LAB ASSIGNMENT – 9

Course: Basic Electrical and Electronics Engineering

Course Code: EEE1001

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Ex. No.: 1 Date: 13/11/2018

Verification of KIRCHHOFF'S LAWS

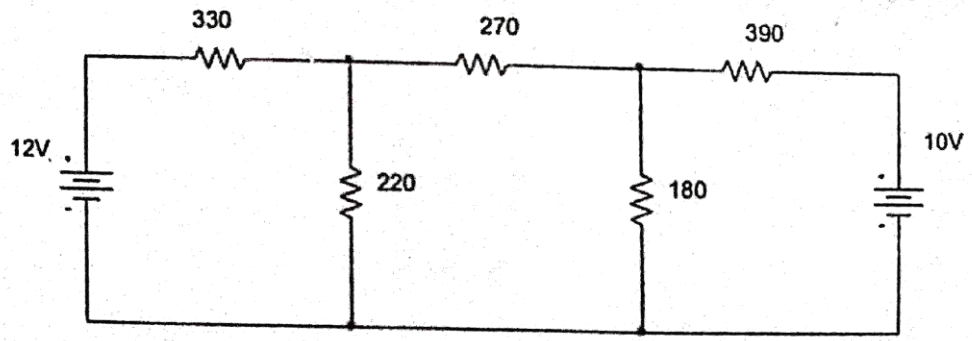
(Mesh and Nodal Analysis)

Aim: Verify nodal & mesh analysis for the given circuit.

Apparatus/Tool required:

Sl. No.	Components Name	Range	Quantity
1	Resister	330Ω, 270Ω, 390Ω, 220Ω, 180Ω	Each 1 No.
2	Ammeter	0-50mA (DC)	1 No.
3	Voltmeter	0-30V (DC)	1 No.
4	RPS	0-32 V (DC)	1 No.
5	Connecting Wires	-	Few
6	Bread Board	-	1 No.

Circuit Diagram:



Theory:

Kirchhoff's Current Law (KCL):

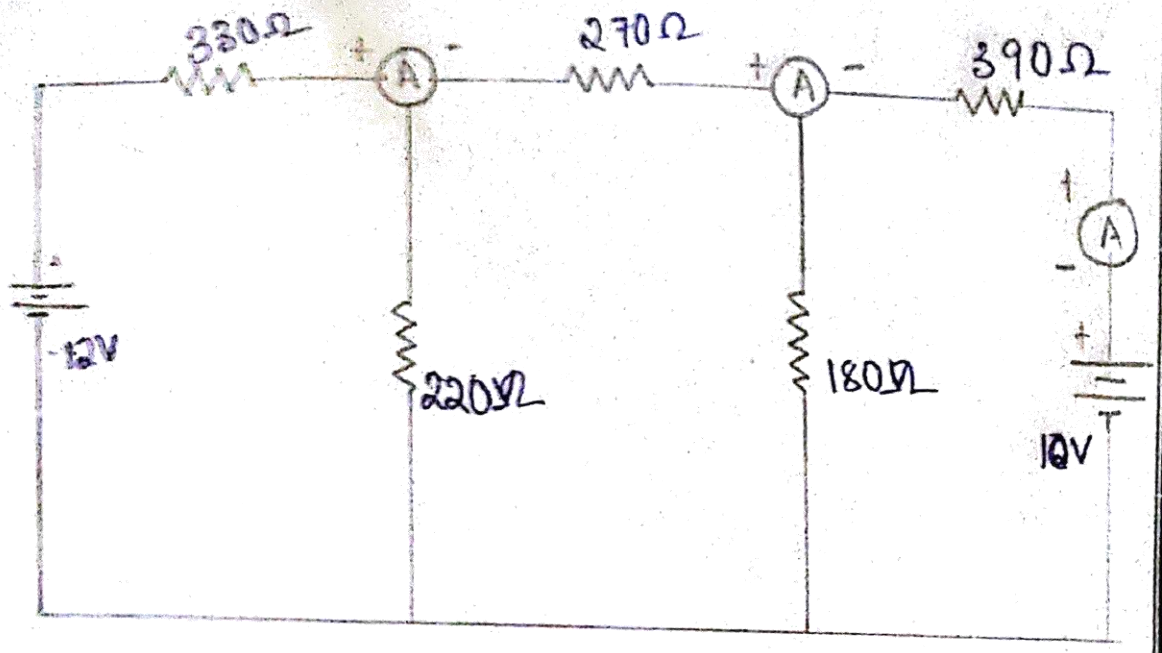
It deals with the conservation of charge i.e entering & leaving currents are equal.

Kirchhoff's Voltage Law (KVL):

The algebraic sum of the products of the resistances of the conductors & the currents in them in a closed loop is equal to the total emf available in the loop.

Practical Circuit and output:

Mesh Analysis:



where i_1, i_2, i_3 are the loop currents.

$$i_1 = 23.069 mA$$

$$i_2 = 3.1269 mA$$

$$i_3 = -16.556 mA$$

KVL for loop 1

$$-12 + 330 i_1 + 220(i_1 - i_2) = 0$$

$$550 i_1 - 220 i_2 = 12 \quad \text{—— (1)}$$

KVL for loop 2

$$270 i_2 + 180(i_2 - i_3) + 220(i_2 - i_1) = 0$$

$$22 i_1 - 67 i_2 + 18 i_3 = 0 \quad \text{—— (2)}$$

KVL for loop 3

$$390 i_3 + 10 + 180(i_3 - i_2) = 0$$

$$18 i_2 - 57 i_3 = 1 \quad \text{—— (3)}$$

From (1), (2) & (3)

$$i_1 = 23.069 \text{ mA}$$

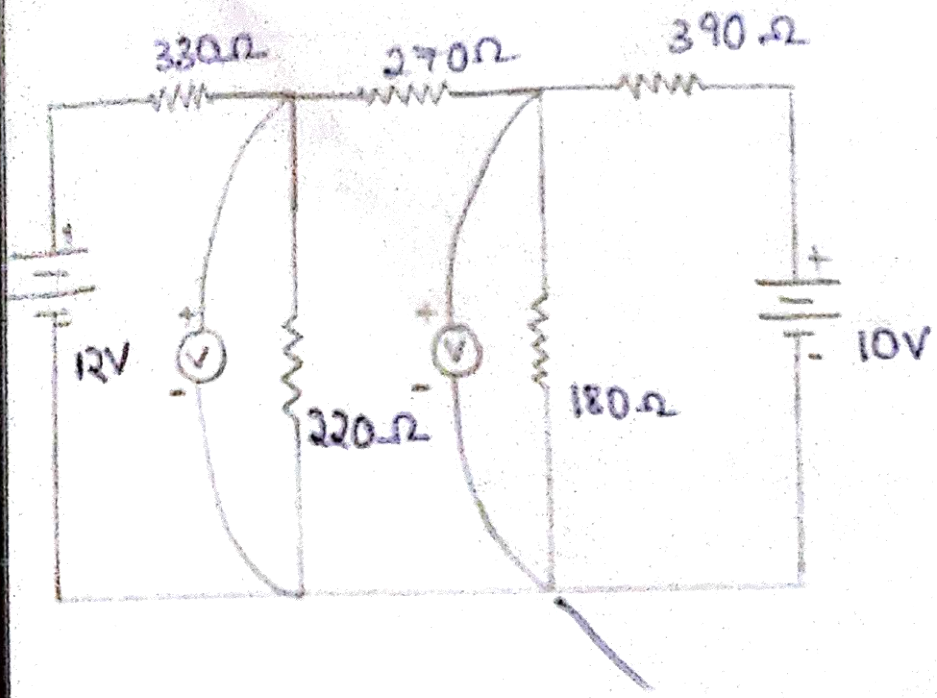
$$i_2 = 3.1269 \text{ mA}$$

$$i_3 = -16.556 \text{ mA}$$

Practical Circuit & Output

Manual Calculations:

Nodal Analysis



V_1 =

V_2 =

NOTE: -

For NODAL Analysis practically circuit was not implemented in class, hence only manual calculations done.

Practical Circuit and output:

manual Calculations

Node Analysis:

Applying KCL at node A :

$$i_1 = i_2 + i_3$$

$$\frac{12 - V_A}{330} = \frac{V_A - 0}{220} + \frac{V_A - V_B}{270}$$

$$67 V_A - 22 V_B = 216 \quad \text{—— (1)}$$

Applying KCL at node B :

$$i_3 = i_4 + i_5$$

$$-\frac{(V_B - V_A)}{270} = \frac{V_B - 0}{180} + \frac{V_B - 10}{390}$$

$$26 V_A - 83 V_B = -180 \quad \text{— (2)}$$

On solving (1) & (2)

$$V_A = 4.387 V$$

$$V_B = 3.543 V$$

Procedure:

1) Find the value of each resistor before fixing them on the breadboard.
2) Connect all other components as per the circuit diagram.
3) Switch the current or voltage source as per the requirement.
4) Using the coarse & fine settings set the voltage as 10V & 12V & find the voltage across the resistors.

Result:

Mesh Analysis:

Manual Calculations	Practical output
$i_1 = 23mA$	$i_1 = 23mA$
$i_2 = 3.1mA$	$i_2 = 3mA$
$i_3 = 16.55mA$	$i_3 = 16.5mA$

Node Voltage Analysis:

Manual Calculations	Practical output
$V_A = 4.3V$	
$V_B = 3.5V$	

Inference:

Thus by using KVL we can solve mesh analysis

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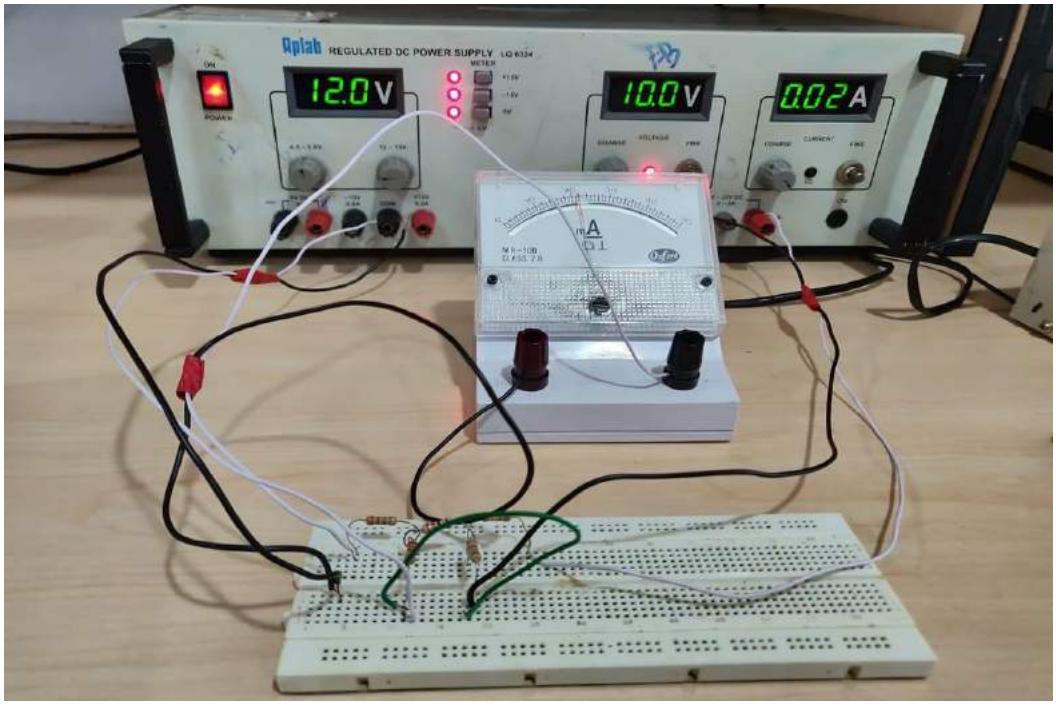
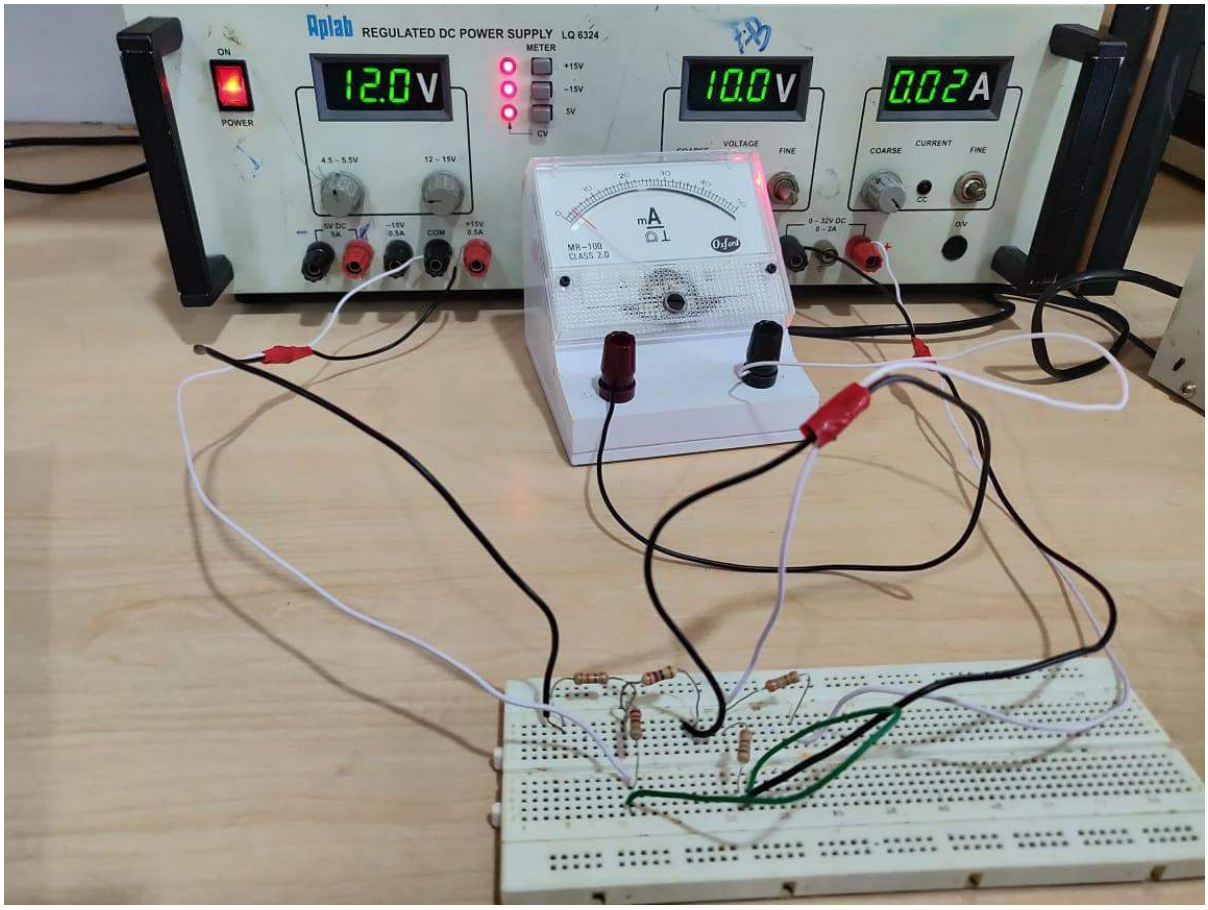
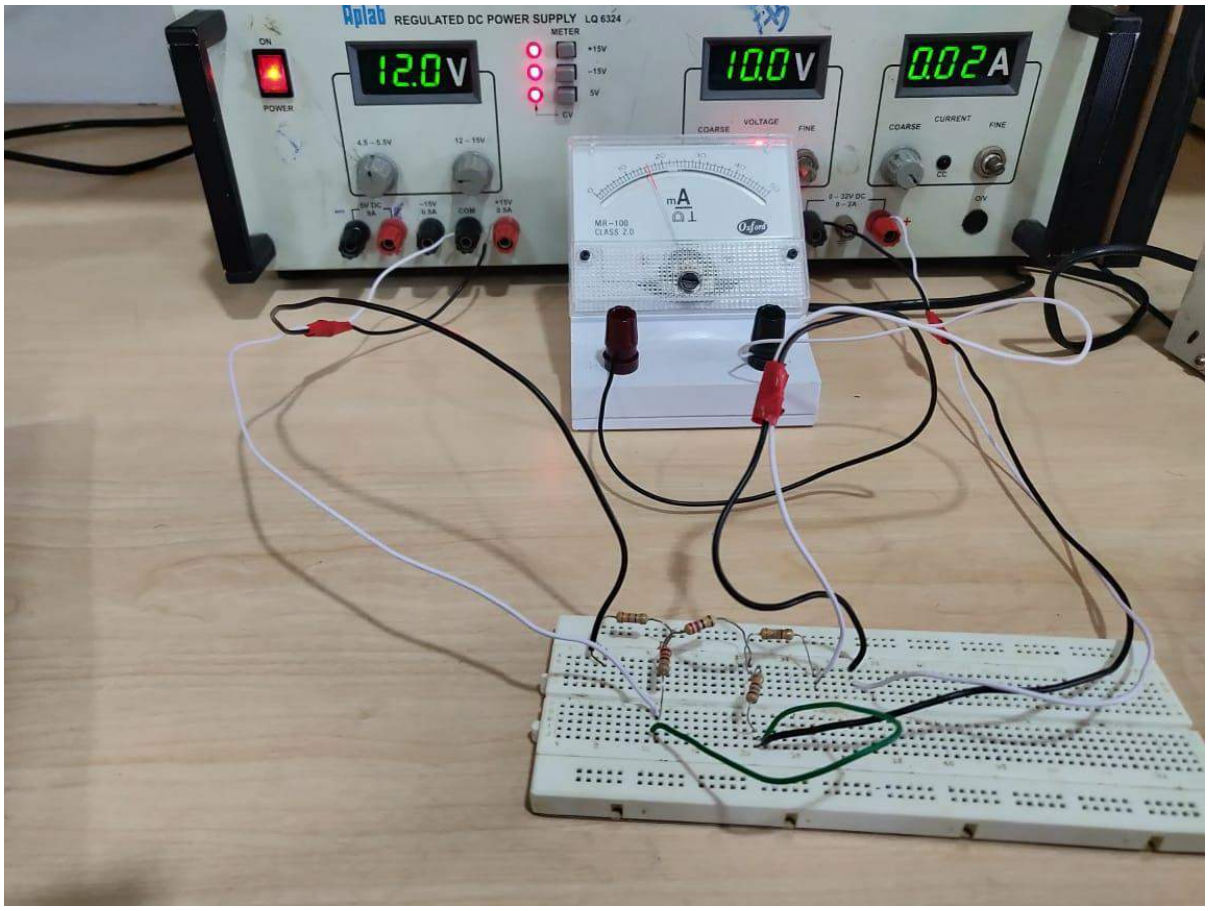
1. I1


Aplab
REGULATED DC POWER SUPPLY
12.0V
10.0V
0.02A

2. I2


Aplab
REGULATED DC POWER SUPPLY LQ 6324
12.0V
10.0V
0.02A

3. I3


Aplab
REGULATED DC POWER SUPPLY
LQ 6324
ON
POWER
12.0V
10.0V
0.02A
VOLTAGE
COARSE
FINE
CURRENT
COARSE
FINE
mA
MR-100
CLASS 2.0
Oxford