AMERICAN INTERNATIONAL UNIVERSITY–BANGLADESH (AIUB)

FACULTY OF ENGINEERING

ELECTRONIC DEVICES LAB

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Section: R

Group: 01

LAB REPORT ON

Study of BJT Biasing Circuit

Supervised By

S. M. IMRAT RAHMAN

Submitted By:

Name	ID
1. Md. Hamid Uddin	19-40250-1
2. Md. Jisun Abedin Aurnob	19-40318-1
3. Wathin Marma	19-40379-1
4. Rifat Al Mamun Rudro	19-39909-1
5. Jahnnabi Mazumder	19-40294-1

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Introduction:

A bipolar junction transistor (BJT) is a three-terminal semiconductor device with two p-n junctions that can amplify or magnify a signal. It is a device that is controlled by current. The base, collector, and emitter are the three terminals of a BJT. Transistor biasing is defined as the correct flow of zero signal collector current and the preservation of proper collector emitter voltage during signal transmission. Biasing Circuit is the circuit that provides transistor biasing. The state of the transistor when no input current is applied is referred to as a DC operating point, also known as quiescent or Q point. The operating point (Q) of a BJT is critical for amplifiers, as incorrect selection of the 'Q' point causes amplifier distortion. It is critical to maintain a stable 'Q' point, which means that the operating point should not be affected by changes in temperature or BJT β, which might fluctuate significantly.

Theory and Methodology:

Biasing is the use of dc voltages to maintain a constant amount of current and voltage. The process of establishing a transistor's DC working voltage or current conditions to the proper level so that any AC input signal may be amplified appropriately by the transistor is known as transistor biasing. For transistor network analysis, the following basic current relationships for a transistor are required:

$VBE = 0.7$ V

$IE = (\beta+1) \times IB \cong IC$

$IC = \beta \times IB$

The applied DC creates an operational point (Q-point) that defines the signal amplification zone. The biasing circuit can be built to operate the device at any of these or other places within then active area. There are 3 states of Bias operation, they are:

1. Saturation Region
2. Active Region
3. Cut-Off Region

BJT Bias Configuration:

1. Fixed-Bias Configuration
2. Emitter-Bias Configuration
3. Voltage-Divider Bias Configuration
4. Collector Feedback Configuration

Simulation Model:

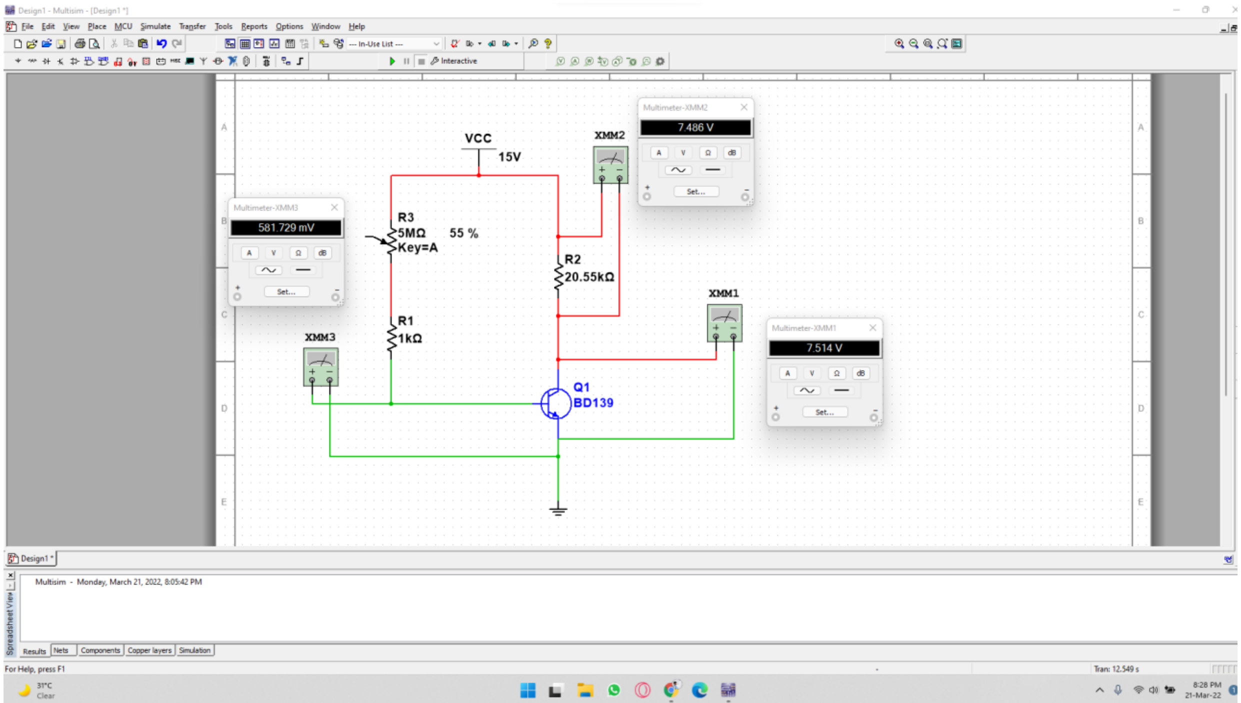

Fig 01: Fixed Bias Circuit 1a

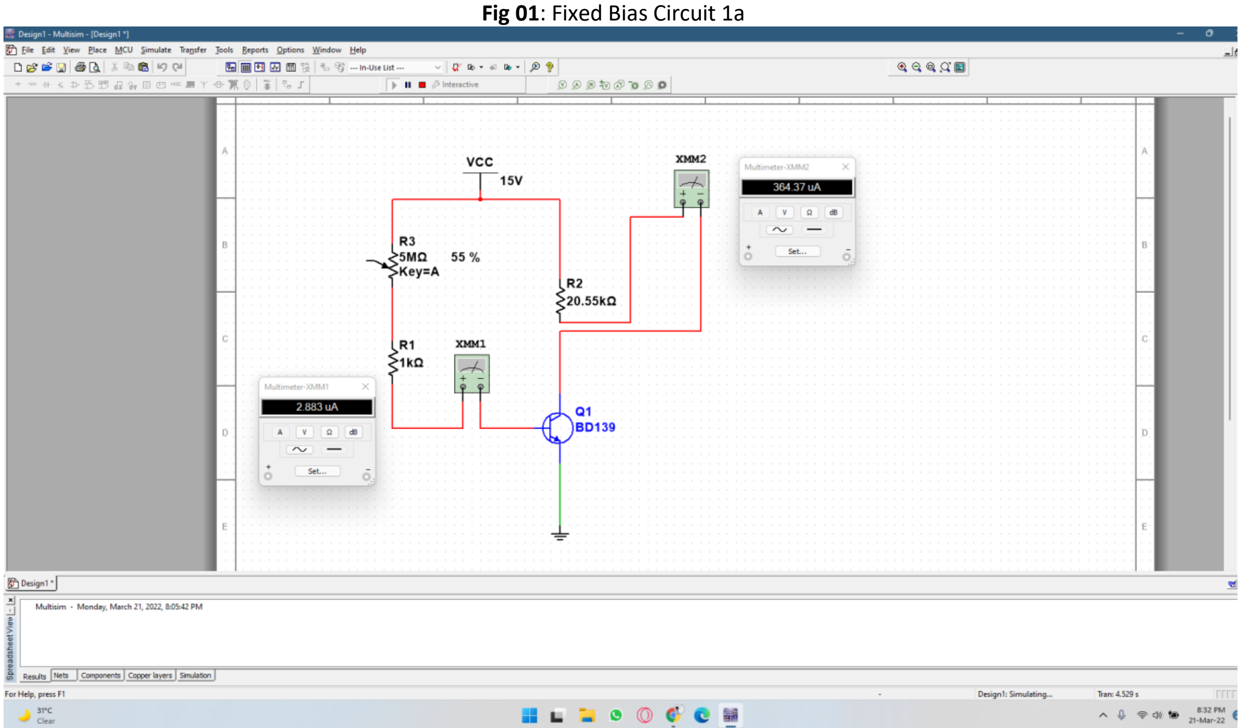

Fig 02: Fixed Bias Circuit 1a

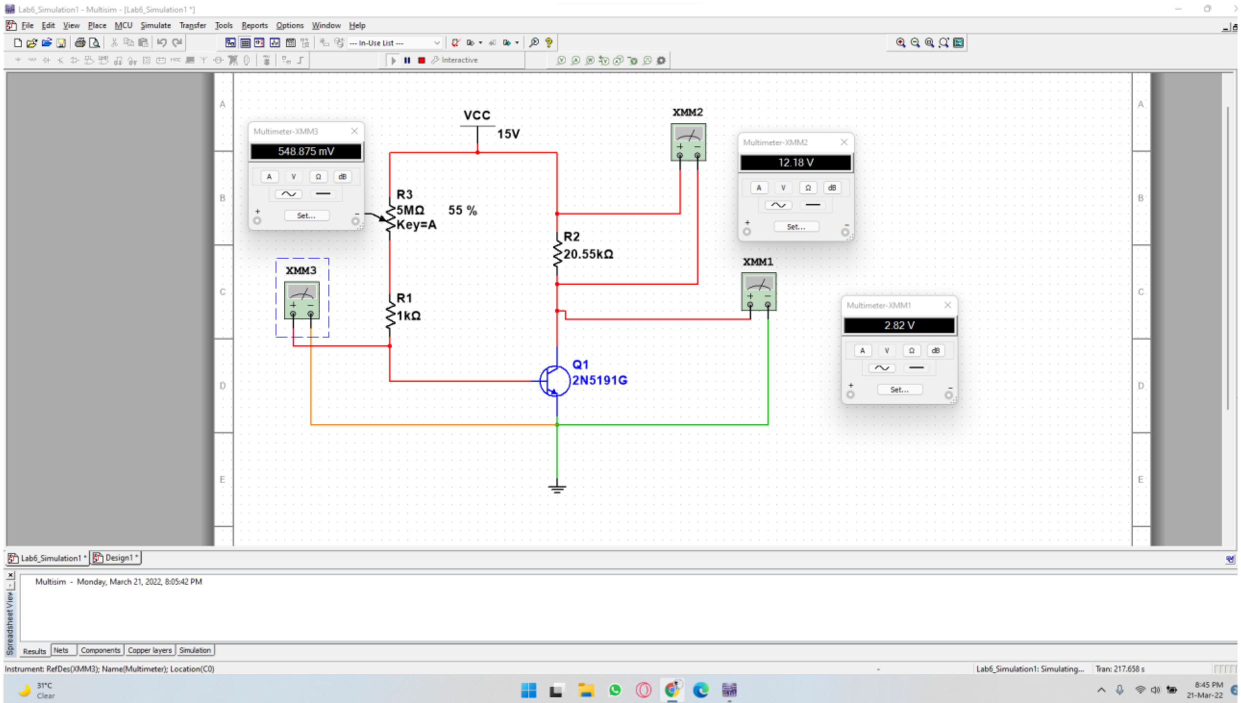

Fig 03: Fixed Bias Circuit 1b

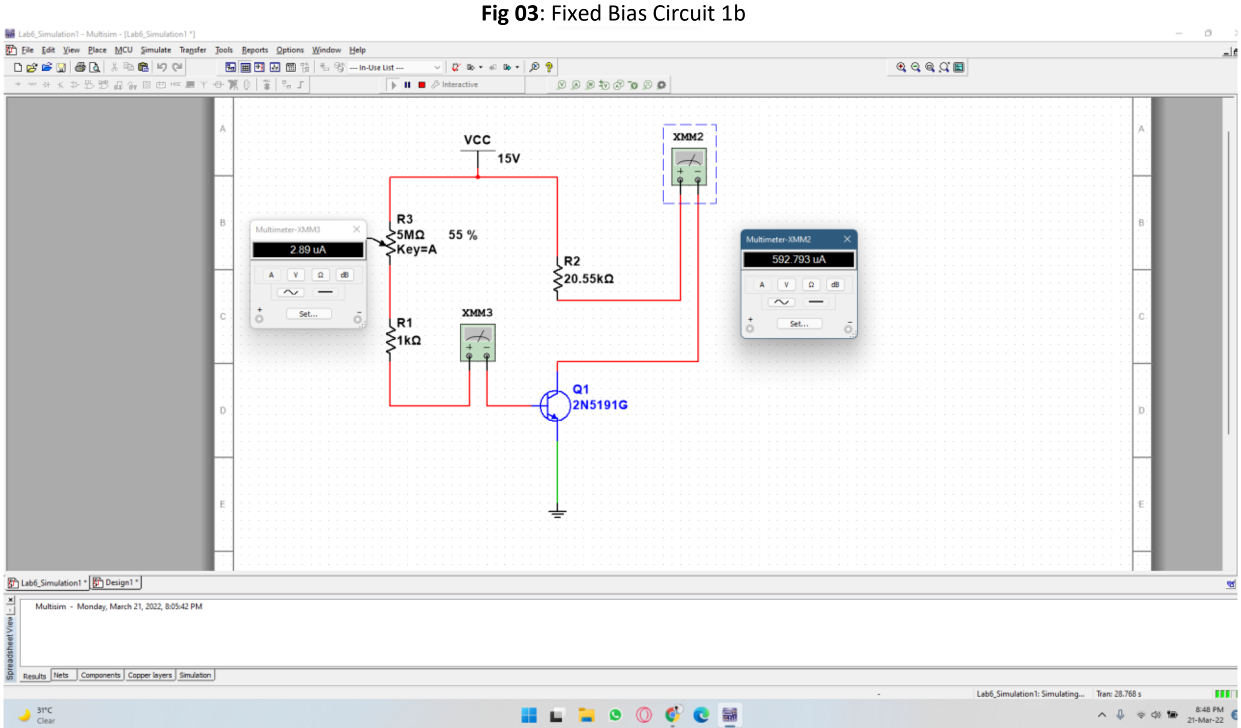

Fig 04: Fixed Bias Circuit 1b

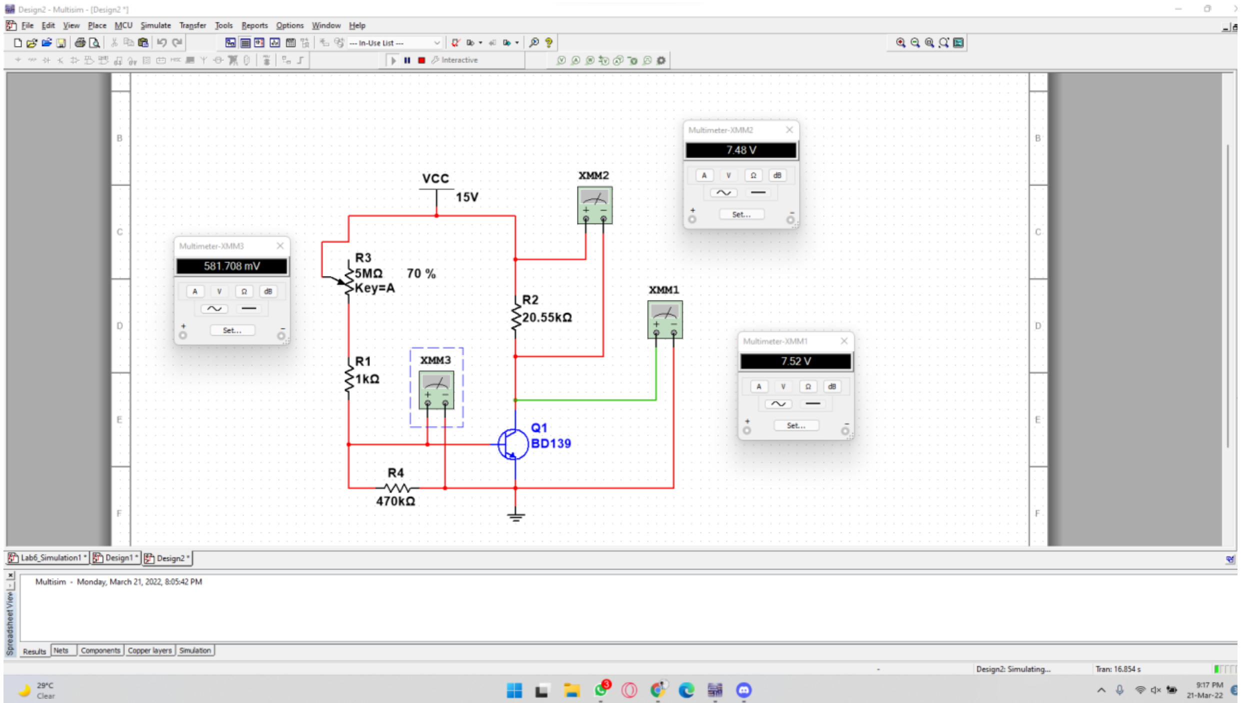

Fig 05: Self Bias Circuit 2a

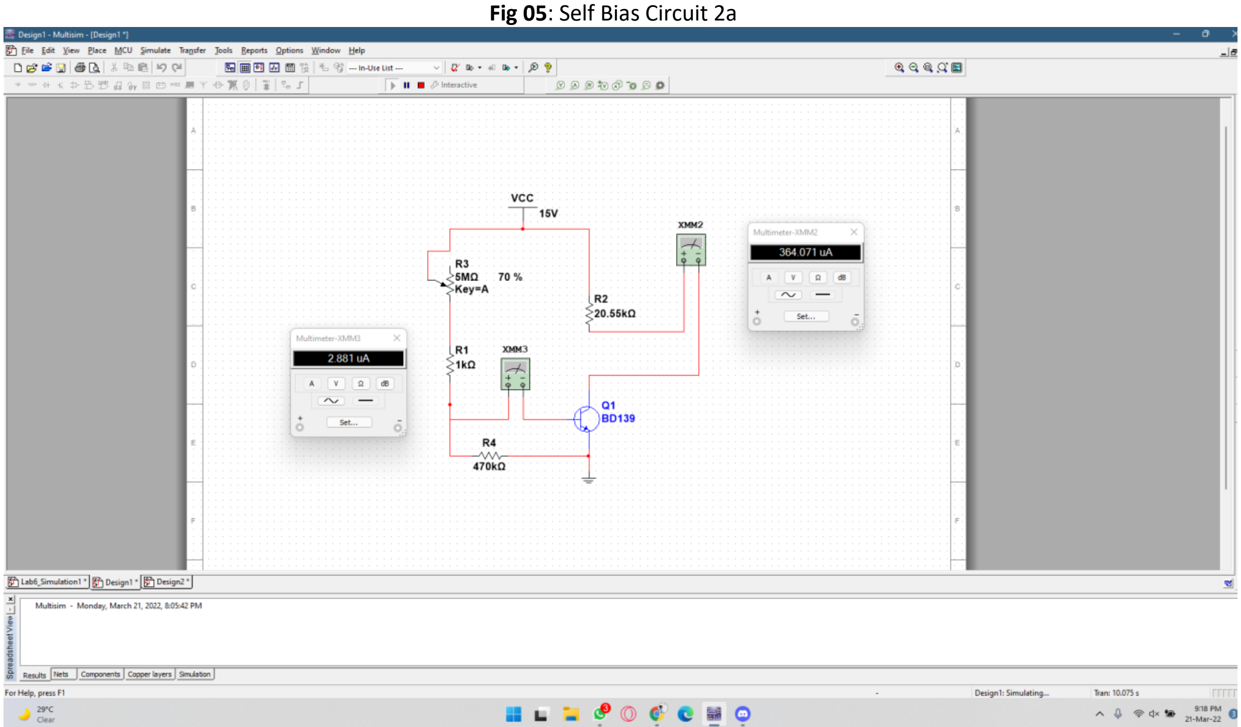

Fig 06: Self Bias Circuit 2a

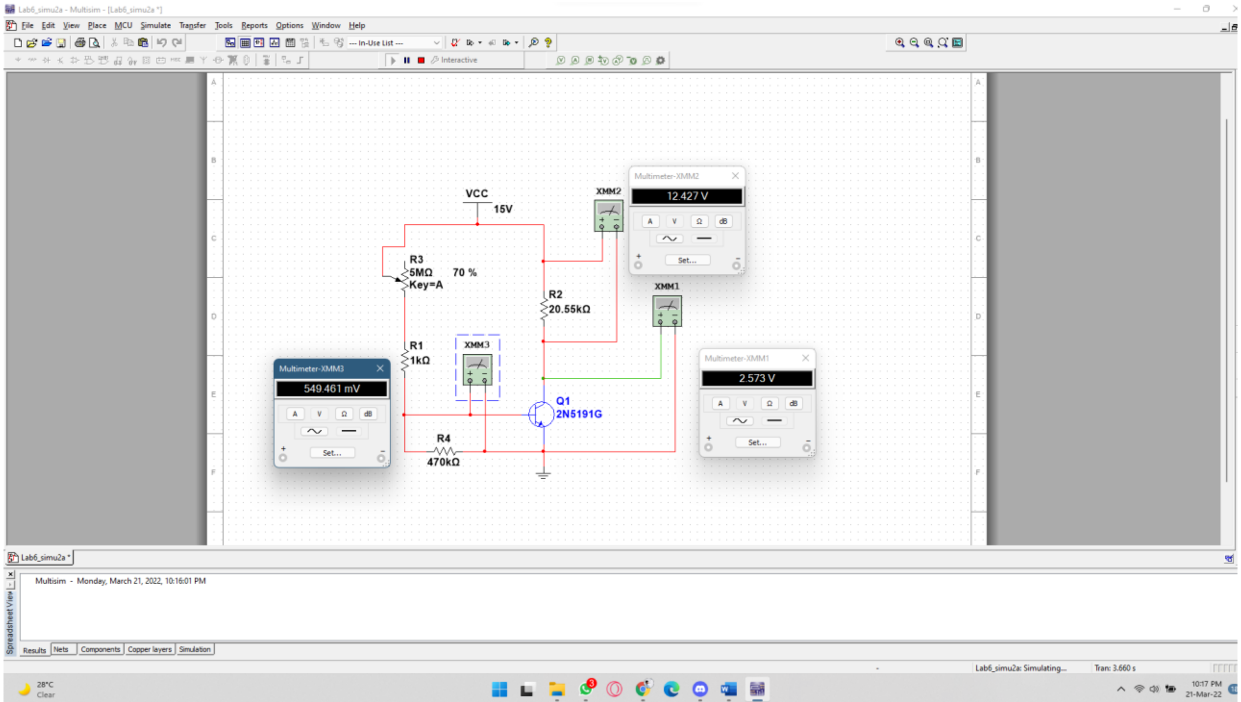

Fig 07: Self Bias Circuit 2b

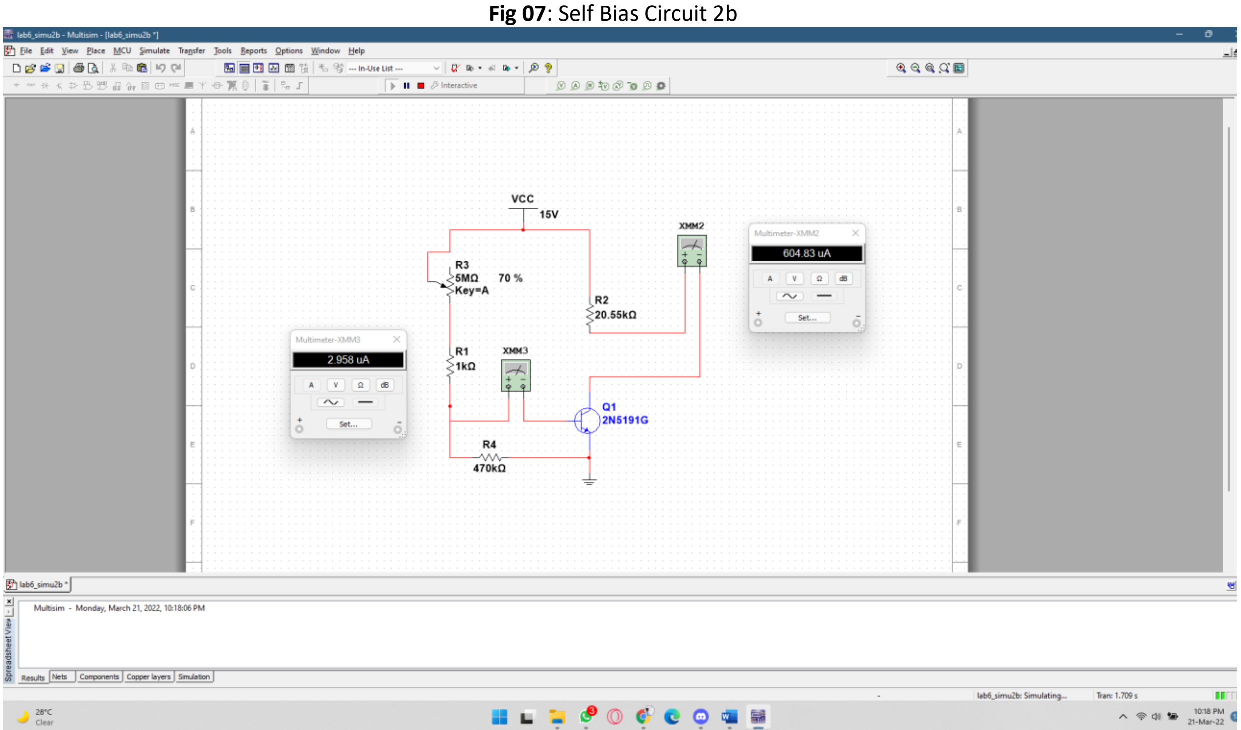

Fig 08: Self Bias Circuit 2b

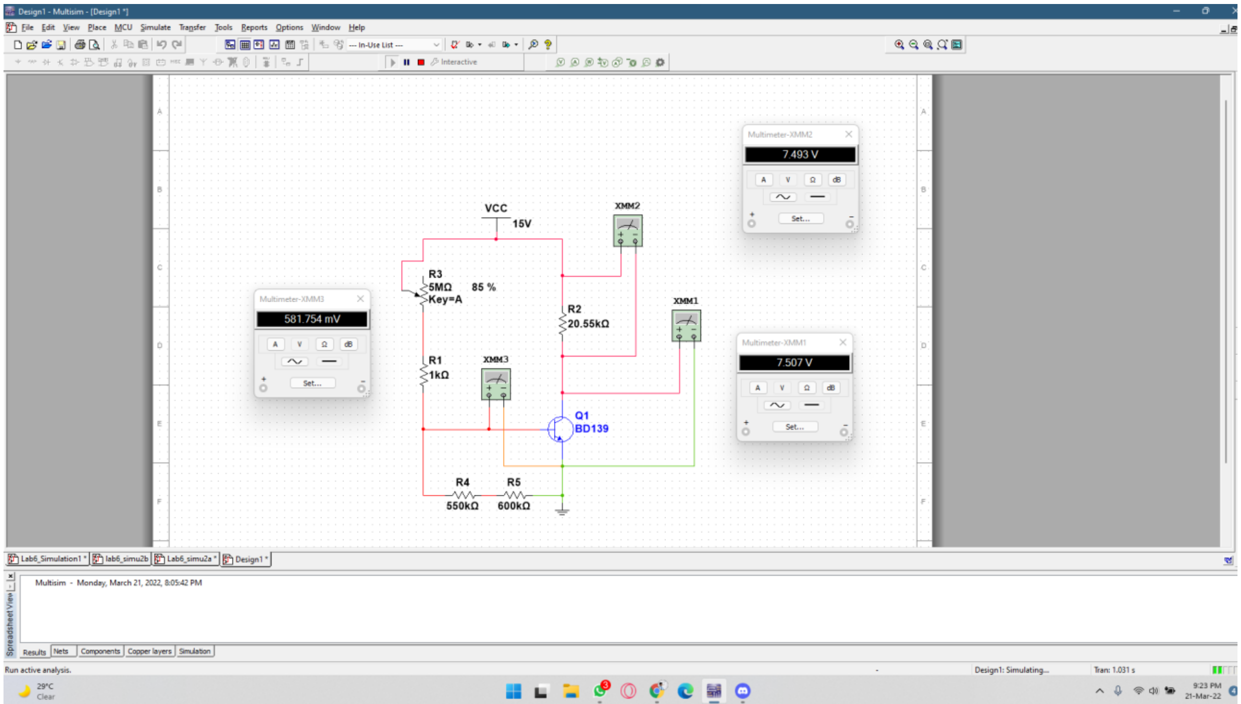

Fig 09: Self Bias Circuit 3a

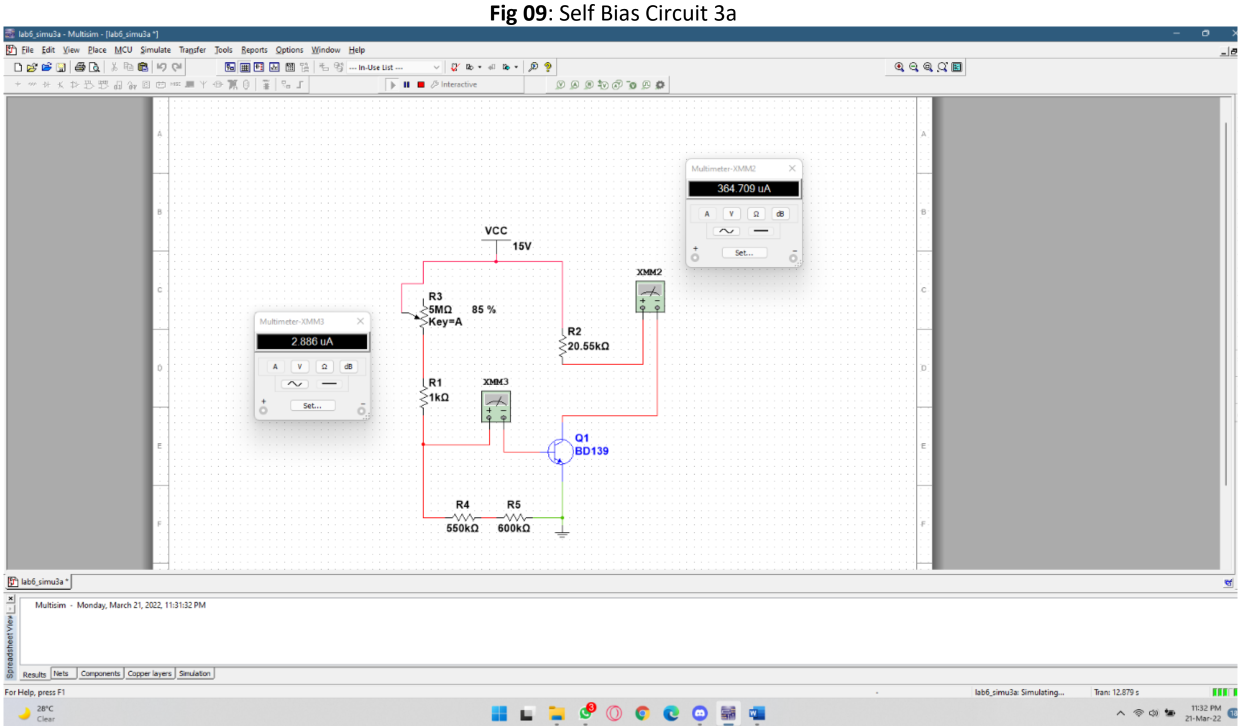

Fig 10: Self Bias Circuit 3a

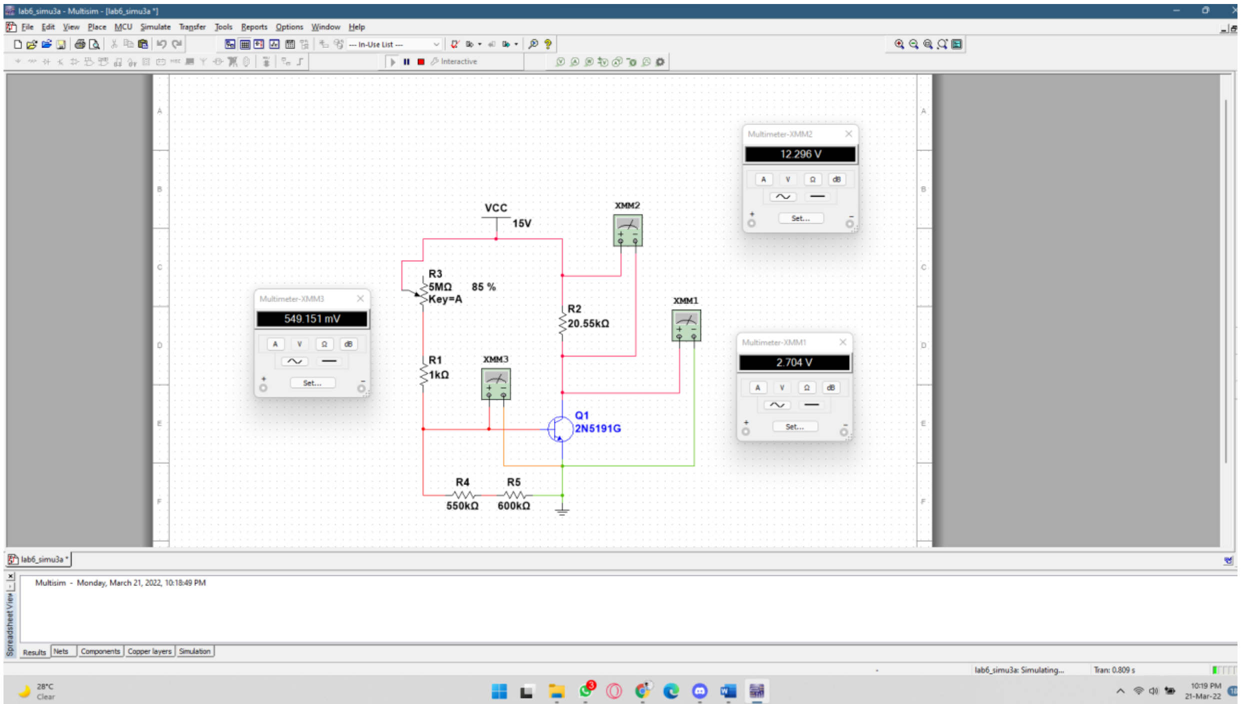

Fig 11: Self Bias Circuit 3b

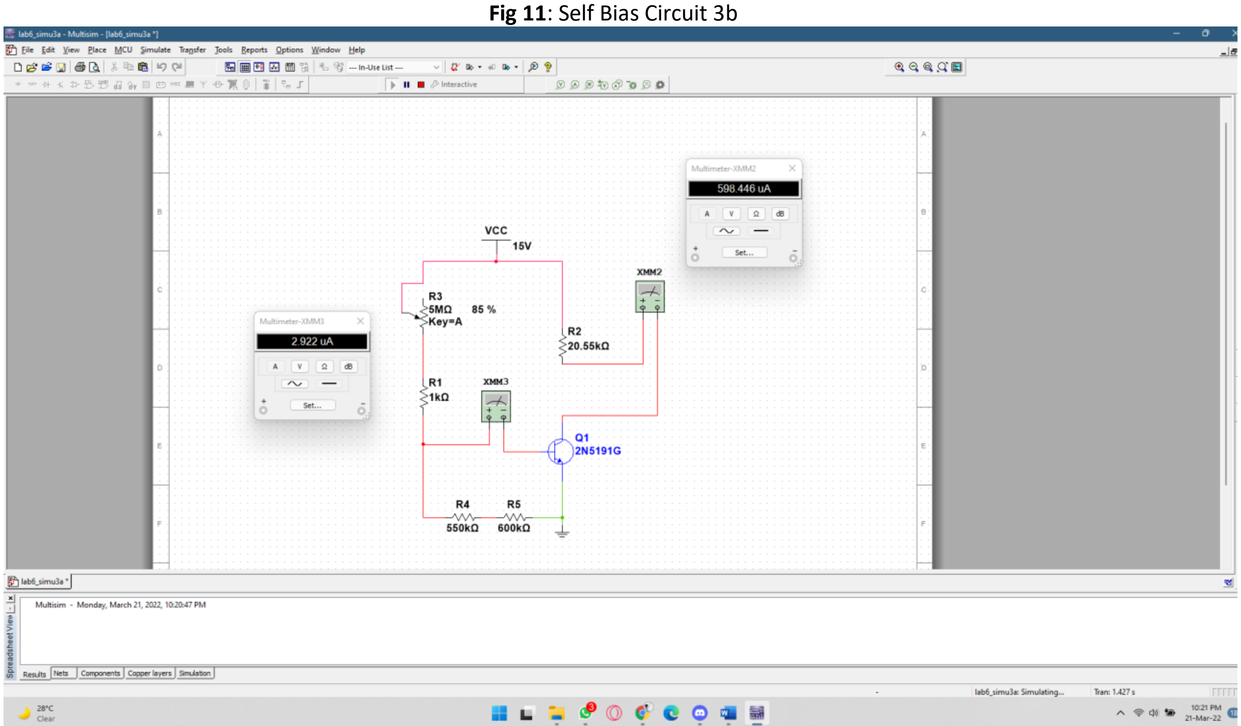

Fig 12: Self Bias Circuit 3b

Result analysis:

	β	V_{CE}	V_{BE}	V_{RC}	I_C	I_B
Fig. 1 (a)	1.04	7.5 v	0.67 v	7.45 v	1.8 mA	1.73 mA
Fig. 1 (b)	1.05	12.57 v	0.727 v	2.433 v	1.82 mA	1.73 mA
% Of Change	0.96%	67.6%	8.5%	206%	1.11%	0%
Fig. 2 (a)	1.04	7.5 v	0.658 v	3.43 v	1.81 mA	1.73 mA
Fig. 2 (b)	1.05	11.95 v	0.722 v	1.394 v	1.81 mA	1.72mA
% Of Change	0.96%	59.33%	9.72%	146%	0	0.58%
Fig. 3 (a)	127.006	7.5 v	0.581 v	7.493 v	0.364 mA	0.002866mA
Fig. 3 (b)	206.89	2.704 v	0.549 v	12.296 v	0.6 mA	0.0029mA
% Of Change	62.89%	177.36%	5.82%	64.1%	64.8%	1.186%

In this table we have taken Fig 1 and Fig 2 value from the lab and for Fig 3 we have taken the value from Simulation. After comparing the lab values with simulation values, we can see that the difference is minimal.

Conclusion:

As a result of this experiment, we had a thorough understanding of the BJT Biasing Circuit's operation and the working procedure. In order to determine the mode of operation of the BJT, as well as the voltages and currents at all nodes and branches, the dc analysis was carried out. The mathematical method was used to find the operating point of a transistor-based circuit. Our goal was to determine the most appropriate operating point for the situation. In the lab class, we constructed the circuits shown in figures 1 and 2, and we used Multisim to design all of the circuits. Both of the values were quite close to one other.