North South University

Department of Electrical & Computer Engineering

LAB REPORT

Course Code : EEE/ETE 312 L

Course Title: Power Electronics Lab

Course Instructor: RTK

Experiment Number: 04

Experiment Name: Study of the Power Thyristor (SCRs)

Date of Experiment: 24/11/2020

Date of Submission: 27/11/2020

Section: 01

Group Number: 01

Submitted By

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Score

Objective:

→ Demonstrate the use of the power thyristor for switching DC and AC.

→ Observe the signal waveforms in power thyristor circuit.

Theory:

The primary function of a thyristor is to control a circuit's power acting as a switch. Thyristor or SCR (silicon controlled rectifier) is a three terminal device. They are Anode, Cathode & Gate. Giving different input values into those terminals in different combination makes the device to perform as a switching device for the output for different situation.

In a circuit, thyristor acts as a closed switch only when anode voltage is greater than cathode & a current pulse flow from gate to cathode. However, there's another condition of holding current, which is the minimum value to turn the device ON.

The described above idea is for DC switching. For AC switching we need to use two power thyristor connected as an inversely parallel. Here, we need to use two thyristors because thyristors conducts only one

direction. Thus, one of them will conduct in each cycle of AC.

Required Equipments:

i) Power Supply Module.
ii) Power diode Module.
iii) Resistive Load.
iv) AC Voltmeter/Ammeter Module.
v) DC Voltmeter/Ammeter Module.
vi) Single Phase Wattmeter.
vii) Connecting Wires.

Circuit Diagram:

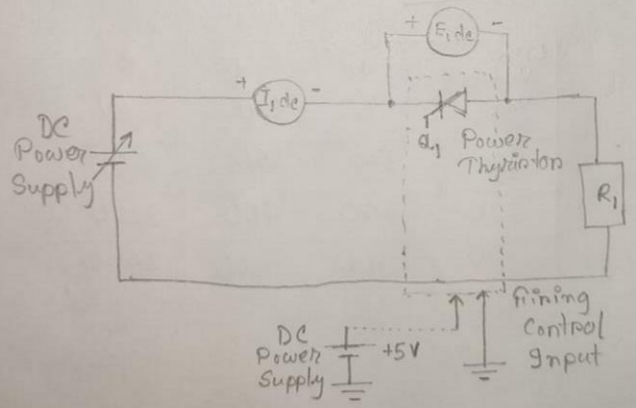


Figure: 1. Simple Thyristor Circuit

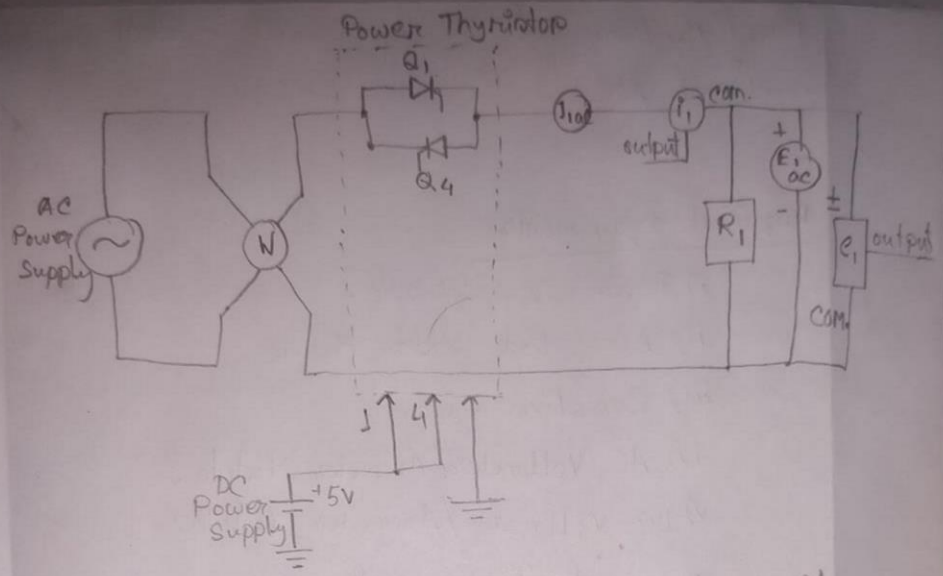


Figure 2: AC electronic contactor circuit.

Result & Discussion:

Line Voltage Vac	I_1 dc (mA)	E_1 dc (V)	R_1 (Ω)
120	500	150	600
220	300	300	2200
240	300	300	2400

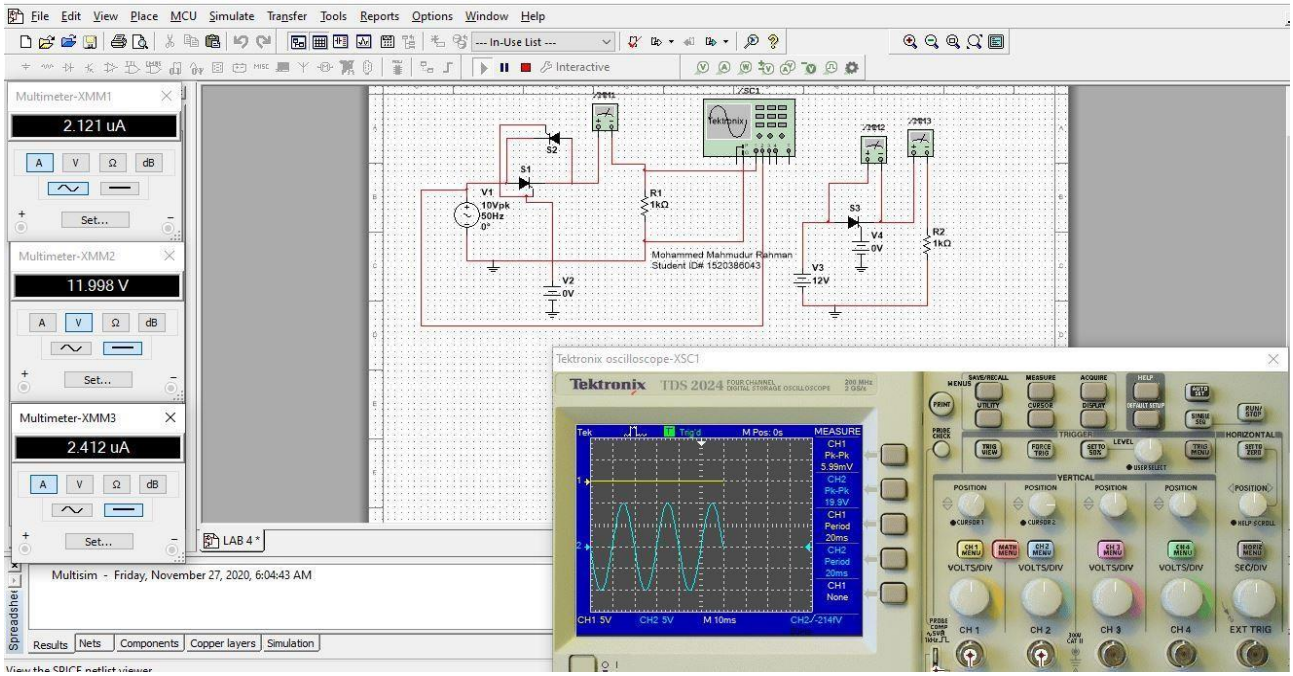
Line Voltage V_{ac}	I_{1ac} (A)	I_1 (A)	E_{1ac} (V)	e_1 (V)	R_1 (Ω)
120	2.5	10	250	300	60
220	1.5	5	250	600	220
240	1.5	5	250	600	240

Result Analysis & Discussion:

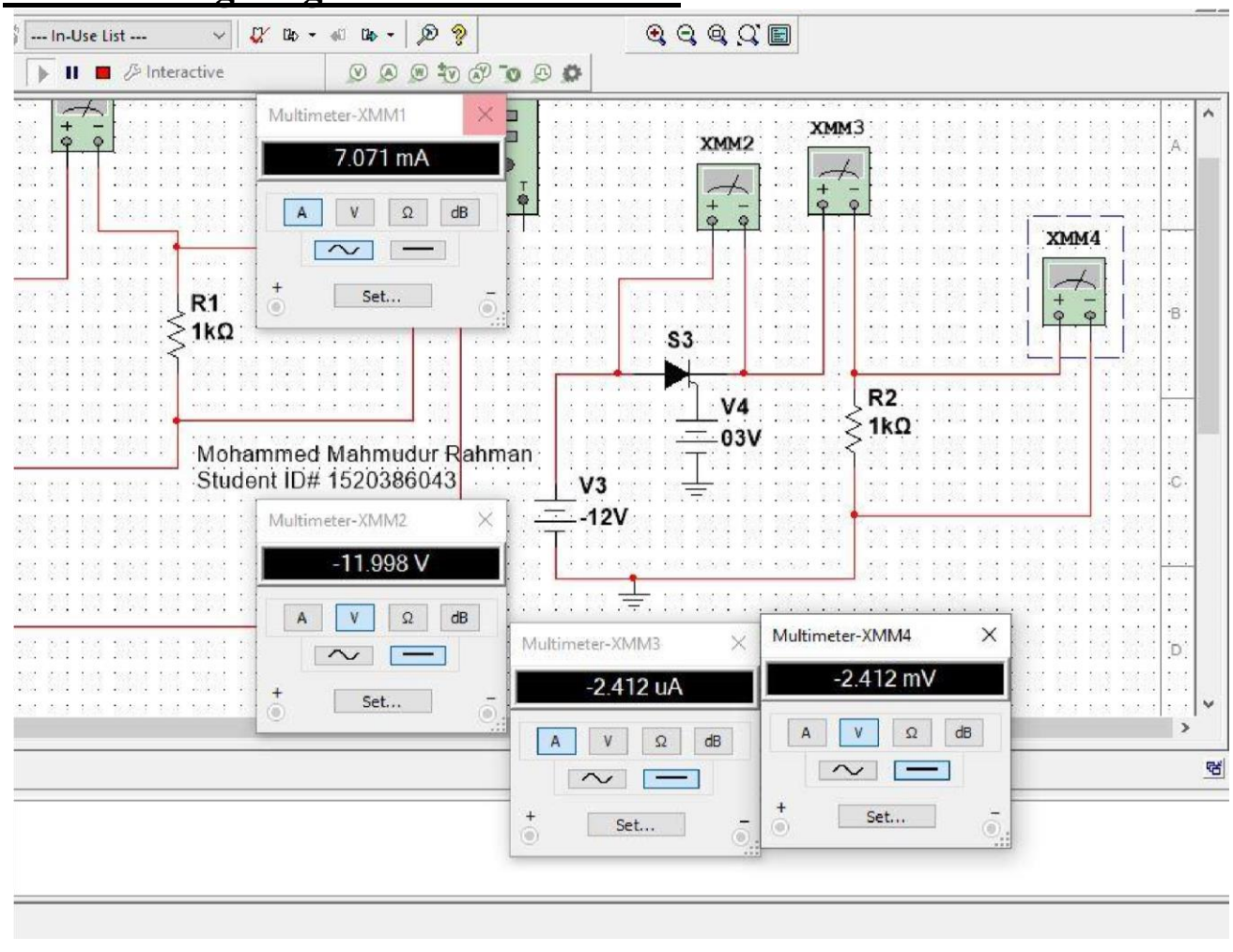
Due to the Pandemic we are attending lab class online & observing the theoretical knowledge through software simulation. In simulation, we built two circuits; one for AC switching & other one for DC. In both circuit, we observed different theoretical idea of a thyristor. For example when gate pulse is not applied or zero thyristor acts as an open circuit. In AC circuit, we observed if one of thyristor gets gate pulse then, only one phase of AC signal can conduct. In DC circuit, for Anode current < cathode current thyristor acts as an open circuit.

During simulation, I did not face any major difficulties. But, I had one confusion what if? Thus, this lab helps us to relate our theoretical knowledge with the practical one's.

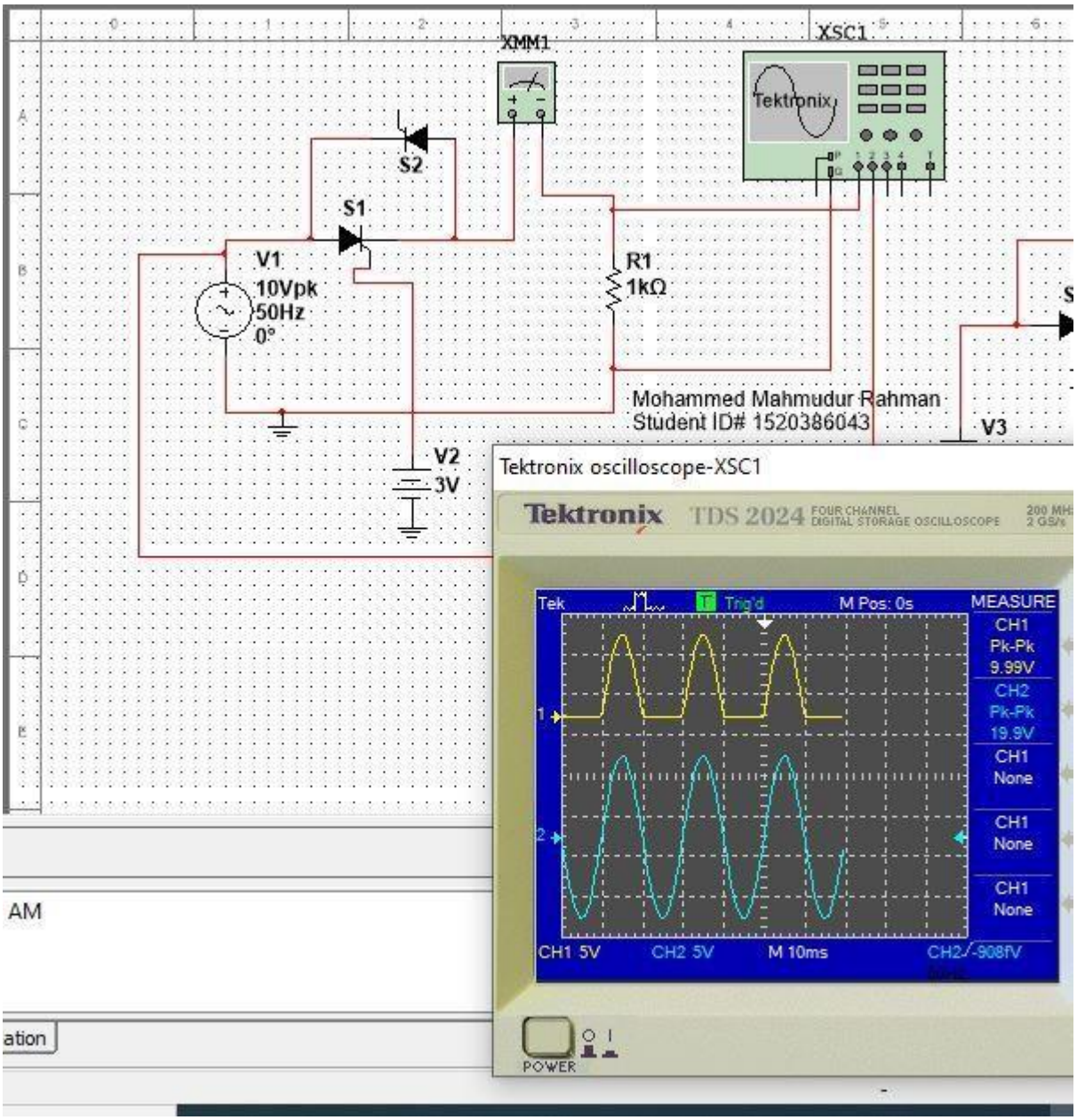
Gate voltage 0 in both circuit:



Source voltage negative for DC Circuit:



Gate pulse applied to one Thyristor:



Question – Answers:

Answer to question NO:1.

Major difference between a diode & thyristor is diode is two terminal device while thyristor is three terminal. In case of power handling ability thyristor performs better comparatively. Diode does not need external triggering while trans thyristor need that for circuit operation.

Answer to question NO:2.

Two conditions that required for the conduction of thyristor:

(a) Voltage applied at anode should be positive in comparison with cathode.

(b) A current pulse must flow through gate.

Answer to question NO:3.

Once a thyristor begins to conduct, to cease the conduction we need to withdraw the conducting charges to neutralize.

Answer to question NO:4

(a) The thyristor is off.

(b) The thyristor is ON.

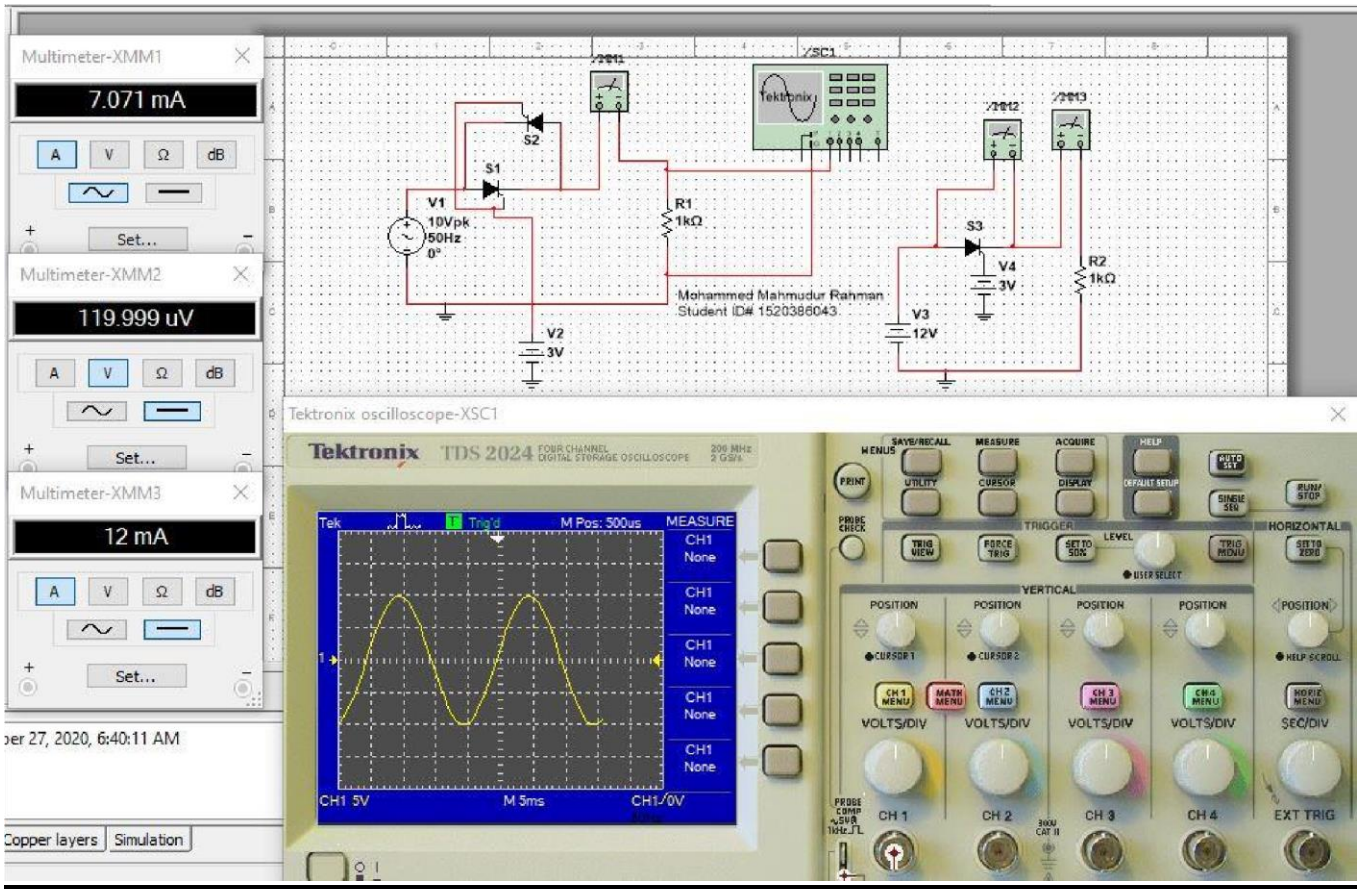
(c) The thyristor is on.

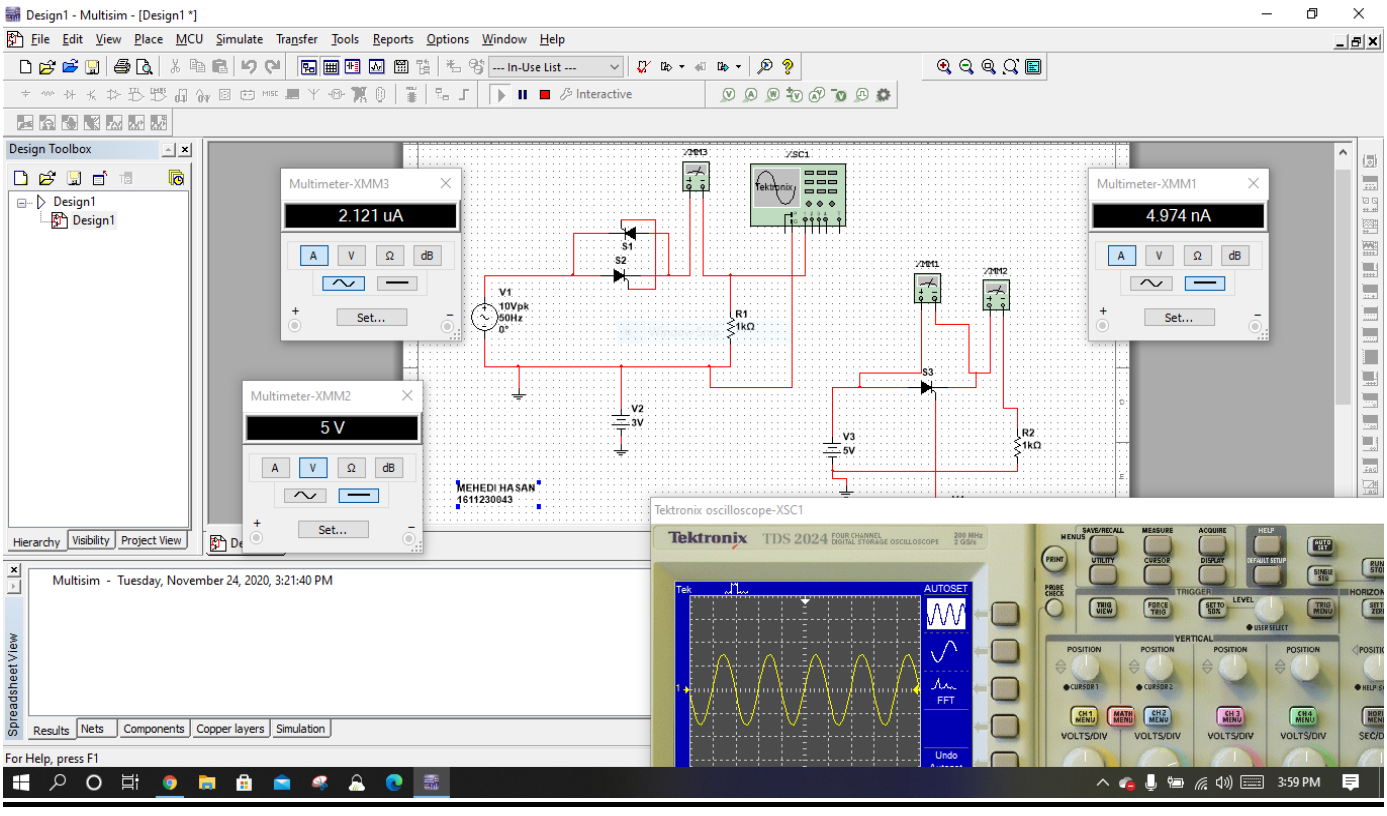
(d) The thyristor is ON.

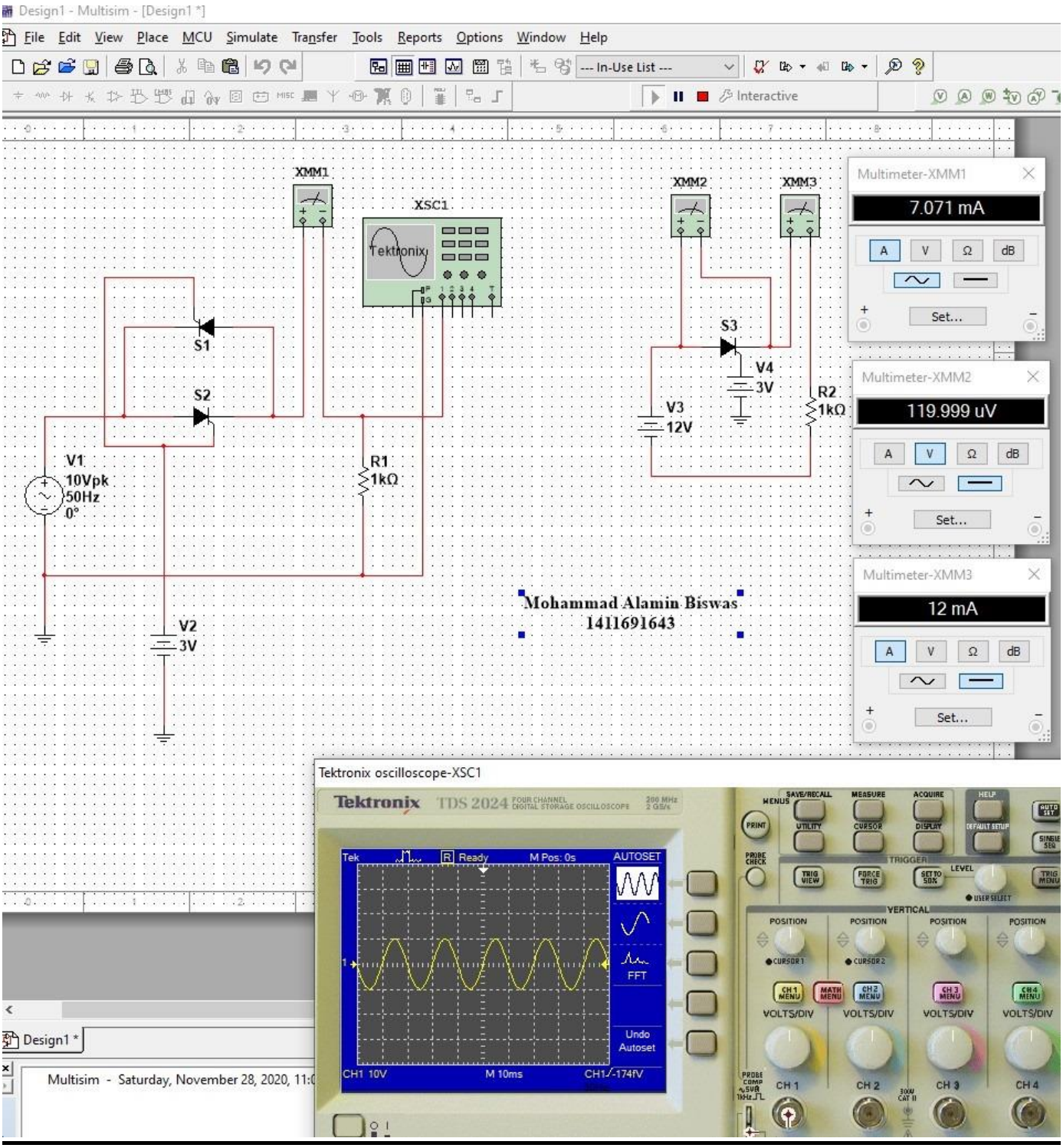
Answer to question NO:5.

AC source has both positive & negative cycle. And, thyristor can conduct in only one direction from positive anode to negative cathode. So, if 1 thyristor is connected across an ac source it will conduct once in a full cycle. Therefore, we use two thyristor so that, one of the each thyristors conducts in each cycle.

Attachments:






Design1 - Multisim - [Design1 *]
File Edit View Place MCU Simulate Transfer Tools Reports Options Window Help
--- In-Use List ---
Interactive
XMM1
XSC1
Tektronix
XMM2
XMM3
S1
S2
S3
V1
10Vpk
50Hz
0°
V2
3V
V3
12V
V4
3V
R1
1kΩ
R2
1kΩ
Multimeter-XMM1
7.071 mA
A V Ω dB
Set...
Multimeter-XMM2
119.999 uV
A V Ω dB
Set...
Multimeter-XMM3
12 mA
A V Ω dB
Set...
Mohammad Alamin Biswas
1411691643
Tektronix oscilloscope-XSC1
Tektronix TDS 2024 FOUR CHANNEL DIGITAL STORAGE OSCILLOSCOPE
Tek Ready M Pos: 0s
AUTOSET
FFT
Undo
Autoset
CH1 10V
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MENUS
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ACQUIRE
HELP
PRINT
UTILITY
CURSOR
DISPLAY
DEFAULT SETUP
PROBE CHECK
TRIGGER
TRIG VIEW
FORCE TRIG
SET TO 50%
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POSITION
CURSOR 1
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CH 1 MENU
MATH MENU
CH 2 MENU
CH 3 MENU
CH 4 MENU
VOLTS/DIV
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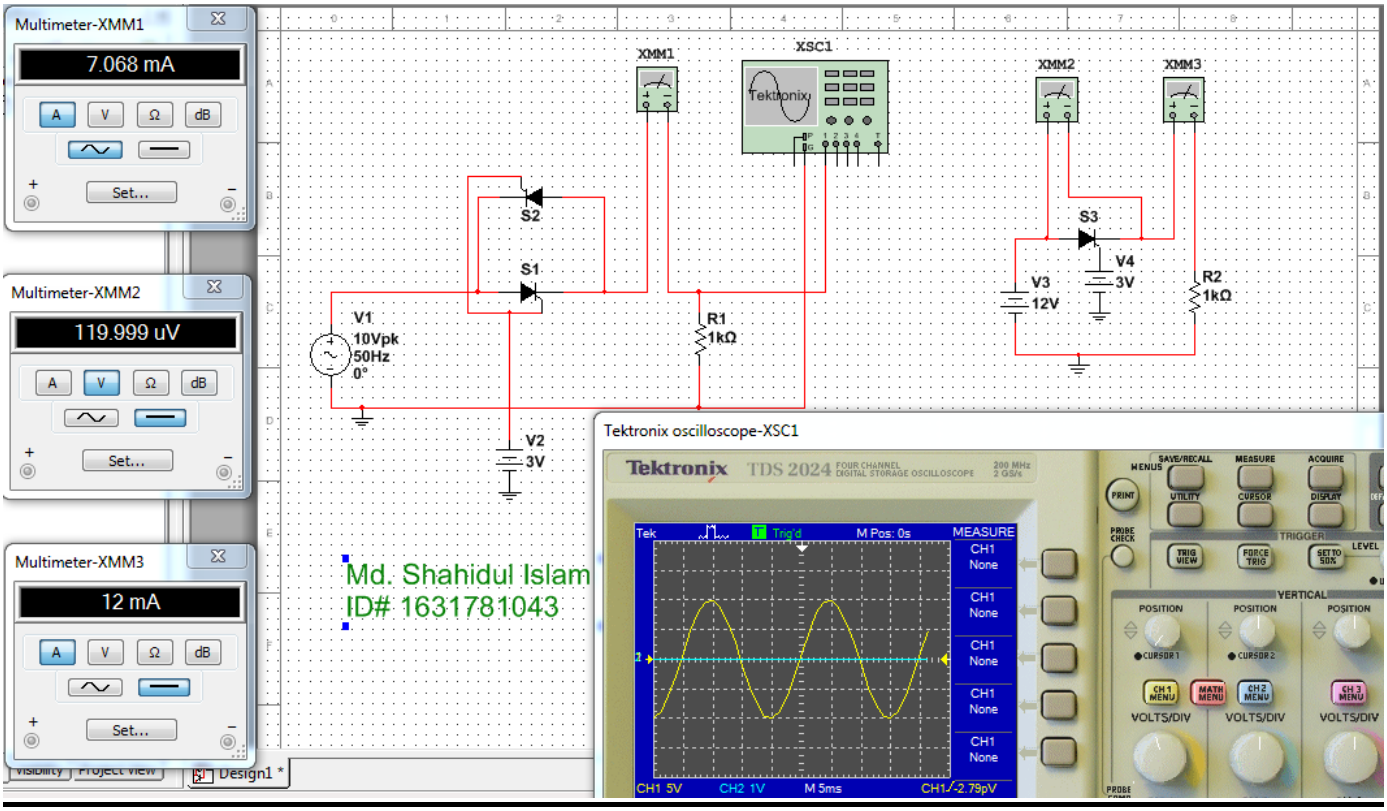
CH 4
Design1 *
Multisim - Saturday, November 28, 2020, 11:


Multimeter-XMM1
7.068 mA
A
V
Ω
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Set...
Multimeter-XMM2
119.999 uV
A
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Ω
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Multimeter-XMM3
12 mA
A
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Ω
dB
Set...
XMM1
XSC1
Tektronix
XMM2
XMM3
S1
S2
S3
V1
10Vpk
50Hz
0°
R1
1kΩ
V2
3V
V3
12V
V4
3V
R2
1kΩ
Md. Shahidul Islam
ID# 1631781043
Design1 *
Tektronix oscilloscope-XSC1
Tektronix
TDS 2024
FOUR CHANNEL
DIGITAL STORAGE OSCILLOSCOPE
200 MHz
2 GS/s
Tek
Trig'd
M Pos: 0s
MEASURE
CH1
None
CH1 5V
CH2 1V
M 5ms
CH1/-2.79pV
SAVE/RECALL
MENUS
MEASURE
ACQUIRE
PRINT
UTILITY
CURSOR
DISPLAY
PROBE CHECK
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FORCE TRIG
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CURSOR2
CH1 MENU
MATH MENU
CH2 MENU
CH3 MENU
VOLTS/DIV