Experiment No. 04

Aim: - To verify Network Theorems.

Apparatus: -

Sr. No.	**Apparatus**	**Range**	**Qty**
01	Resistors.		
02	Voltage Sources.		
03	Connecting Wires.		
04	Voltmeter.		
05	Ammeter		

Theory:-

1. **Superposition Theorem**

If network contains two or more than two sources, then principle of superposition theorem is used to simplify network calculations. It may be stated as follows. "In a linear and bilateral network if two or more than two energy sources are present, then the current which flows at any point is the vector sum of all currents which would flow at that point if each source was considered separately and all other sources replaced at the time by impedance equal to their internal impedances."

2. **Thevenin's Theorem**

When interest is focused on one part of the network under analysis, the remainder of the network may be replaced to advantage by a simple equivalent network determined by using Thevenin's theorem. M. L. Thevenin, a French Engineer working in telegraphy, published the statement of the theorem in 1883. Thevenin's theorem tells us that it is possible to replace everything except the load impedance by a simple equivalent network containing only an independent voltage source in series with impedance. The new simpler network enables us to make rapid calculations of the voltage, current and power which the original network is able to deliver to the load impedance. This theorem is essentially useful in such applications as determining the load for an electronic circuit which will result in maximum average power delivery to that load.

3. **Norton's Theorem**

Norton's theorem may be considered as a corollary of the Thevenin's theorem. It was proposed by E. L. Norton, a scientist with the bell Telephone laboratories. Norton's theorem states that with respect to any pair of terminals of an active network, the active network may be replaced by an equivalent network containing an independent current source (I_N) in parallel with an impedance Z_N. I_N is the current flowing between the two terminals when these two terminals are short circuited. The impedance Z_N is the equivalent impedance of the network as seen from the two terminals with all independent sources suppressed. This impedance Z_N is the same as Z_{TH} found for Thevenin's network equivalent.This equivalent network, called the Norton's equivalent network is the dual of Thevenin's equivalent network.

Procedure for Superposition Theorem:-

1. Connect circuit as shown in diagram.
2. Short circuit voltage source (V_2) and measure current through load resistor R_2.
3. Short circuit voltage source (V_1) and measure current through load resistor R_2.
4. Connect both of the voltage sources and measure current through load resistor R_2.
5. Verify algebraic summation of current due to individual voltage source is equal to total current or not.

Procedure for Thevenin's Theorem :-

1. Connect circuit as shown in diagram.
2. Measure value of current through load resistance (R_L)
3. Element network divided in two parts, network A and network B. the network B is the load or branch whose current is required.
4. Temporarily remove the network B (the branch in which the current is to be determined R_L) across which the thevenin's equivalent network to be found. Mark the terminal AB on the network A from where network B is removed.
5. Measure Voltage value across AB. Thevenin's equivalent Voltage V_{TH}.
6. Measure value of resistance across AB. Thevenin's equivalent resistance R_{TH}.
7. Replace the entire network A across the terminal pair AB by a single Thevenin's equivalent Voltage(V_{TH}) in series with Thevenin's equivalent resistance (R_{TH}).
8. Connect network B back to the terminal pair AB from where it was previously removed.
9. Calculate the current value flowing in the network B by using the following equation,

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

Procedure for Norton's Theorem :-

1. Connect circuit as shown in diagram.
2. Measure value of current through load resistance (R_L)
3. Element network divided in two parts, network A and network B. the network B is the load or branch whose current is required.
4. Temporarily remove the network B (the branch in which the current is to be determined R_L) across which the Norton's equivalent network to be found. Mark the terminal AB on the network A from where network B is removed.
5. Measure current value across AB. Norton's equivalent current I_L.
6. Measure value of resistance across AB. Norton's equivalent resistance R_N.
7. Replace the entire network A across the terminal pair AB by a single Norton's equivalent current (I_L) in parallel with Norton's equivalent resistance (R_L).
8. Connect network B back to the terminal pair AB from where it was previously removed.

9. Calculate the current value flowing in the network B by using the following equation,

$$I = I_N \frac{R_N}{R_N + R_L}$$

Circuit Diagram:-

Observation Table for Superposition's theorem:-

I_1 (Due to V_1)	I_2 (Due to V_2)	I (Due to V_1 and V_2)	$I=I_1+I_2$ (Measured)	I (Calculated)

Observation Table for Thevenin's theorem:-

V_{TH}	R_{TH}	R_L	I (Measured)	I (Calculated)

Observation Table for Norton's theorem:-

I_N	R_N	R_L	I (Measured)	I (Calculated)

Calculations:-

Conclusion:-