CHITTAGONG UNIVERSITY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ELECTRONICS & TELECOMMUNICATION ENGINEERING
CHITTAGONG-4349, BANGLADESH.

Course No. EEE-182

Course Title: Basic Electrical Engineering Sessional

Experiment No. 5

VERIFICATION OF RECIPROCITY THEOREM AND COMPENSATION THEOREM

PRELAB WORK:

- **Read this laboratory manual carefully before coming to the laboratory class, so that you know what is required.**
- Try to **follow** the lecture notes of **EEE 111.**
- **DONOT** copy others blindly!!!
- **Submit your lab report before the roll call.**

(FOR RECIPROCITY THEOREM)

THEORY:

In any linear bilateral network, if a source of emf E in any branch produces a current I in any other branch, then the same emf ***E*** acting in the second branch would produce the same current ***I*** in the first branch.

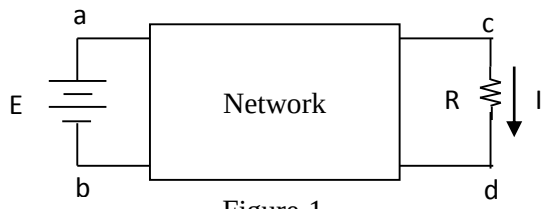

Figure-1

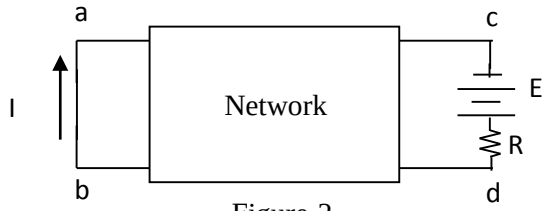

Figure-2

APPARATUS:

1. Resistors 120Ω, 0.5 w (3 Pieces), 220 Ω, 0. 5w (2 pieces).
2. 470 Ω, 0. 25w (1 piece), 1KΩ, 0.25w (1 piece).
3. DC voltmeter.
4. DC ammeter.
5. Multimeter.
6. Bread Board.

CIRCUIT DIAGRAM:

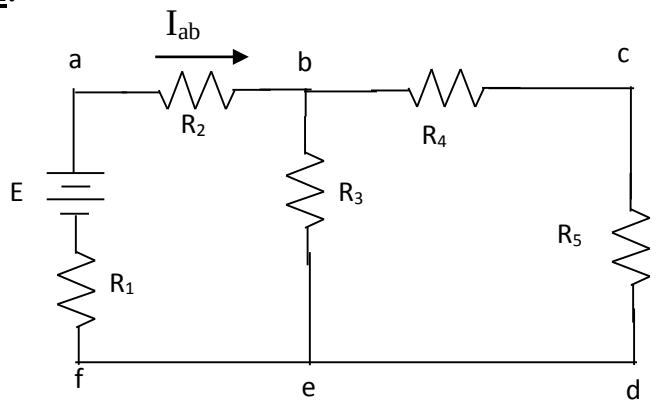

Figure-3

PROCEDURES:

1. Construct the circuit as shown in Fig. 3 with ***E=15 Volts, R_1=120 Ω, R_2=220 Ω, R_3=120 Ω, R_4=120 Ω, R_5=220 Ω.***
2. Now measure the currents in all branches and note down them in the Table-1.

Table-1:

When the source E is located in the branch 'af '

I_{ab}	I_{be}	I_{bc}	I_{cd}

3. Now replace the source of the 'af ' branch with a short. Place the source E in the 'ab' branch with correct polarity so that the direction of current before and after the placement of the source is the same. Measure the current in 'fa ' branch, ***I_{fa} (ab).*** I_{fa} (ab) = Current in 'fa' branch when source is located in 'ab' branch. Note down this value in Table –2.

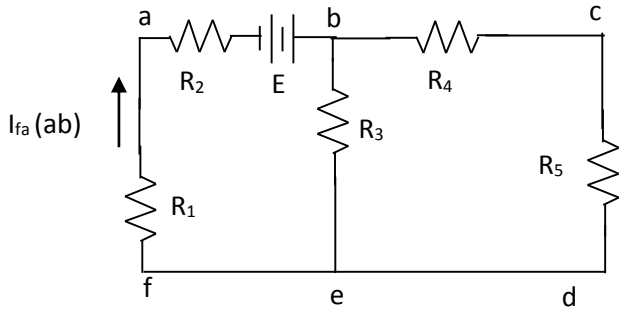

Figure-4

4. Similarly place the source in the branch 'be', 'bc', 'cd' step by step and measure the current in 'fa' branch at each step and put down these values in Table-2.

Table-2:

When the source E is located in different branch

I_{fa}(ab)	I_{fa}(be)	I_{fa}(bc)	I_{fa}(cd)

5. Now note down the actual values of ***E, R_1, R_2, R_3, R_4 & R_5*** for theoretical calculation.

(FOR COMPENSATION THEOREM)

THEORY:

If the resistance of any branch of a network is changed from ***R*** to (R+ ΔR) where the current flowing originally is I, the change of current at any other place in the network may be found by assuming that an emf of -I. ***ΔR*** has been injected into the modified branch while all other sources are suppressed and are represented by internal resistances only.

CIRCUIT DIAGRAM

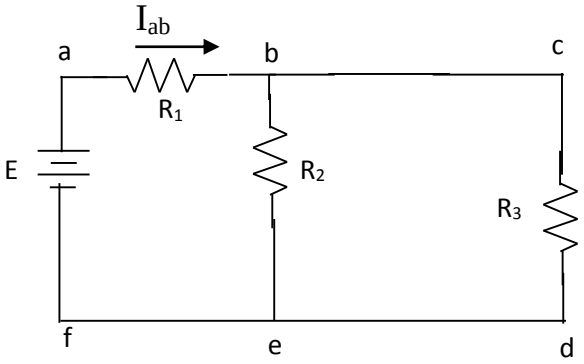

Figure-5

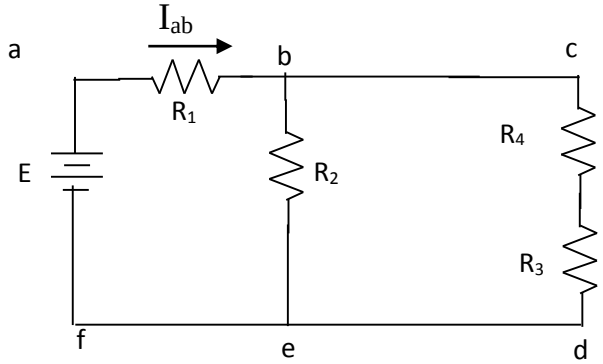

Figure-6

PROCEDURES:

1. Construct the circuit as shown in Fig. 5 with ***E=15 Volts, R_1=220 Ω, R_2=220 Ω, R_3=470 Ω.***
2. Now measure the currents in all branches and note down them in the Table-3.
3. Insert R_4 =1000 Ω resistance in series with R_3 =470 Ω in 'cd' branch as in Fig. 6 and again measure all branch currents and note down in Table-3.

Table-3:

	I_{ab}	I_{be}	I_{cd}
When Rcd=470 Ω			
When Rcd=1470 Ω			
Difference (I_{1470}- I_{470})			

4. Calculate the voltage, ΔV= - I×ΔR =- I×R_4
5. Now apply a source of ΔV volts in the 'cd' branch with correct polarity deactivating source E and measure the current in all branches and note down them in Table-4.

Table-4:

When the source ΔV is located in the branch 'cd '

I_{ab}	I_{be}	I_{cd}

6. Now note down the actual values of E, R_1, R_2, R_3, & R_4 for theoretical calculation

REPORT:

1. Verify the experimental results with those obtained by theoretical calculations.
2. Mention the applications of these theorems.