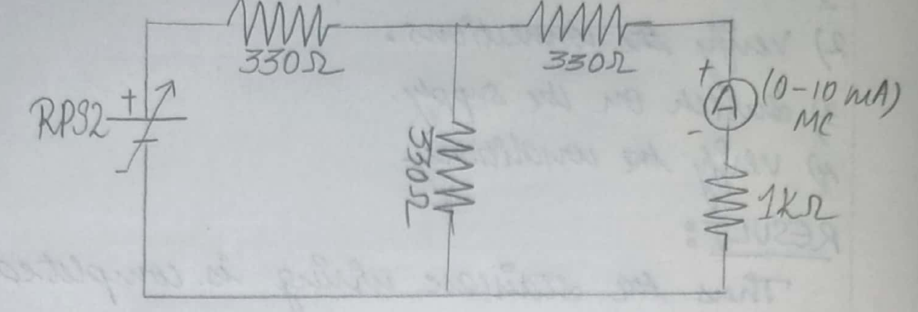
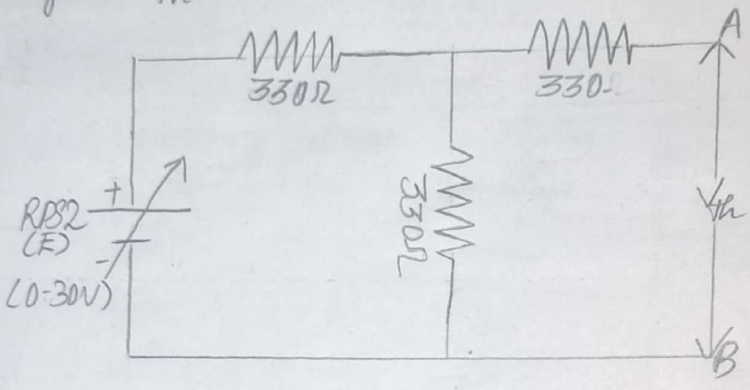
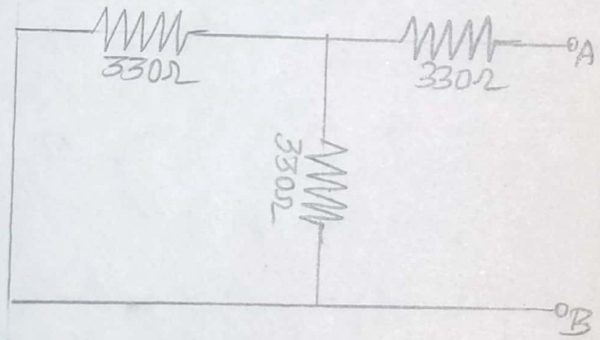
Circuit-1: To find load current



To find V_{Th}

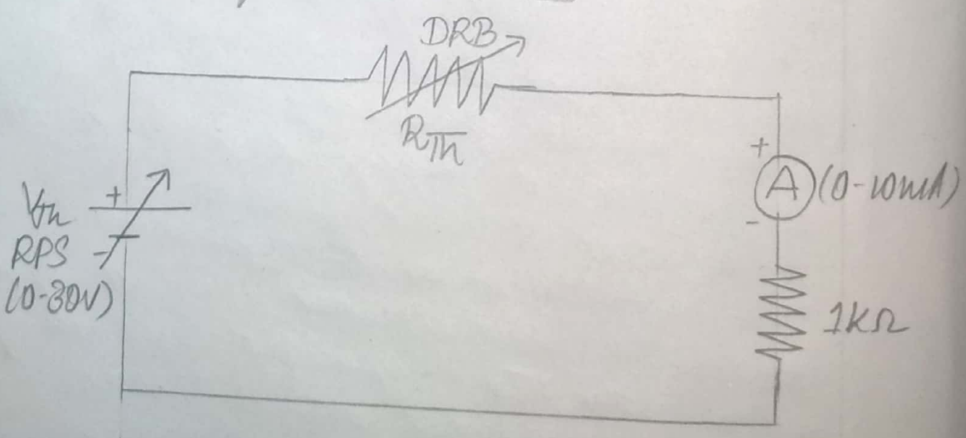


To find R_{Th}



$R_{Th} = 495\Omega$

thevenin's Equivalent circuit:



Expt 3(a)

THEVENIN'S THEOREM

AIM:
To verify thevenin's theorem and to find the full load current for the given circuit.

APPARATUS:-

Serial No.	Apparatus	Range	Quantity
01)	RPS (Regulated power supply)	0-30V	2
02)	Ammeter	0-10mA	1
03)	Resistor	1KΩ, 330Ω	3, 1
04)	Bread Board	-	Required
05)	DRB	-	1

STATEMENT:
Any linear bilateral, active two terminal network can be replaced by a equivalent voltage source (V_{Th}) thevenin's voltage or V_{OC} in series with looking pack resistance R_{Th}.

PRECAUTION:
1. Voltage control knob of RPS should be kept at minimum position.
2. Current control knob of RPS should be kept at maximum position.

PROCEDURE:
1. Connections are given as per the circuit diagram.
2. Set a particular value of voltage using RPS and note down the corresponding ammeter reading.

To find V_{Th}:

3. Remove the load resistor and measure the open circuit voltage using multimeter (V_{Th})

Theoretical and Practical values

	E (V)	V_{Th} (V)	R_{Th} (Ω)	I_L (mA) Circuit-I	I_L (mA) Eq. Cir
Theoretical	10	4.95	4.95	3.34	3.31
	20	9.9	4.95	6.69	6.62
Practical	10	4.95	4.95	3.54	3.31
	20	9.9	4.95	6.69	6.62

Model calculation:

W.K.T, $R_{Th} = 495\Omega$

1) $I_1 = \frac{10}{660} = 0.015$

$V_{Th} = 0.015 \times 330 = 4.95V$

$I_L = \frac{V_{Th}}{R_{Th}+R_L} = \frac{4.95}{495+1000} = 3.31mA$

2) $I_1 = \frac{20}{660} = 0.030$

$V_{Th} = 0.030 \times 330 = 9.9V$

$I_L = \frac{V_{Th}}{R_{Th}+R_L} = \frac{9.9}{495+1000} = 6.62mA$

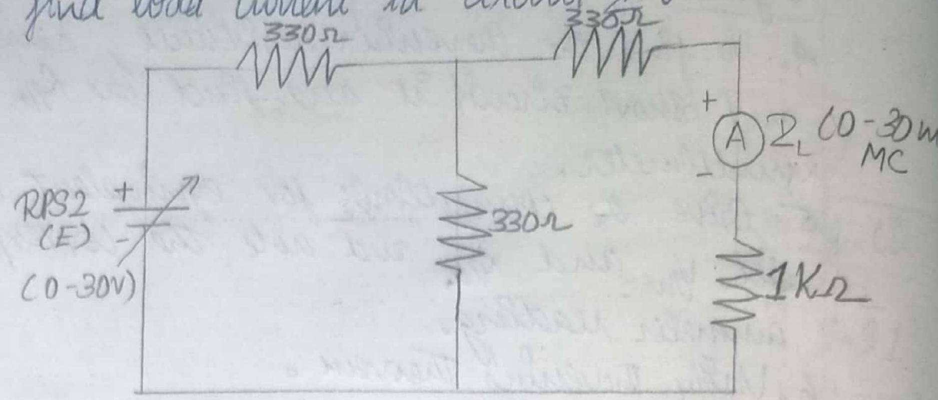
To find R_{Th}

4. To find the thevenin's resistance, remove the RPS and short circuit it and find the R_{Th} using multimeter.
5. Give the connections for equivalent circuit and set V_{Th} and R_{Th} and note the corresponding ammeter reading.
6. Verify thevenin's theorem.

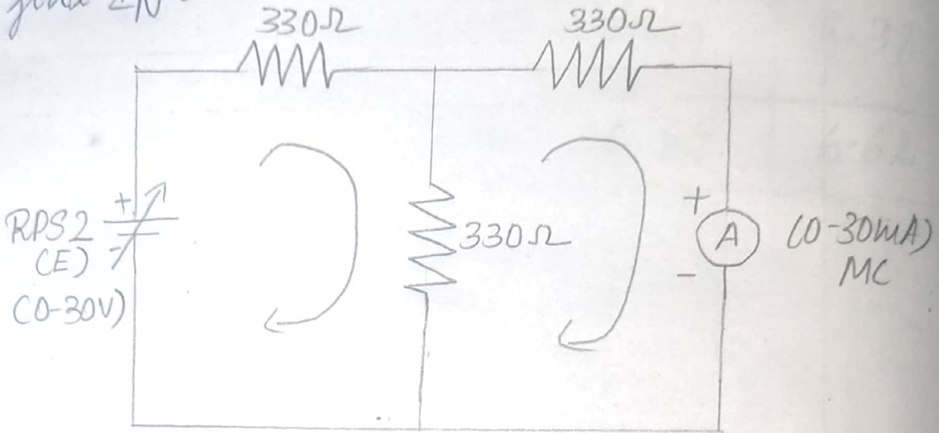
RESULT:

thus the Thevenin's theorem is verified.

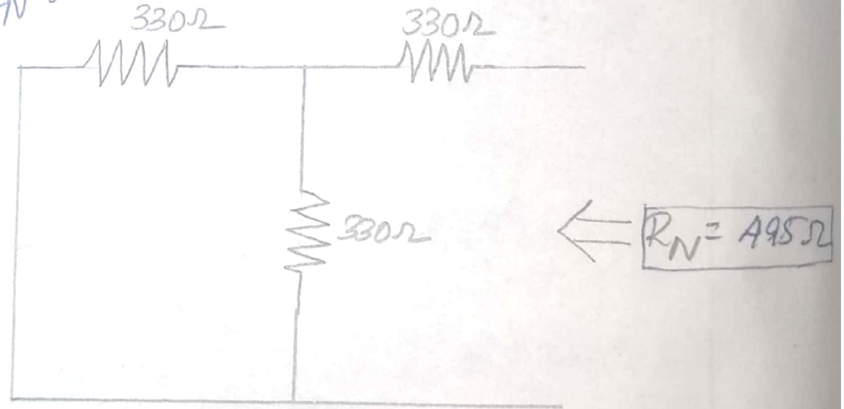
To find load current in circuit I :



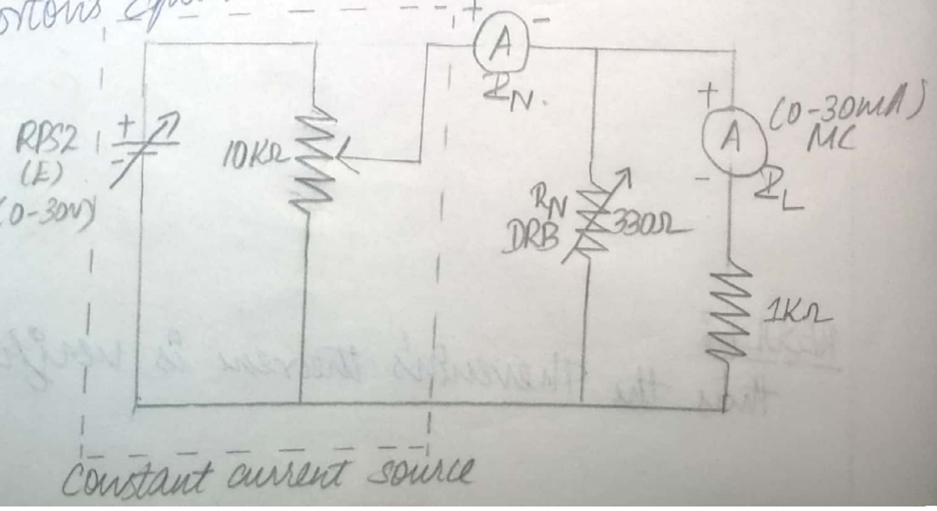
To find I_N :



To find R_N :



Norton's Equivalent circuit :



Expt 3(b)

VERIFICATION OF NORTON'S THEOREM:

AIM:

To verify Norton's theorem for the given circuit.

APPARATUS:

Serial No.	Apparatus	Range	Quantity
1)	Ammeter	(0-10mA) MC (0-30mA) MC	1 1
2)	Resistor	330, 1KΩ	3,1
3)	RPS (Regulated power supply)	(0-30V)	2
4)	Bread board	—	1
5)	Wires	—	Required

STATEMENT:

Any linear, bilateral, active two terminal network can be replaced by an equivalent current source (I_N) in parallel with Norton's resistance (R_N).

PRECAUTIONS:

1) voltage control knob of RPS should be kept at minimum position.
2) control knob for current of RPS should be kept at maximum position.

PROCEDURE:

1) connections are given as per circuit diagram.
2) Set a particular value in RPS and note down the ammeter readings in the original circuit.

To find I_N

3) Remove the load resistance and short circuit the terminals.
4) For the same RPS voltage note down the ammeter reading.

To find R_N

5) Remove RPS and short circuit the terminal & remove the load and note down the R across the 2 terminal.

Theoretical and Practical values

	E (volt)	I_N (mA)	R_N (Ω)	I_L (mA)	
				Circuit I	Eq. circu
Theoretical values	10	0.010	495	3.34	3.31
	20	0.020	495	6.69	6.62
Practical values	10	0.010	495	3.34	3.31
	20	0.020	495	6.69	6.62

Model Calculation: ① For E = 10 volts

By Mesh Analysis,

Loop I $\Rightarrow$ $-10 + 330I_1 + 330(I_1 - I_2) = 0$

$660I_1 - 330I_2 = 10$ — ①

Loop II $\Rightarrow$ $+330(I_1 - I_2) + 330(I_2) = 0$

$-330I_1 + 660I_2 = 0$ — ②

by solving ① & ② by cramers rule we get

$I_1 = 0.02\,mA$

$I_2 = I_N = 0.01\,mA$

W.K.T

$R_N = 495\Omega$

To find I_L : $I_L = \dfrac{I_N \times R_N}{R_N + R_L}$

$= \dfrac{0.01 \times 495}{495 + 1000} = 3.31 \times 10^{-3} A$

$\Rightarrow 3.31\,mA$

② For E = 20 volts;

Similarly, find I_1, $I_2 (I_N)$

$\therefore I_1 = 0.04\,mA$, $I_2 = 0.02\,mA$

W.K.T, $R_N = 495\Omega$

$I_L = \dfrac{I_N \times R_N}{R_N + R_L} = \dfrac{0.02 \times 495}{495 \times 1000} = 6.62\,mA$

Equivalent circuit:

6) Set I_N and R_N and note down the ammeter Reading.

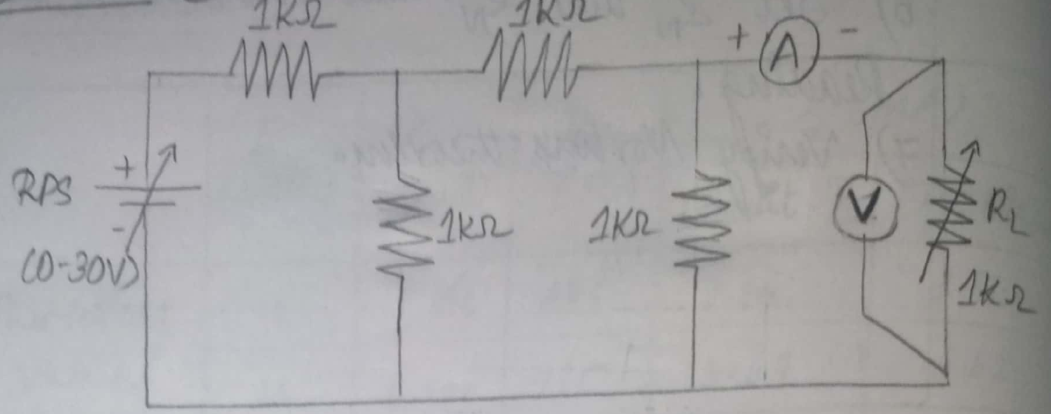
7) Verify Norton's theorem.

RESULT:

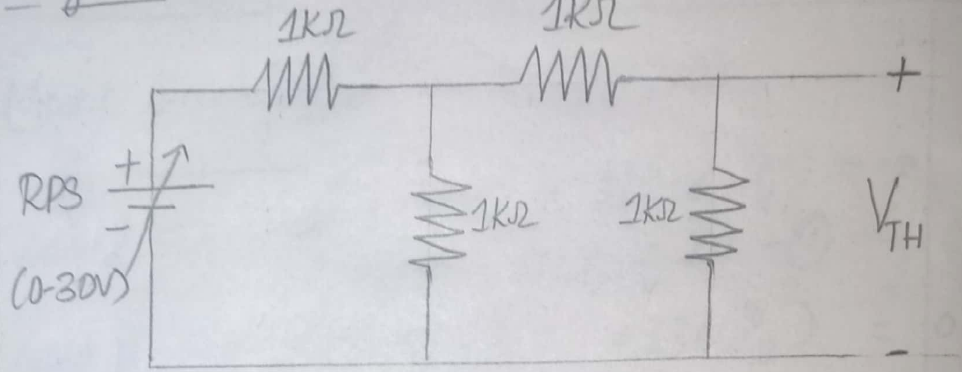
Thus the Norton's theorem is studied.

Scanned with CamScanner

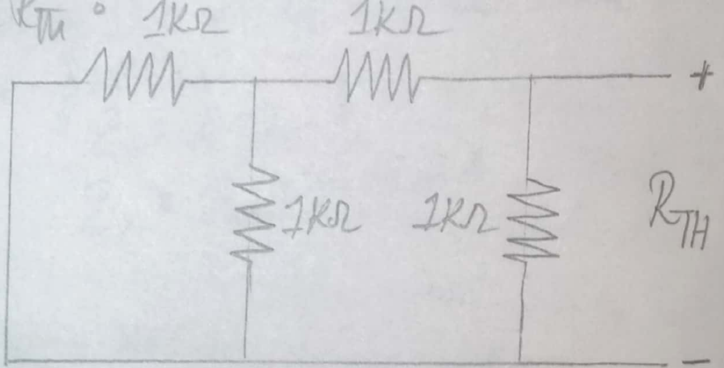
CIRCUIT-2



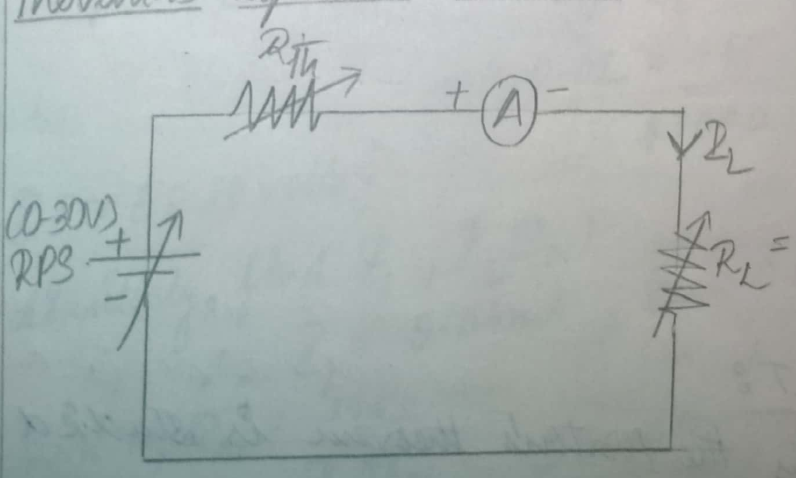
To find V_{Th}:



To find R_{Th}:



Thevenin's Equation circuit



Expt 3(c)

MAXIMUM POWER TRANSFER THEOREM

AIM:

To verify maximum power transfer theorem for the given circuit.

APPARATUS REQUIRED:

S.No	Apparatus	Range	Quantity
01)	RPS	(0-30V)	1
02)	Voltmeter	(0-10V) MC	1
03)	Resistor	1KΩ, 1·3KΩ, 3Ω	3
04)	DRB	-	1
05)	Bread Board & wires	-	As Required

STATEMENT:

In a linear, bilateral circuit the max. power will be transferred from source to the load resistance is equal to source resistance.

PRECAUTION:

1) Voltage control knob of RPS should be kept at minimum point.
2) Current control knob of RPS should be kept at maximum point.

PROCEDURE:

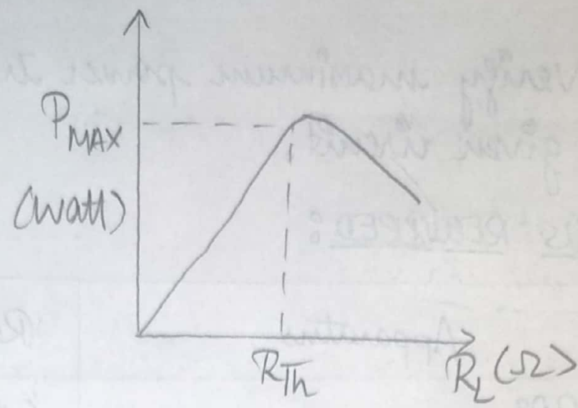
CIRCUIT-I

1) Connections are given as per the diagram & set a particular voltage in RPS.
2) Vary R_L and note down the corresponding ammeter and voltmeter reading.
3) Repeat the procedure for diff. value of R_L & tabulate.
4) Calculate the power for each value of R_L.

To find V_{Th}:

5) Remove the load, determine the open circuit voltage using multimeter (V_{Th}).

Power vs R_L



CIRCUIT - II

Sl.No	$R_L(\Omega)$	I (mA)	Volt	P=VI (watts)
01)	500	9.09	10	41.314
02)	600	8.3	10	41.334 (Max.)
03)	1500	4.76	10	33.986
04)	2000	3.84	10	29.491

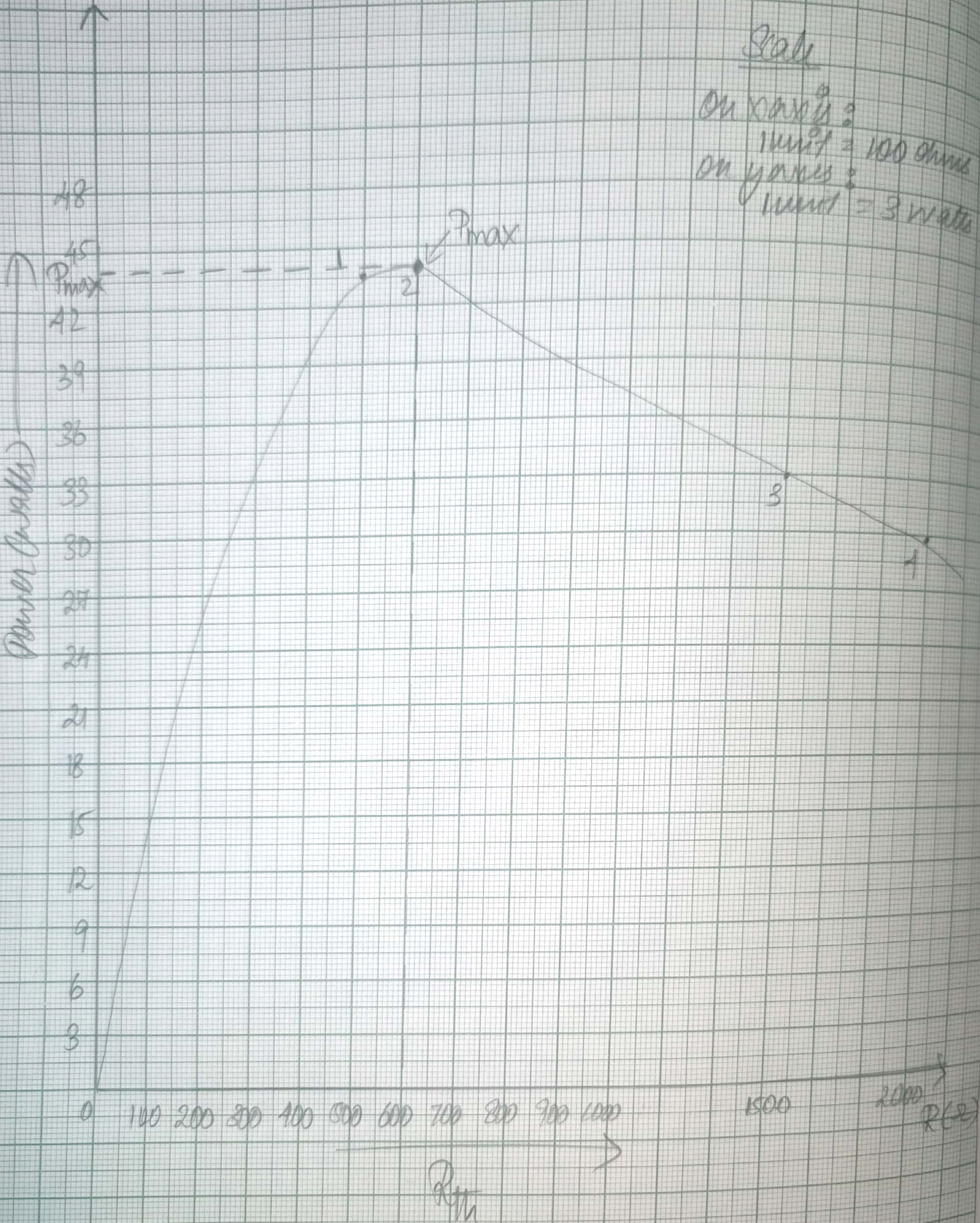
Maximum Power Transfer theorem

Power Vs R_L

Scale

On x axis: 1 unit = 100 ohms

On y axis: 1 unit = 3 watts



Scanned with CamScanner

<u>To find R_{Th}</u> :

6) Remove the load and short circuit the voltage source (RPS).

7) Find the looking back resistance (R_{Th}) using multimeter.

<u>Equivalent circuit</u> :

8) Set V_{Th} using RPS and R_{Th} using DRB and note down the ammeter reading.

9) Calculate the power delivered to the load.

10) Verify maximum power transfer theorem.

To find Thevenin's equivalent circuit

	V_{Th} (V)	R_{Th} (R)	I_L (mA)	P(milli watt)
Theoretical value	2	600	8.3	41.334
Practical value	2	600	8.3	41.334

Calculation:

$$\star \quad \frac{x-10}{1000} + \frac{x}{1000} + \frac{x}{200} = 0$$

$$5x = 20$$

$$x = 4V$$

Find I_L:

$$V_{th} = \frac{1000}{1000+1000} \times 4 = 2V$$

$$R_{th} = \frac{1000 \times 1000}{2000} = 500\Omega$$

$$R_{th} = \frac{1500 \times 100}{2500} = 600\Omega$$

current ~~through~~ load

$$\boxed{I_L = 8.3mA}$$

power through 600Ω (R_L)

$$P = (I_L)^2 R_{th}$$

$$\Rightarrow 8.3 \times 8.3 \times 600$$

$$\Rightarrow 41.334 \text{ m Watts.}$$

Result:

This experiment verifies that get max. power output through a resistor (R_L). the resistance should be equal to R_{eq} of the circuit without R_L.