Website : www.tcetmumbai.in

Zagdu Singh Charitable Trust's (Regd.)
THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY
Autonomous College Affiliated to University of Mumbai
Approved by All India Council for Technical Education(AICTE) and Government of Maharashtra(GoM)
Conferred Autonomous Status by University Grants Commission (UGC) for 10 years w.e.f. A.Y 2019-20
Amongst Top 200 Colleges in the Country, Ranked 193rd in NIRF India Ranking 2019 in Engineering College category
• ISO 9001:2015 Certified • Programmes Accredited by National Board of Accreditation (NBA), New Delhi
• Institute Accredited by National Assessment and Accreditation Council (NAAC), Bangalore
Estd. in 2001

Subject :- BEE Experiment / ~~Tutorial~~ / ~~Assignment~~ No. :- 01 Page :- 01 Date :- 24/01/2022

## * Experiment NO. 01 : MESH AND NODAL ANALYSIS *

**Aim :** To perform mesh and NOdal analysis for the given Circuit.

**Objective :** After performing the practical, the learner will be able to :

PRO 1 : Implement the given Circuit On breadboard
PRO 2 : Explain the basic Concept of Mesh and Nodal Analysis
PRO 3 : Calculate Voltage and Current across different Component in circuit.

**Apparatus :**
Digital multimeter, Power Supply, resistors, bread board, Wires.

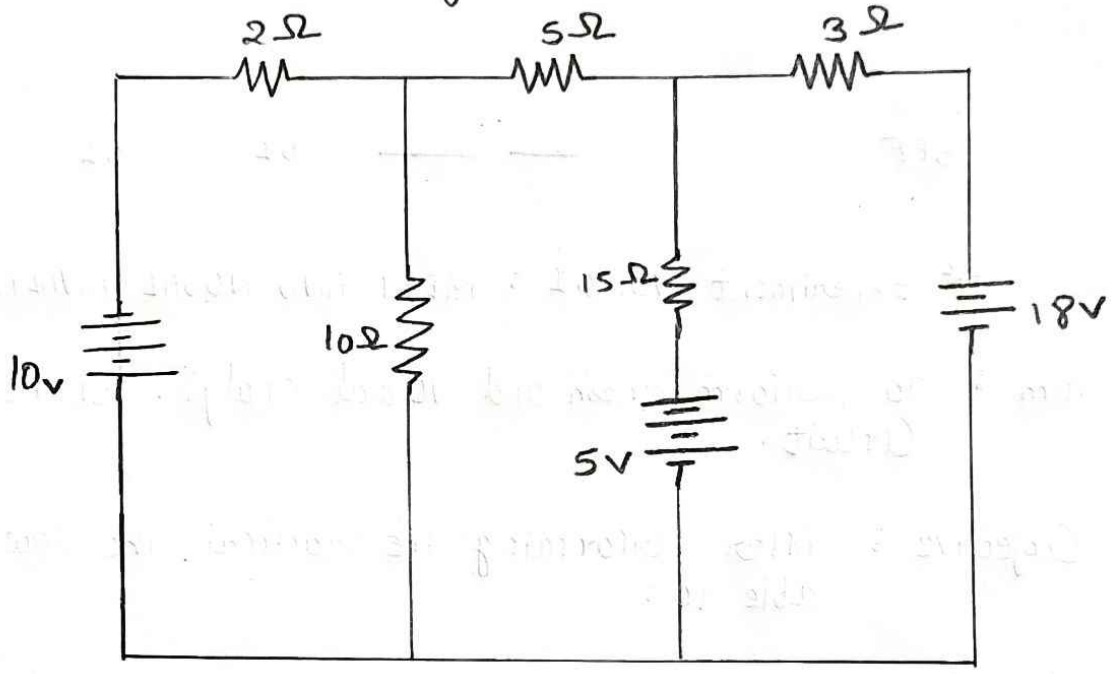
**Procedure :**

PRO 1 : 1.1 Construct the circuit as shown in the Circuit diagram 1.

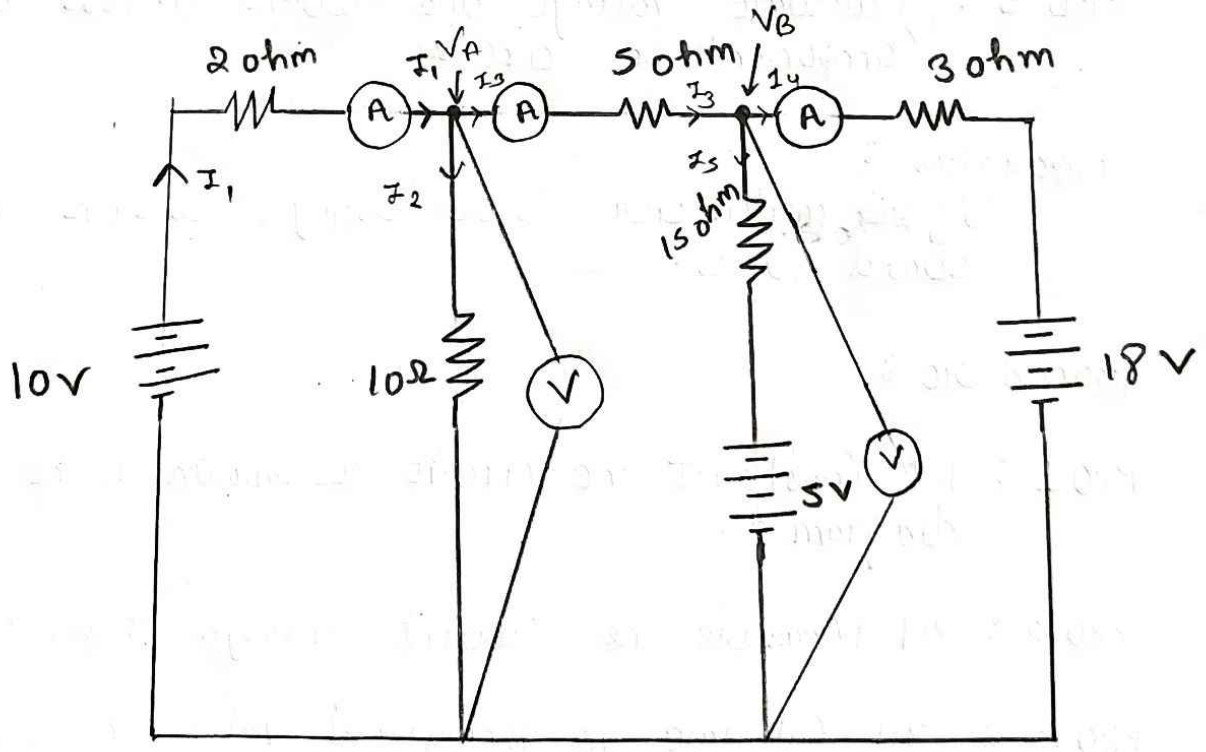
PRO 2 : 2.1 Measure the Current through resistors.

PRO 3 : 3.1 Calculate the theoretical value for Current through all resistor Using Mesh analysis.
3.2 Compare it with the Practical Value.

Electric circuit diagram :-




PRACTICAL CIRCUIT DIAGRAM :-



Subject :- BEE Experiment / ~~Tutorial~~ / ~~Assignment~~ No. :- 1 Page :- 02 Date :- 24/01/2022

PRO 1 : 1.2 Construct the Circuit as shown in the diagram 2

PRO 2 : 2.2 Measure the voltage across all Nodes

PRO 3 : 3.3 Calculate the theoretical value for the voltage across all nodes using Nodal Analysis
3.4 Compare it with the practical value.

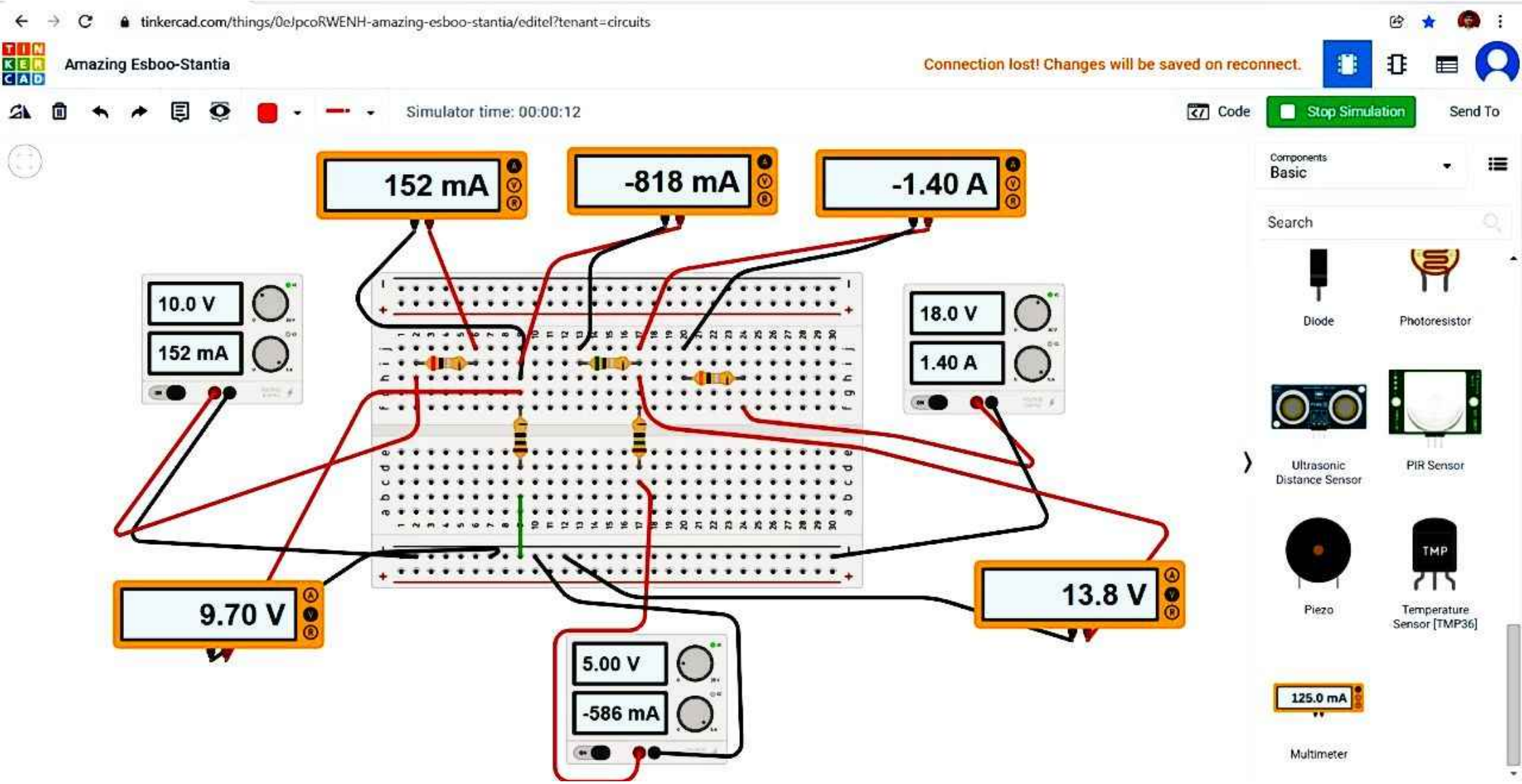
Result and Discussion :

PRO 1 : Bread board is easy to use for creating temporary prototypes and experimenting with Circuit design.

PRO 2 : Mesh and Nodal Analysis is used for measuring the current and voltage of the circuit.

PRO 3 : Current is measured using Mesh analysis and voltage ~~across any resistance can be calculated.~~ is measured using Nodal Analysis.

Conclusion : Hence by applying mesh and nodal analysis Current and voltage across any resistance can be calculated.


tinkercad.com/things/0eJpcoRWENH-amazing-esboo-stantia/editel?tenant=circuits
Amazing Esboo-Stantia
Connection lost! Changes will be saved on reconnect.
Simulator time: 00:00:12
Code
Stop Simulation
Send To
152 mA
-818 mA
-1.40 A
10.0 V
152 mA
18.0 V
1.40 A
9.70 V
13.8 V
5.00 V
-586 mA
Components
Basic
Search
Diode
Photoresistor
Ultrasonic Distance Sensor
PIR Sensor
Piezo
Temperature Sensor [TMP36]
125.0 mA
Multimeter

* mesh Analysis

| $I_1$ | | $I_2$ | | $I_3$ | |
|---|---|---|---|---|---|
| calculated | observed | calculated | observed | calculated | observed |
| 0.15A | 0.15 A | -0.818 A | -0.818 A | -1.40A | -1.40A |

Calculation :-

By applying KVL fn loop-I

$$10 - 2I_1 - 10(I_1 - I_2) = 0$$

$$\therefore -2I_1 - 10I_1 + 10I_2 = -10$$

$$\therefore 12I_1 - 10I_2 = 10 \quad \cdots (i)$$

By applying KVL fn loop - II

$$-5I_2 - 15(I_2 - I_3) - 5 + 10(I_1 - I_2) = 0$$

$$\therefore -5I_2 - 15I_2 + 15I_3 - 5 + 10I_1 - 10I_2 = 0$$

$$\therefore 10I_1 - 30I_2 + 15I_3 = 5$$

$$\therefore 2I_1 - 6I_2 + 3I_3 = 1 \quad \cdots (ii)$$

By applying KVL fn loop - III

$$-3I_3 - 18 + 15(I_2 - I_3) + 5 = 0$$

$$-3I_3 - 13 + 15I_2 - 15I_3 = 0$$

$$15I_2 - 18I_3 = 13 \quad \cdots (iii)$$

$$\therefore I_1 = \frac{5}{33} = 0.1515$$

$$\therefore I_2 = -\frac{9}{11} = -0.8182$$

$$\therefore I_3 = \frac{-139}{99} = -1.404$$

## * Nodal Analysis :-

| $V_A$ | | $V_B$ | |
|---|---|---|---|
| calculated | Observed | Calculated | Observed |
| 9.69V | 9.70V | 13.78V | 13.80V |

Calculation :

Applying KCL to node A

$I_1 = I_2 + I_3$

$\therefore \frac{10 - V_A}{2} = \frac{V_A - 0}{10} + \frac{V_A - V_B}{5}$

$\therefore 4V_A - V_B = 25 \quad \ldots\ldots (i)$

Applying KCL to node B

$I_3 = I_4 + I_5$

$\therefore \frac{V_A - V_B}{5} = \frac{V_B - 18}{3} + \frac{V_B - 5}{15}$

$\therefore 3V_A - 9V_B = -95$

$\therefore V_A = \frac{320}{33} = 9.697\ V$

$\therefore V_B = \frac{455}{33} = 13.79V$

Subject :- BEE Experiment / ~~Tutorial~~ / ~~Assignment~~ No. :- 1 Page :- 03 Date :- 24/01/2022

## Quiz

Q.1) What is use of Breadboard and multimeter?

Ans → Breadboard is used to build and test circuit's quickly before finalizing any circuit design and multimeter is used to measure electrical charging of voltage, current and resistor.

Q.2) Why do you require mesh and nodal analysis?

Ans → nodal analysis used to determine node voltage by solving KCL equation for the incoming and outgoing voltage at each node. mesh analysis used to determine current across each component in loop.

Q.3) Define voltage and current.

Ans → Voltage → Its difference in potential between points

Current → It is rate at which charge is flowing through circuit.

Estd. in 2001

Zagdu Singh Charitable Trust's (Regd.)

**THAKUR COLLEGE OF ENGINEERING & TECHNOLOGY**

Autonomous College Affiliated to University of Mumbai

Approved by All India Council for Technical Education(AICTE) and Government of Maharashtra(GoM)

Conferred Autonomous Status by University Grants Commission (UGC) for 10 years w.e.f. A.Y 2019-20

Amongst Top 200 Colleges in the Country, Ranked 193rd in NIRF India Ranking 2019 in Engineering College category

• ISO 9001:2015 Certified • Programmes Accredited by National Board of Accreditation (NBA), New Delhi

• Institute Accredited by National Assessment and Accreditation Council (NAAC), Bangalore

Subject :- BEE Experiment / ~~Tutorial / Assignment~~ No. :- 01 Page :- 04 Date :- 24/01/2022

| Objective | PRO 1 | PRO 2 | PRO 3 | Total score | ES & H Department |
|---|---|---|---|---|---|
| Weight | 20 | 30 | 30 | | Date of performance:- |
| points | | | | | |
| Score | | | | | Date of correction:- |
| Earned points (EP) = Total score/100 = | | | | | Roll No. → 29<br>Marks : ___ /100<br>Signature → |