CSE250: CIRCUITS AND ELECTRONICS

EXPERIMENT 4 :

VERIFICATION OF THEVENIN'S THEOREM AND MAXIMUM POWER TRANSFER THEOREM

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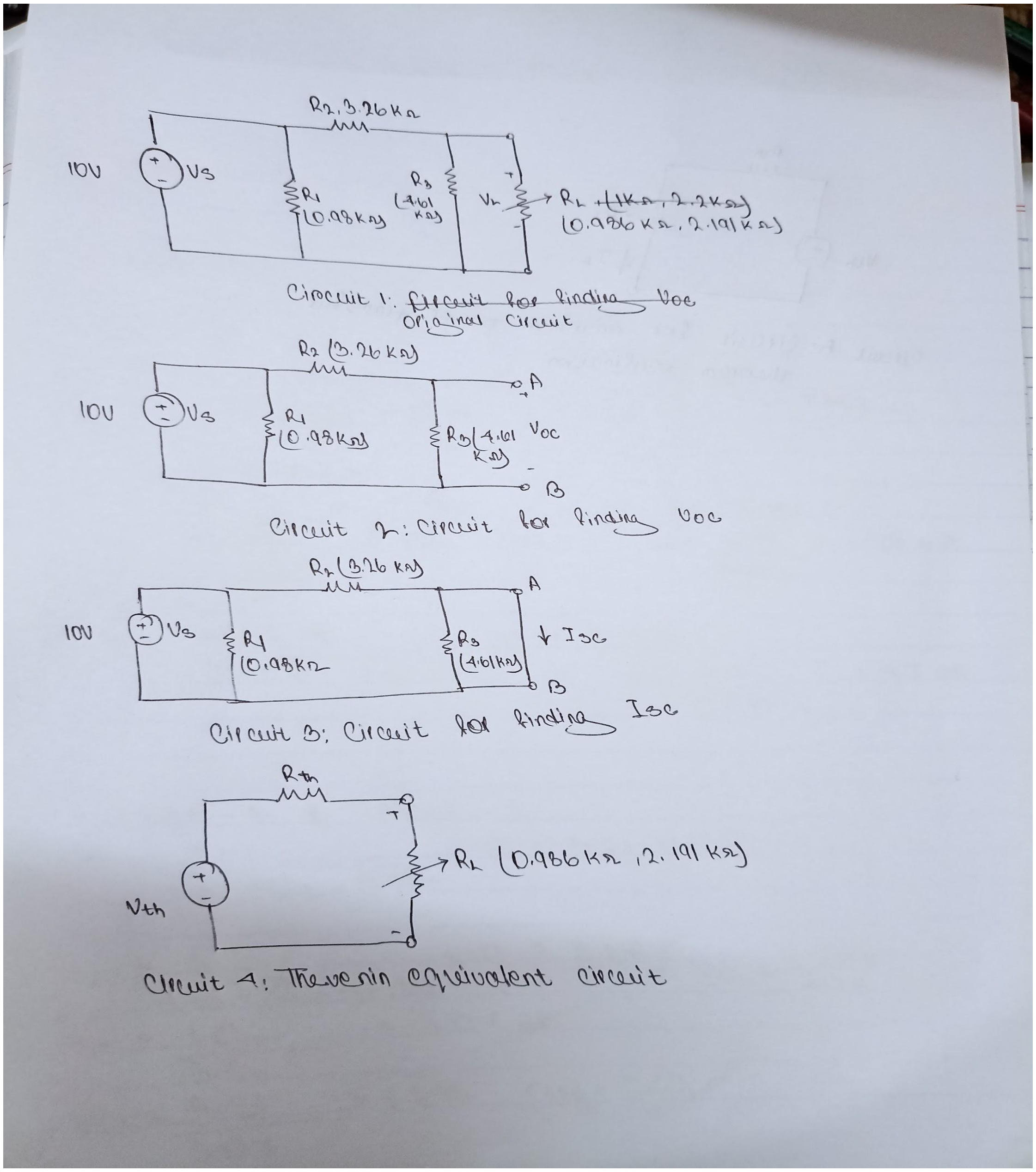
PART - 1

CIRCUIT DIAGRAMS



REPORT

(1) Theoretical Calculations :-

Using Circuit - 1 :

R1 = 0.98 kΩ , R2 = 3.26 kΩ , R3 = 4.61 kΩ , VS = 10V

RL = 0.986 kΩ
VL = (0.986) * 10 / (0.986+4.61) = 1.76 V
IL = 1.76 / 0.986 = 1.78 mA

RL = 2.191 kΩ
VL = (2.191) * 10 / (2.191+4.61) = 3.22 V
IL = 3.22 / 2.191 = 1.47 mA

Using Circuit - 2 and Circuit - 3 :

VOC = (4.61) * 10 / (4.61+3.26+0.98) = 5.21 V
ISC = 10 / 3.26 = 3.07 mA
VTH = V_OC = 5.21 V
RTH = 5.21 / 3.07 = 1.698 kΩ

Using Circuit - 4 :

RL = 0.986 kΩ
VL = (0.986) * 5.21 / (0.986+1.698) = 1.91 V
IL = 1.91 / 0.986 = 1.94 mA

RL = 2.191 kΩ
VL = (2.191) * 5.21 / (2.191+1.698) = 2.94 V
IL = 2.94 / 2.191 = 1.34 mA

(2) Results in Tabular Form

Table 1 : Circuit 1

	R1 (kΩ)	R2 (kΩ)	R3 (kΩ)
Experimental	0.98	3.26	4.61
Theoretical	0.98	3.26	4.61

Table 2 : Circuit 1

Circuit	No. of Obs		RL (kΩ)	Load Voltage VL (V)	Load current IL = VL/RL (mA)
For circuit 1	1.	Experimental	0.986	1.994	2.022
	1.	Theoretical	0.986	1.76	1.78
	2.	Experimental	2.191	3.125	1.426
	2.	Theoretical	2.191	3.22	1.47

Table 3 : Circuit 2 and Circuit 3

		VOC (V)
For Circuit 2	Experimental	5.84
	Theoretical	5.21

		ISC = V2 / R2 (mA)
For Circuit 3	Experimental	3.064
	Theoretical	3.07

	RTH = VTH / ISC (kΩ)
Experimental	1.906
Theoretical	1.698

Table 4 : Circuit 4

Circuit	No. of Obs		RL (kΩ)	Load Voltage VL (V)	Load current IL = VL/RL (mA)
For circuit 4	2.	Experimental	0.986	1.81	1.836
	3.	Theoretical	0.986	1.76	1.94
	4.	Experimental	2.191	2.91	1.328
	2.	Theoretical	2.191	3.22	1.34

(3) Comment on the results obtained and discrepancies

The difference between the experimental and theoretical values are almost close enough . The slight difference can be caused due to the fluctuations of voltage reading while taking from the multimeter and while adjusting the potentiometer knob to get the specified resistance for the RTH .

QUESTION

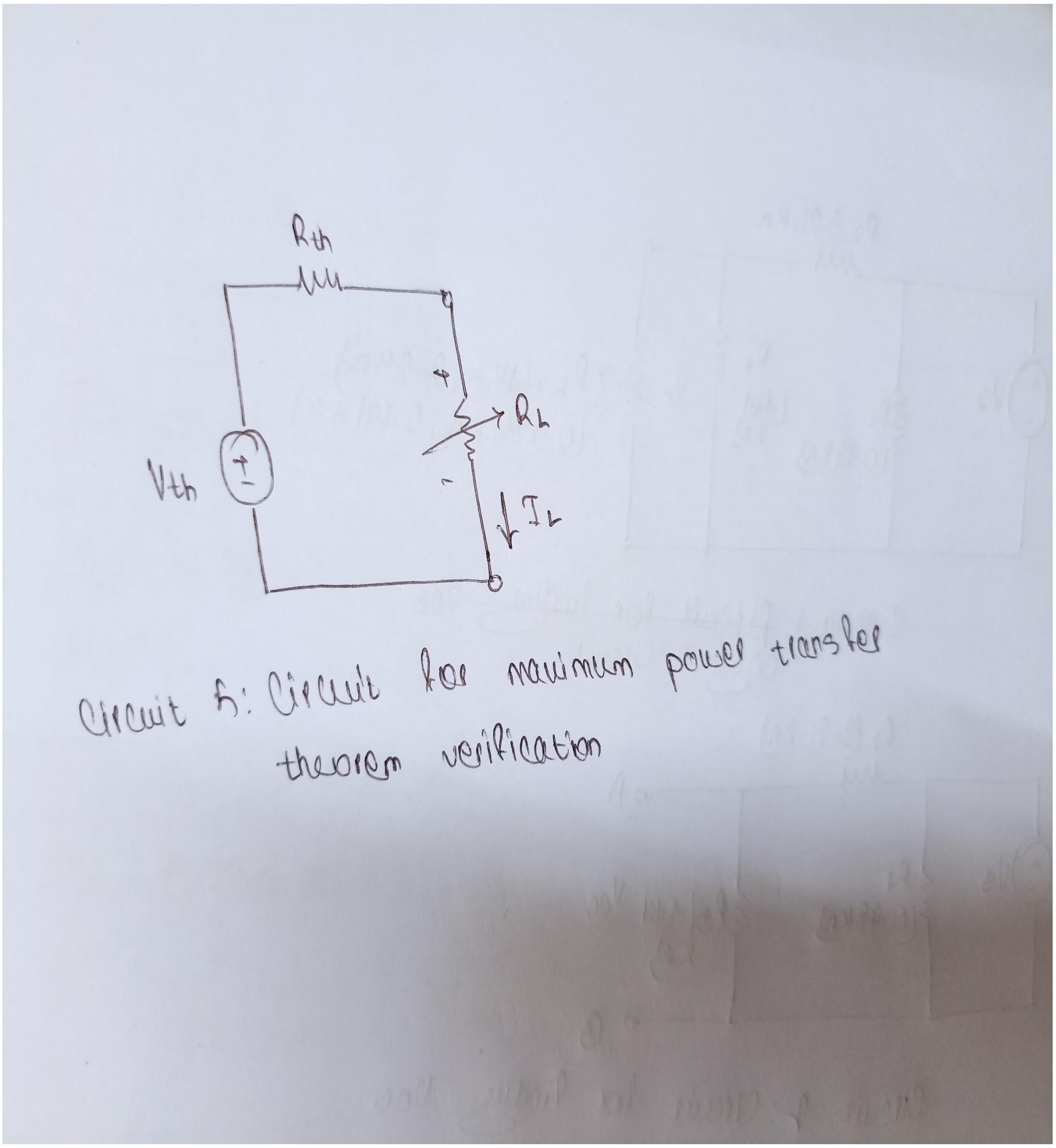
(1) The advantage of using Thevenin's theorem is that we can use a simple and equivalent circuit which is reduced from the complex circuit to solve a complex circuit to find out the load resistance, voltage and current without finding out each and every components' resistance , voltage and current from the complex circuit.

DISCUSSION

First of all, the circuit was built as shown in circuit 1 and the resistances of all the resistors were measured using the multimeter set to measure resistance . The voltage across the load resistors were taken one after another using the multimeter set to measure the voltage. Then the load is disconnected and the overall voltage across the remaining resistors are measured to get the VOC voltage . After this, a wire is connected in place of the load to form a shorting and measure the voltage across V2 to get the ISC through calculations. Now , through all the necessary calculations , we came up with the RTH . At this moment, we did not have the resistor bearing the resistance of RTH. For this reason, we used a potentiometer to get the required resistance by rotating the knob of the potentiometer and checking the resistance using the multimeter set to measure the resistance . Then , we built the circuit shown in circuit 4 and found the voltage across the load resistors one after another.

PART - 2

CIRCUIT DIAGRAMS



REPORT

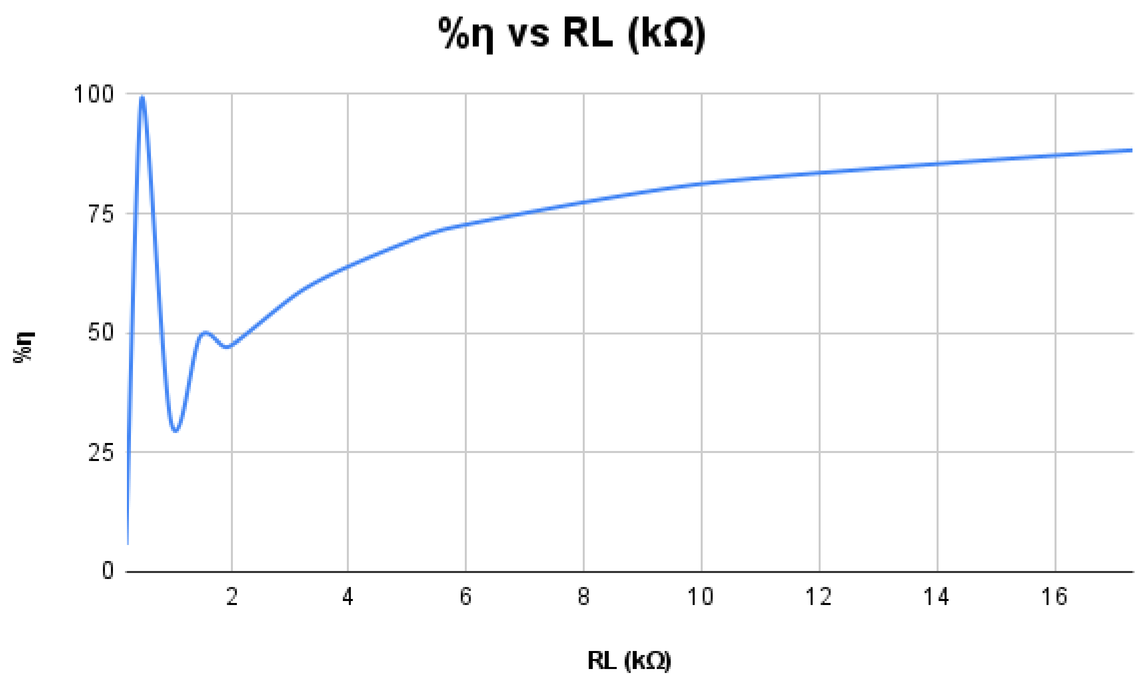
(1) Results in tabular form

Table 5 : Circuit 5

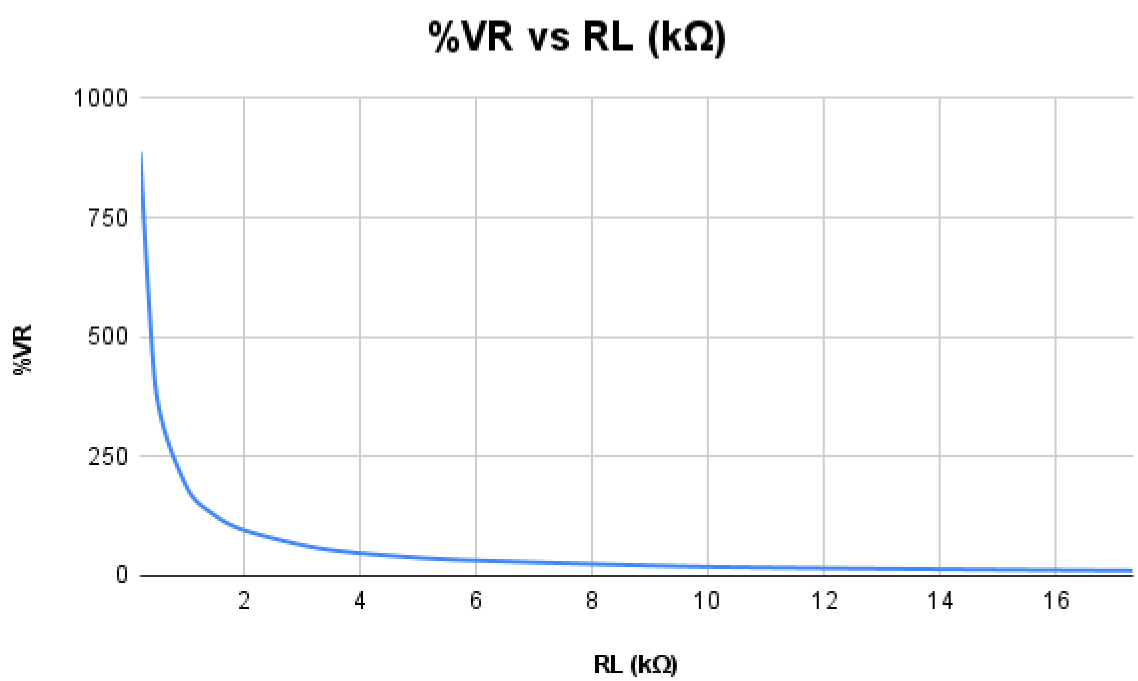
RL (kΩ)	VTH (V)	VL (V)	IL = VL / RL (mA)	PIN = VTH * IL (mW)	POUT = VL * IL (mW)	LOSS = PIN - POUT (mW)	%η = (POUT / PIN) * 100	%VR = (RTH / RL) * 100
0.215	5.8	0.327	1.52	8.82	0.497	8.32	5.63	888
0.47	5.8	5.71	12.1	70.2	69.1	1.10	98.4	406
0.986	5.8	1.81	1.84	10.7	3.33	7.37	31.1	194
1.48	5.8	2.86	1.93	11.2	5.52	5.68	49.3	129
1.94	5.8	2.73	1.41	8.18	3.85	4.33	47.1	98.5
3.26	5.8	3.45	1.06	6.15	3.65	2.50	59.3	58.6
4.70	5.8	3.92	0.834	4.84	3.27	1.57	67.6	40.6
5.60	5.8	4.15	0.741	4.30	3.08	1.22	71.6	34.1
9.91	5.8	4.70	0.474	2.75	2.23	0.52	81.1	19.3
17.34	5.8	5.12	0.295	1.71	1.51	0.200	88.3	11.0

(2) Plot :- Spreadsheet for plotting graphs

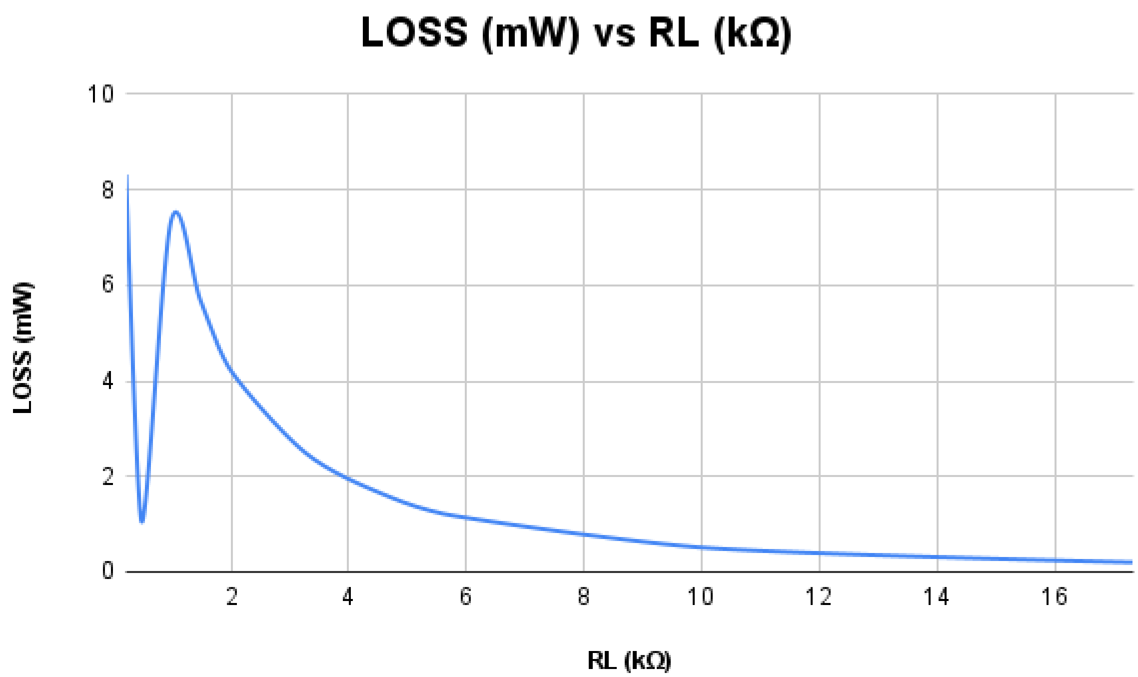
(i) %n vs RL



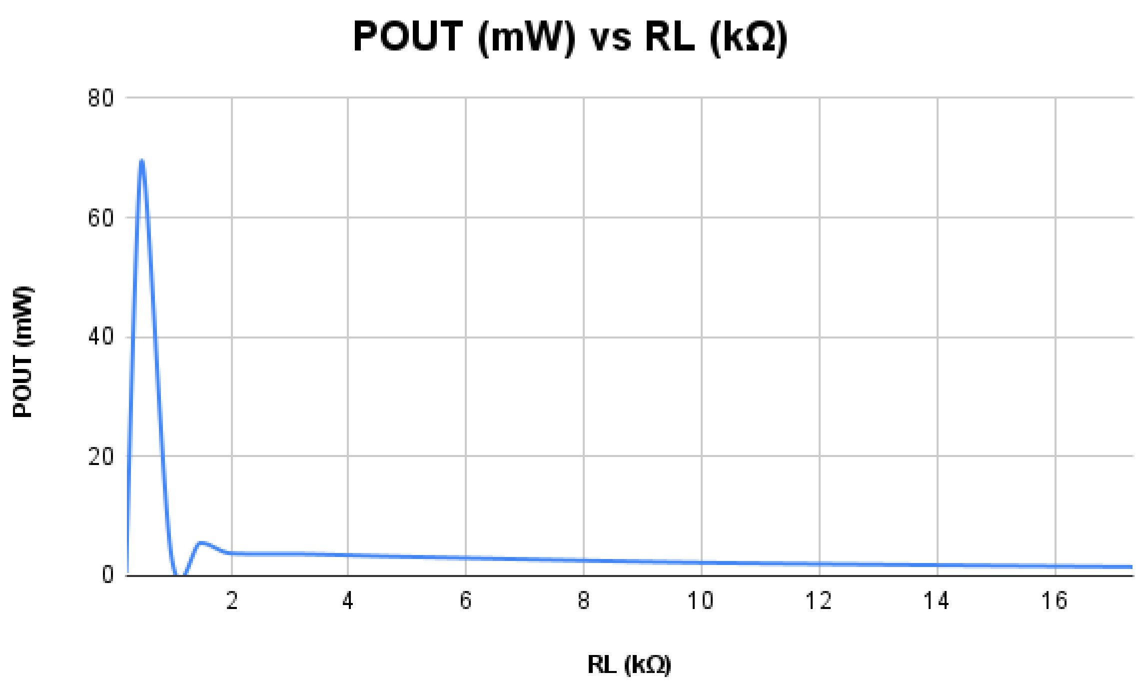
(ii) %VR vs RL



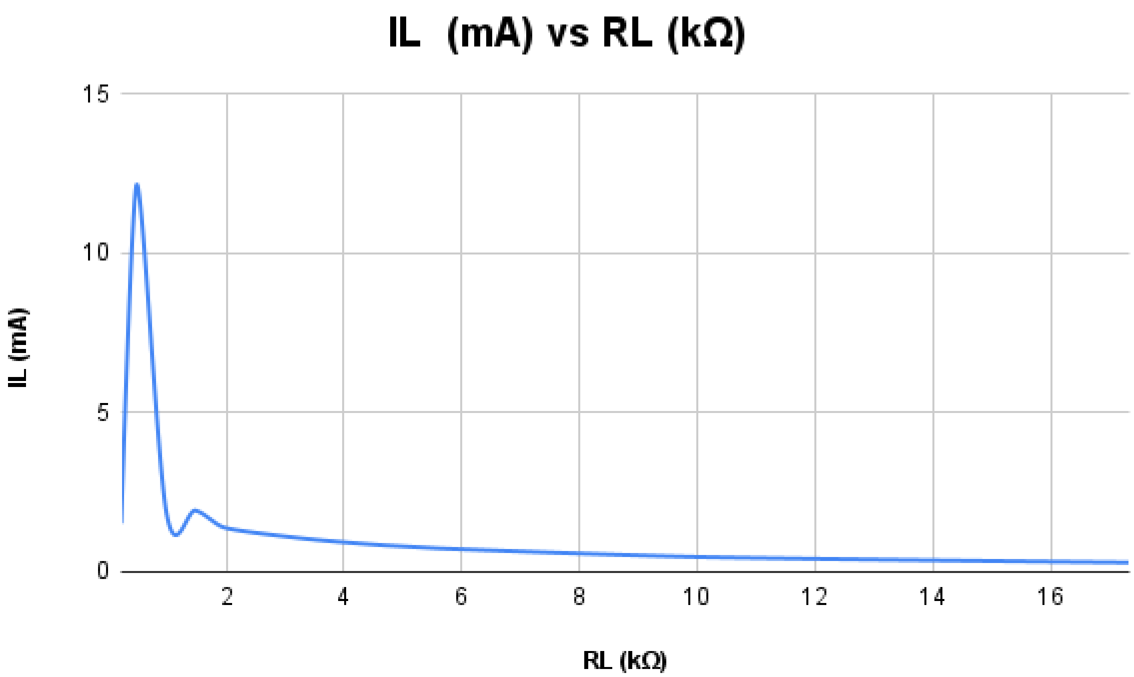
(iii) LOSS vs RL



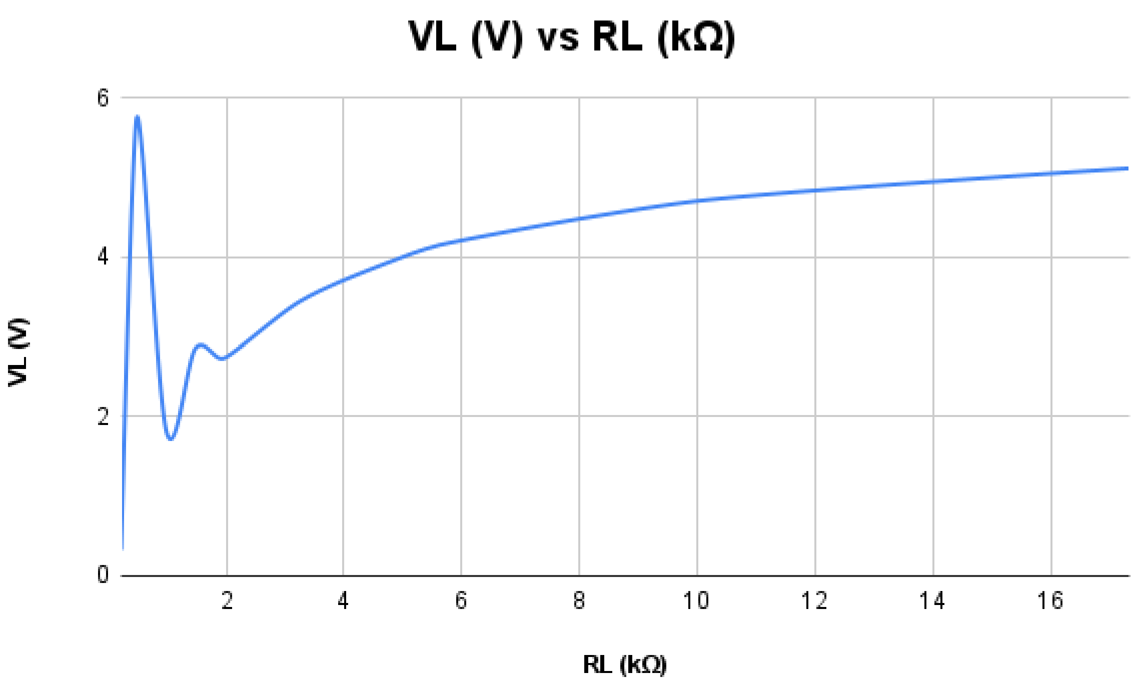
(iv) POUT vs RL



(v) IL vs RL



(vi) VL vs RL



DISCUSSION

The same circuit as in circuit 4 is used and the load resistors are changed to get different values of voltages for different loads to calculate the power in and power out .