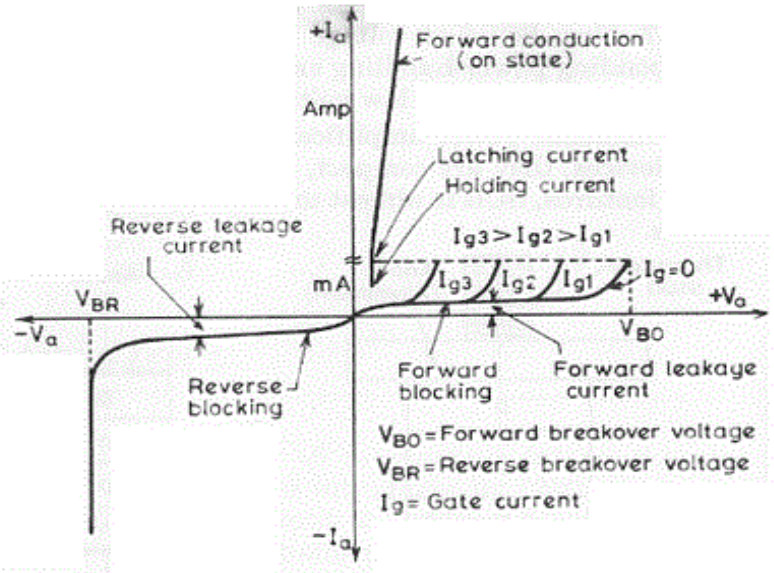
EXPERIMENT 13: SCR I-V CHARACTERISTICS

AIM: To plot the I-V characteristics of SCR

APPARATUS: D C Power Supply (0-128 V), (0-32V), Voltmeter (0-100V), SCR TYN604, Digital multimeter, Ammeters (0-100mA, 0-25mA, 0-1mA), Resistors 1K,10W & 1K,1W.

THEORY:

Thyristor Characteristics: - A thyristor is a four layer semiconductor device of PNPN structure with three PN junctions. It has three terminal anode, cathode and gate. When the anode voltage is made positive with respect to cathode, the junctions J1 and J3 are forward biased. The junctions J2 is reversed biased and, only a small leakage current flows from anode to cathode. The thyristor is then said to be in the **OFF mode**. If a Anode to Cathode voltage is increased to a sufficiently large value, the reversed biased junction J2 will break. This is known as avalanche breakdown and the corresponding voltage is called **forward breakdown voltage V_{BO}**. Since junctions J1 and J3 are already forward biased, there will be free movement of carriers across all three junctions, resulting in a large forward anode current. The device will then be in a **conducting state or on state**. The voltage drop would be due to the ohmic drop in the four layers and it is small, typically, 1V. In the on state, the anode current is limited by an external impedance or resistance.



V-I characteristics of thyristor.

Latching current is the minimum anode current required to maintain the thyristor in the on state immediately after the thyristor has been turned on and the gate signal has been removed. Once the thyristor is turned on, it behaves like a conducting diode and there is no control over the device. The device will continue to conduct because there is no depletion layer on the junction J2 due to the free movements of the carriers. However if the forward anode current is reduced below a level known as the holding current, a depletion layer will develop around the junction J2, due to reduced number of carriers and the thyristor will be in the blocking state. **Holding current** is the minimum anode current required to maintain the thyristor in the on state.

Holding current is less than latching current. A thyristor can be turned on by increasing the forward voltage V_{AK} beyond V_{BO}, but such a turn on could be destructive. In practice, the forward voltage is maintained below V_{BO} and the thyristor is turned on by applying a positive voltage between its gate and cathode. Once a thyristor is turned on by a gating signal and its anode current is greater than holding current, the device continues to conduct due to positive feedback, even if the gating signal is removed.

PROCEDURE:

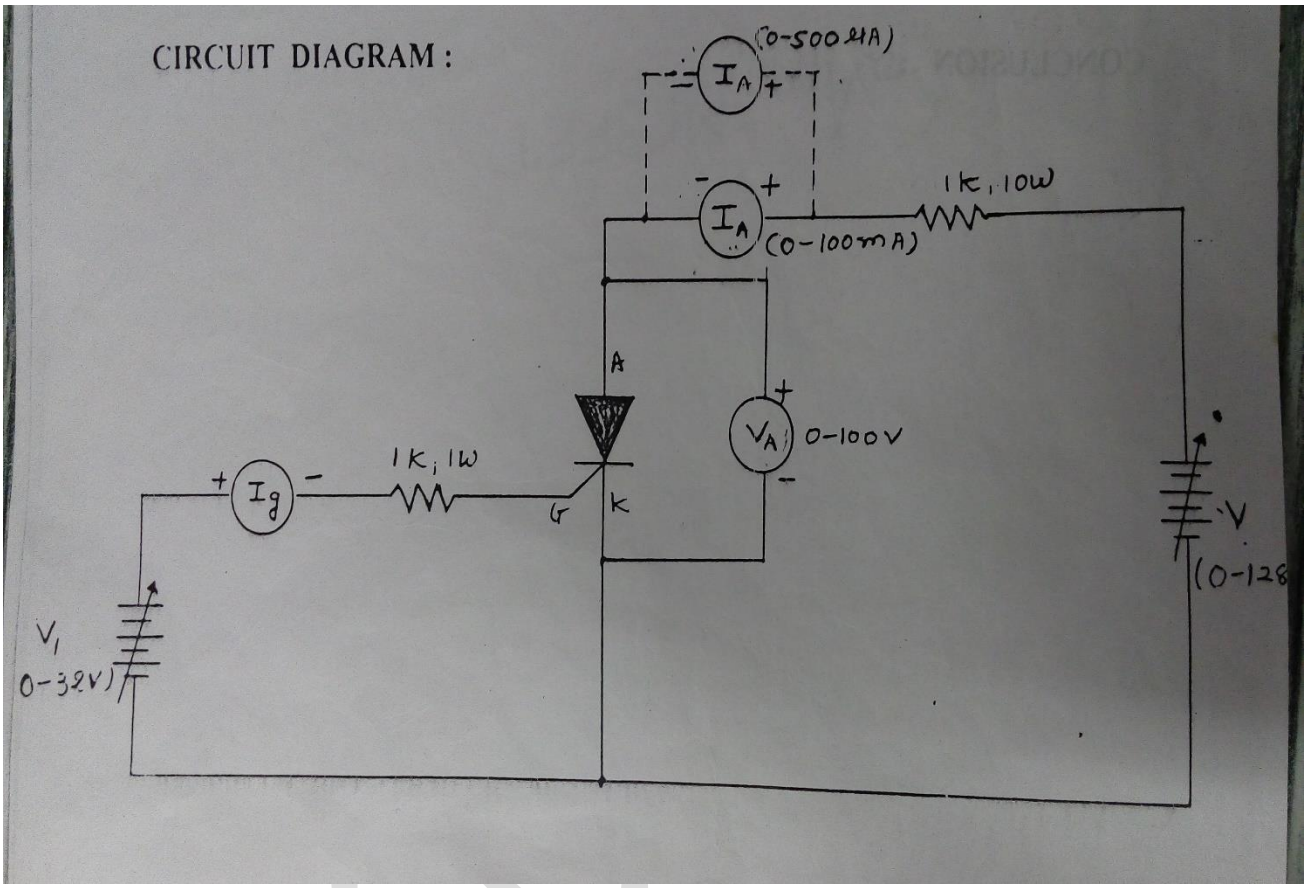
A. Forward Blocking State / OFF state

1) Connect the circuit as shown in the figure.
2) Keep SCR gate open.
3) Vary the voltage between anode & cathode by changing supply V_2.
4) To find the leakage current, keep gate open and increase voltage V_2 to firing value. A small magnitude of current will flow through the device which is called leakage current. (I_L).
5) Note down the voltage & current and find out the drop across SCR.

B. **Forward Conducting State / ON State**

6) Connect the gate of the SCR to supply V_1.
7) Adjust gate current by changing V_1 and find out the firing voltage of SCR.
8) Switch off the V_1 supply. Increase V_2 slowly, note down I_A. Now reduce the voltage between anode & cathode by changing V_2. Note down the holding current (I_H) at which SCR turns off.
9) Repeat the step 6 to 8 for different values of Ig.
10) Plot the graph.

CIRCUIT DIAGRAM :



OBSERVATION TABLE:

A. Forward Blocking State / OFF state:

Supply Voltage	Ig=0	
V_2 (V)	V_A(V)	I_A (μA)
0		
5		
10		
.		
.		
60		

B. Forward Conducting State / ON State:

Supply Voltage	Ig= _____ mA	
V_2 (V)	V_A(V)	I_A (mA)
60		
65		
70		
.		
.		
90		

Gate Triggering Voltage = ___ volts
Gate Triggering current = ___ mA
Latching Current = _____ mA
Holding Current = _____ mA

SCR Ratings : Get the info from SCR TYN604 Datasheet

CONCLUSION:

APPLICATIONS: