Summer 2023
EEE/ETE 111L
Analog Circuits-I Lab (Sec-11)
Faculty: Professor Dr. Monir Morshed (DMM)
Instructor: Rokeya Siddiqua

Lab Report 07: BJT biasing circuits.

Date of Performance: 29 September 2023 **Date of Submission:** 14 October 2023	**Group no.:** 05 1. **Mahmudul Hasan- 2011551043** 2. Sabrina Haque Tithi- 2031265642 3. Afrin Akter- 2112246642 4. Joy Kumar Ghosh – 2211424642 5. Sazid Hasan- 2211513642

Experiment no-07

Name of the Experiment:

The BJT Biasing circuits

Objective:

Study of the BJT biasing circuits

Theory:

Bipolar junction Transistor are semiconductors devices commonly used in electronic circuits for amplification and switching purposes. BJT biasing is a crucial aspect of designing BJT circuits to ensure proper transistor operation and desired circuit performance.

~~There are~~ Biasing is essential to establish a stable Q point in the active region of a BJT. The Q-point determines the DC operating point of the transistor and it is crucial for faithful reproduction of the input signal

Acheiving a stable Q-point is vital to ensure that the transistor responds linearly to small input signals. In the lab, we learned about the fixed bias circuit and self bias circuit. In the fixed bias circuit I_C is determined of the ~~base~~ resistance, $I_C = \frac{V_C}{R_C}$. The main drawback is its susceptibility to β variations leading to Q point instablity.

The self bias circuit overcomes the β sensitivity issue by incorporating a self-biasing resistor RE connected to the emitter terminal. In the lab, studying both fixed bias and self bias circuits provides valueable scenerio between stablity and simplicity. Self bias circuits, through more complex offer better stablity in acheiving a reliable Q point for faithful signal production.

List of equipments:

1. NPN Transistor – C828, BD 135 → 1 piece
2. Resistor – 470Ω, 560Ω 220Ω → 1 piece each
3. POT – 10 kΩ – 1 unit
4. Trainer board – 1 unit
5. DC power supply → 1 unit
6. Digital multimeter → 1 unit
7. Chords and wire → as required

Circuit Diagram:

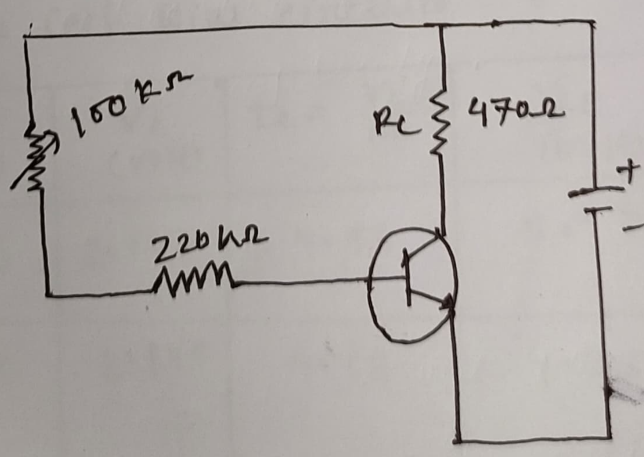


Figure 7.1: Circuit 1

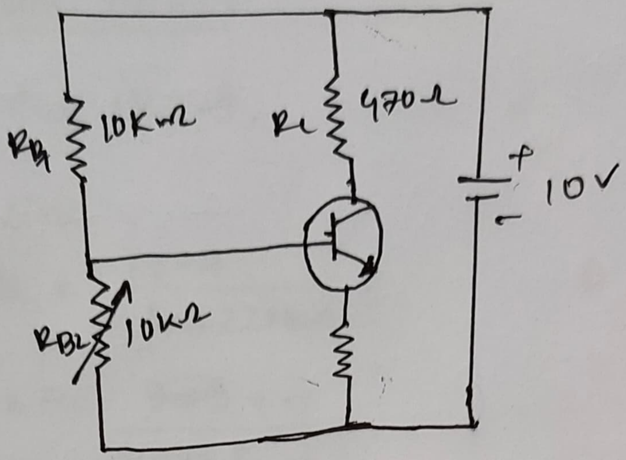


Figure: 7.2 : circuit 2

Data table:

Data for fixed bias circuit

Transistor	Rc (Ω)	Vc (Volt)	$I_C = \frac{V_C}{R_C}$ mA	V_{CE} (Volt)	Q-point
C828	460	4.96	10.78	5.01	(5.01, 10.78)
BD135	460	4.20	9.13	5.61	(5.61, 9.13)

Data for self Bias circuits

Transistor	Rc (Ω)	Vc (volt)	$I_C = \frac{V_C}{R_C}$	V_{CE} (volt)	Q-point
C828	460	2.107	4.58	5.00	(5.00, 4.58)
BD135	460	2.155	4.68	4.98	(4.98, 4.68)

Answer the ques: no-1:

From the CKT-1,

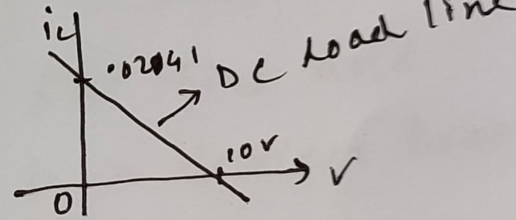
DC load line,

$$i_b = \frac{10-.7}{R_a + 220\,k\Omega}$$

$$i_b = \frac{9.3}{(220 + R_a)\,k\Omega}$$

$i_c = \beta i_b$ for active region

$$i_c = \frac{10 - V_{CE}}{470}$$



for $V_{CE} = 0$, $i_c = 0.241\,A$

The circuit is fixed bias circuit whose stablity is given by $S = 1 + \beta$

Stablity factor should be low for better performance, $S = 101$

Circuit-2 is called safe bias circuit.

Here, $R_B = R_{B1} \parallel R_{B2}$

$$S = \frac{(1+\beta)\left(\frac{R_B}{R_E} + 1\right)}{1 + \beta + \frac{R_B}{R_E}} = \frac{101\left(\frac{5000}{500} + 1\right)}{\left(101 + \frac{5000}{500}\right)}$$

$$= 9.122$$

So, circuit-2 shows better stablity.

2. Ans:

* Graph attached

Discussion: In this lab, we experienced the analysis of BJT biasing circuits. We have covered fixed bias and self bias and build up two circuits in a trainer board. In the lab, we used two transistor. For the ~~first~~ both circuit, we used C828 and for the ~~second~~ both ckt, we used BD135 transistors. We have used POT which was $R_B = 10k\Omega$. For the first ckt, we measured R_C and set R_B to maximum value and decreasing POT R_B gradually, so that $V_{CE} = V_{CC}/2$. For both circuit we have measured V_{CE} and I_C and recorded Q-point.

Shot by Legend T JOY

After finishing the recorded Q-point, we ~~have~~ got some error for fixed bias circuit. ~~How~~ then we build up the circuit again and measured the value of I_C an V_{CE} and found the Q-point.

Contribution:

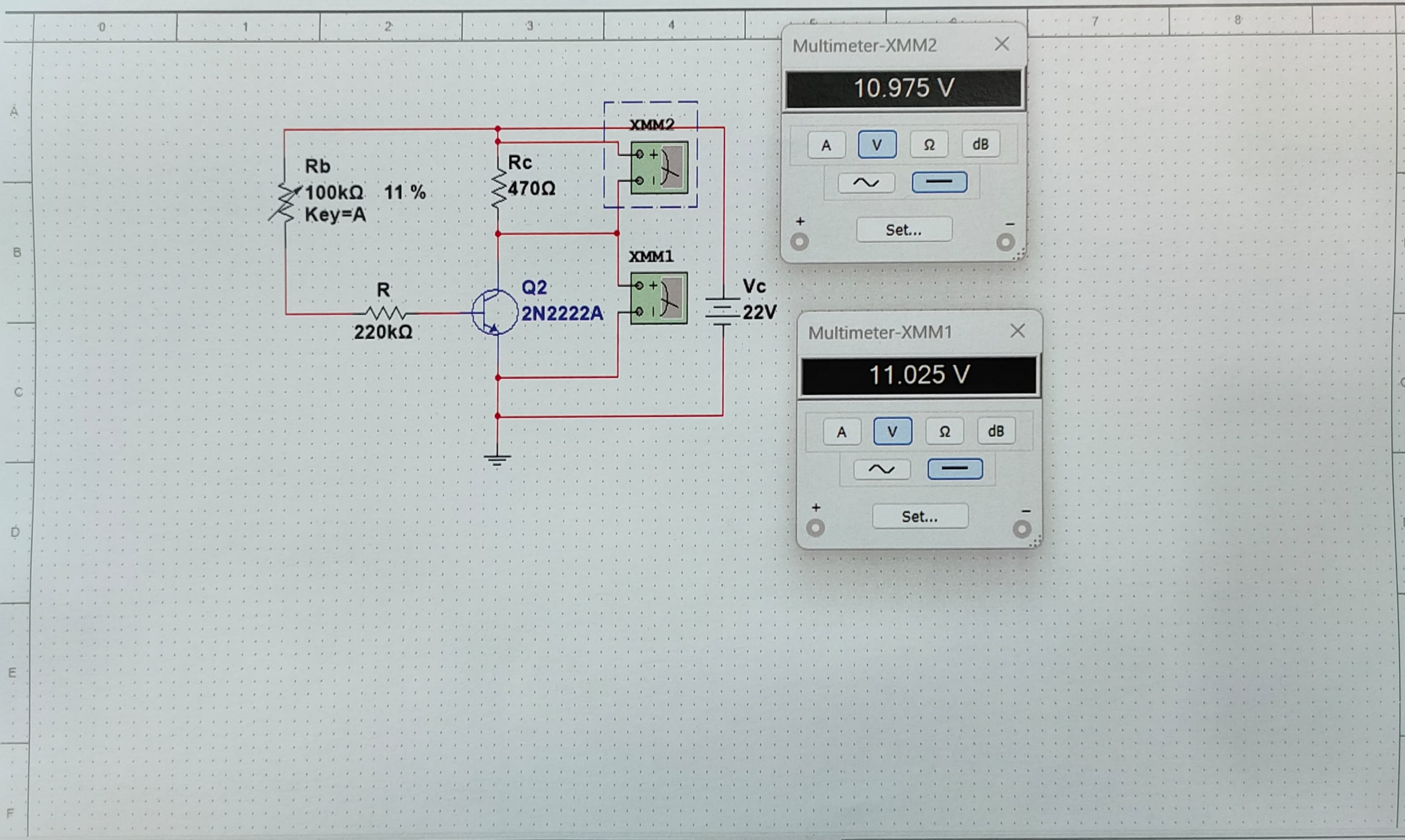
1. Mahmudul Hasan → Full report writing, help to build circuit-1
   Id-2011551043

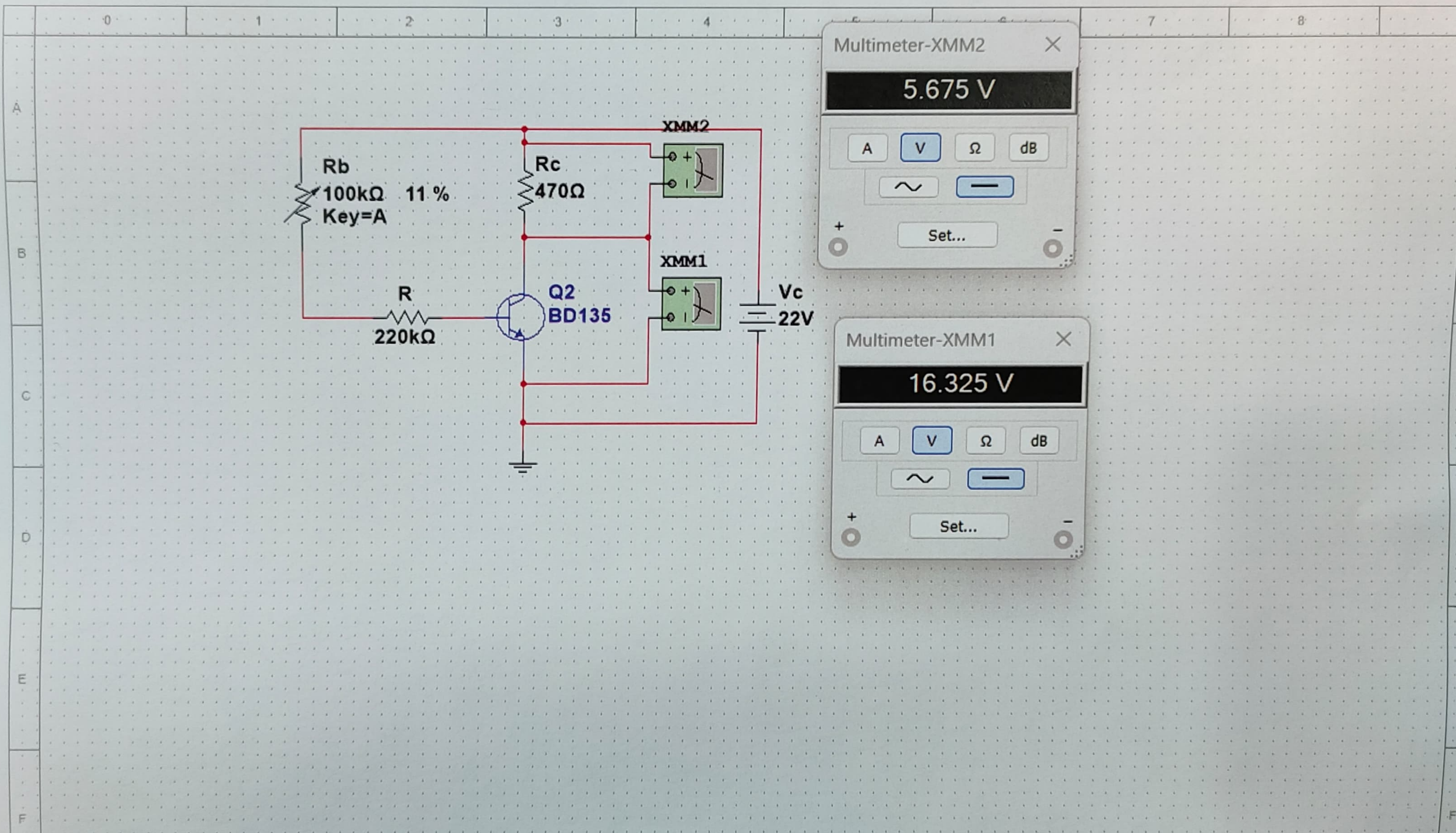
2. Sazid Hasan → ~~1st~~ circuit build and took measurements
   ID-2211513642

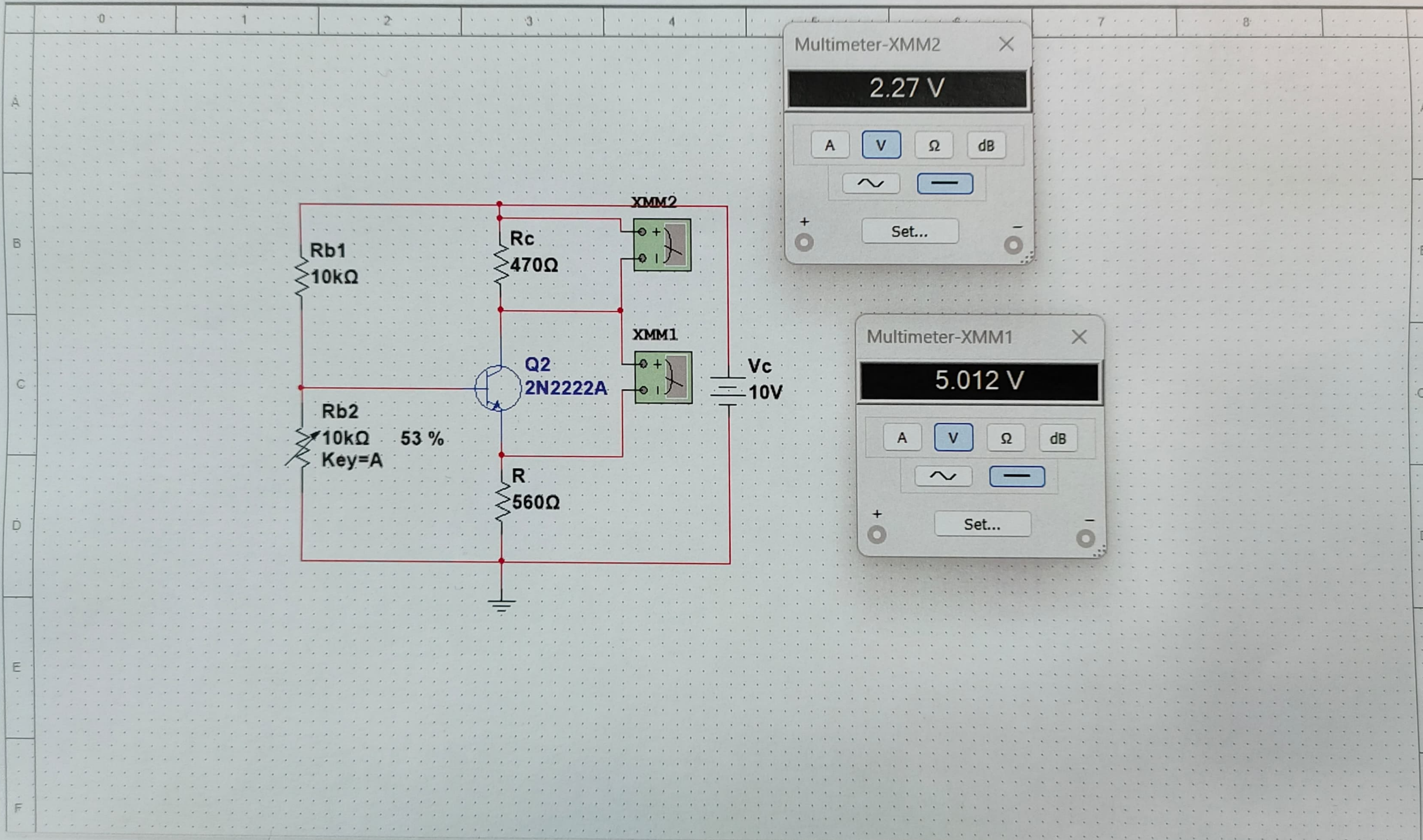
3. Sabrina Haque Tithi → operating DC power supply and POT
   ID-2031265642

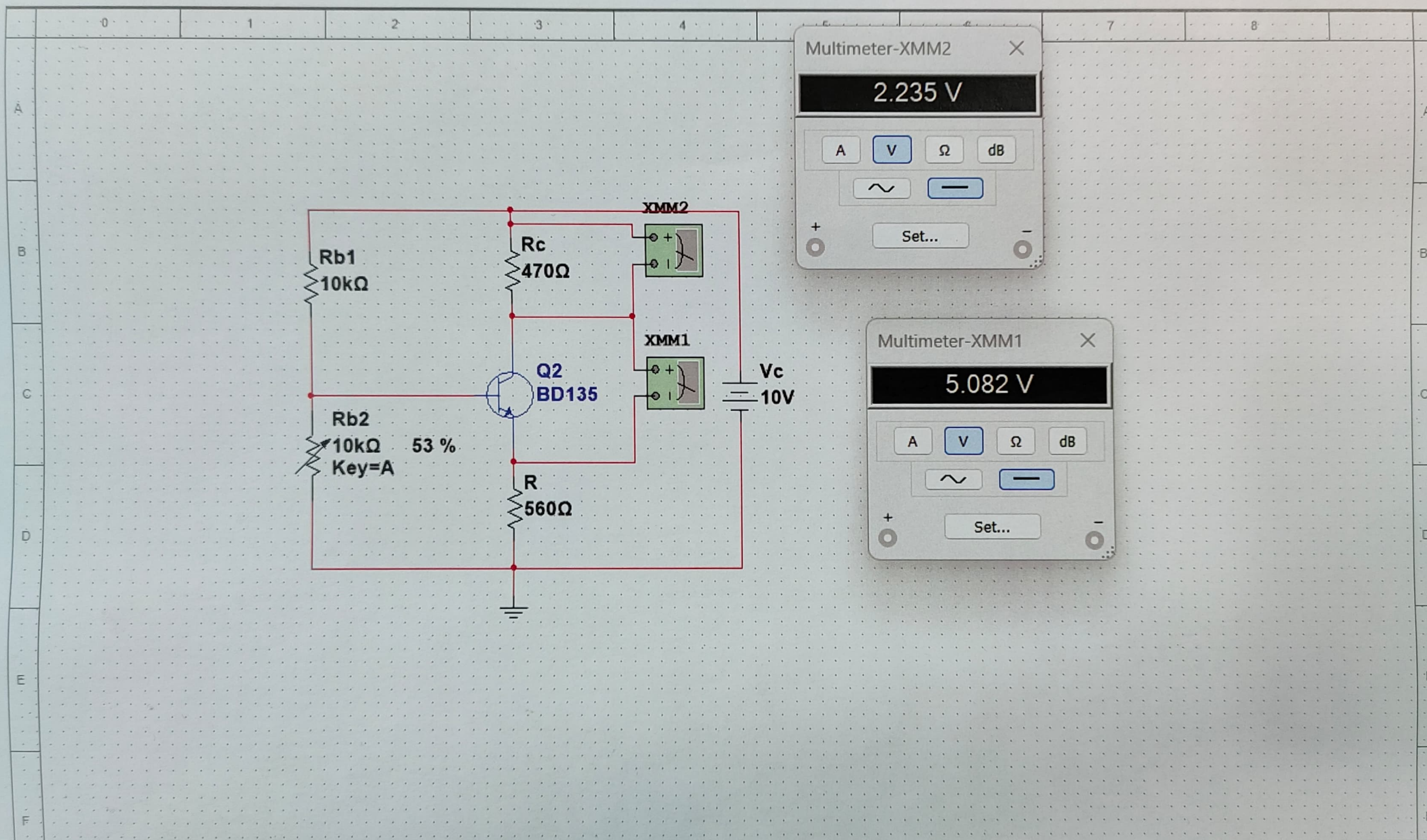
4. Joy Kumar Ghosh → Multisim, 2nd ckt build up and took measurement
   Id- ~~2112246642~~
   2211424642

5. Afrin Akter → Help to took measurement and report writing.
   Id-2112246642


Rb
100kΩ 11 %
Key=A
R
220kΩ
Rc
470Ω
Q2
2N2222A
XMM2
XMM1
Vc
22V
Multimeter-XMM2
10.975 V
A V Ω dB
Set...
Multimeter-XMM1
11.025 V
A V Ω dB
Set...


Rb
100kΩ 11 %
Key=A
R
220kΩ
Rc
470Ω
Q2
BD135
XMM2
XMM1
Vc
22V
Multimeter-XMM2
5.675 V
A
V
Ω
dB
Set...
Multimeter-XMM1
16.325 V
A
V
Ω
dB
Set...


Rb1
10kΩ
Rc
470Ω
XMM2
XMM1
Q2
2N2222A
Vc
10V
Rb2
10kΩ
53 %
Key=A
R
560Ω
Multimeter-XMM2
2.27 V
A
V
Ω
dB
Set...
Multimeter-XMM1
5.012 V
A
V
Ω
dB
Set...



Rb1
10kΩ
Rc
470Ω
XMM2
XMM1
Q2
BD135
Vc
10V
Rb2
10kΩ
53 %
Key=A
R
560Ω
Multimeter-XMM2
2.235 V
A
V
Ω
dB
Set...
Multimeter-XMM1
5.082 V
A
V
Ω
dB
Set...

NORTH SOUTH UNIVERSITY

DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Data Sheet:

Table 7.1 : Data for Fixed Bias Circuit. Rsiddiqua 30.09.23

Transistor	R_C (Ω)	V_C (volt)	$I_C = V_C / R_C$ m(Amp)	V_{CE} (volt)	Q-point
C828	460	4.96	10.78	5.01	(5.01, 10.78)
BD135	460	4.20	9.13	5.61.	(5.61, 9.13)

Table 7.2 : Data for Self Bias Circuit.

Transistor	R_C (Ω)	V_C (volt)	$I_C = V_C / R_C$ m(Amp)	V_{CE} (volt)	Q-point
C828	460	2.107	4.58	5.00	(5.00, 4.58)
BD135	460	2.155	4.68	4.98	(4.98, 4.68)

Report:

1. Which circuit shows better stability? Explain in the context of the results obtained in the laboratory.
2. Draw the DC load line for both the circuits and show the Q-point.