<u>**Department of Computer Science and Engineering**</u>

Lab Project

Sub Code: CSE-209(1)

Course Title: Electrical Circuits.

Semester: Summer-2021

Submitted To:

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Submitted By:

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Experiment No: Final project

Name of the Experiment: PSpice Analysis for Maximum Power Transfer.

Date of Performance: 12/09/2021

Data of Report Submission: 12/09/2021

Q 1. Using PSpice Simulation, determine the Thevenin's equivalent of the circuit looking from

the load resistance R_L .

Solution: the original circuit given on the question is

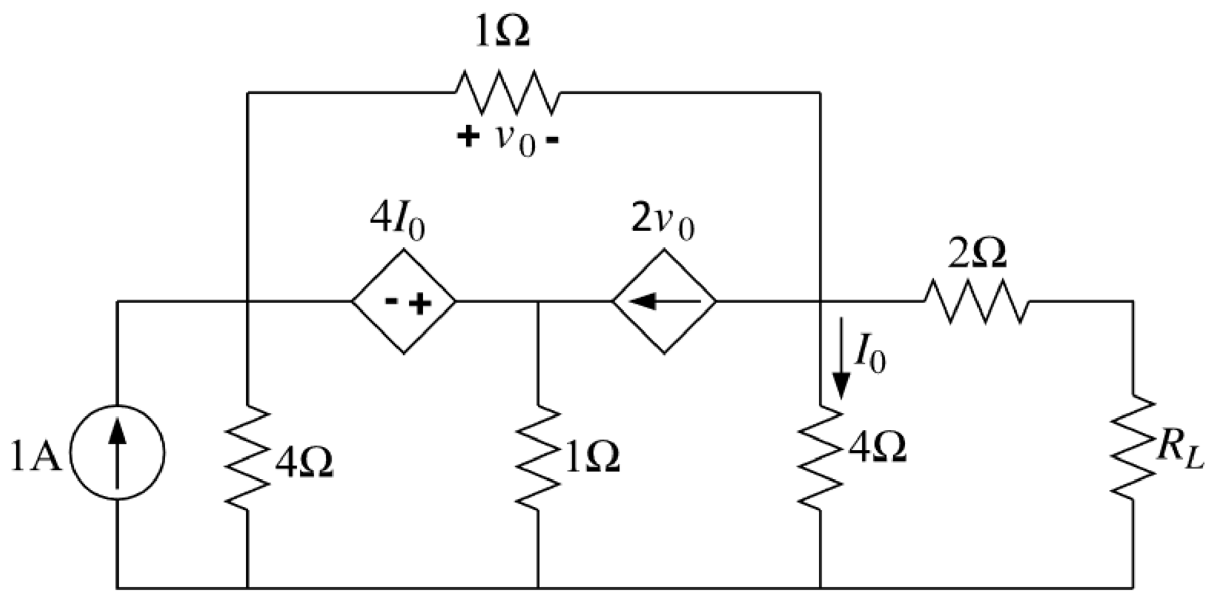

Fig-01(original circuit)

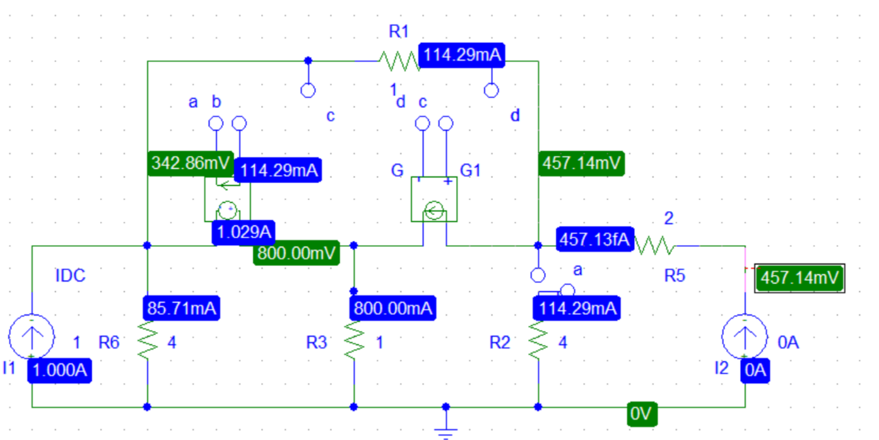

Fig-02 (Replace the R_l with a 0 A source to measure open circuit voltage(V_{oc}))

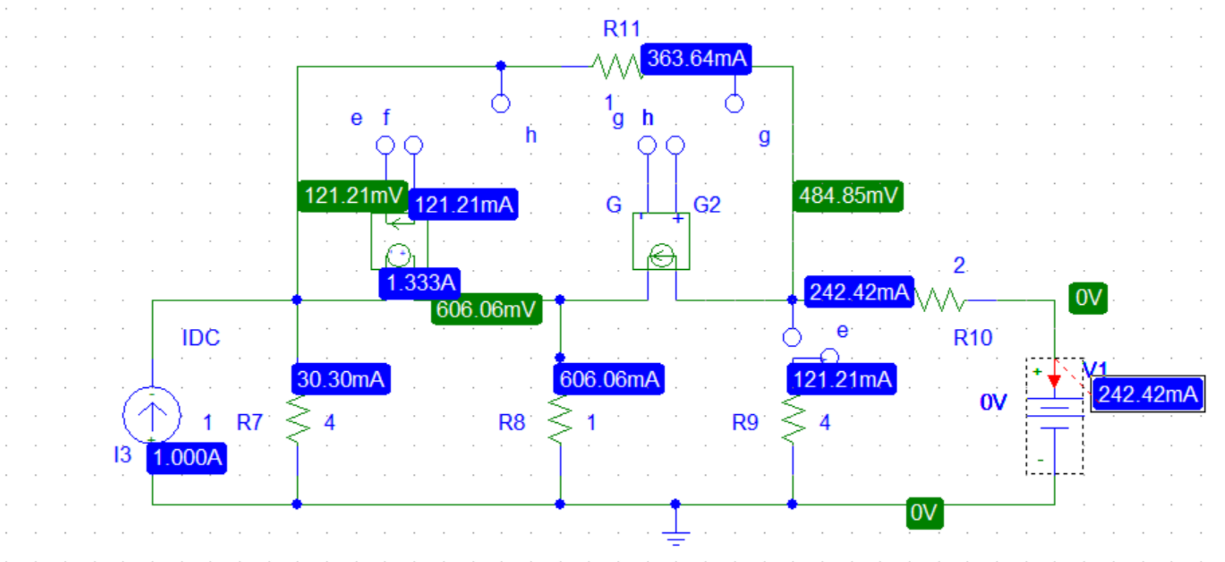

Fig-03 (replaced the R_L with a 0V voltage to measure short circuit current (I_{sc}))

From Fig-02 and 03

We get,

Voc = 457.14 mV

Isc = 242.42 mA

We know Thevenin equation resistance,

$R_{th} = \frac{Voc}{Isc}$

$R_{th} \frac{457.14}{242.42} = 1.89\Omega$

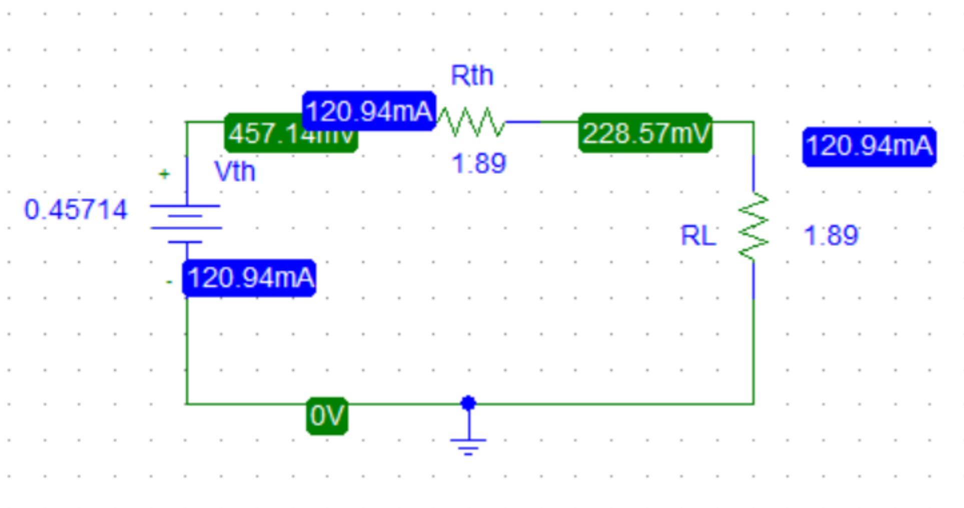

Fig-04(replace the load resistor R_L by the Thevenin equivalent resistance (R_{th}))

Q 2. From the Thevenin's equivalent circuit, theoretically determine the value of load resistance R L for maximum power transfer. Using PSpice Simulation of the Thevenin's equivalent circuit with R_L for maximum power transfer, determine the value of maximum power transferred to R_L .

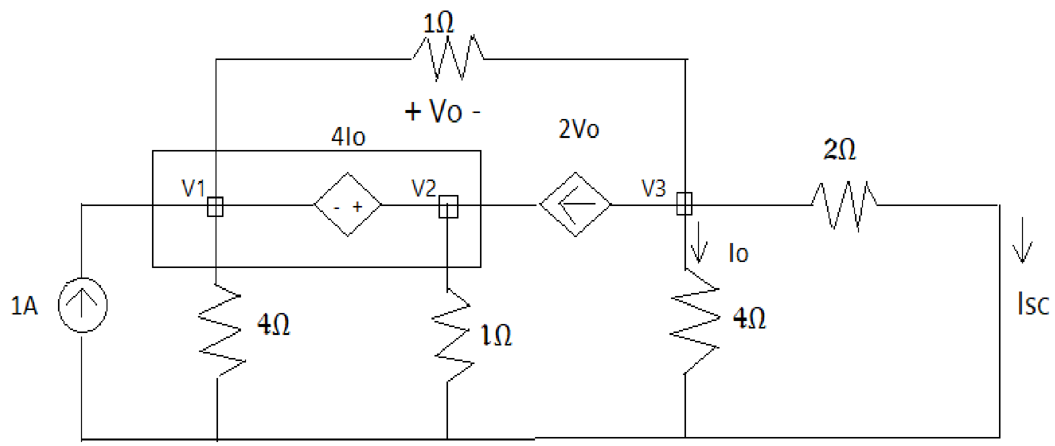

Fig-05(Short Circuit)

Applying KCL at Super Node,

$-1+(V_1/4)+V_1-V_3+V_2-2(V_1-V_3)=0$

or, $-3/4\ V_1+V_2+V_3=1$........(1)

Applying KCL at Super Node 3,

$V_3 - V_1 + 2(V_1 - V_3) + V_3/4 + V_3/2 = 0$

or, $V_1 - 1/4\ V_3 = 0$......(2)

Voltage difference of super node ,

$- V_1 + V_2 - V_3 = 0$......(3)

After calculation from equation 1,2 and 3

$V_3 = 0.48484V$

So, $I_{sc} = V_3/2$

I_{sc} = 0.4848/2

I_{sc} =0.24242 A

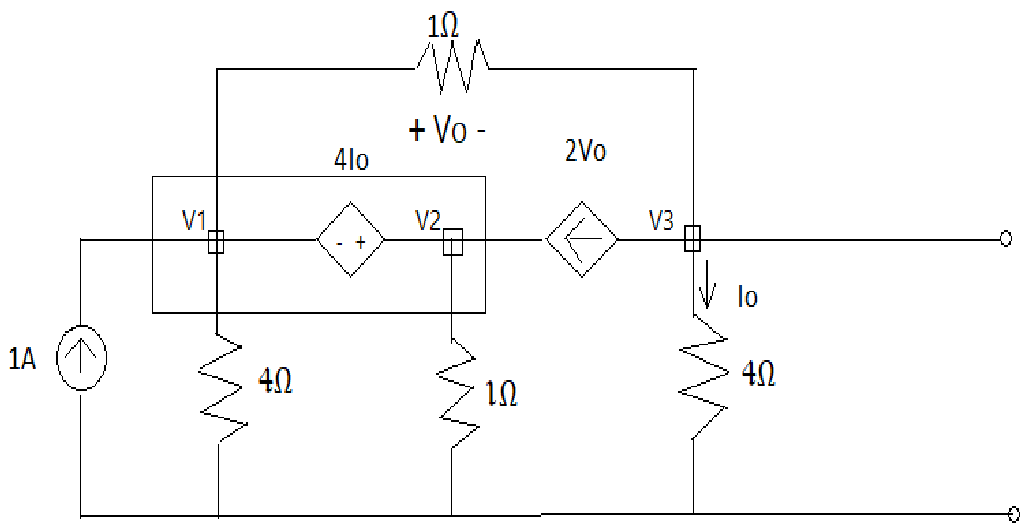

Fig-06(Open Circuit)

Applying **KCL** at super node respectively,

$-1+(V_1/4)+V_1-V_3+V_2-2(V_1-V_3)=0$

or,$(-3/4\ V_1)+V_2+V_3=1$……………….(1)

Applying **KCL** at node 3 respectively,

$V_3-V_1+2(V_1-V_3)+V_3/4=0$

or, $V_1-(3/4\ V_3)=0$ …………………..(ii)

Voltage difference of super node respectively ,

$V_2 - V_1 = 4 * V_3 / 4$

or, $- V_1 + V_2 - V_3 = 0$ …………………(iii)

After calculation from equation (i), (ii) ,And iii

$V_3 = 16/35 = 0.45714$ V

$V_3 = V_{oc} = V_{th} = 0.45714$ V

$R_{th} = R_L = V_{oc}/I_{sc}$

$R_{th} = 0.45714/0.24242$

$R_{th} = 1.89\ \Omega$

$P_{Lmax} = V_{th}^2 / 4R_{th}$

$P_{Lmax} = (0.45714)^2 / 4 * 1.89$

$P_{Lmax} = 0.0276W$

OR, $P_{Lmax} = 0.0278W$

So, $P_{Lmax} = 0.028W$

Q 3. Using PSpice Simulation with resistance sweep, determine the value of R L for maximum power transfer and the corresponding maximum power.

Solution :-

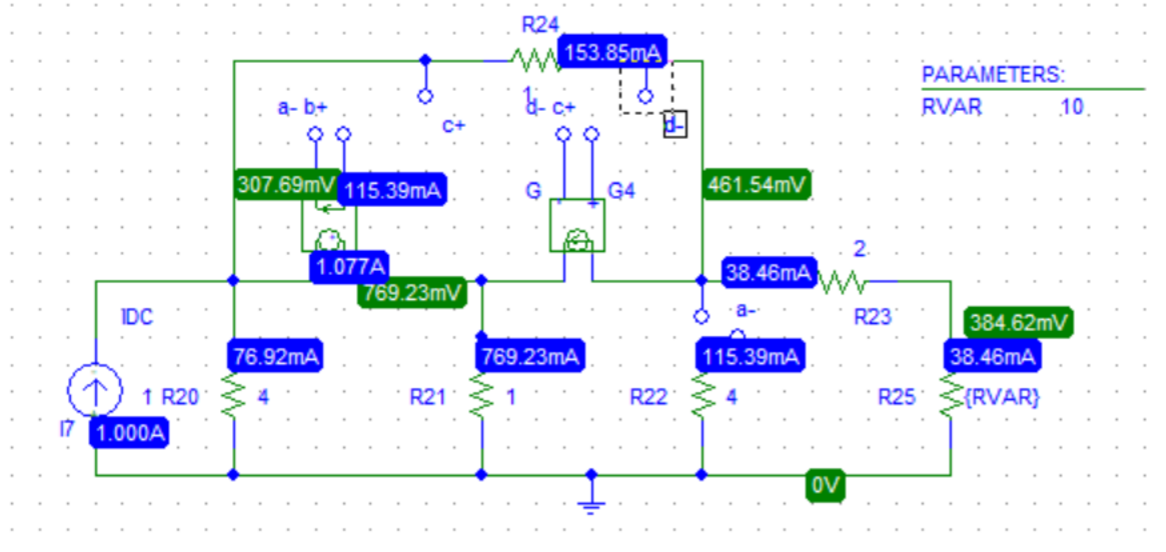

Fig-07

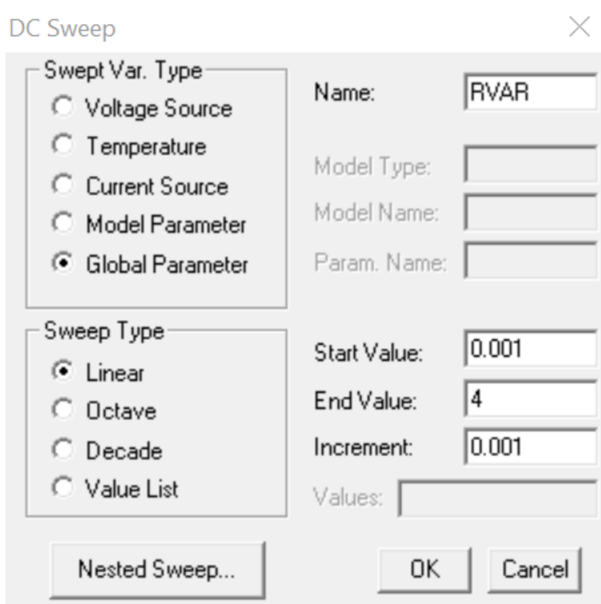

Fig-08(Start Value, End Value, Increment)

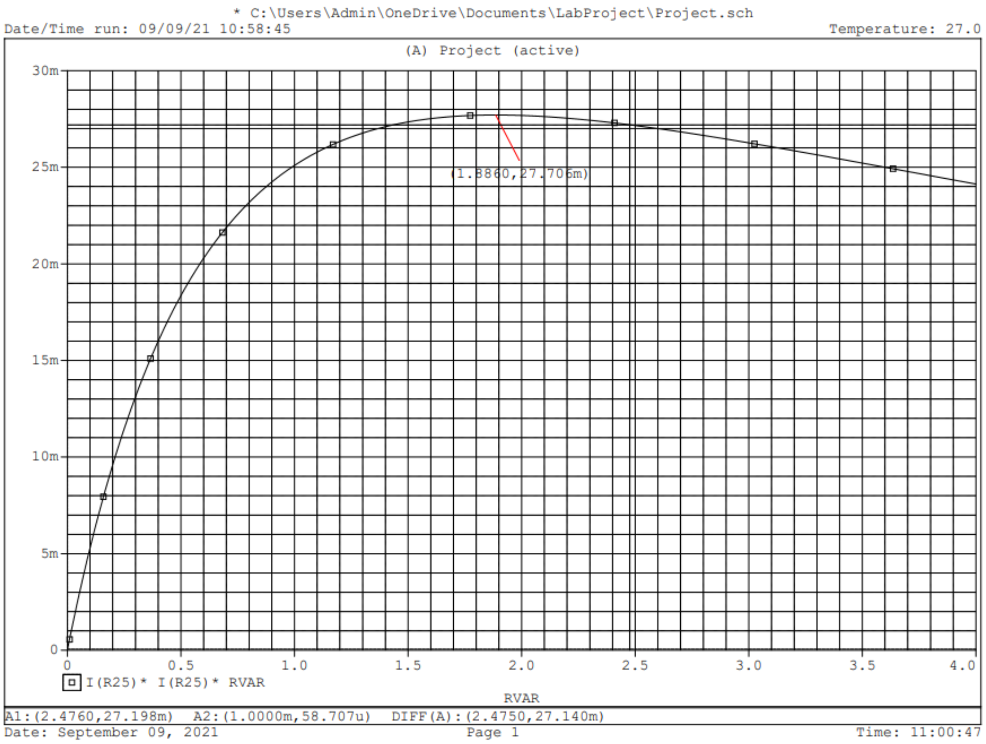

*Fig-09(I(R_{25})*I(R_{25})*(RVAR)'s graph)*

From the graph max power is 27.706mw =0.027706W

Q4. Compare the value of R L and maximum power obtained in steps 2 and 3.

ANS: from the table we can see there is no difference between theoretically calculation and simulation

	STEP 2	**STEP 3**
$\mathbf{R_L}$	1.89 Ω	1.886 Ω =1.89Ω
$\mathbf{P_{Lmax}}$	0.028W	0.027706W =0.028W