# ***LAB ASSIGNMENT – 3***

**Course:** Basic Electrical and Electronics Engineering

**Course Code:** EEE1001

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**Slot:** L-19+L-20

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**Registration Number:** 18BIT0272

**Submission Date:** 14.09.2018

Ex. No.:2 Date: 14.09.2018

# Verification of NETWORK THEOREMS
## (Maximum Power Transfer Theorem)

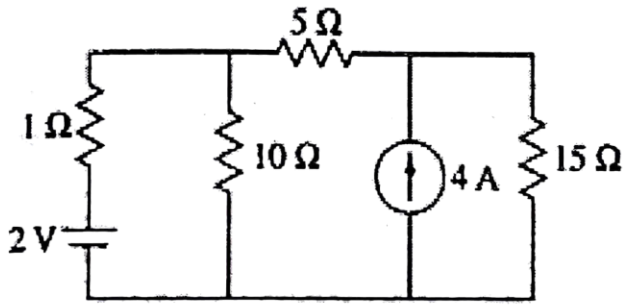
**Aim:**

**Apparatus/Tool required:**

ORCAD / Capture CIS --> **Analog Library – R,**
**Source Library – Vdc, Idc &**
**Ground (GND) – 0 (zero)**

Simulation Settings: **Analysis Type - Bias Point**

**Circuit Diagram**

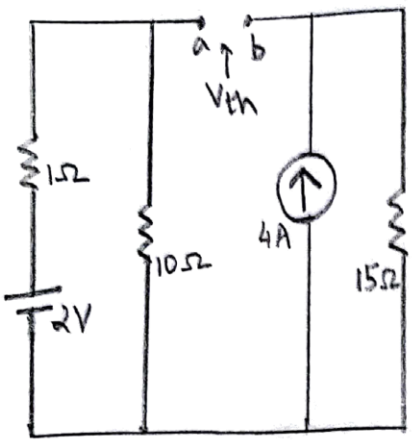



**Statement: Maximum Power Transfer Theorem**

The theorem states that "maximum power is transferred from the source to the load when the load resistance ($R_L$) is equal to the Therenin's equivalent resistance ($R_{th}$)".

**Manual Calculations:**

**To Find $V_{th}$:**



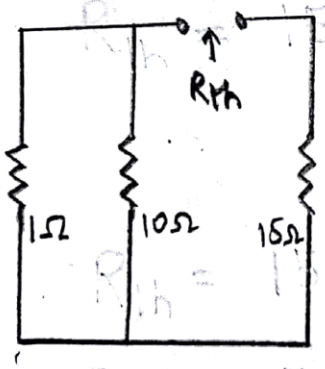

$$V_{th} = V_a - V_b$$

$$V_a = \frac{2 \times 10}{11} = 1.818\,V$$

$$V_b = 60\,V$$

$$V_{th} = V_a - V_b = 58.182\,V$$

**To Find $R_{th}$:**




1Ω & 10Ω in parallel & 15Ω is in series

$$\rightarrow R_{th} = 15 + \frac{10 \times 1}{10 + 1}$$

$$R_{th} = 15.91\,\Omega$$

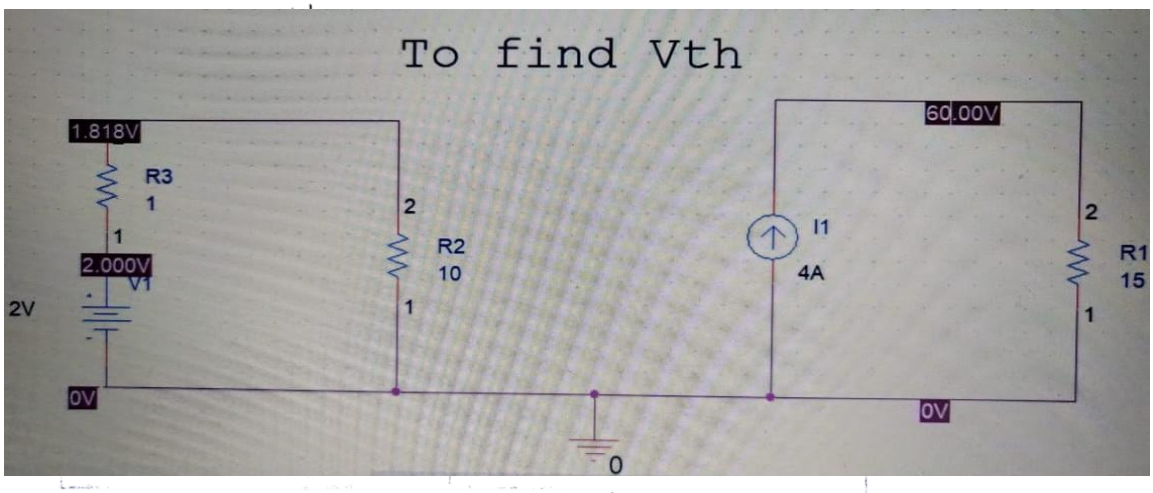
**To Find Power:**

$$P_{max} = \frac{(V_{th})^2}{4 R_{th}} = \frac{58.182 \times 58.182}{4 \times 15.91}$$

$$P_{max} = 53.19\,W$$

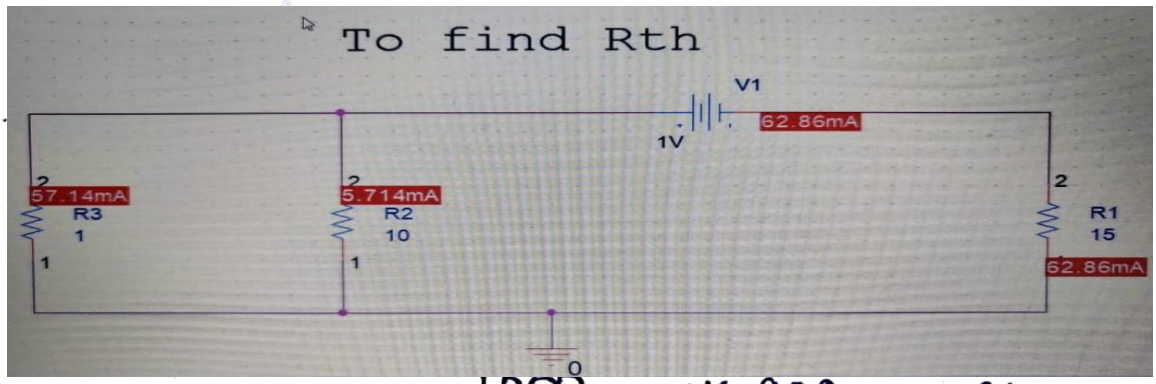
**Simulation Circuit:**

**To Find $V_{th}$:**



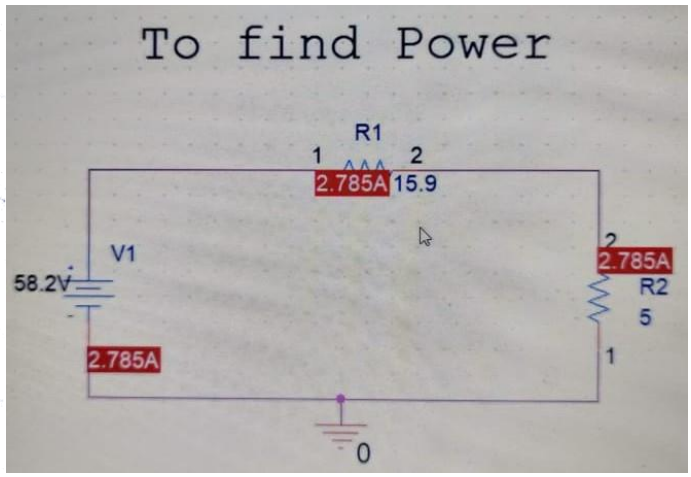

$V_{th} = 60 - 1.818 = 58.182V$

**To Find $R_{th}$:**




$R_{th} = 1/62.86\,(mA) = \frac{1000}{62.86} = 15.908 \simeq 15.91\,\Omega$

**To Find Power:**




$I_L = 2.785\,A$

**Procedure:**

1) Construct the circuit given.
2) To find $V_{th}$, remove load resistance, replace current & voltage sources with open circuit & short circuit respectively (Nodal Analysis).
3) Mark the ends as A & B (of removed load resistance).
4) Thevenin's Resistance ($R_{th}$) is equal to resistance across A & B.
5) Using KVL, find Thevenin's voltage which is equal to $V_B - V_A$.
6) Now find power for the different resistances by simulation.
7) From the theorem & Power formula; Maximum Power obtained ($P_{max}$) = $\left[(V_{th})^2 / 4R_{th}\right]$.
8) Check whether manually calculated results are equal to simulated results.

**Result:**

**Maximum Power Transfer Theorem**

| Manual Calculations | Simulated Result |
|---|---|
| $V_{th} = 58.2182$ V | $V_{th} = 58.182$ V |
| $R_{th} = 15.91\ \Omega$ | $R_{th} = 15.91\ \Omega$ |
| $P_{max} = 53.19$ W | $P_{max} = 53.19$ W |

**Inference:**

Since Simulated values = Manual Calculations, Maximum Power Transfer Theorem is verified.

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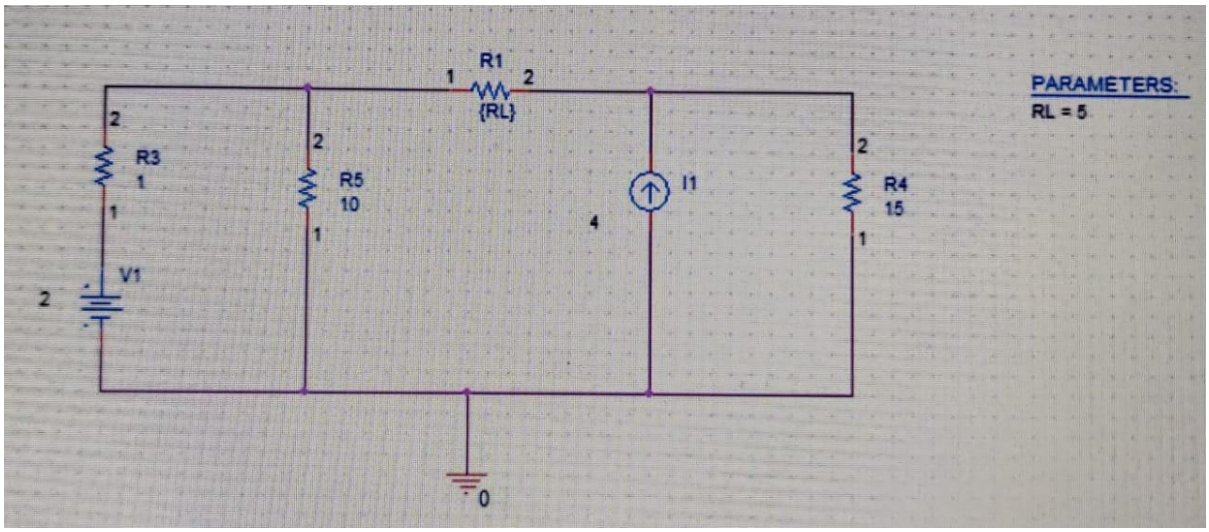
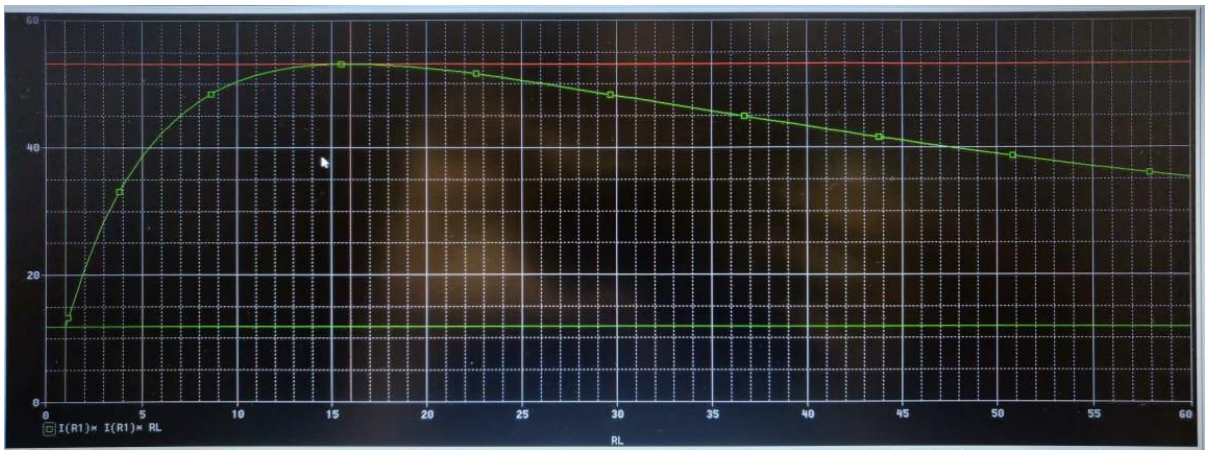
# SIMULATED CIRCUIT & GRAPH




| Trace Color | Trace Name | Y1 | Y2 | Y1 - Y2 | Y1(Curso |
|---|---|---|---|---|---|
| | X Values | 16.000 | 1.0000 | 15.000 | Y1 - Y1(Curs |
| CURSOR 1,2 | I(R1)* I(R1)* RL | 53.194 | 11.840 | 41.355 | 0.000 |

Y=38.4 RL = 60 100%