

LAB ASSIGNMENT – 1

Course: Basic Electrical and Electronics Engineering

Course Code: EEE1001

Faculty Name: Prof. Medaramelta Praveenkumar

Slot: L-19+L-20

Name: Priyal Bhardwaj

Registration Number: 18BIT0272

Submission Date: 30.08.2018

Aim:

1. Verify Kirchhoff's current and voltage laws (Nodal and Mesh) for the given circuits.

Apparatus/Software Required:

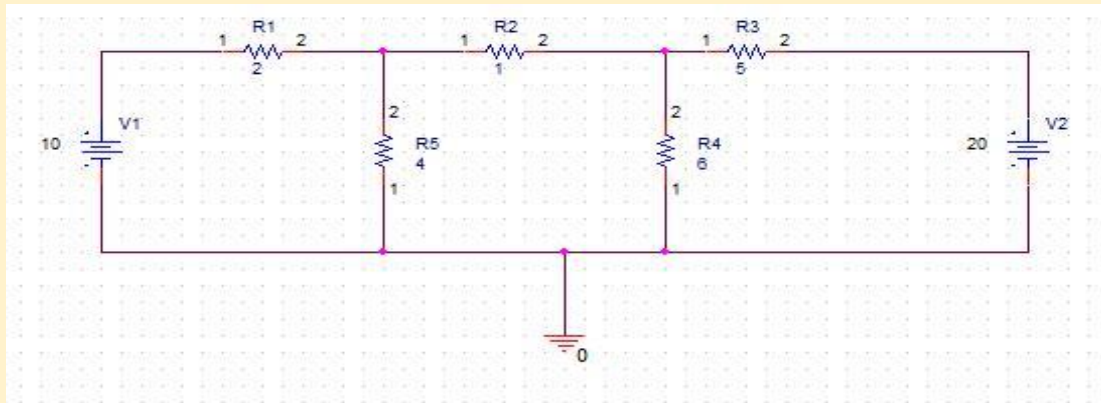
ORCAD/Capture CIS-Analog Library-R,

Source Library-V DC

Ground (GND)-0(zero)

Simulation Settings-Analysis Type-Bias Point

Circuit Diagram:



Procedure:

- 1) Construct the same circuit as mentioned in the question.
- 2) For mesh analysis, assign current in each mesh.
- 3) Apply Kirchhoff's Voltage Law in each mesh.
- 4) Obtain Equations for each mesh.
- 5) Solve Equations and find the current in respective meshes.
- 6) For nodal analysis assign nodes as V1, V2, V3, V4 and ground node as V5=0 Volt.
- 7) Apply Kirchhoff's Current Law in each node.
- 8) Obtain Equations for each node.
- 9) Solve Equations and find the voltage at different nodes.
- 10) Place the circuit in Orcad Capture CIS software.
- 11) Simulate the circuit using PSpice & obtain values for currents & voltages.

Manual Calculations:

Mesh Analysis:

$$\textcircled{1} \quad 2i_1 + 4(i_1 - i_2) = 100$$

$$6i_1 - 4i_2 = 100$$

$$\rightarrow 3i_1 - 2i_2 = 50$$

$$\textcircled{2} \quad -4(i_1 - i_2) + i_2 + 6(i_2 - i_3) = 0$$

$$\rightarrow -4i_1 + 11i_2 - 6i_3 = 0$$

$$\textcircled{3} \quad -6(i_2 - i_3) + 5i_3 = -20$$

$$\rightarrow 6i_2 - 11i_3 = 20$$

Solving $\textcircled{1}$, $\textcircled{2}$ & $\textcircled{3}$

$$i_1 = 1.107 \text{ A} ; i_2 = -0.838 \text{ A} ; i_3 = -2.275 \text{ A}$$

Nodal Analysis:

$$V_1 = 10 \text{ V} ; V_4 = 20 \text{ V} ; V_5 = 0 \text{ V}$$

$\textcircled{1}$ At V_2 :-

$$i_1 = i_2 + i_3$$

$$\frac{V_1 - V_2}{2} = \frac{V_2}{4} + \frac{V_2 - V_3}{1}$$

$$\rightarrow 7V_2 - 4V_3 = 20$$

$\textcircled{2}$ At V_3 :-

$$i_3 = i_4 + i_5$$

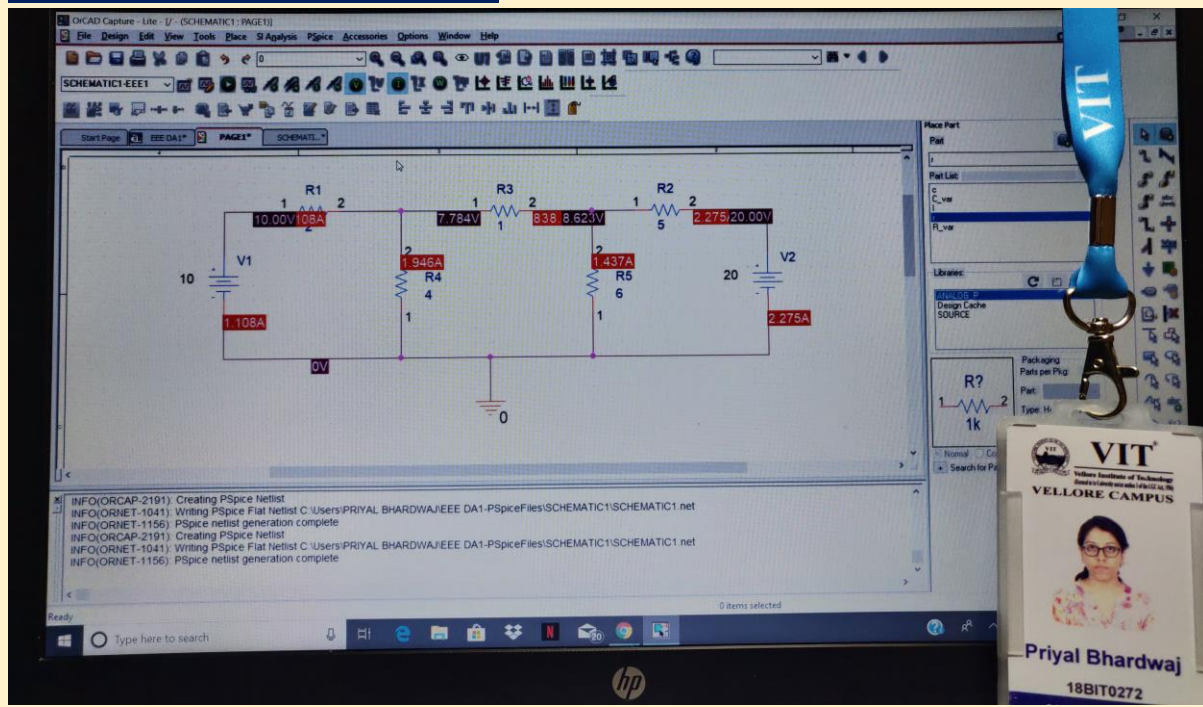
$$\frac{V_2 - V_3}{1} = \frac{V_3}{6} + \frac{V_3 - V_4}{5}$$

$$\rightarrow 30V_2 - 41V_3 = -120$$

Solving $\textcircled{1}$ & $\textcircled{2}$

$$V_2 = 7.784 \text{ V} ; V_3 = 8.622 \text{ V}$$

SIMULATION CIRCUIT:



Values:

Simulated Value:

$$i_1 = 1.108A \quad i_2 = -0.838A \quad i_3 = -2.275A$$

$$V_1 = 10.00V \quad V_2 = 7.784 \quad V_3 = 8.623V \quad V_4 = 20V \quad V_5 = 0V$$

Manual Calculation:

$$i_1 = 1.108A \quad i_2 = 0.838A \quad i_3 = 2.275A$$

$$V_1 = 10.00V \quad V_2 = 7.784 \quad V_3 = 8.623V \quad V_4 = 20V \quad V_5 = 0V$$

Inference:

Manual Calculations = Simulated Values

Result:

Hence, Kirchhoff's Voltage and Current Laws are verified.