21BDS0340

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Electronics Lab

Task 1

Exercise No.: 1 Date: 24/02/22

Introduction to the Hardware Equipment's, components to be used, Resistor coding , Capacitors , Multimeters, Function Generator and CRO

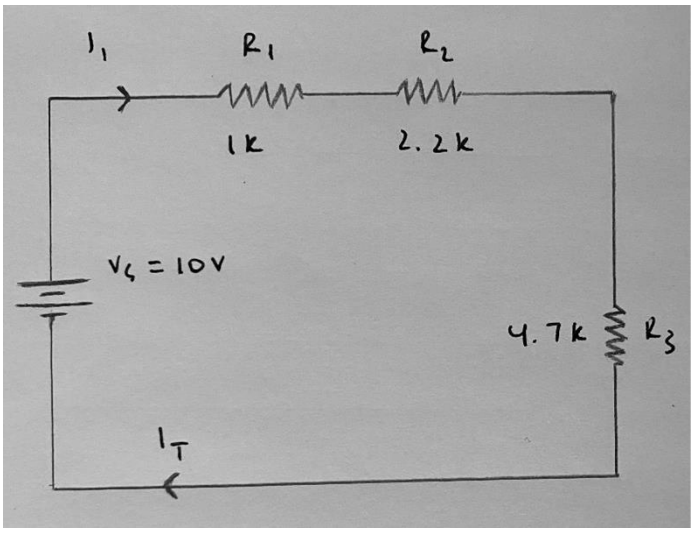
Part A: Reading Resistor by Colour Coding

No.	Band 1	Band 2	Band 3	Band 4	Nominal Value (ohm)
1	orange	orange	black	gold	33 ± 5%.
2	orange	white	red	gold	3.9 k ± 5%.
3	brown	green	orange	gold	15 k ± 5%.
4	red	violet	orange	gold	27 k ± 5%.
5	orange	white	orange	gold	39 k ± 5%.
6	brown	black	gold	none	1 ± 20%.
7	red	violet	orange	gold	27k ± 5%.
8	brown	black	red	gold	1k ± 5%.
9	blue	grey	brown	gold	680 ± 5%.
10	yellow	violet	red	gold	4.7k ± 5%.
11	red	red	red	gold	2.2k ± 5%.

Part B: Using Multimeter to Measure Resistance, Voltage and Current

Exercise 1

Circuit Diagram



Components Required

Basic – Resistors

Sources – Power Sources – DC_Power, Ground

Manual Workings

$V = 10\,V$

$R_{eq} = (1 + 2.2 + 4.7) \times 10^3$

$= 7900$ ohms

1. $I_1 = I_T$ because the resistors are in series

$$I_1 = I_T = \frac{V}{R_{eq}}$$

$$= \frac{10}{7900}$$

$$= 1.26\,mA$$

2. $V_{R1} = I_1 R_1$

$$= 1.26 \times 10^{-3} \times 10^3$$

$$= 1.26\,V$$

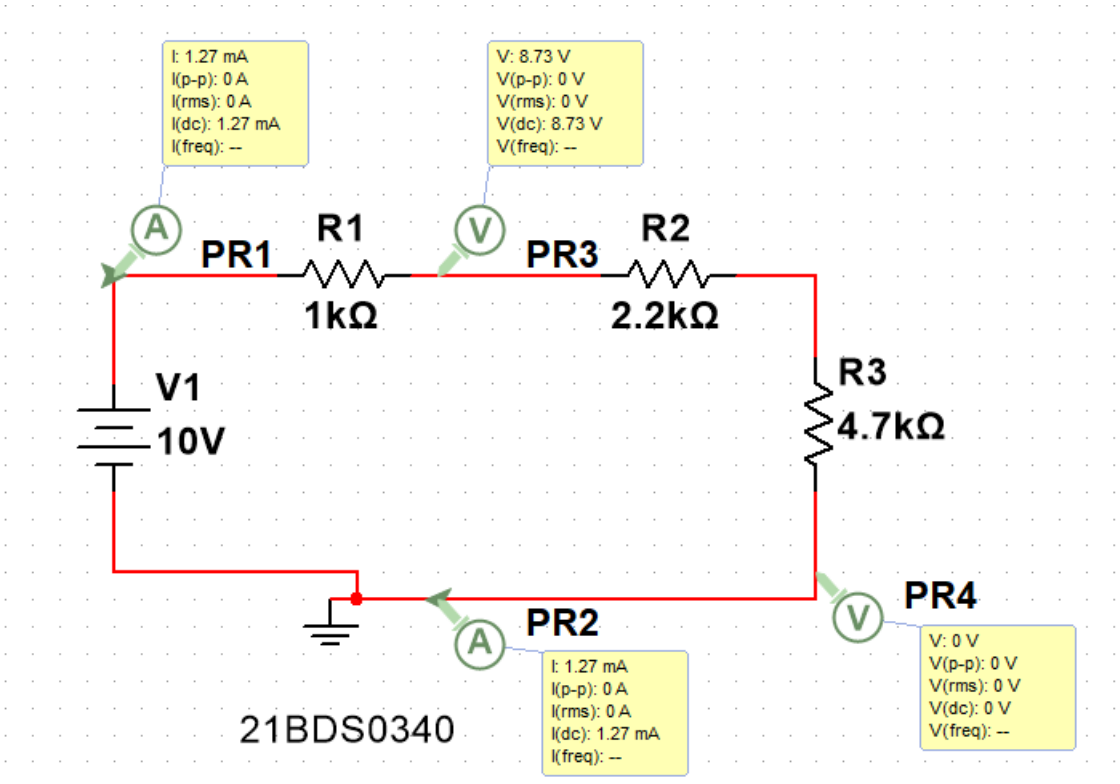
3. $V_{R2R3} = V_S - V_{R1}$

$$= 10 - 1.26$$

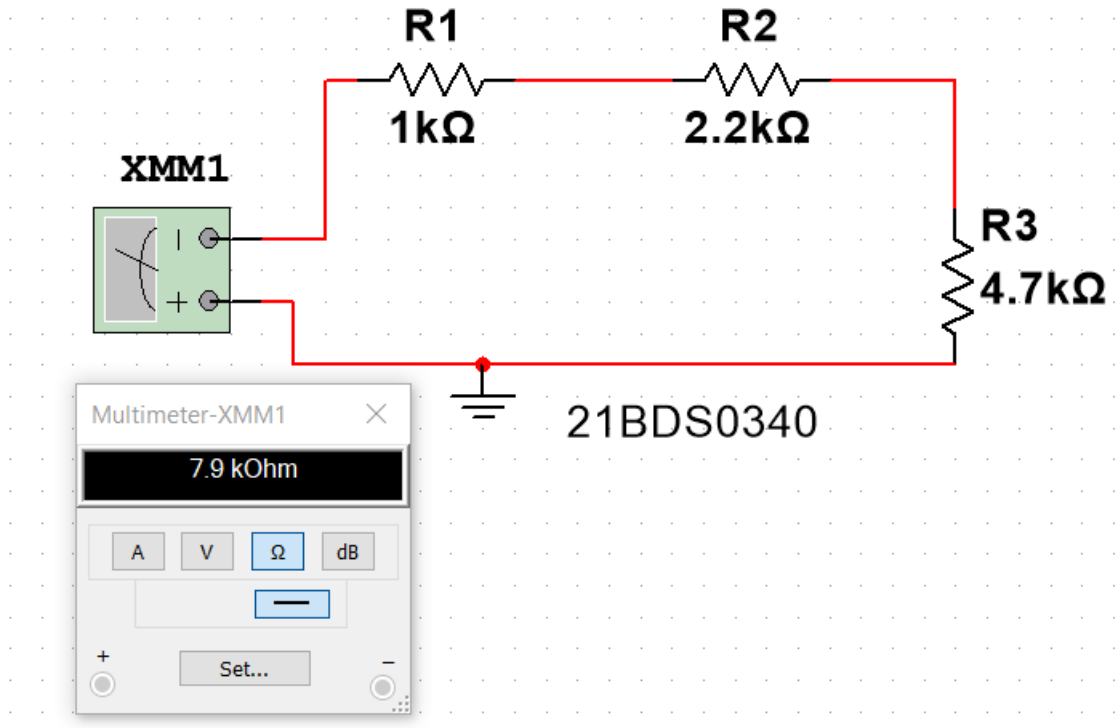
$$= 8.74\,V$$

4. $R_{eq} = 7900$ ohms

Simulated Circuit Diagram for Finding Current and Voltage



Simulated Circuit Diagram for Finding Resistance

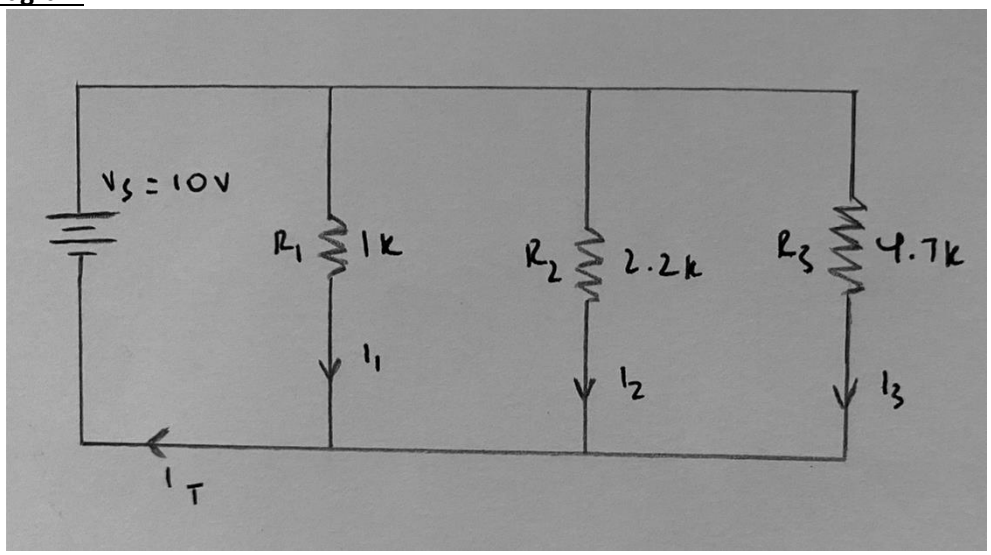


Results

NOTATION	MANUAL CALCULATIONS	SIMULATED RESULT
I_1	1.26 mA	1.27 mA
I_T	1.26 mA	1.27 mA
V_{R1}	1.26 V	1.27 V
V_{R2R3}	8.74 V	8.73 V
R_{eq}	7900 ohms	7900 ohms

Exercise 2

Circuit Diagram



Components Required

Basic – Resistors

Sources – Power Sources – DC_Power, Ground

Manual Workings

$V_S = 10\ V$

1. $I_1 = \frac{V_S}{R_1}$

$= \frac{10}{1000}$

$= 10\ mA$

$I_2 = \frac{V_S}{R_2}$

$= \frac{10}{2200}$

$= 4.5\ mA$

$I_3 = \frac{V_S}{R_3}$

$= \frac{10}{4700}$

$= 2.1\ mA$

2. $I_T = I_1 + I_2 + I_3$ because they are in parallel.

$= 10 + 4.5 + 2.1$

$= 16.6\ mA$

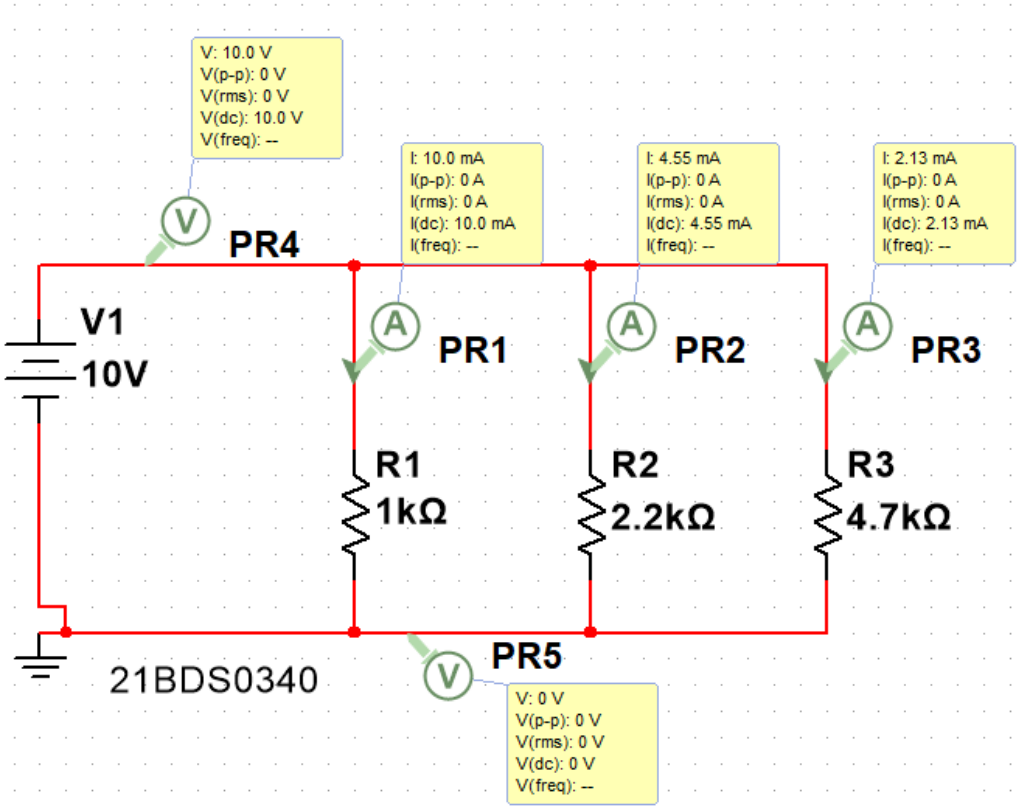
3. $R_{eq} = \frac{V_S}{I_T}$

$= \frac{10}{16.6 \times 10^{-3}}$

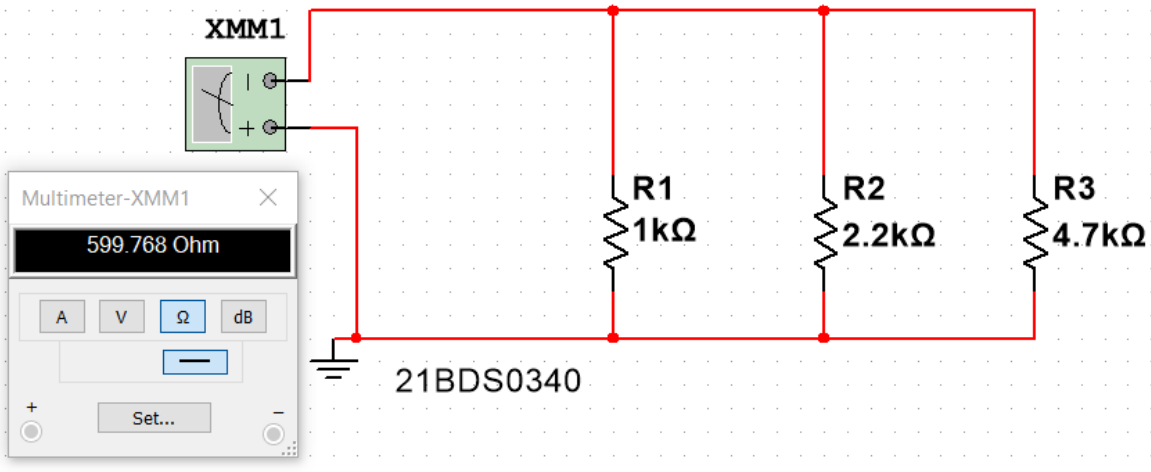
$= 599.78\ ohms$

4. $V_{R1} = V_{R2} = V_{R3} = V_S = 10\ V$

Simulated Circuit Diagram for Finding Current and Voltage



Simulated Circuit Diagram for Finding Resistance

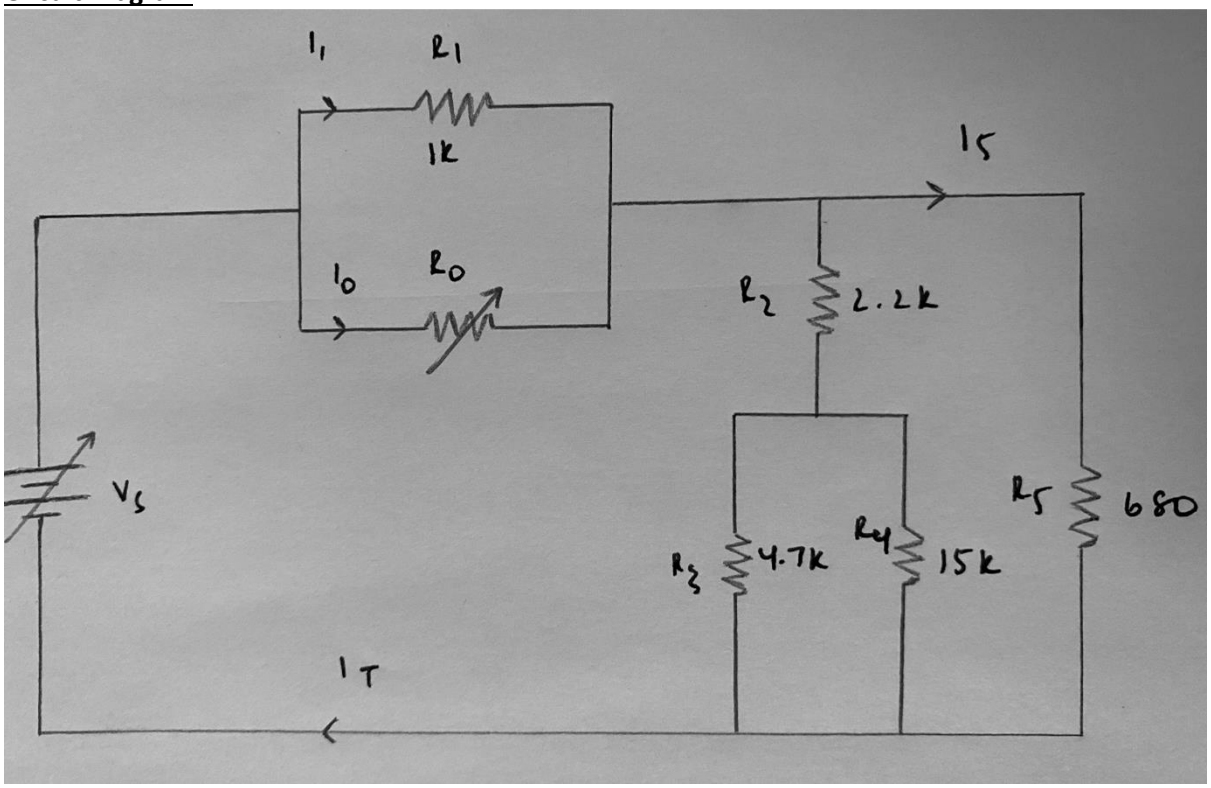


Results

NOTATION	MANUAL CALCULATIONS	SIMULATED RESULT
I_1	10 mA	10 mA
I_2	4.5 mA	4.5 mA
I_3	2.1 mA	2.1 mA
I_T	16.6 mA	16.6 mA
R_{eq}	599.78 ohms	599.78 ohms
V_{R1}	10 V	10 V
V_{R2}	10 V	10 V
V_{R3}	10 V	10 V

Exercise 3

Circuit Diagram



Components Required

Basic – Resistors

Sources – Power Sources – DC_Power, Ground

Manual Workings

1. $V_S = 15\ V$

$R_0 = 500$ ohms

2. $R_{xy} = \left(680^{-1} + \left(2200 + \left(4700^{-1} + 15000^{-1}\right)^{-1}\right)^{-1}\right)^{-1}$

$= 608.41$ ohms

$$I_T = \frac{V_S}{\left(\frac{1}{1000} + \frac{1}{500}\right) + 608.41}$$

$= 15.93\ mA$

$$I_1 = \frac{I_T R_0}{R_0 + R_1} = 5.31\ mA \quad \text{when } R_0 = 500$$

$$I_2 = \frac{I_T R_1}{R_0 + R_1} = 10.62\ mA \quad \text{when } R_0 = 500$$

$$I_T = \frac{V_S}{\left(\frac{1}{1000} + \frac{1}{5000}\right) + 608.41}$$

$= 10.4\ mA$

$$I_1 = \frac{I_T R_0}{R_0 + R_1} = 8.67\ mA \quad \text{when } R_0 = 5000$$

$$I_0 = \frac{I_T R_1}{R_0 + R_1} = 1.73\ mA \quad \text{when } R_0 = 5000$$

3. $V_{xy} = 15 - V_{ROR1}$

$= 15 - I_T \left(\frac{1}{1000} + \frac{1}{5000} \right)^{-1}$

$= 15 - 8.67$

$= 6.33\ V$

$I_{R2} = 1.09\ mA$

$V_{R4} = V_{xy} - V_{R2}$

$= 6.33 - 1.09 \times 2200 \times 10^{-3}$

$= 3.93\ V$

$V_{R5} = V_{xy}$

$= 6.33\ V$

4 and 5. $R_{xy} = 608.41\ ohm$

$R_{12} = 833.33\ ohm$

$V_{xy} = V_s - V_{12}$

$\Rightarrow V_{xy} = V_s - 833.33 \times I_{12}$

$\Rightarrow V_{xy} = V_s - 833.33 \times \frac{V_s}{R_{xy} + R_{12}}$

$\Rightarrow 8.5 = V_s - \frac{833.33 V_s}{1441.74}$

$\Rightarrow V_s = 20.142\ V$ if $V_{xy} = 8.5V$

6. $I_o = \frac{I_T R_1}{R_0 + R_1}$ - ①

and $I_T = \frac{V_S}{\left(\frac{1}{R_1} + \frac{1}{R_0}\right)^{-1} + 608.41}$ - ②

① $I_T = \frac{I_o (R_0 + R_1)}{R_1}$

② $\frac{I_o (R_0 + R_1)}{R_1} = \frac{V_S}{\left(\frac{1}{R_1} + \frac{1}{R_0}\right)^{-1} + 608.41}$

$\Rightarrow \frac{I_o (R_0 + R_1)}{R_1} = \frac{V_S (R_1 + R_0)}{R_1 R_0 + 608.41 (R_1 + R_0)}$

$\Rightarrow R_1 R_0 + 608.41 (R_1 + R_0) = \frac{V_S R_1}{I_o}$

$\Rightarrow R_0 (R_1 + 608.41) = \frac{V_S R_1}{I_o} - 608.41 R_1$

$\Rightarrow R_0 = \frac{\frac{V_S R_1}{I_o} - 608.41 R_1}{R_1 + 608.41}$

Putting values:

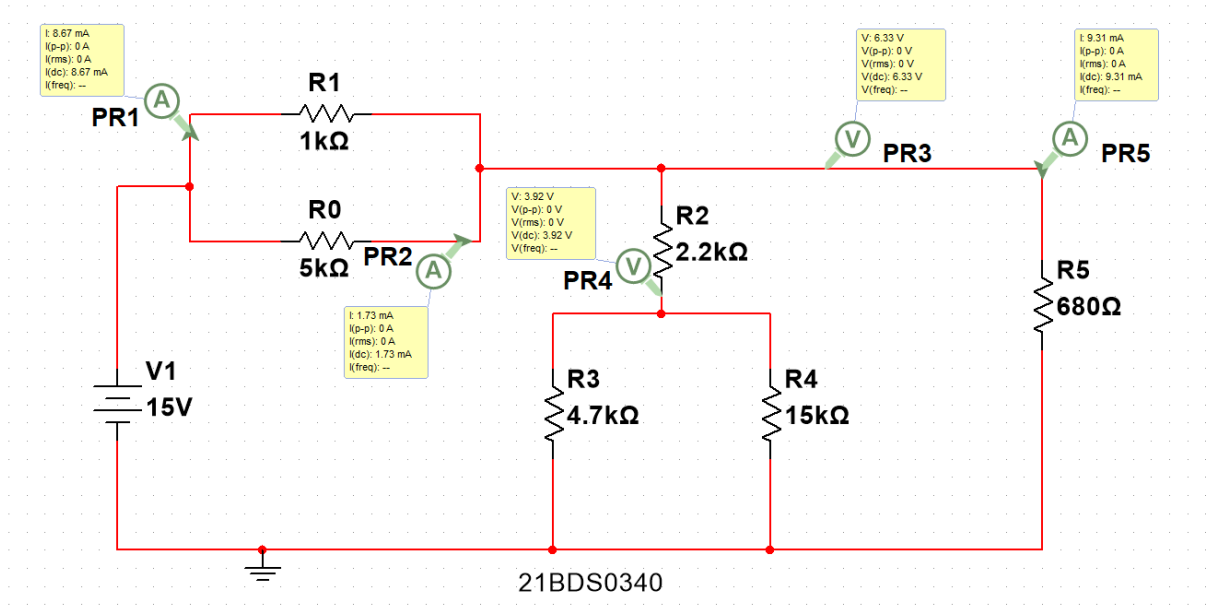
$R_0 = 1486.93$ ohms for I_o to be 5 mA

$\therefore I_5 = \frac{I_T \times 5778.68}{5778.68 + 680}$ and $I_T = 12.4$ mA

$= 11.09$ mA

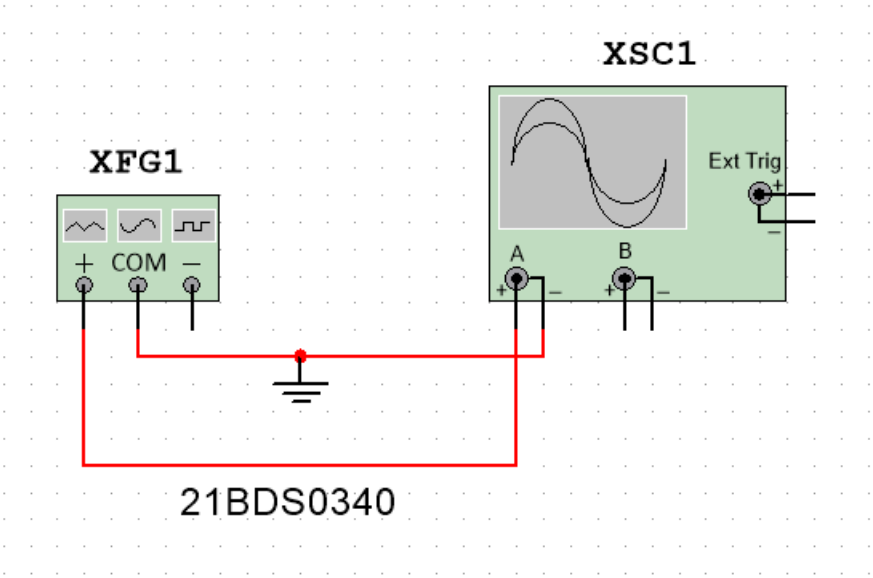
$I_T = 12.4$ mA

Simulated Circuit Diagram

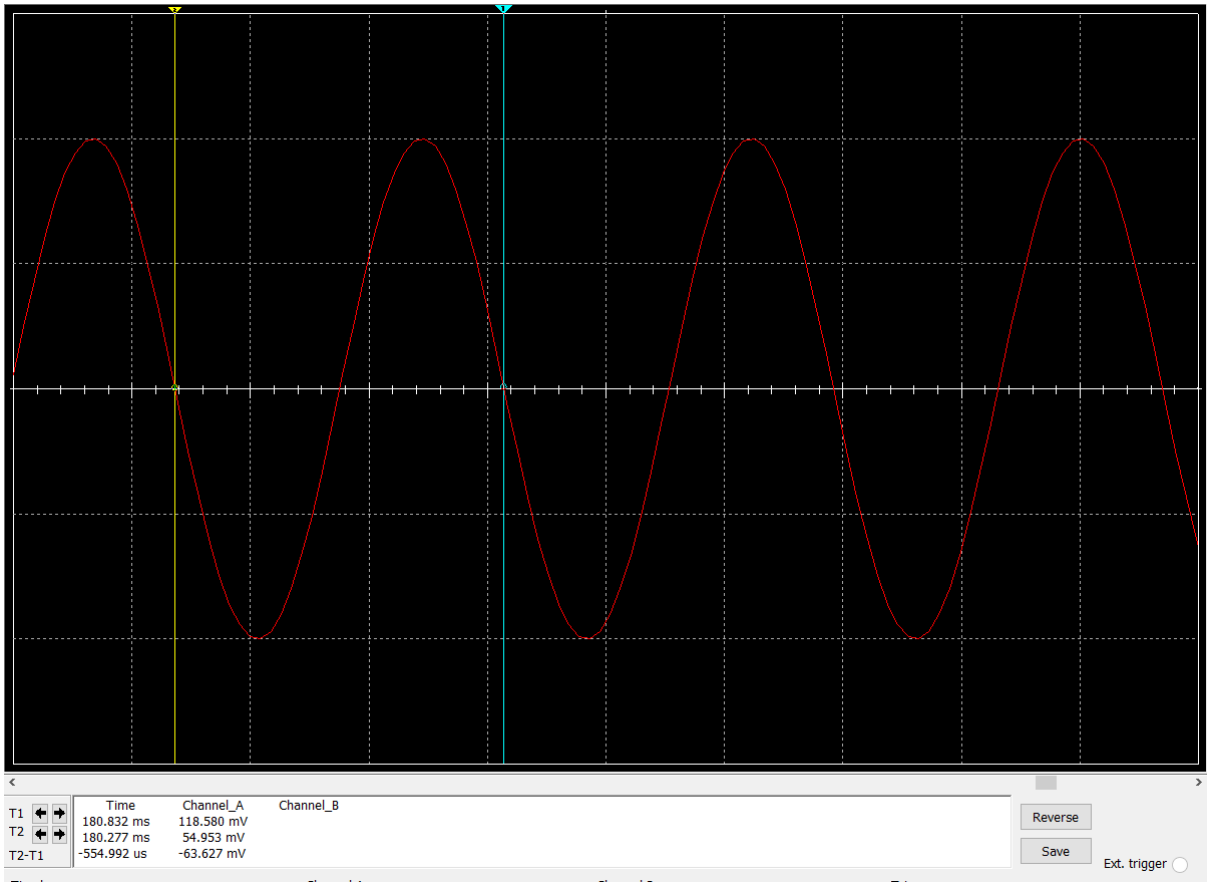


Part C: Study of Function Generator and CRO

Simulated Circuit Diagram



Simulated Sin Wave Output



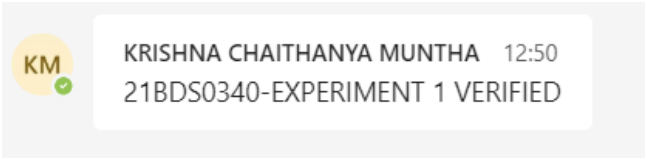
Components Required

Simulate – Instruments – Oscilloscope, Function Generator

Result

S. No.	Function Generator			CRO		
	Waveform Type	Amp (V)	Freq (Hz)	Amp (V)	Time Period (s)	Freq (Hz)
1	Sin	10	1.8k	10	554.82u	1.8k
2	Triangle	34	95M	34	10.482n	95M
3	Square	20	28	20	71.344m	14

Verification Message

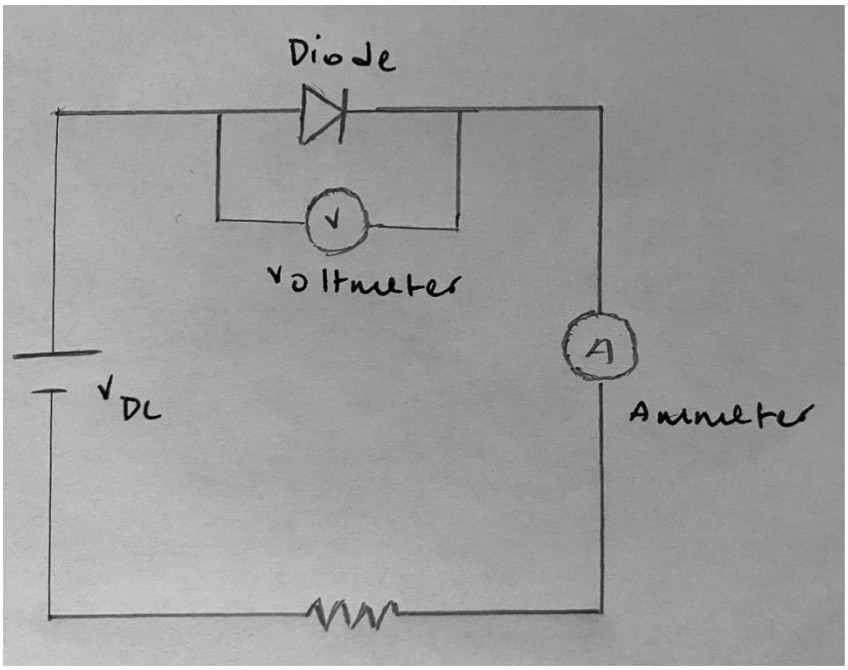


Exercise No.: 2 Date: 24/02/22

VI Characteristics of PN Junction Diode

Forward Bias

Circuit Diagram



Components Required

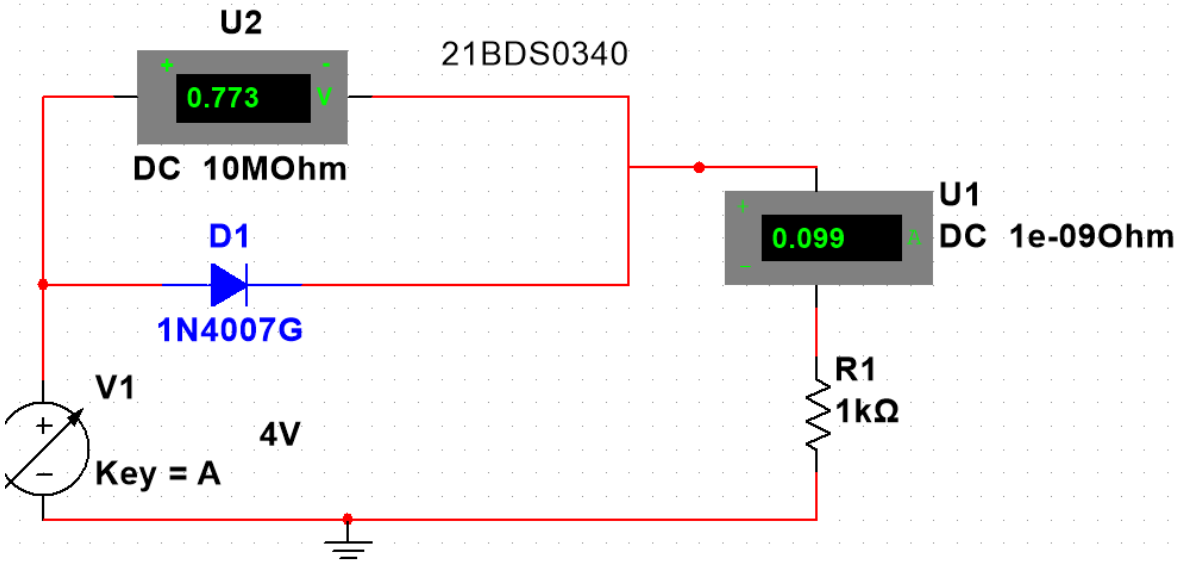
Basic – Resistors

Sources – Power Sources – DC_Power, Ground

Diodes – 1N4007G

Toolbars – Measurement Components – Ammeter, Voltmeter

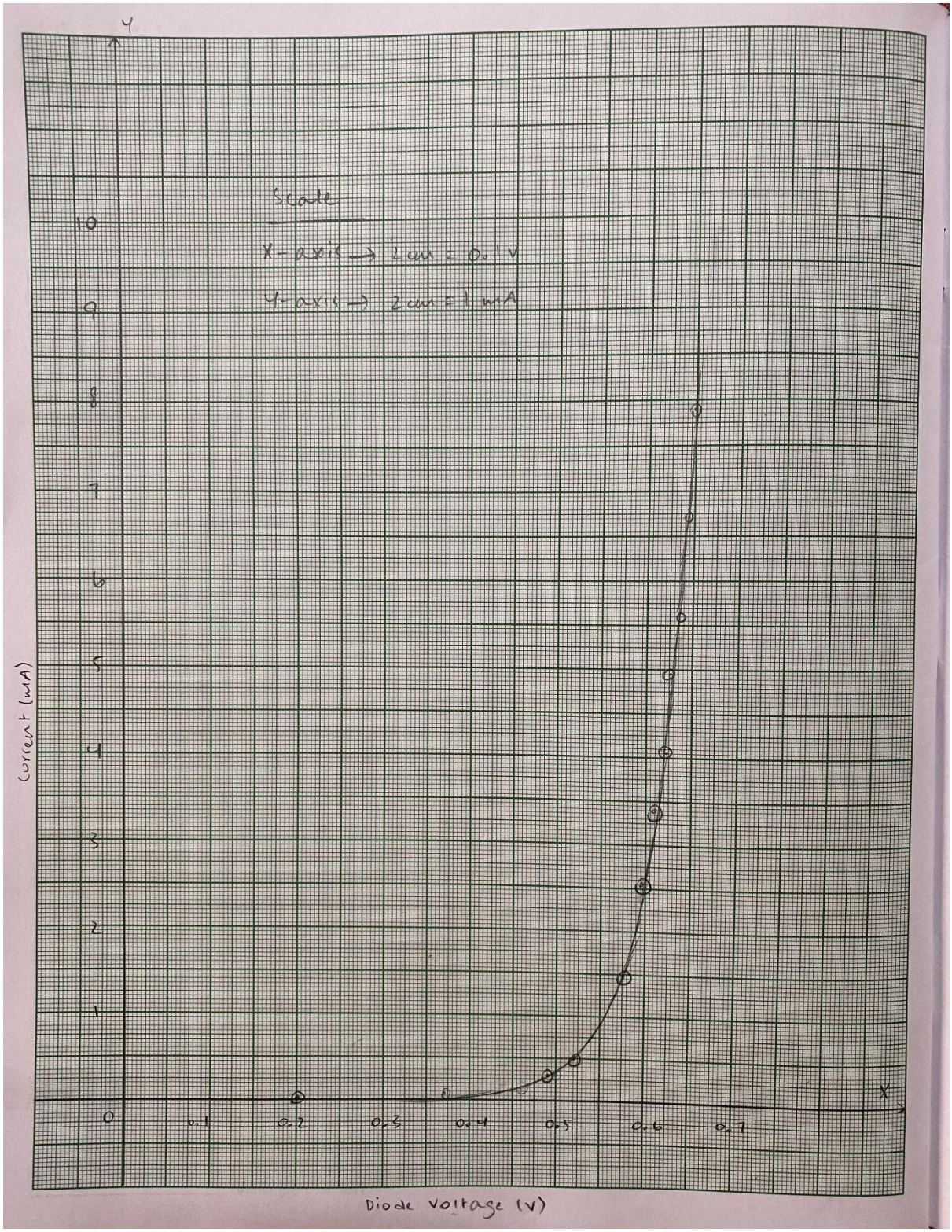
Simulated Circuit Diagram



Readings

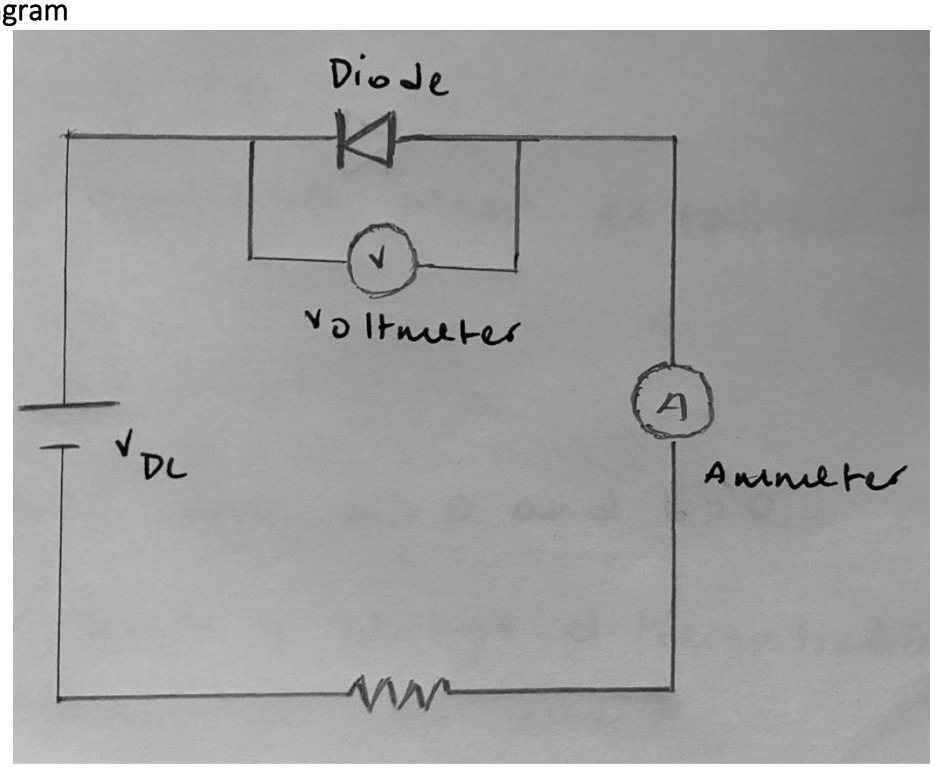
S. No.	Supply voltage (V)	Diode voltage (V)	Circuit current (A)
1	0.2	0.199	5.31×10^{-7}
2	0.4	0.377	2.3×10^{-5}
3	0.6	0.462	1.38×10^{-4}
4	0.8	0.499	3.01×10^{-4}
5	1	0.521	4.8×10^{-4}
6	2	0.572	1.43×10^{-3}
7	3	0.596	2.4×10^{-3}
8	4	0.612	3.39×10^{-3}
9	5	0.624	4.38×10^{-3}
10	6	0.634	5.37×10^{-3}
11	7	0.642	6.36×10^{-3}
12	8	0.648	7.35×10^{-5}
13	9	0.654	8.35×10^{-3}
14	10	0.66	9.34×10^{-3}

Graph


Y
Scale
X- axis → 2 cm = 0.1 V
Y- axis → 2 cm = 1 mA
10
9
8
7
6
5
4
3
2
1
0
Current (mA)
0.1
0.2
0.3
0.4
0.5
0.6
0.7
X
Diode voltage (V)

Reverse Bias

Circuit Diagram



Components Required

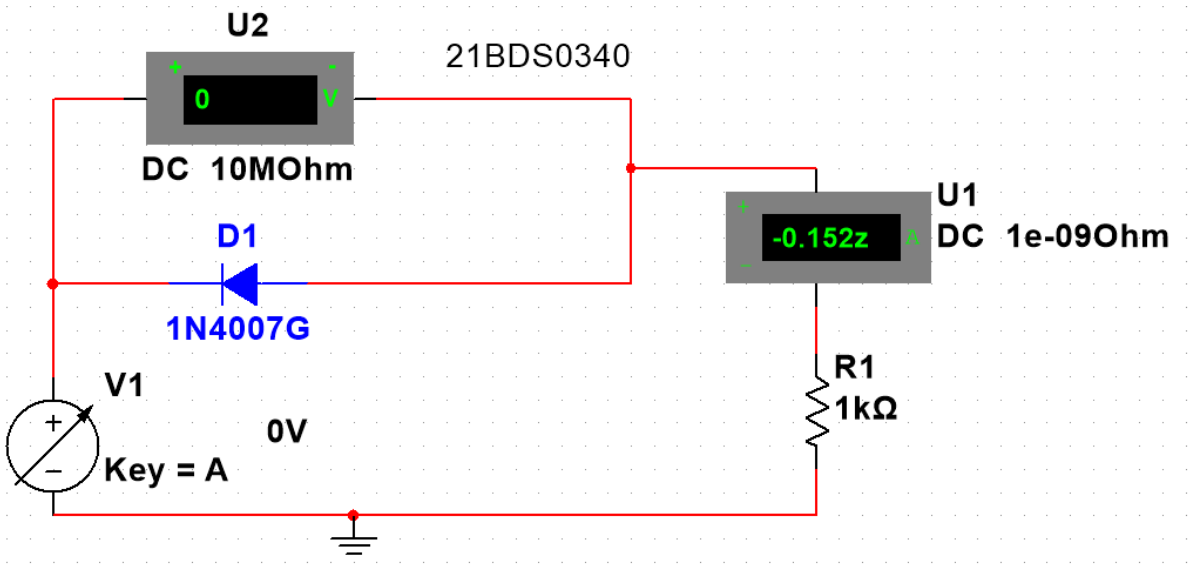
Basic – Resistors

Sources – Power Sources – DC_Power, Ground

Diodes – 1N4007G

Toolbars – Measurement Components – Ammeter, Voltmeter

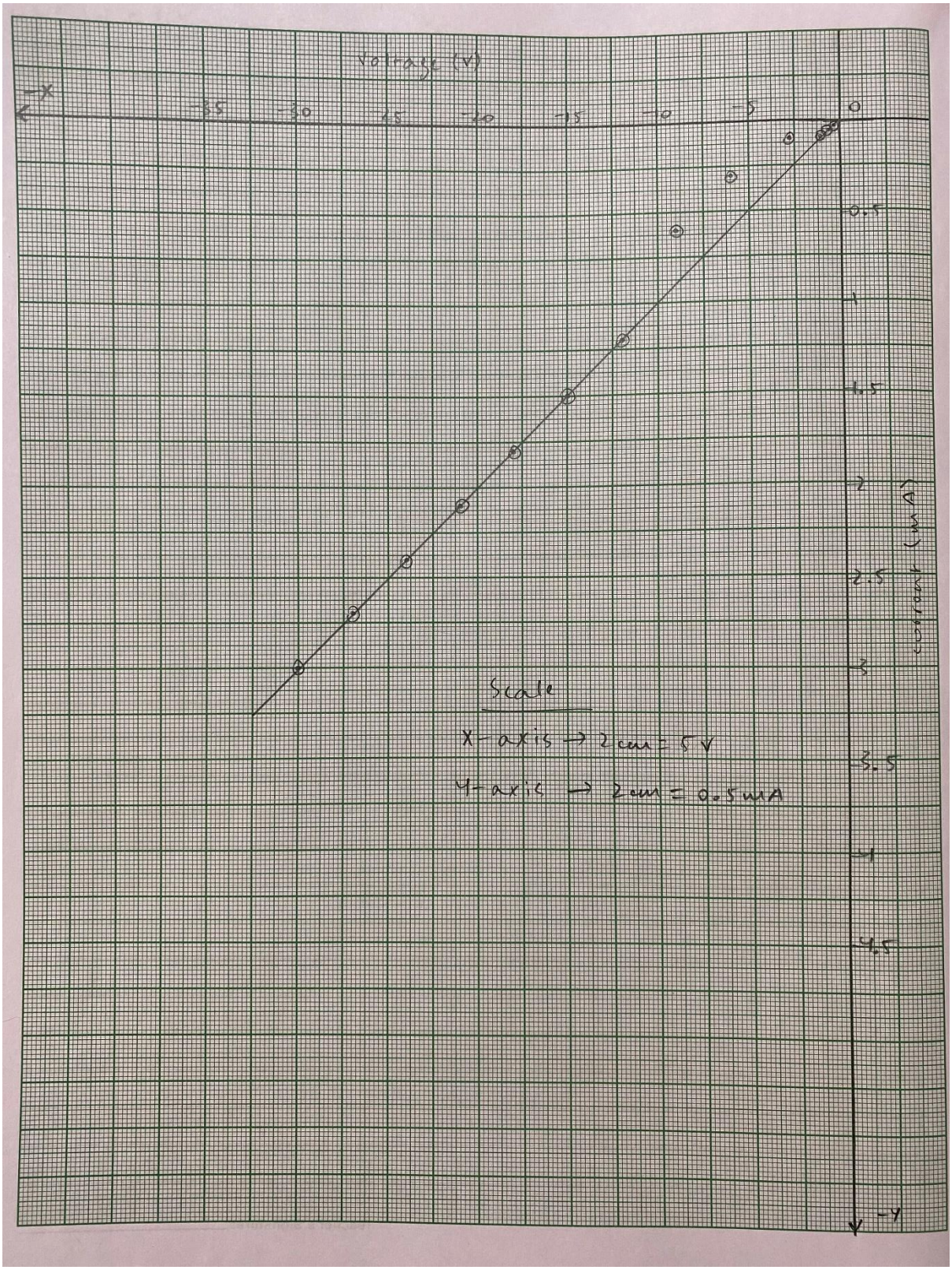
Simulated Circuit Diagram



Readings

S. No.	Supply Voltage (V)	Diode Voltage (−V)	Diode/circuit current (A)
1	0.2	0.2	2.7×10^{-8}
2	0.4	0.4	4.7×10^{-8}
3	0.6	0.6	6.7×10^{-8}
4	0.8	0.8	8.7×10^{-8}
5	1	1	1.07×10^{-7}
6	3	3	3.07×10^{-7}
7	6	5.999	6.07×10^{-7}
8	9	8.999	9.07×10^{-7}
9	12	11.999	1.21×10^{-6}
10	15	14.998	1.51×10^{-6}
11	18	17.998	1.81×10^{-6}
12	21	20.998	2.11×10^{-6}
13	24	23.998	2.41×10^{-6}
14	27	26.997	2.71×10^{-6}
15	30	29.997	3.01×10^{-6}

Graph


Voltage (V)
-X
-35
-30
-25
-20
-15
-10
-5
0
0.5
1
1.5
2
2.5
3
3.5
4
-Y
Current (mA)
Scale
X-axis → 2 cm = 5 V
Y-axis → 2 cm = 0.5 mA

Verification Message

Reg. No: 21BDS0340	Name: Abhinav Dinesh Srivatsa	Date: 27/09/2021