SARKAR, Mohul

# Experiment Number 1

## Unknown Board Measurements - Voltage, Current, and Reference Direction

TUESDAY

February 27

ECE 1101L

Spring 2024

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Lab:

ECE 1101L Experiment 1

## VOLTAGE, CURRENT, AND REFERENCE DIRECTIONS

## OBJECTIVES

The student will measure voltages and conventional currents for arbitrarily specified reference directions.

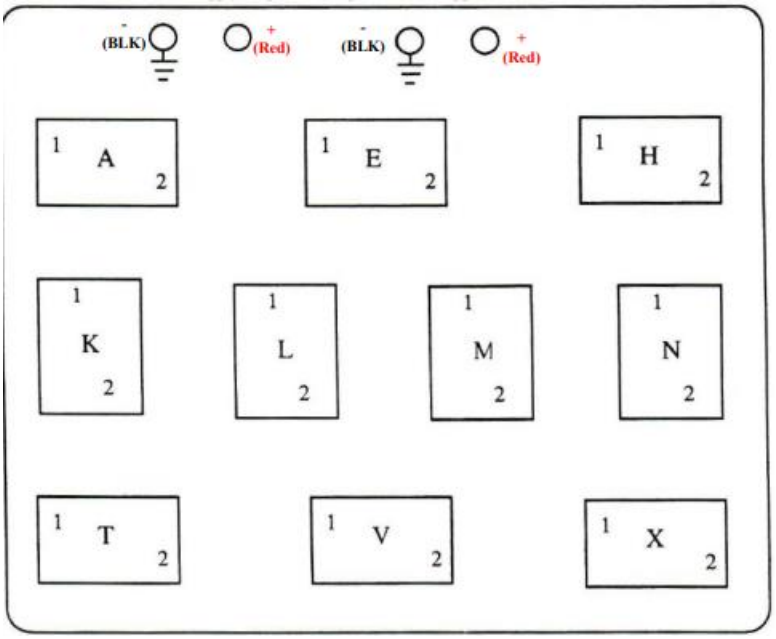
The student will also verify some basic relationships

## MATERIALS REQUIRED BY STUDENT

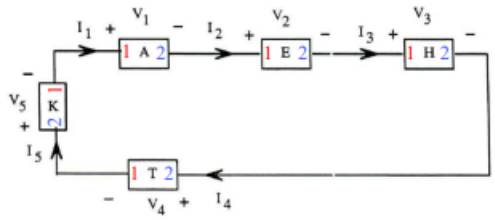
11 clip leads

## MATERIALS TO BE SUPPLIED

Power Cables and a breadboard looking like:

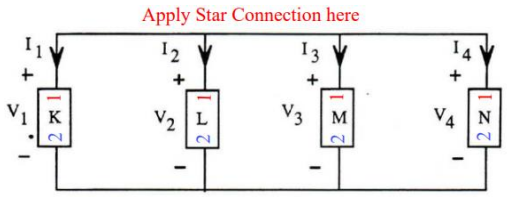


Given CKT1:




| Per sign convention shown on CKT1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Voltage Across Element | | Current through Element | | Power Calculations | For P>0 Equiv. CKT | For P<0 Equiv. CKT | Comments |
| Element | Ref Des | Measured Value [V] | Ref Des | Measured Value [mA] | $P_i=V_i*I$ [mW] | $R_{eq(i)}=V_i/I$ [Ω] | $R_K=V_{RK}/I$ [Ω] | |
| A | $V_1$ | 1 | $I_1$ | 1 | 1 | 1 | | Load |
| E | $V_2$ | 2 | $I_2$ | 1 | 2 | 2 | | Load |
| H | $V_3$ | 1.6 | $I_3$ | 1 | 1.6 | 1.6 | | Load |
| T | $V_4$ | 0 | $I_4$ | 1 | 0 | DNE | | Current Source |
| K | $V_5$ | 5.4 | $I_5$ | 1 | 5.4 | 5.4 | 5.4 | Load |
| | $V_1+V_2+V_3+V_4+V_5=0$ | | Series Circuit: $I_1 = I_2= I_3 =I_4 = I_5$ | 1 | | | | |

# Given CKT2:




| Per sign convention shown on CKT2 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Voltage Across Element | | Current through Element | | Power Calculations | For P>0 Equiv. CKT | For P<0 Equiv. CKT | Comments |
| Element | Ref Des | Measured Value [V] | Ref Des | Measured Value [mA] | $P_i=V_i*I$ [mW] | $R_{eq(i)}=V_i/I$ [Ω] | $R_K=V_{RK}/I$ [Ω] | |
| K | $V_1$ | 4.9 | $I_1$ | 0.6 | 2.94 | 8.17 | | Load |
| L | $V_2$ | 4.9 | $I_2$ | 31 | 151.9 | 2 | | Load |
| M | $V_3$ | 4.9 | $I_3$ | 0 | 0 | 1.6 | | Voltage Source |
| N | $V_4$ | 4.9 | $I_4$ | 31.6 | 154.84 | 0.16 | | Load |
| | $V_1=V_2=V_3=V_4$ | 4.9 | Series Circuit: $I_1 + I_2 +I_3 + I_4= 0$ | 0 | Conservation of Power: $P_1+P_2+P_3+P_4=0$ | | | |

Sample calculation:

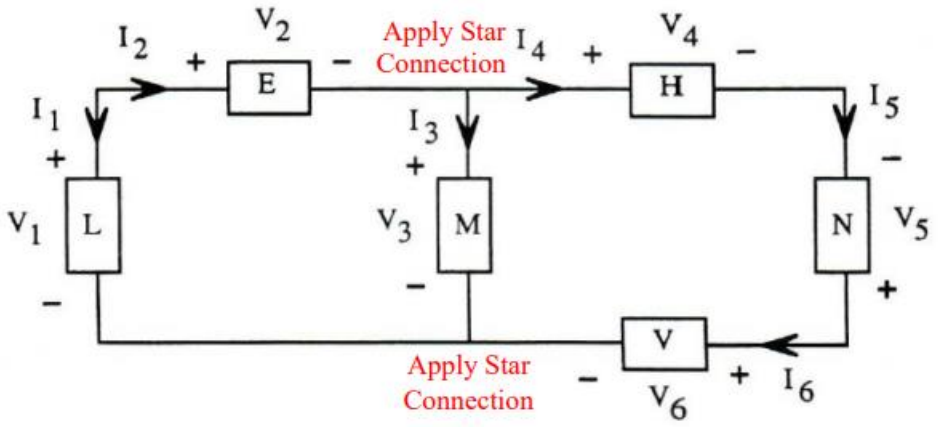
$P_i=V_i*I$

4.9*0.6=2.94 mW

$R_{eq(i)}=V_i/I$

4.9/0.6= 8.17 Ω

Given CKT3:

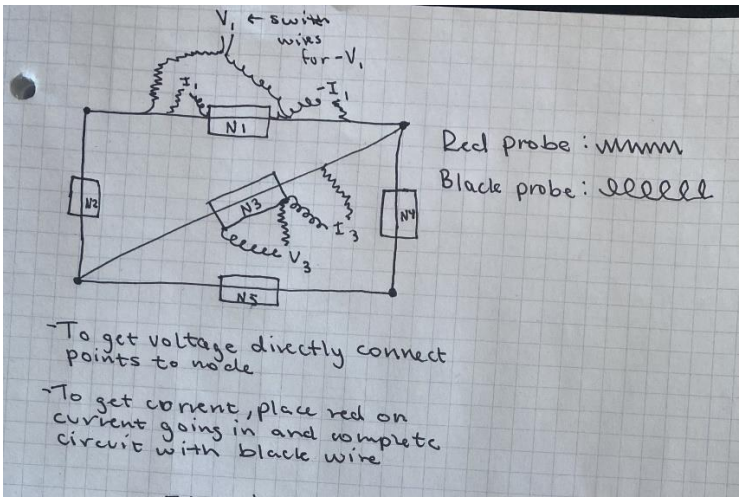



| Per sign convention shown on CKT1 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Voltage Across Element | | Current through Element | | Power Calculations | For P>0 Equiv. CKT | For P<0 Equiv. CKT | Comments |
| Element | Ref Des | Measured Value [V] | Ref Des | Measured Value [mA] | $P_i=V_i*I$ [mW] | $R_{eq(i)}=V_i/I$ [Ω] | $R_K= V_{RK}/I$ [Ω] | |
| L | $V_1$ | 5 | $I_1$ | 0.6 | 3.12 | 8.33 | 8.33 | Load |
| E | $V_2$ | 1.7 | $I_2$ | -0.6 | -1.02 | -2.83 | | Load |
| M | $V_3$ | 3.6 | $I_3$ | 0 | 0 | DNE | | Voltage Source |
| H | $V_4$ | 0.9 | $I_4$ | -0.6 | -0.54 | -1.5 | | Load |
| N | $V_5$ | -2 | | -0.6 | -1.2 | 1.2 | | Load |
| V | $V_6$ | 0.6 | | -0.6 | -0.36 | -0.36 | | Load |
| | $V_1+V_2+V_3+V_4+V_5+V_6=0$ | 0 | Series Circuit: $I_1 + I_2 +I_3 + I_4= 0$ | 0 | Conservation of Power: $P_1+P_2+P_3+P_4+P_5=0$ | | | |

Reflection: Our lab resulted in accurate findings and all the circuits matched up with the reference destination equation. We had small error with our calculations by around 5 percent, but they were close to perfect.

Post Lab:

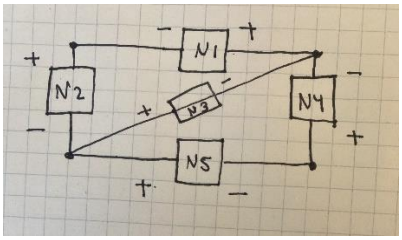
1.Conventional Current: Conventional current assumes that electric current flows from the positive terminal of a voltage source to the negative terminal.

2. 


3a. The electrons are flowing right to left through the positive side

3b. Power is being received because it is going from positive terminal to negative terminal

4.No it is not possible, the sign would be wrong but the value identical, this can lead to analysis error, but the value would simply be the reciprocal of the correct reference direction

5. 


6.The tolerance is ±0.1%, so the maximum allowable error is 0.1% of the full-scale voltage:

Tolerance = 0.1% * 10 V = 0.01 V
Minimum real value = 5V-0.01=4.99V
Maximum real value=5V+0.01=5.01V