Ex. No.:2 Date: 28/09/19

Verification of NETWORK THEOREMS

(Maximum Power Transfer Theorem)

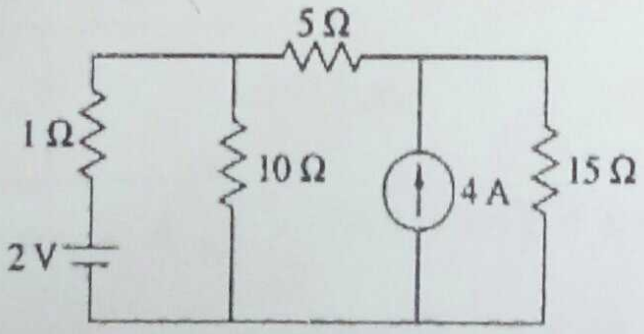
Aim: To verify the maximum power transfer theorem for the given network by theoritical values and simulation values

Apparatus/Tool required:

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

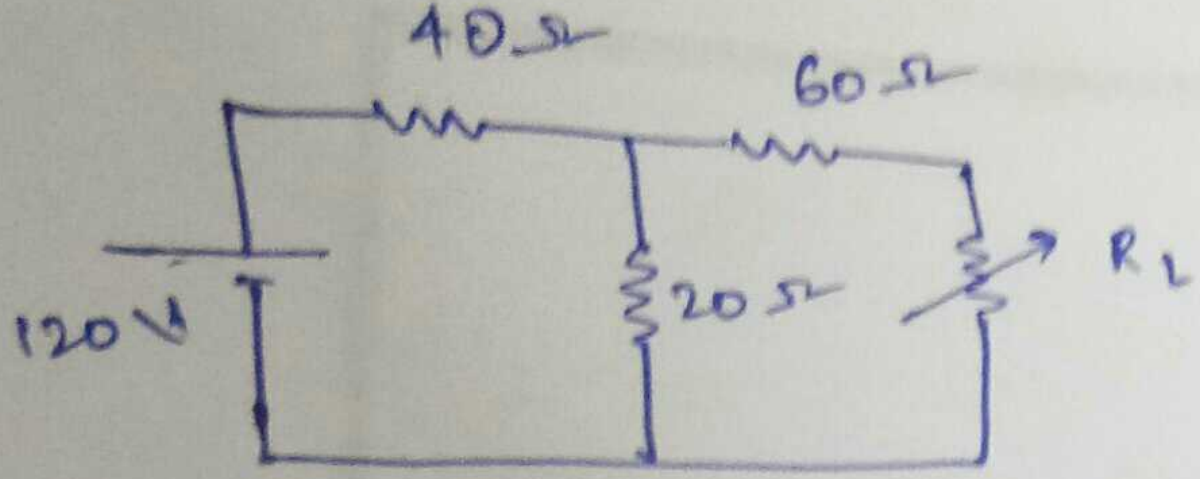
Simulation Settings: Analysis Type - Bias Point

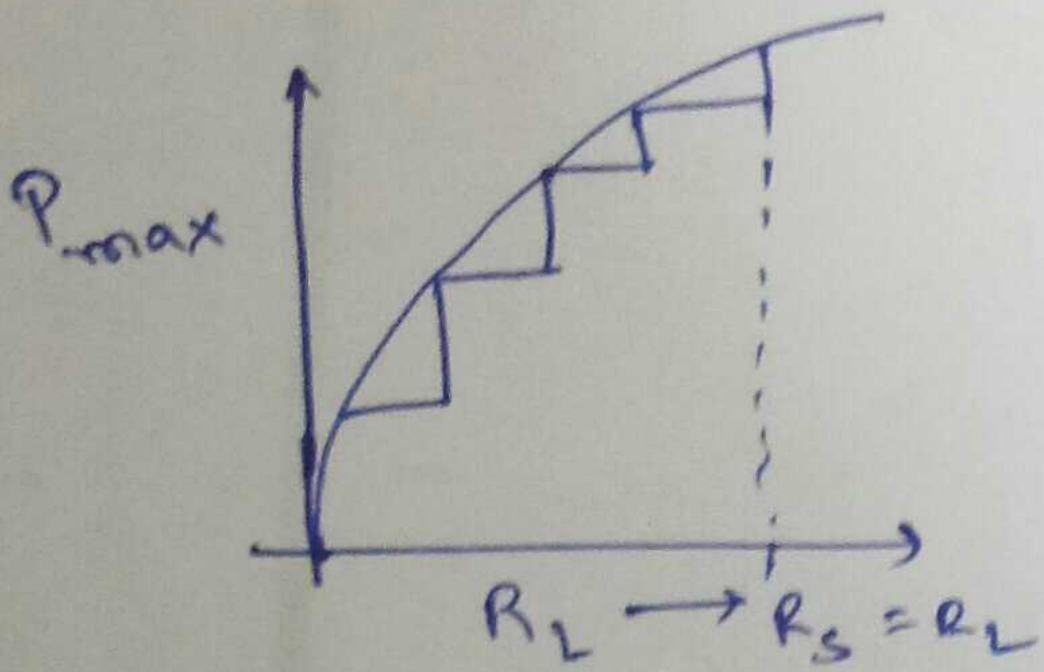
Circuit Diagram



Statement: Maximum Power Transfer Theorem

In a linear bilateral network, the maximum power is transfered from source to the load resistance. When the source resistance equal to load resistance

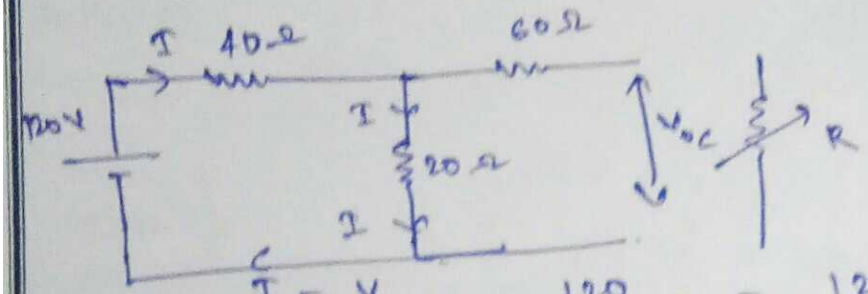




$(R_L = R_{Th})$

Manual Calculations:

To Find V_{th}:

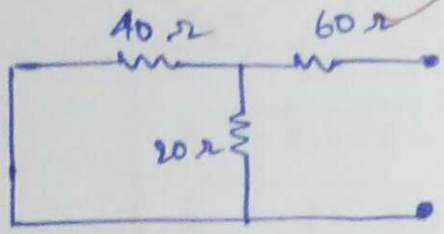


$$I = \frac{V}{R_T} = \frac{120}{40+120} = \frac{120}{60} = 2 \text{ Amp.}$$

$$V_{20\Omega} = I_{20\Omega} \times R_{20\Omega} = 2 \times 20 = 40V$$

$$V_{oc} = V_{Th} = \boxed{40\ V}$$

To Find R_{th}:



$\Leftarrow R_{Th}$

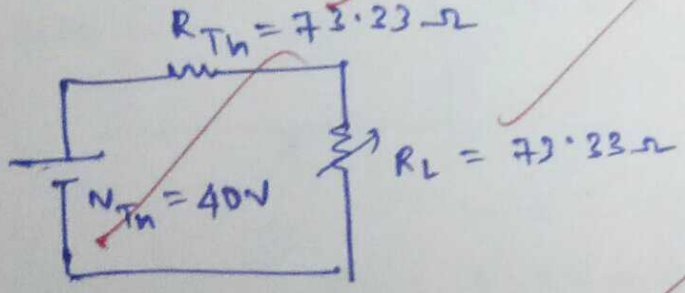
$$R_{AB} = R_i = R_{Th} = (40 \| 120) + 60$$

$$= \frac{40 \times 20}{40+20} + 60 = \frac{800}{60} + 60$$

$$= 72.33\Omega$$

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

To Find Power:



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

$$= \frac{40}{73.33 + 73.3}$$

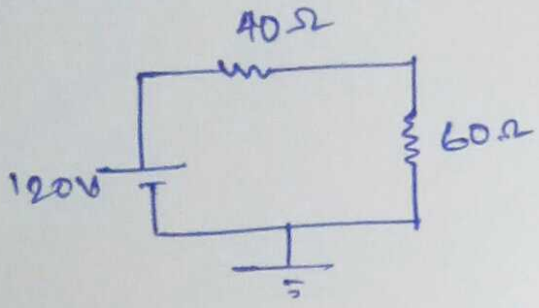
$$I_L = 0.27A$$

$$P_L = I_L^2 R_L = (0.27)^2 \times 73.33$$

$$\boxed{P_L = 5.45\ W}$$

Simulation Circuit:

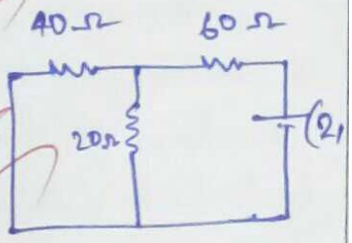
To Find V_{th}:



$V_L = 40V$

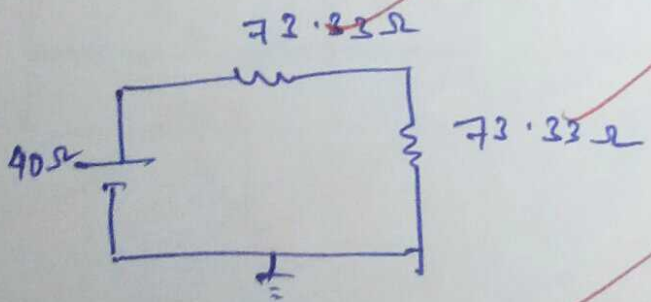
To Find R_{th}:

V(V)	I(mA)	R(KΩ)
2	27.27	0.0733
4	54.55	0.0733
6	81.82	0.0733



$(R_{Th})\ R_{avg} = 0.0733 K\Omega$

To Find Power:



$I_L = 0.27mA$

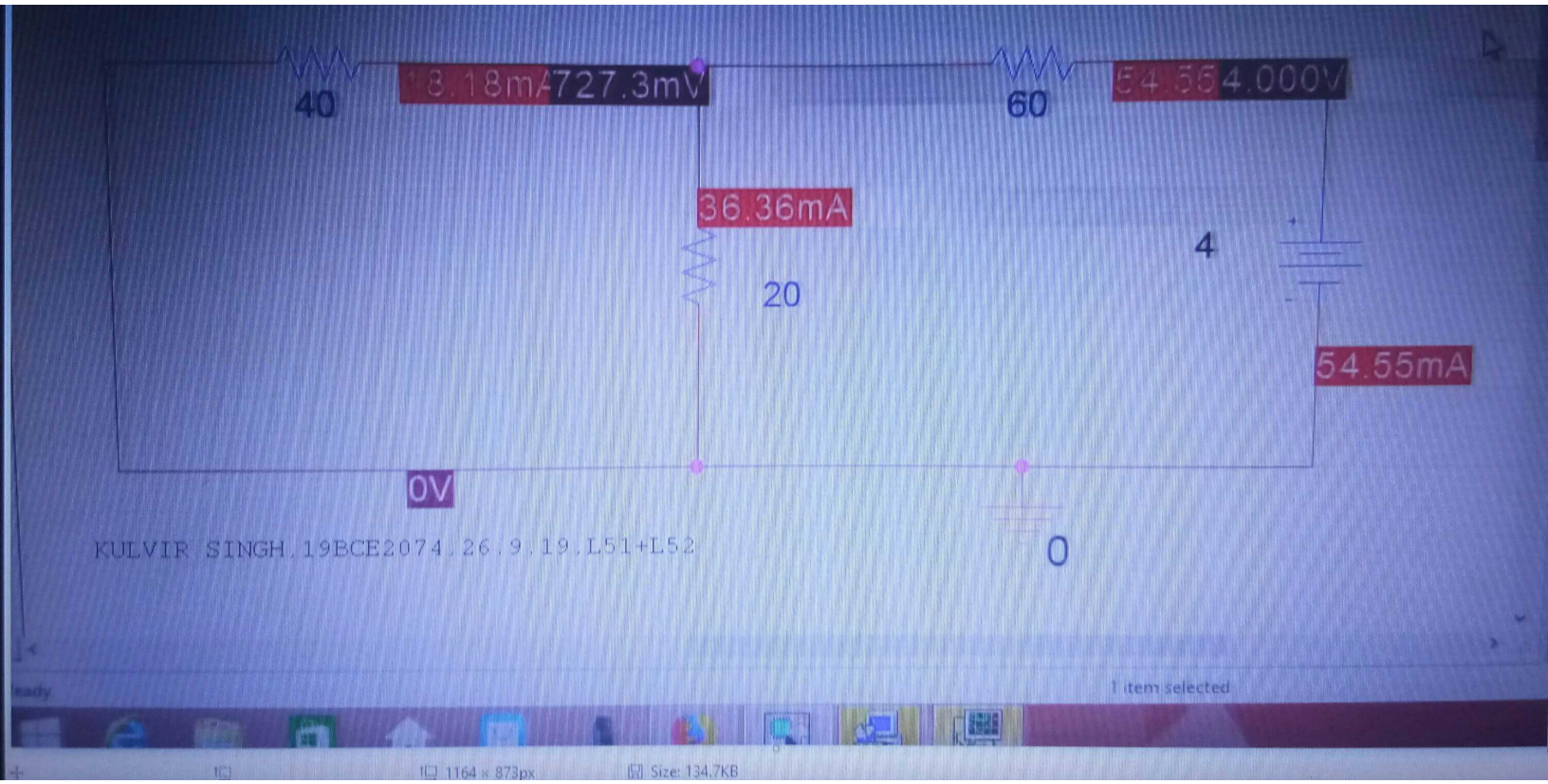
$P = 5.45W$

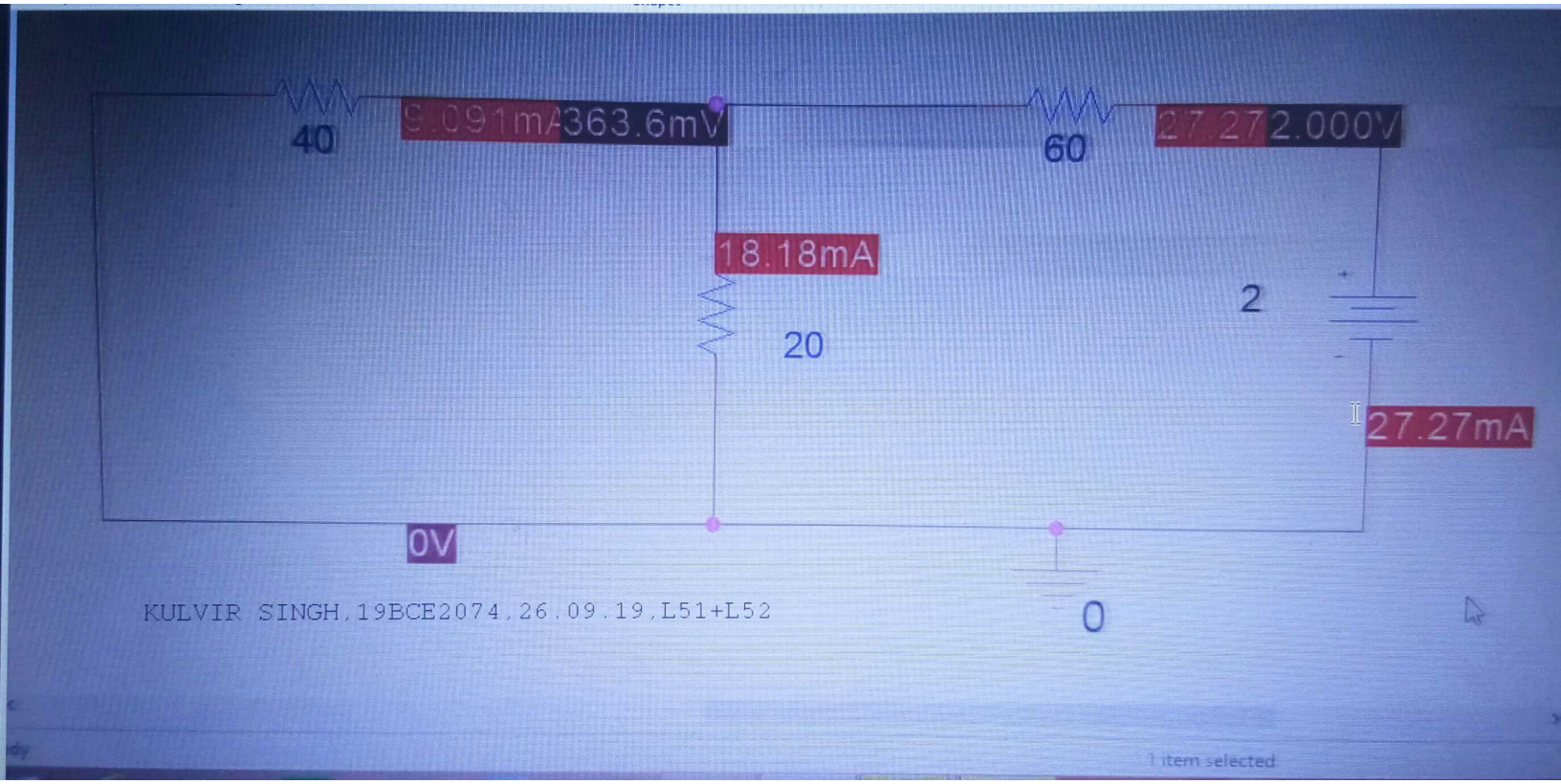
Result:

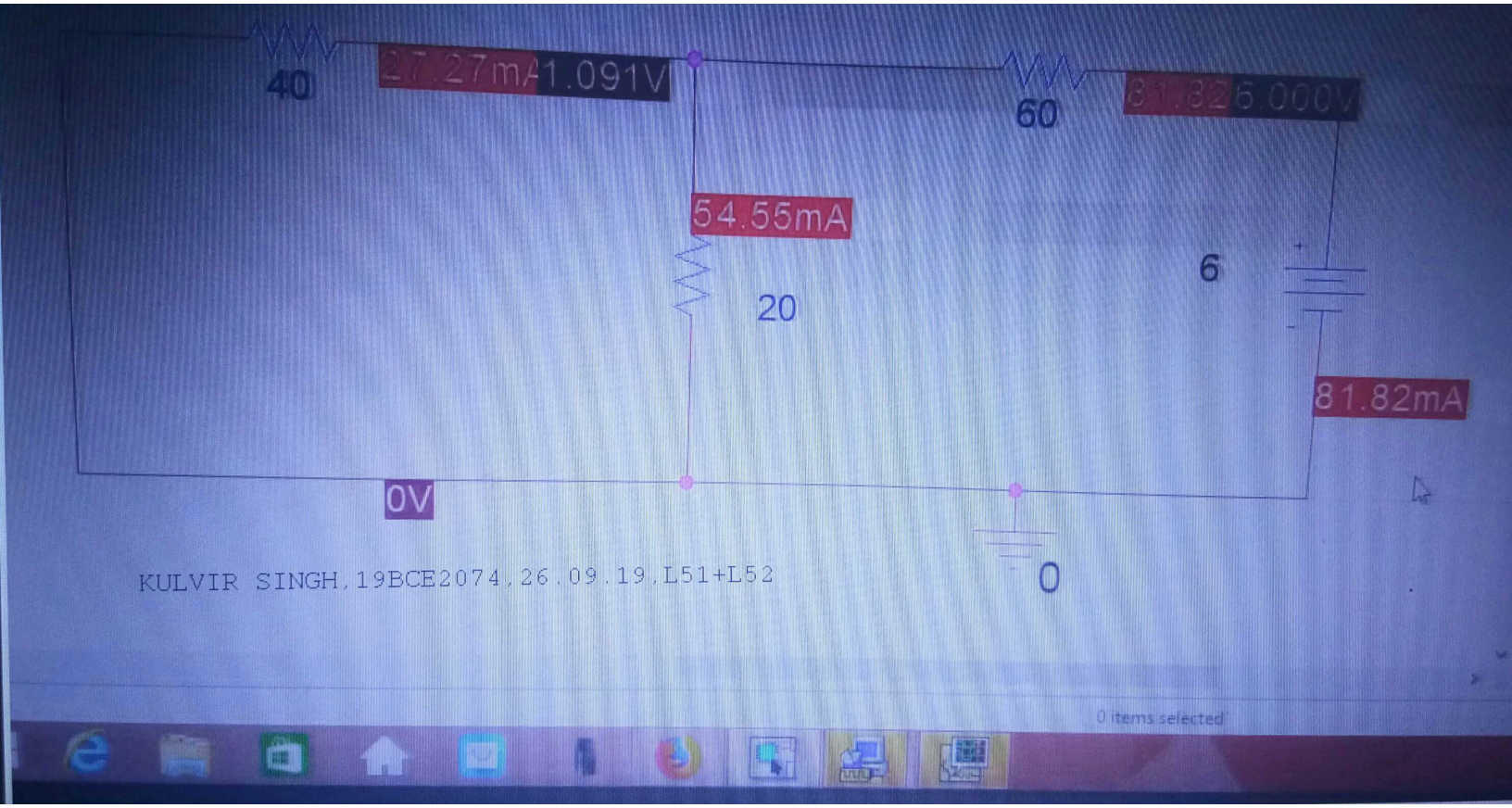
The maximum power transfer theorem have been verified for the given network by theoritical and simulation values and the following results are tabulated

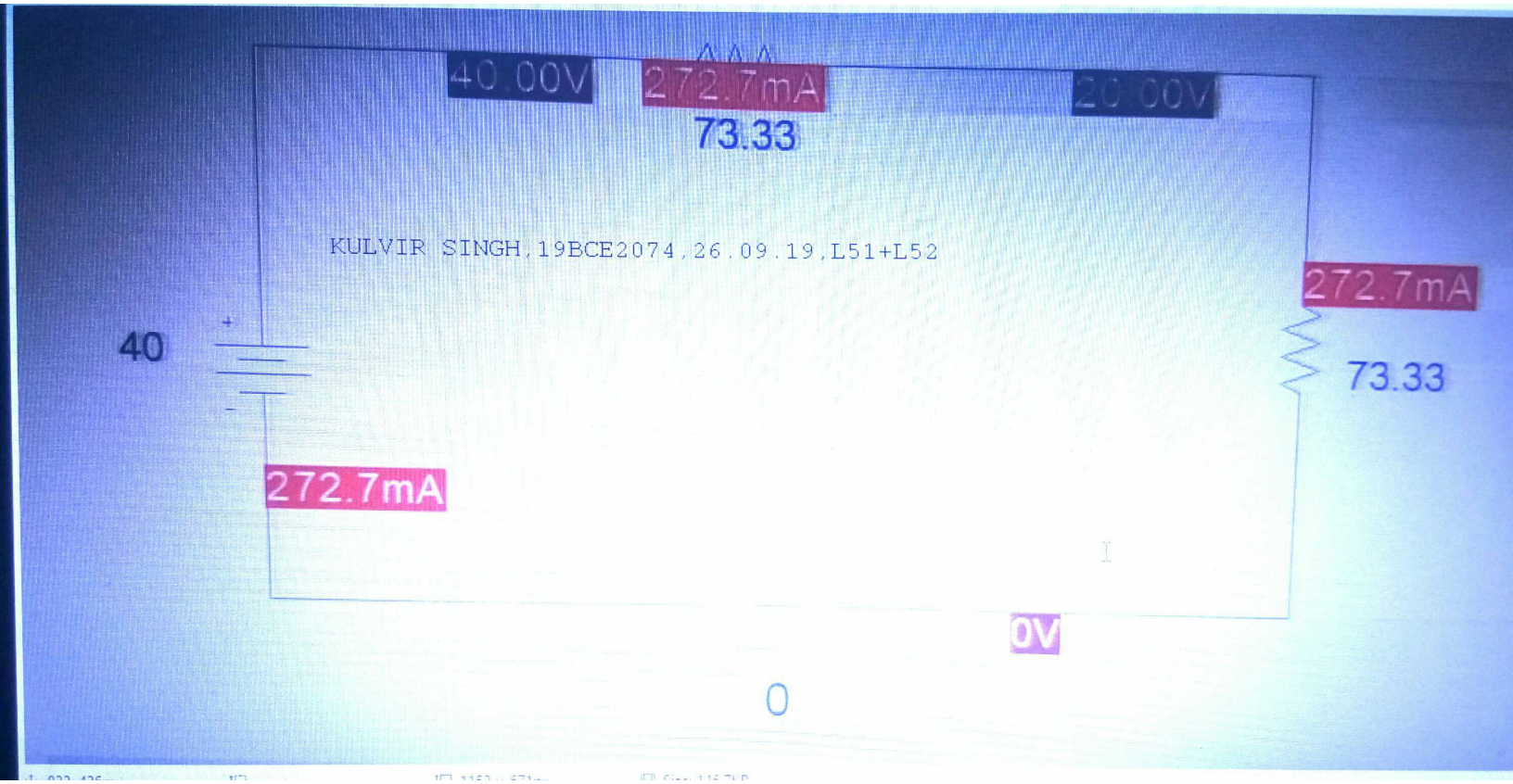
Parameters	Theory	Simulation
V_{Th}	40 V	40 V
R_{Th}	73.33 Ω	73.33 Ω
Maximum Power Transfer Theorem		
Manual Calculations		Simulated Result
I_L	0.27 A	0.27 A
P_{max}	5.45 W	5.45 W

Inference:


40
18.18mA
727.3mV
60
54.554.000V
36.36mA
20
4
54.55mA
0V
0
KULVIR SINGH.19BCE2074.26.9.19.L51+L52


40
9.091mA
363.6mV
60
27.27
2.000V
18.18mA
20
2
27.27mA
0V
0
KULVIR SINGH,19BCE2074,26.09.19,L51+L52
1 item selected


40
27.27mA
1.091V
60
81.826.000V
54.55mA
20
6
81.82mA
0V
0
KULVIR SINGH,19BCE2074,26.09.19,L51+L52
0 items selected


40.00V
272.7mA
73.33
20.00V
KULVIR SINGH,19BCE2074,26.09.19,L51+L52
272.7mA
40
73.33
272.7mA
0V
0