SCR

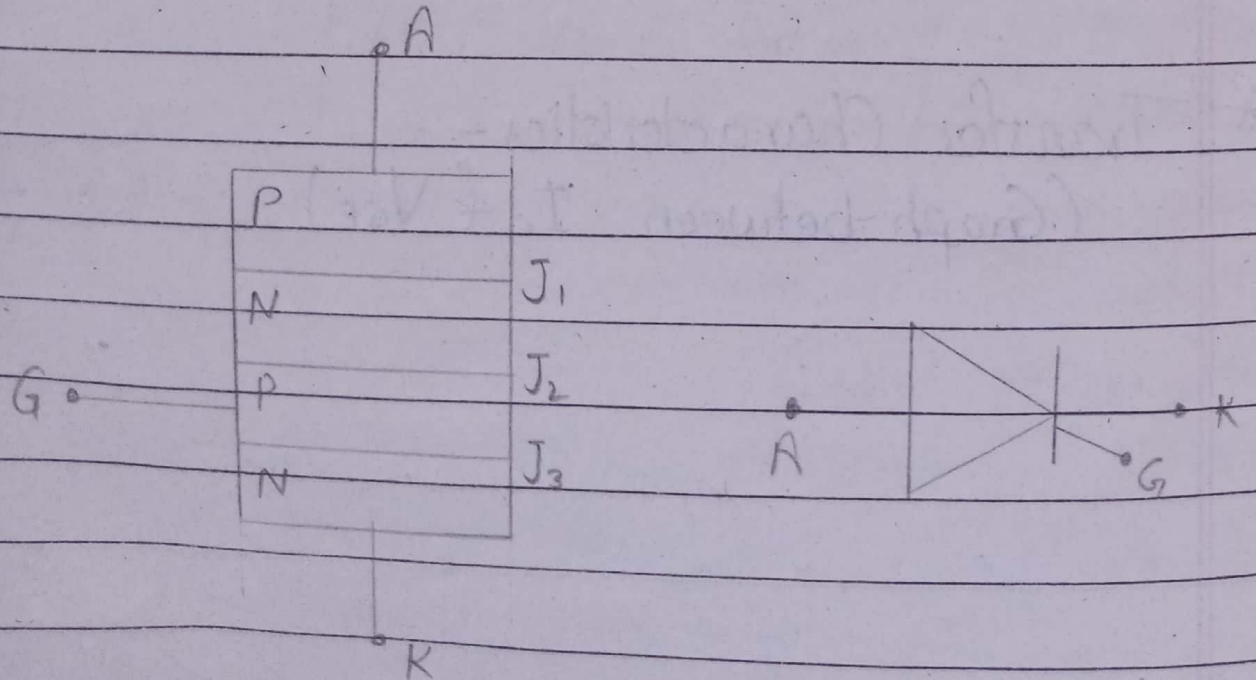
(Silicon Controlled Rectifier)

SCR is an unidirectional device that allows the current in one direction & opposes in another direction. It can handle several thousands of voltages & currents.

Construction –

The SCR is a four layer, three terminals device. The four layer is PNPN having three junctions J_1, J_2 & J_3.

The outer (P & N layer) are heavily doped & the inner P & N layers are lightly doped. The outer P-layer is called anode(A), the outer N-layer is called cathode(K) & the inner P-layer is called gate(G).



Forward Conduction Mode -

In this mode, SCR comes into conduction mode from blocking mode. It can be done in two ways as either by applying +ve pulse to gate terminal or by increasing the forward voltage beyond the breakover voltage of SCR.

(a) If the voltage between anode & cathode is further increasing, a stage comes when the depletion layer at J_2 vanishes. The R.B. junction J_2 will breakdown due to the large voltage gradient across its depletion layer. This phenomenon is called avalanche breakdown.

Once the avalanche breakdown occurs at junction J_2, the SCR acts as closed switch and turns into conduction mode.

(b) If the gate current value is very high, the minimum will be the time to come in conduction mode. If the gate current is increasing, the voltage required to turn on the SCR is less.

- The current at which the SCR turns into conduction mode from blocking mode is called latching current (I_L).
- The current at which the SCR returns to blocking mode from conduction mode is called holding current (I_H).

Reverse Blocking Mode -

In this mode, cathode is more positive than anode, then the junctions J_1 & J_3 are in R.B. & the junction J_2 is in F.B. A small amount of leakage current flows because of drift of the charges.

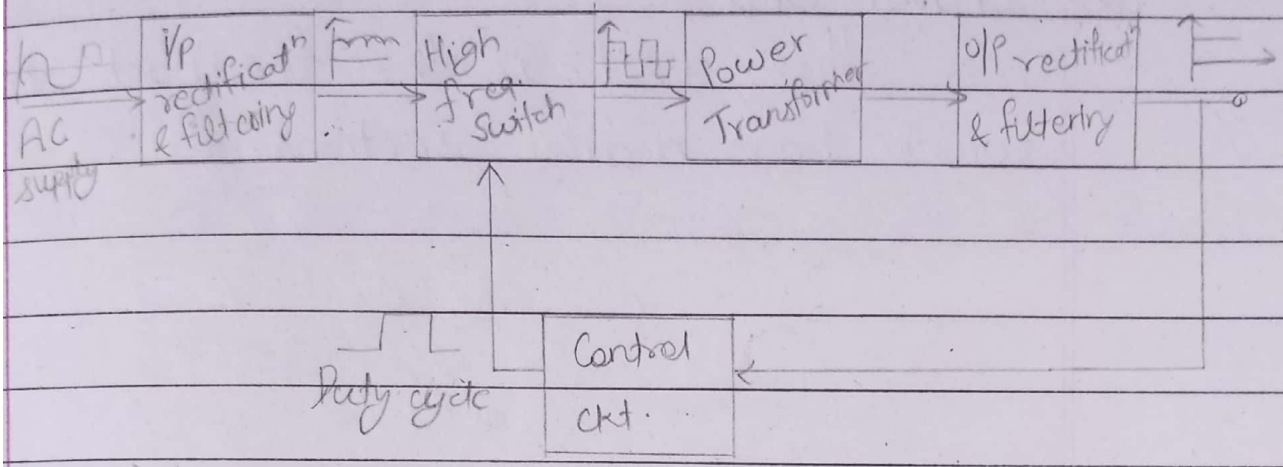
Again, this leakage current is insufficient to make the device conduct. Therefore, the SCR acts as an open switch. This is known as off-state of SCR or reverse blocking state.

Application of SCR -

(i) High power controlling devices
(ii) Power regulators
(iii) Motor control
(iv) Rectifier
(v) Switch.

Switched Mode Power Supply (SMPS)

The disadvantages of LPS such as lower efficiency, large value of capacitors to reduce ripples & heavy and costly transformers etc. are overcome by the implementation of SMPS.



Input Stage -

The AC i/p signal (50Hz) is given to the rectifier & filter ckt. without using transformers. This o/p has many variations & the capacitance value of the capacitor should be higher. This unregulated DC is given to central switching section.

Switching Section -

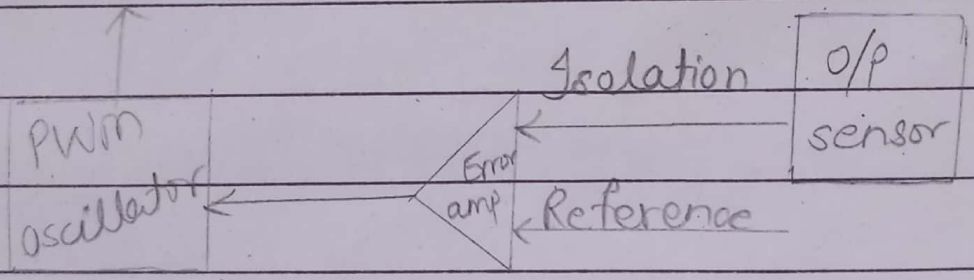
A fast switching device (Transistor or MOSFET) is employed in this section which switches ON & OFF according to variations & o/p is given to the primary of transformer present in this section. Here, the power conversion ratio is high.

(iii) Output Stage -

The o/p signal from the switching section is again rectified & filtered to get the required DC voltage. This is a regulated o/p voltage which is then given to the control unit.

(iv) Control Unit -

This unit is the feedback circuit which has many sections.



The o/p sensor senses the o/p signal. The signal is isolated from other sections, so that any sudden spikes should not affect the circuitry. A reference voltage is given as one i/p to the error amplifier which is a comparator.

Applications -

(i) Motherbaard of computers.
(ii) Mobile chargers.
(iii) Battery chargers.
(iv) HVDC measurements.
(v) Laptops
(vi) Space stations
(vii) Motor vehicles.