

Lab Session 09

Analyze and Implement Maximum Power Transfer Theorem

Objective:

- Analyze and Implement Maximum power transfer theorem for a given circuit

Equipments and Components required:

- DC Power Supply
- Ammeter
- Voltmeter
- Five dial decade resistor box
- Resistors
- Breadboard
- Connecting wires

Statement:

“Maximum power is transferred to the load when the load resistance equals the Thevenin’s resistance as seen from the load ($R_L = R_{Th}$)”.

$$P_{\max} = \frac{V_{Th}^2}{4R_{Th}}$$

Procedure:

1. Connect the circuit diagram as shown in fig.9.1
2. Remove the load resistance R_L for finding R_{th} & V_{th} , we will connect R_L with Thevenin's equivalent circuit.
3. Find R_{Th} by turned off all independent sources (Voltage source Short Circuit & Current Source open Circuit)
4. Measure open circuit voltage V_{oc} by open circuiting terminals i.e, V_{TH}
5. Draw the Thevenin’s equivalent circuit as shown in fig 9.4
6. Change / Vary the value of load resistance (R_L) and note down the corresponding voltages and currents.

Circuit Diagram:

Procedure # 1

1. Connect the circuit diagram as shown in fig.9.1

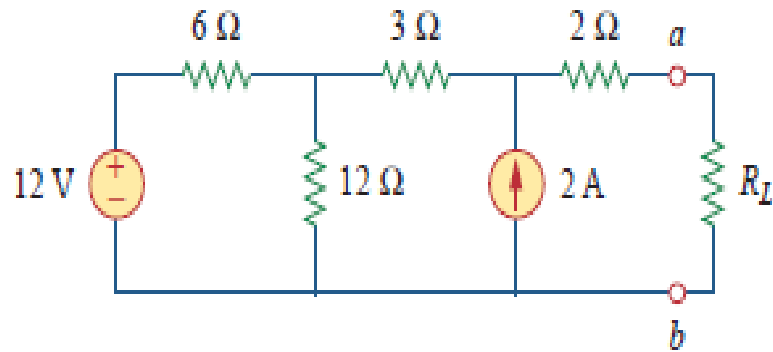


Fig 9.1

Procedure # 2 & 3

Remove the load resistance R_L for finding R_{Th} & V_{th} , we will connect R_L with Thevni's equivalent circuit and Find R_{Th} by turned off all independent sources (Voltage source Short Circuit & Current Source open Circuit) as shown in fig 9.2

$$R_{Th} = 9 \Omega$$

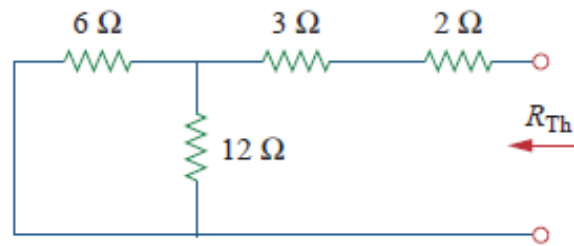


Fig 9.2 (finding R_{Th})

Simulation results

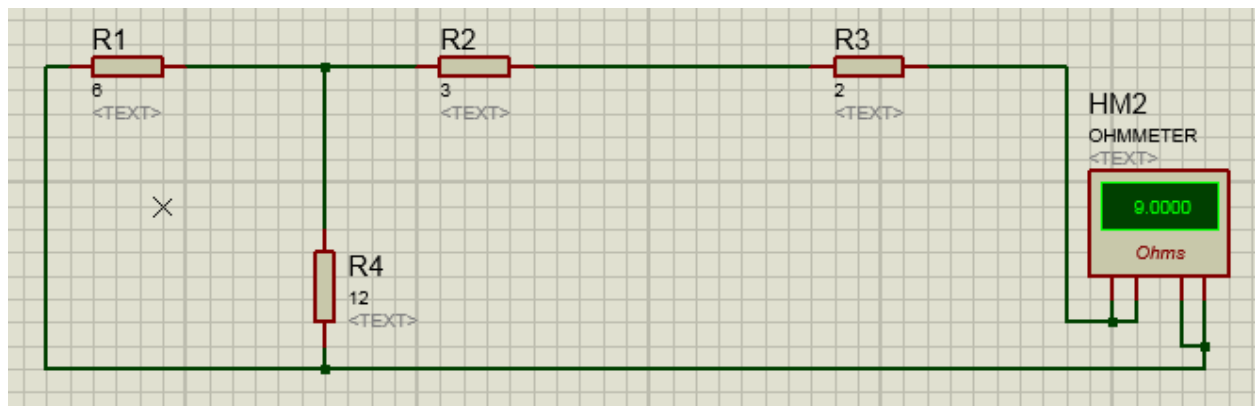


Fig 9.2 (finding R_{Th})

Procedure # 4 Measure open circuit voltage V_{oc} by open circuiting terminals i.e, V_{TH} as shown in fig. 9.3

$$V_{TH} = 22 \text{ v}$$

Simulation results

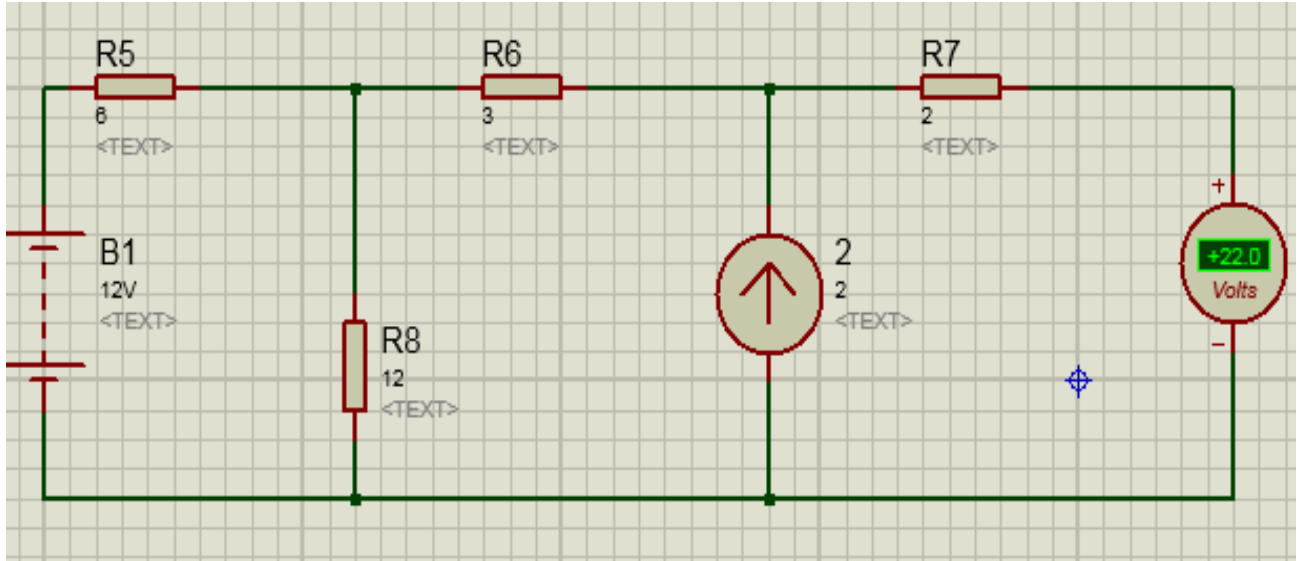


Fig. 9.3 (Finding V_{TH})

For maximum power transfer,

$$R_L = R_{Th} = 9 \Omega$$

and the maximum power is

$$p_{max} = \frac{V_{Th}^2}{4R_L} = \frac{22^2}{4 \times 9} = 13.44 \text{ W}$$

Procedure # 5 & 6

5. Draw the Thevenin's equivalent circuit as shown in fig 9.4
6. Change / Vary the value of load resistance (R_L) and note down the corresponding voltages and currents.

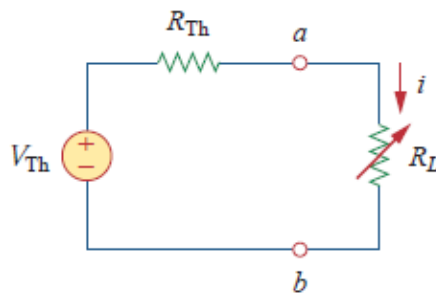


Fig. 9.4

Simulation Results

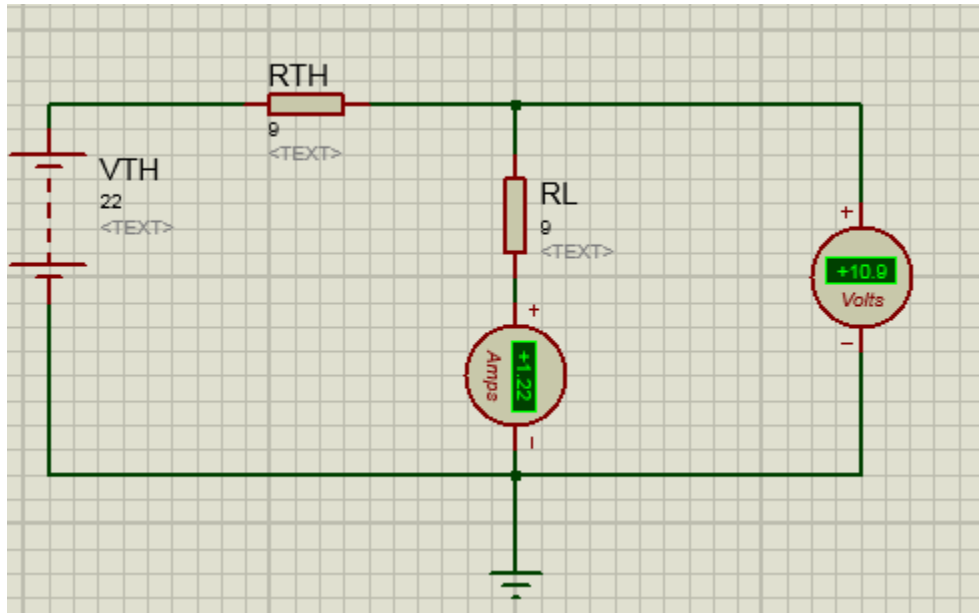


Fig. 9.4

Results and Observation

Table 9.1

Load resistance	Practical values			Theoretical values		
	Voltage (DMM)	Current (DMM)	Power (W)	V_{TH}	R_{TH}	Maximum Power $P_{max} = \frac{V_{TH}^2}{4R_L}$

Task : Find the maximum power that can be delivered to the resistor R in the circuit given below

