DEPARTMENT OF ELECTRICAL ENGINEERING
FIRST YEAR E.T. LAB EXP. NO. – 2

VERIFICATION OF NETWORK THEOREMS
OBJECTIVE:

Verification of
i) Thevenin Theorem.
ii) Superposition Theorem.

A) THEVENIN'S THEOREM

CIRCUIT DIAGRAM:

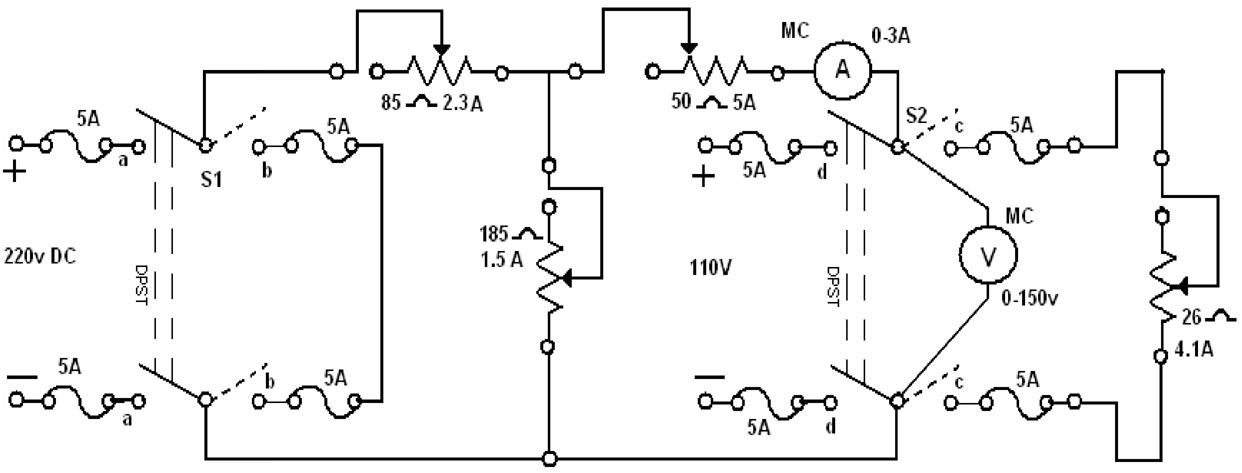

Fig-1. CIRCUIT DIAGRAM FOR VERIFICATION OF THEVENIN'S THEOREM

PROCEDURE:
1. Keep all the rheostats close to their maximum resistance values.
2. Close the switch S_1 to position 'aa' and S_2 to 'cc'. Observe the load (26 ohm rheostat) current (I_L) and terminal voltage (V_L) readings. Then the value of load resistance $R_L=V_L/I_L$.
3. Disconnect the load by opening the switch S_2 and read the open circuit voltage (or Thevenin equivalent voltage) V_{TH}.
4. Next, to compute the Thevenin equivalent resistance (R_{TH}) of the network as seen from the load terminals:
   i) Replace the 220V source by a short by closing S1 to 'bb'.
   ii) Apply 110V at the output terminals by closingS2 to 'dd'. Read the voltmeter (V) and ammeter(I) and get R_{TH}= V/I.
5. Now compute the load current applying Thevenin's theorem as $I_L=V_{TH}/(R_{TH}+R_L)$.
6. Compare the above computed load current with its observed value in step (2) and verify the Theorem.
7. Adjust all the rheostats to new settings and repeat from step (2) to step (6) for at least six sets of readings without exceeding rated current in any element.

Table – I Thevenin's Theorem

Sl. No.	Observed Load Current I_L	V_L	$R_L = V_L/I_L$	V_{TH} (V)	V (V)	I (A)	R_{TH} = V/I (Ω)	Computed load Current (A) $V_{TH}/(R_{TH}+R_L)=I_L$

DISCUSSION:

(i) Why are you applying 110 V instead of 220 V while finding R_{TH}?
(ii) Can you suggest an alternative procedure for the determination of R_{TH}?
(iii) Is there any restriction for choice of circuit elements?
(iv) What type of ammeter and voltmeter (MC or MI) will you use and why?

B) **SUPERPOSITION THEOREM**

CIRCUIT DIAGRAM

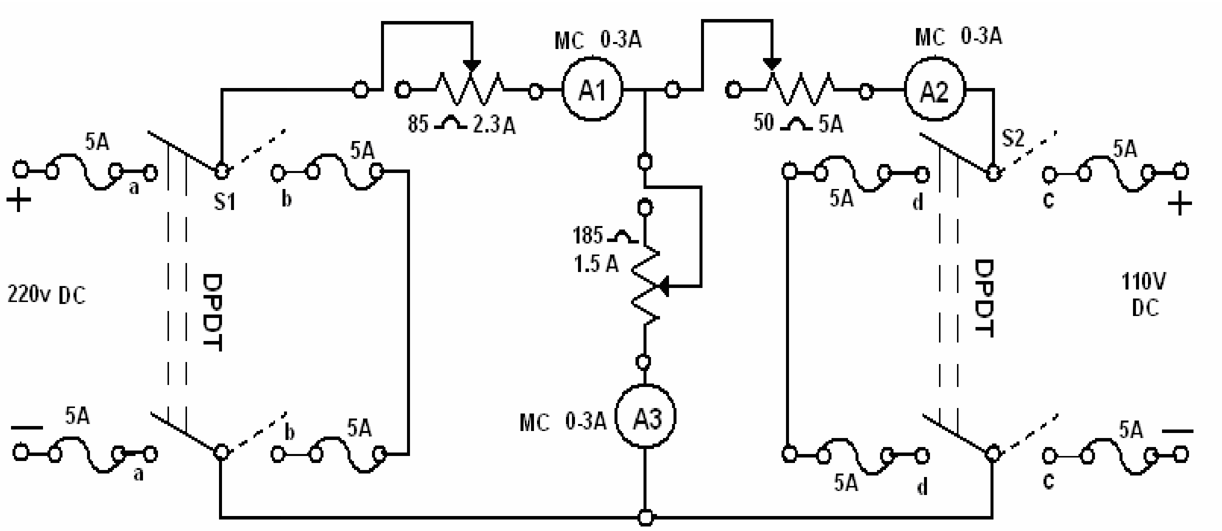

FIG:2 CIRCUIT DIAGRAM FOR VERIFICATION OF SUPERPOSITION THEOREM

PROCEDURE:

i) Connect the circuit as shown in the diagram, keeping the switches open and resistances at their maximum positions.

ii) Set S_1 to position 'aa' and S_2 to position 'cc' respectively which means both the sources are energized. Note down the currents I_1, I_2 and I_3 from the ammeter. A_1, A_2 and A_3.

iii) Set S_1 on position 'aa' and S_2 on position 'dd' respectively, i.e. only 220 V source is energized and the terminals of S_2 are shorted. Note down the current I_1', $I_2'$and I_3'.

iv) Set S_1 to position 'bb' and S_2 to position 'cc' respectively and note I_1'', I_2'' and I_3''. [Please note the polarity of the currents]

v) Compare I_1, I_2 and I_3 with $(I_1'+I_1'')$, $(I_2'+I_2'')$ and $(I_3'+I_3'')$ taking care of the signs properly to verify the theorem.

vi) Repeat this from step (ii) to (v) for three different sets of resistance value of the three rheostats.

vii) Tabulate the results as shown.

Table – II Superposition Theorem

Sl. No	Step 1	Step 2	Step 3	Computed currents	Error	% Error
1.	$I_1=$ $I_2=$ $I_3=$	$I_1' =$ $I_2' =$ $I_3' =$	$I_1'' =$ $I_2'' =$ $I_3'' =$	$I_1c=I_1'+I_1'' =$ $I_2c =I_2'+I_2'' =$ $I_3c = I_3'+I_3'' =$	$\Delta I_1=I_1-I_{1c} =$ $\Delta I_2 = I_2-I_{2c} =$ $\Delta I_3=I_3-I_{3c} =$	$(\Delta I_1 / I_1)100 =$ $(\Delta I_2 / I_2)100 =$ $(\Delta I_3 / I_3)100 =$
2.						

DISCUSSION:

i) What type of ammeters (MI or MC) will you choose?

ii) While considering the effect of a single source, the other source is short circuited why? How far is it justified?

iii) Why are you noting the direction of the deflection of the meter?

iv) If the rheostats are replaced by three incandescent lamps, can you verify the theorem?