Kaushal Bansthia
19CS10039

Page No.
Date :

Experiment 1 Part 2

Aim: Verification of Reciprocity Theorem.

Theory: The reciprocity theorem states that if an emf E in one branch of a reciprocal network produces a current I in another, then if the emf E is moved from the first branch to the second branch, it will cause the same current in the first branch, where the emf now has been replaced by a short circuit.

A general formula can be written as

$$\frac{V_1}{I_2} = \frac{V_2}{I_1}$$

, where V_1 is emf in first branch and other branch is short circuited.

I_1 is current in the second branch, when V_1 is the emf in the first branch

V_2 is emf in second branch and first branch is short circuited

I_2 is current in the first branch, when V_2 is the emf in the second branch.

Kaushal Bantia
19CS10039

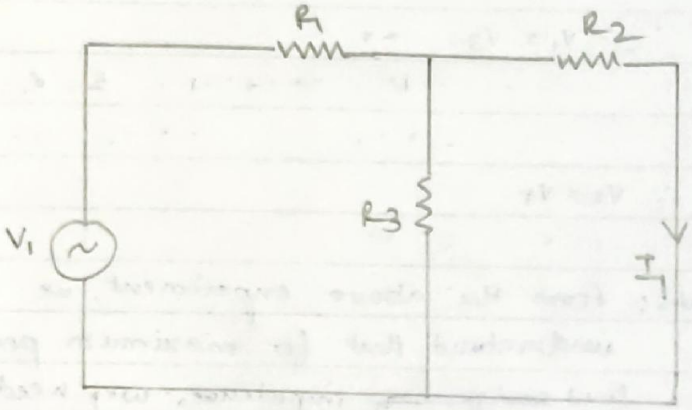


Fig. 1

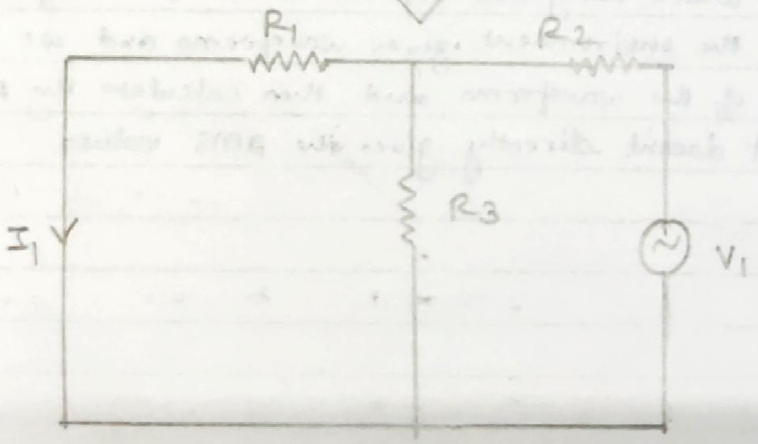
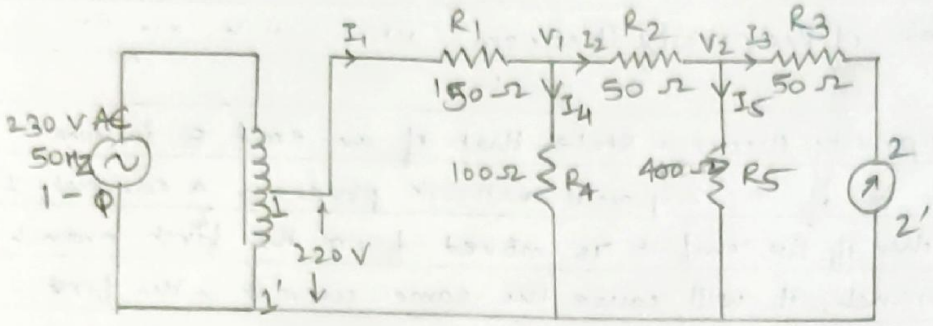


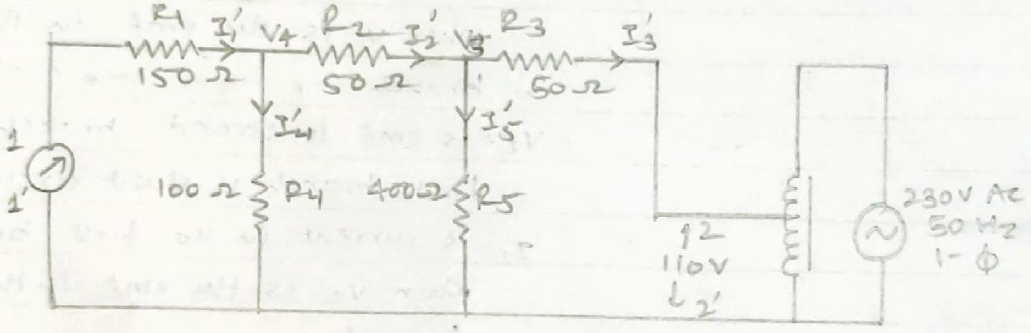
Fig. 2

Figure 1 implies Figure 2.

Kaushal Banthia
19CS10039



Circuit 1



Circuit 2.

Kaushal Bansilia
19CS10039

Page No.
Date :

Observation Table: (for $k = 0.99$)

V_s (V)	I_3 (A)	V_s / I_3 (V/A)	V_s' (V)	I_1' (A)	V_s' / I_1' (V/A)
220	0.504	436.51	110	0.252	436.51

Also, $I_1 = 1.088\,A$ $\quad I_1' = 0.252\,A$

$I_2 = 0.561\,A$ $\quad I_2' = 0.631\,A$

$I_3 = 0.504\,A$ $\quad I_3' = 0.804\,A$

$I_4 = 0.527\,A$ $\quad I_4' = 0.378\,A$

$I_5 = 0.063\,A$ $\quad I_5' = 0.173\,A$

$V_1 = 53.45\,V$ $\quad V_3 = 69.23\,V$.

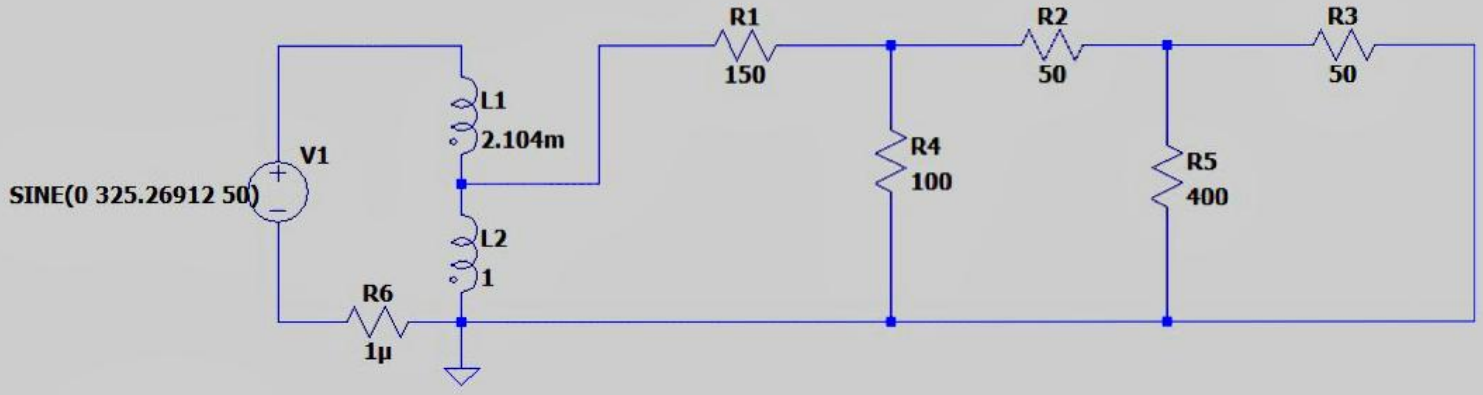
$V_2 = 25.17\,V$ $\quad V_4 = 37.82\,V$

Inference and Sample Calculation:

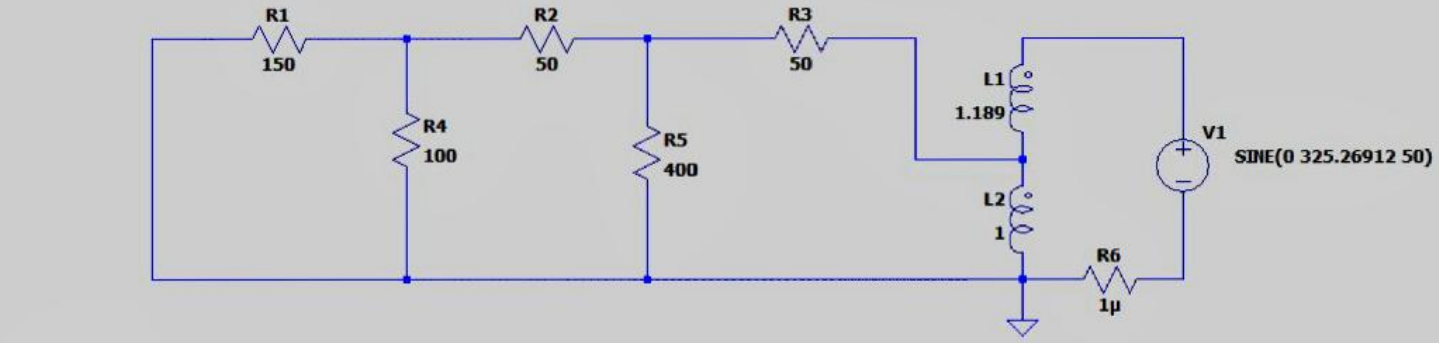
Here we can see that, $\frac{V_s}{I_3} = \frac{V_s'}{I_1'} = 436.51\ \frac{V}{A}$

Discussion and Comments: After performing the above experiment, we can conclude that Reciprocity Theorem is valid and that it can be generalised into the formula of $\frac{V_s}{I_3} = \frac{V_s'}{I_1'}$ for different voltages too.

One point to note is that, there is no component of ammeter, so to measure the current, in circuit 1, the current is measured across R_3 (for I_3) and in circuit 2, the current is measured across R_1 (for I_1').



K L1 L2 0.99
.tran 0 5 0 1



K L1 L2 0.99

.tran 0 5 0 1