Ex. No.:2 **Date: 26/9/2019**

Verification of NETWORK THEOREMS
(Maximum Power Transfer Theorem)

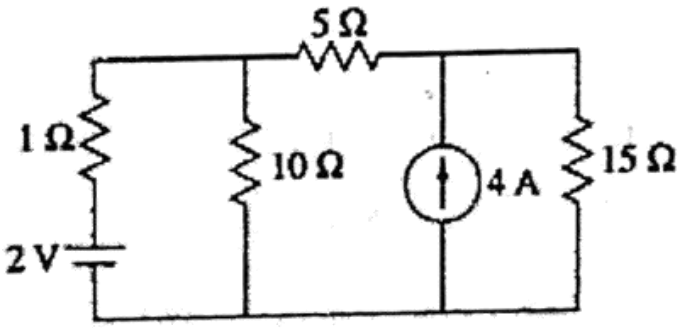
Aim: To verify the Maximum power Transfer Theorem for the given network by theoretical values and simulation values.

Apparatus/Tool required:

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

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

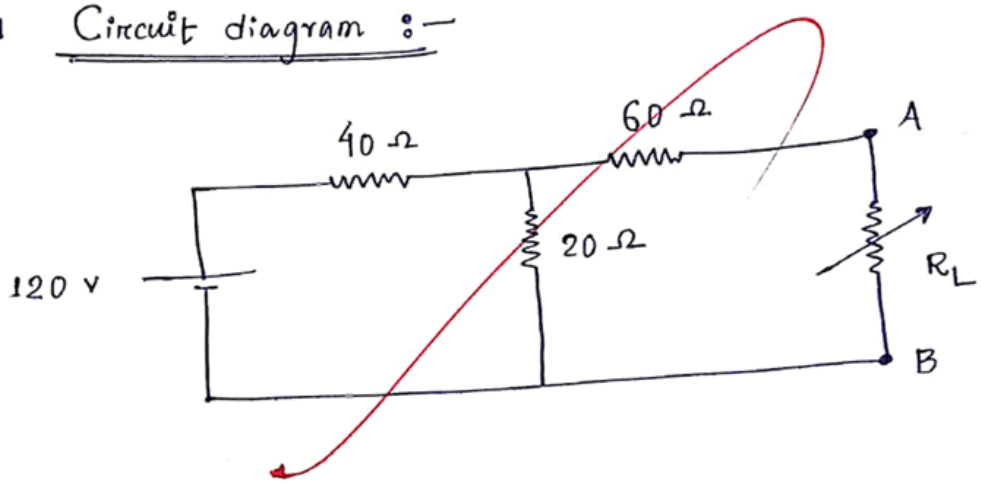
Circuit Diagram

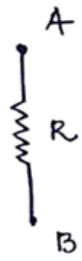


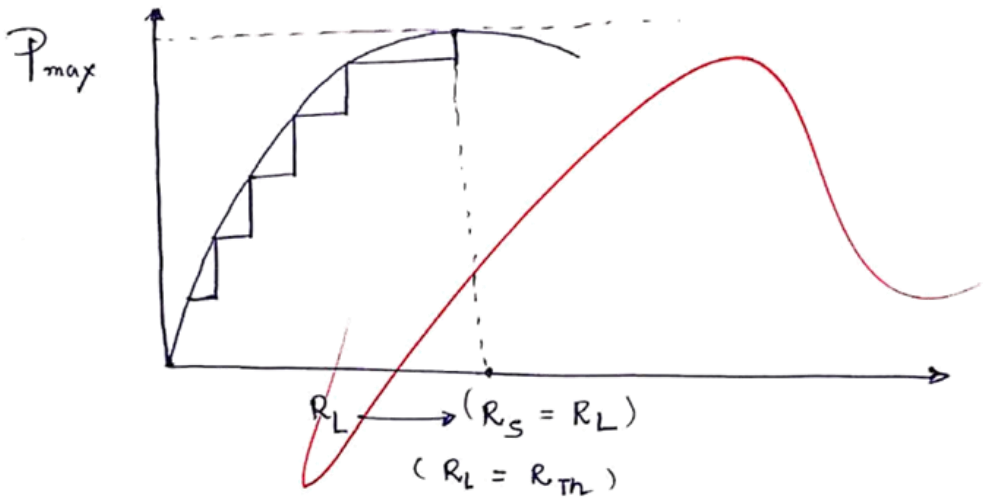
Statement: Maximum Power Transfer Theorem

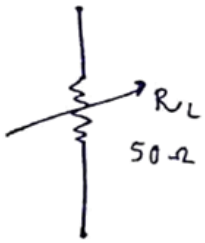
In a linear bilateral network, the maximum power is transferred from the source to the load when the source resistance must be equal to load resistance.

Circuit diagram :-



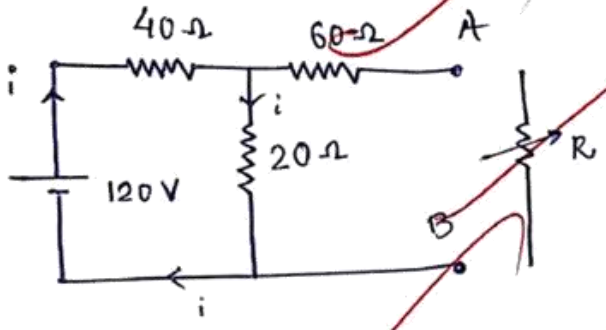






Manual Calculations:

To Find V_{th}:



$$i = V/R_T$$

$$i = \frac{120}{(40+20)}\ A$$

$$= \frac{120}{60}\ A$$

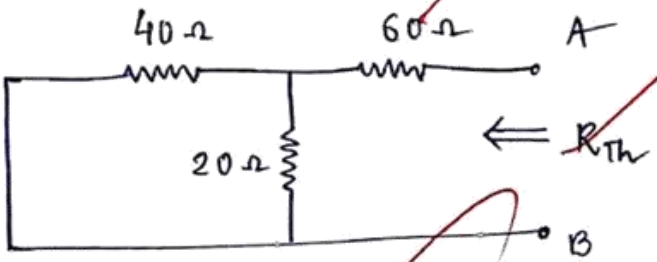
$$= 2\ A$$

$$\therefore V_{20\Omega} = i_{20\Omega} \times R_{20\Omega}$$

$$= (2 \times 20)\ V$$

$$\therefore \boxed{V_{OC} = V_{Th} = 40\ Volts.}$$

To Find R_{th}:



$\Longleftarrow R_{Th}$

$$R_{AB} = R_i = R_{Th}$$

$$(40 \,||\, 20) + 60\ \Omega$$

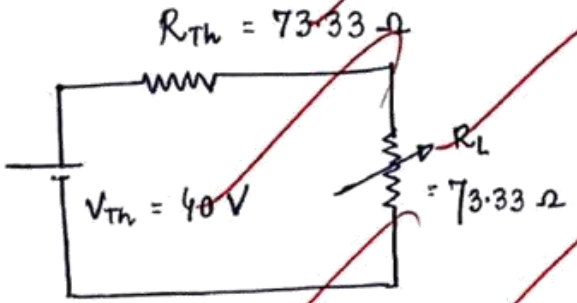
$$= \frac{40 \times 20}{40+20} + 60\ \Omega$$

$$= 13.33 + 60\ \Omega$$

$$\therefore R_{Th} = 73.33\ \Omega$$

$$\therefore \boxed{R_{Th} = R_L = 73.33\ \Omega}$$

To Find Power:



$$i_L = \frac{V_{Th}}{R_{Th} + R_L}$$

$$= \frac{40}{73.33 + 73.33}\ A$$

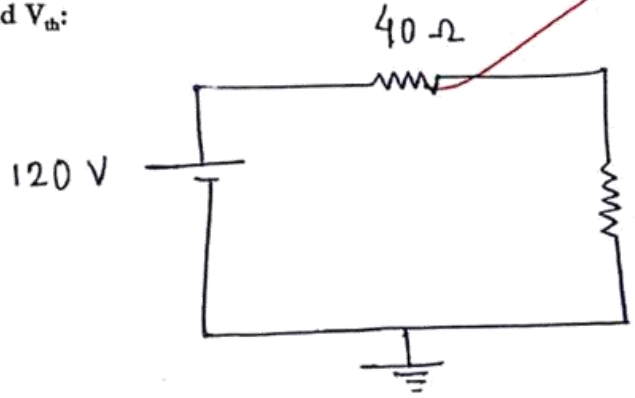
$$\therefore i_L = 0.27\ Amps$$

$$\therefore P_L = i_L^2 \cdot R_L = (0.27)^2 \times 73.33\ Watts$$

$$\therefore \boxed{P_L = 5.45\ Watts}$$

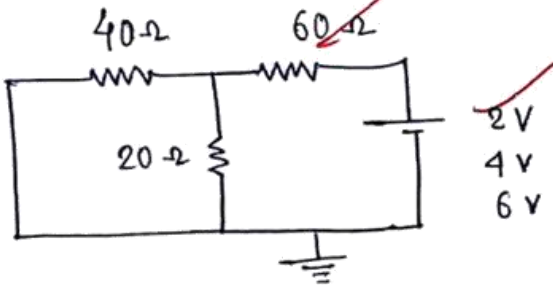
Simulation Circuit:

To Find V_{th}:



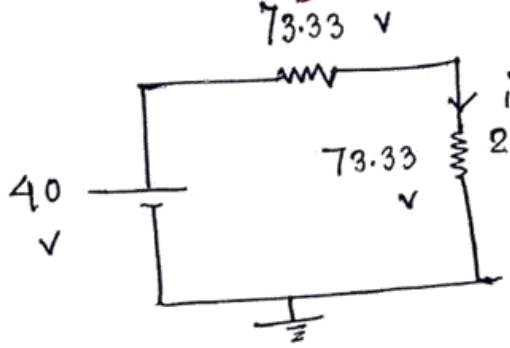
$V_L = 40$ V

To Find R_{th}:



V (volt)	i (mA)	R (Ω)
2	27.27	73.34
4	54.55	73.327
6	81.82	73.33

To Find Power:



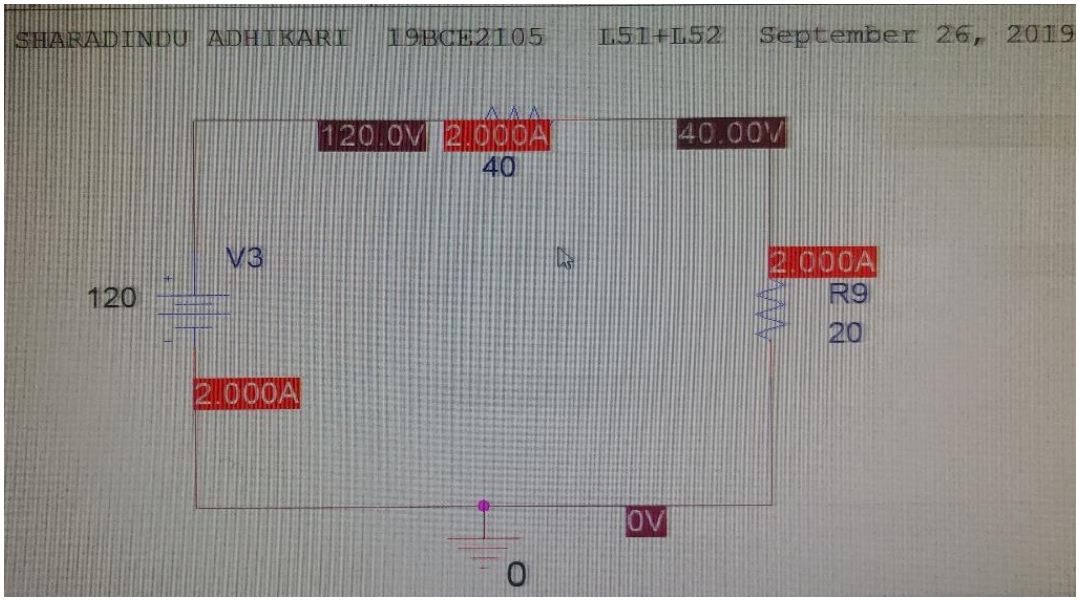
$$P_{avg} = \frac{73.34 + 73.327 + 73.33}{3} \text{ W}$$

$i_L = 0.27$ mA

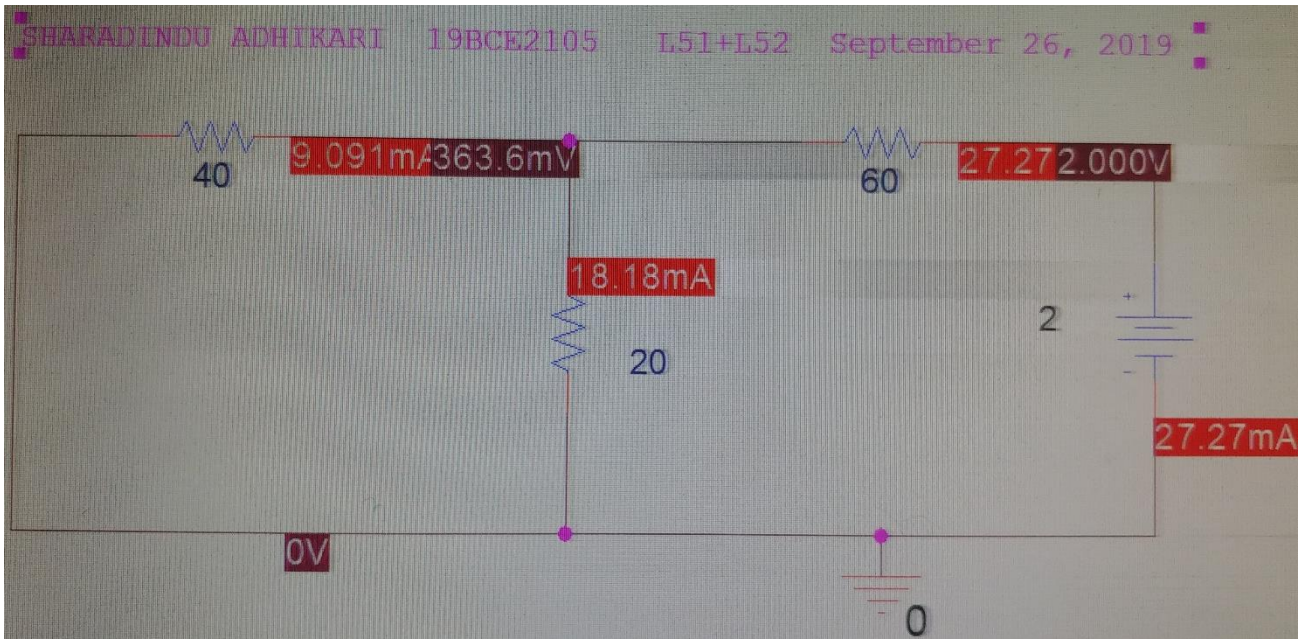
$= 73.3323$ W

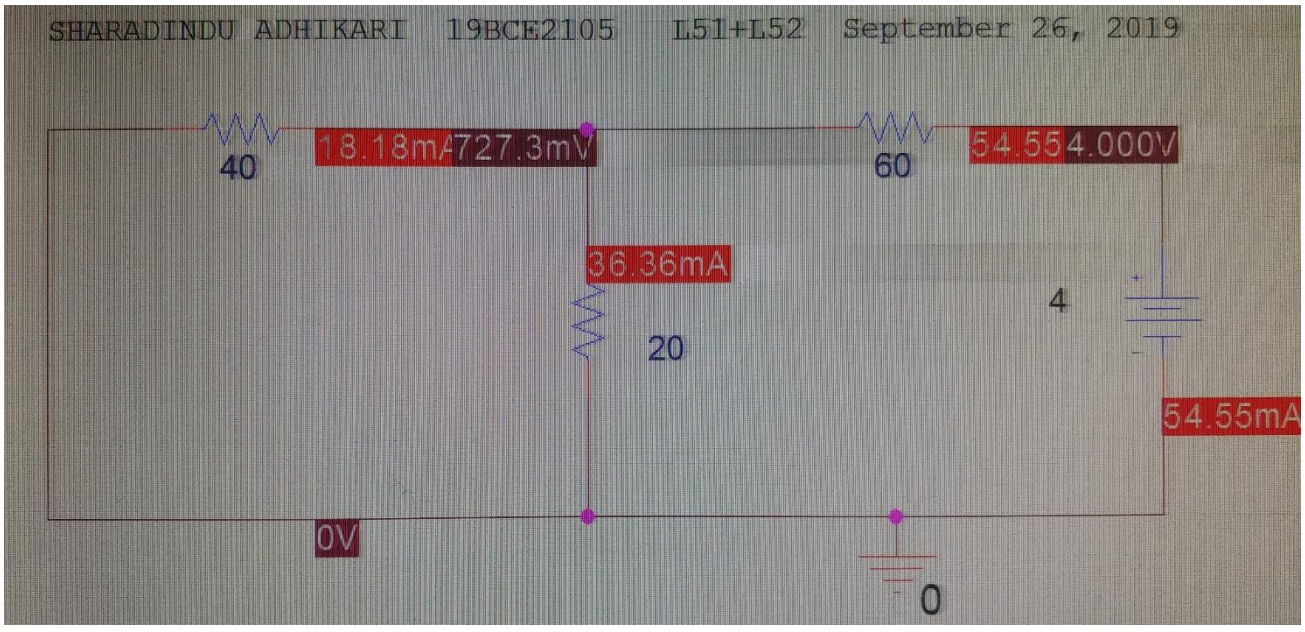
Simulation Circuits:

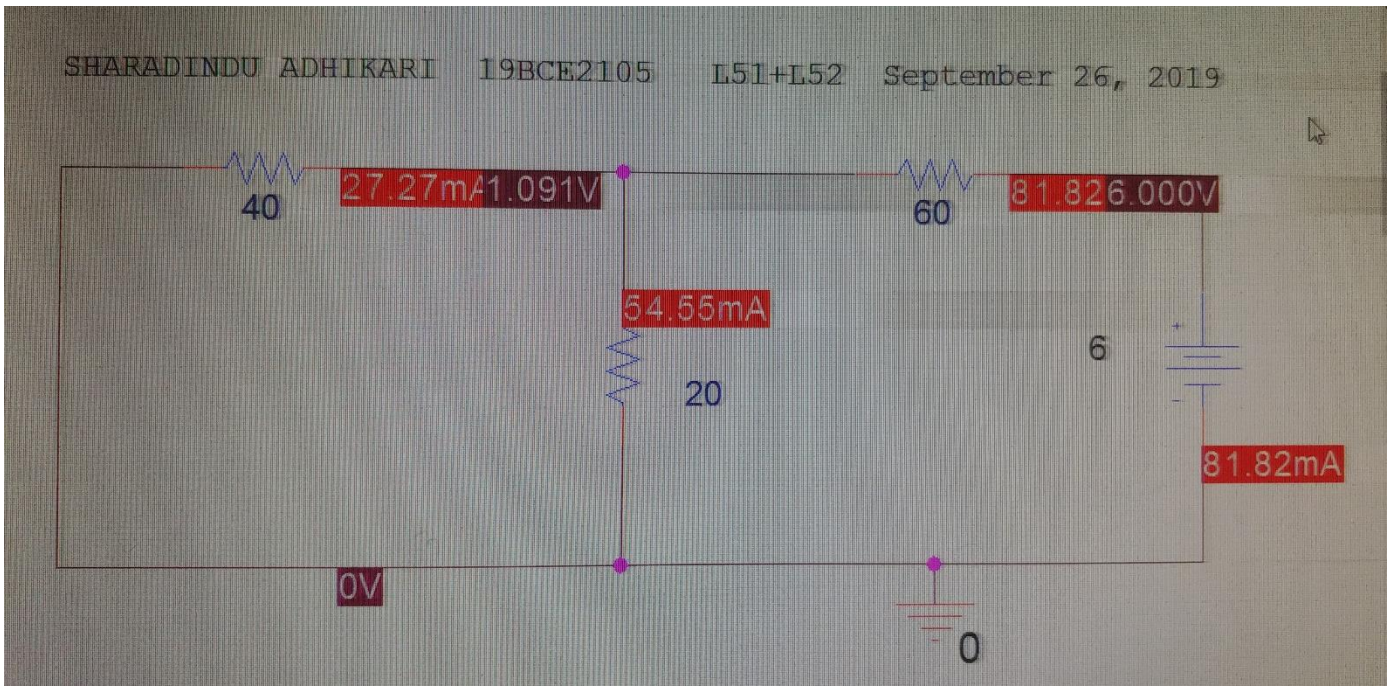
- To find V_{th}:



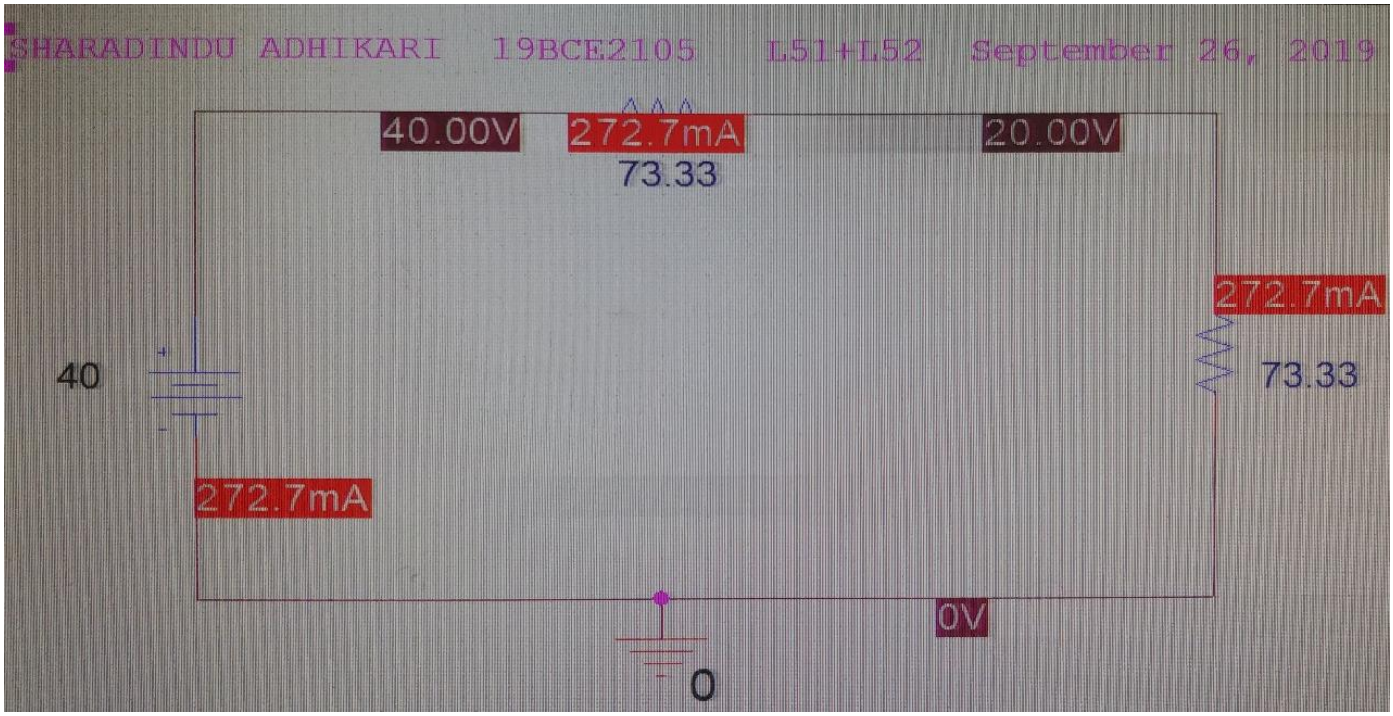
- To find Rth:







- **To find Power:**



Procedure:

Result: The maximum power transfer Theorem have been verified for the given network by theoretical & simulation values, and the following results are tabulated :

Maximum Power Transfer Theorem

parameters	Manual Calculations	Simulated Result
V_{Th}	40 V	40 V
R_{Th}	73.33 Ω	73.3323 Ω
i_L	0.27 A	0.2727 A
P_{max}	5.45 W	5.455 W

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