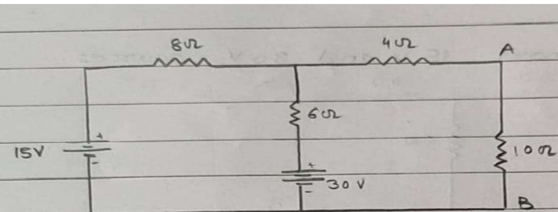
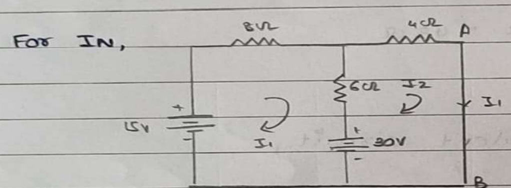


Fig. 1(b) Voltage across across a and b

Theoretical Calculations:



For I_N,



KVL in loop 1,

$-14 I_1 + 6 I_2 + 15 - 30 = 0$

$\therefore -14 I_1 + 6 I_2 = 15$ — (1)

KVL in loop 2,

$-10 I_2 + 6 I_1 + 30 = 0$

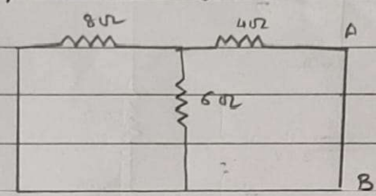
$\therefore 6 I_1 - 10 I_2 = -30$ — (2)

Solving (1) and (2)

$\therefore I_1 = 0.288A$ $\quad I_2 = 3.17A$

$\therefore \boxed{I_N = 3.17\ A}$

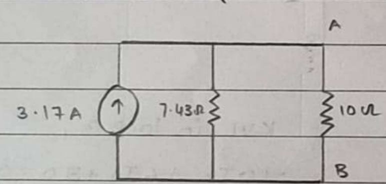
For R_N, short 15 V and 30 V sources.



$\therefore R_N = (8 \| 6) + 4 = 7.43\,\Omega$

$\therefore \boxed{R_N = 7.43\,\Omega}$

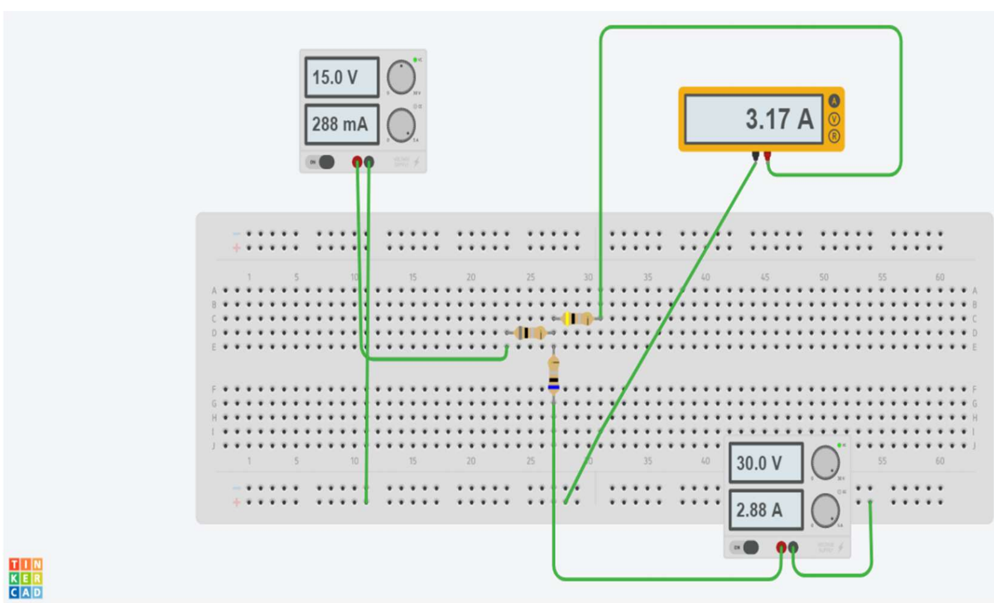
∴ Norton's equivalent circuit,

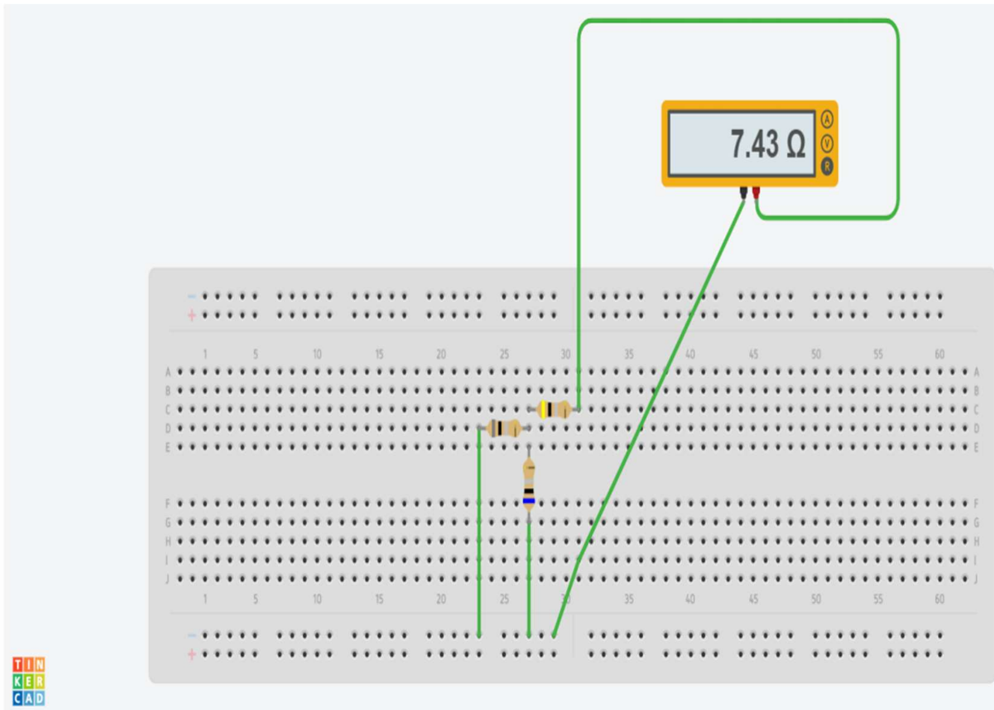
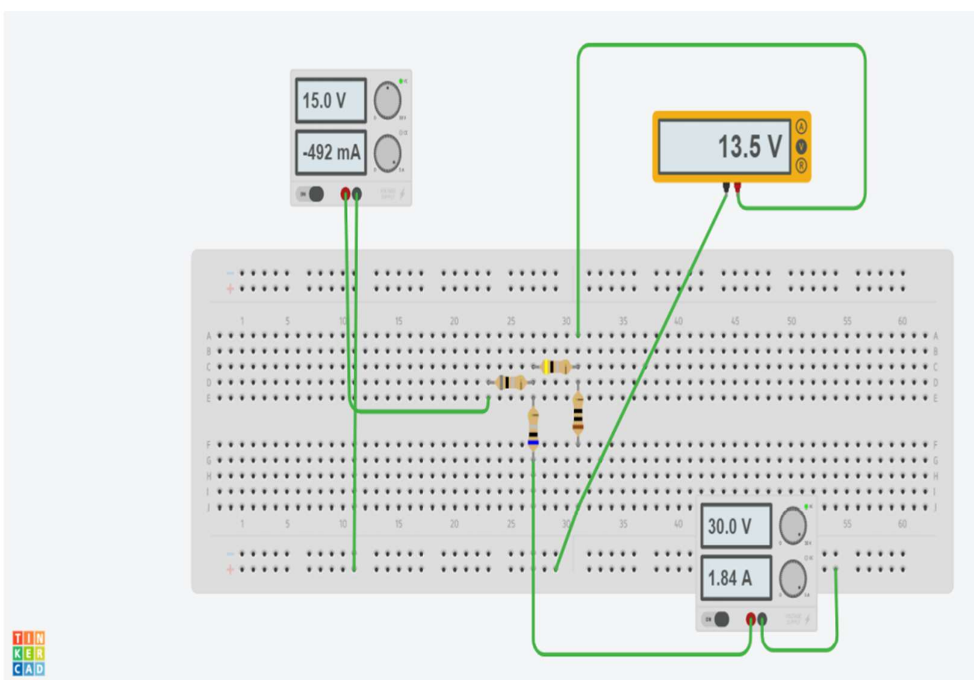


$$\therefore I_{10\Omega} = \frac{3.173 \times 7.43}{17.43} = 1.35\ \text{A}$$

$\therefore$ Voltage across a and B $= V_{AB} = 1.35 \times 10$

$\therefore \boxed{V_{AB} = 13.5\ \text{V}}$



		Theoretical values	**Practical values**
Observation Table	Thevenins Voltage, V_{TH}	**2.44V**	**2.44V**
	Equivalent resistor, R_{TH}	**38.2 ohm**	**38.2 ohm**
	Voltage $V_{10\Omega}$	**507 mV**	**507mV**
	Voltage $V_{20\Omega}$	**838 mV**	**838 mV**
	Voltage $V_{30\Omega}$	**1.07 mV**	**1.07 mV**

		Theoretical values	**Practical values**
Observation Table	Nortons Current, I_N	**3.17 A**	**3.17 A**
	Equivalent resistor, R_N	**7.43 ohm**	**7.43 ohm**
	Voltage $V_{10\Omega}$	**13.5 V**	**13.5 V**

Conclusion:

- The Practical values has been attained using online simulation tool Tinkercad.
- Thevenins and Nortons Theorems are used to determine the values of current,resistance and voltage.
- The Theoretical and Practical values are equal to each other