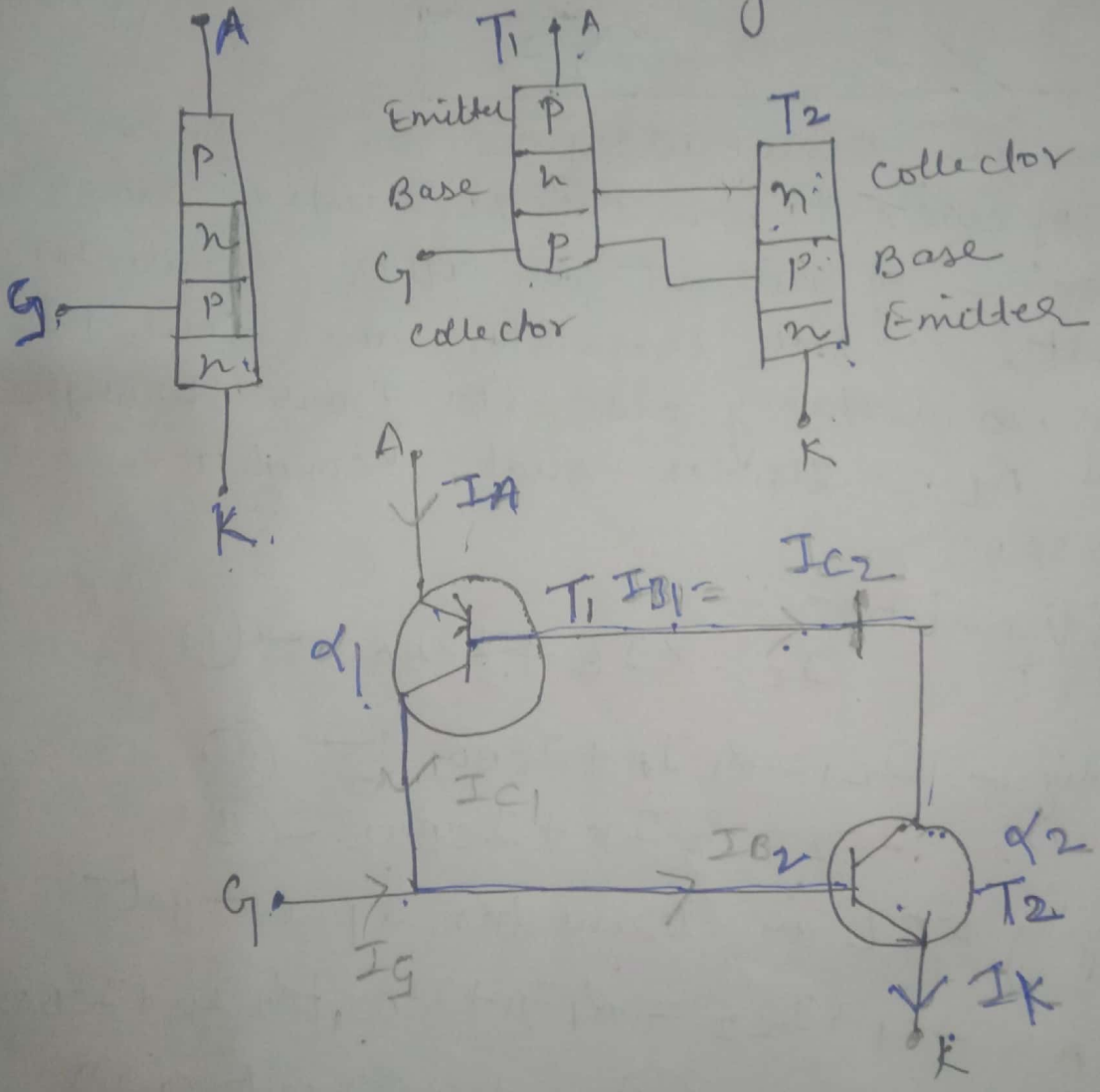
IEC

Lec-2

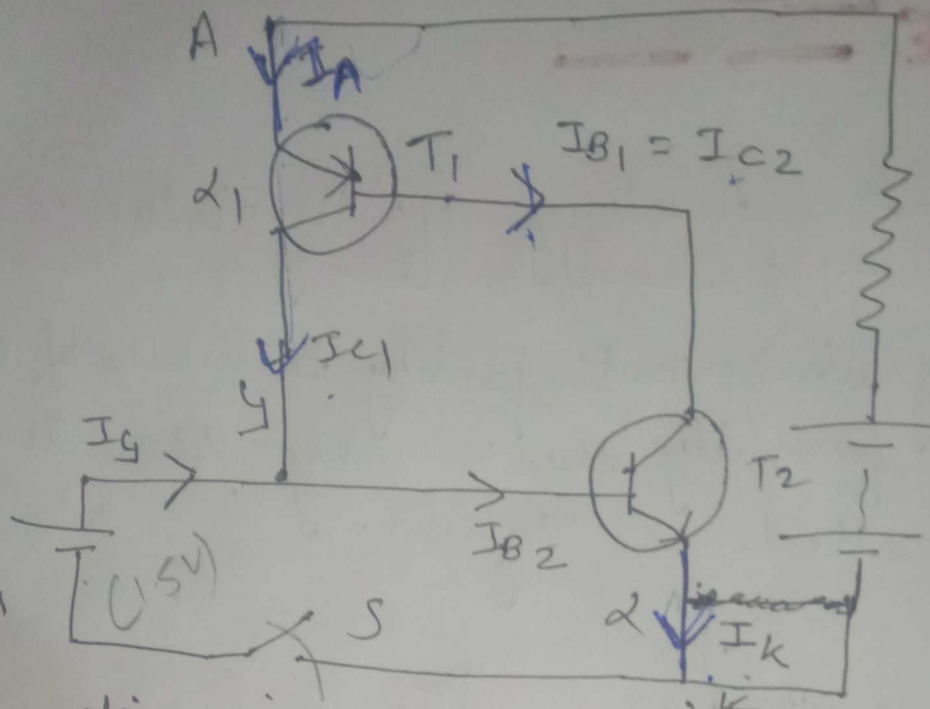
Two Transistor Analogy of Thyristor :-

SCR is very important family member of a Thyristor family that is why sometimes SCR is called as Thyristor.



NOTE :- It is clear that collector of each transistor is coupled to the base of the other, there by making a positive feedback loop.

(Regenerative or Latching)



$I_G \neq 0$

$I_A = I_{C1} + I_{B1}$
$= I_{C1} + I_{C2}$

This action is accumulative since an increase of current in one transistor causes an increase of current in other transistor. As a result, both transistor are drive to saturation, and heavy current flows through the load R_L. Under such conditions SCR closes.

For any transistor:

$$I_C = \alpha I_E + I_{CBO} \quad -(1)$$

From CK dig:- $I_{C1} = \alpha_1 I_A + I_{CBO1}$ — (2)

$I_{C2} = \alpha_2 I_K + I_{CBO2}$ — (3)

Now applying KCL in transistor Q1 we get

$$I_A = I_{C1} + I_{C2} = \alpha_1 I_A + I_{CBO1} + \alpha_2 I_K + I_{CBO2} \quad (4)$$

Now, $I_K = I_A + I_G$ — (5) put eq (5) into eq (4)

$$I_A = \frac{\alpha_2 I_G + I_{CBO1} + I_{CBO2}}{1 - (\alpha_1 + \alpha_2)}$$

Anode current

SCR TURN ON METHOD

① - By rising temperature [Thermal Triggering]

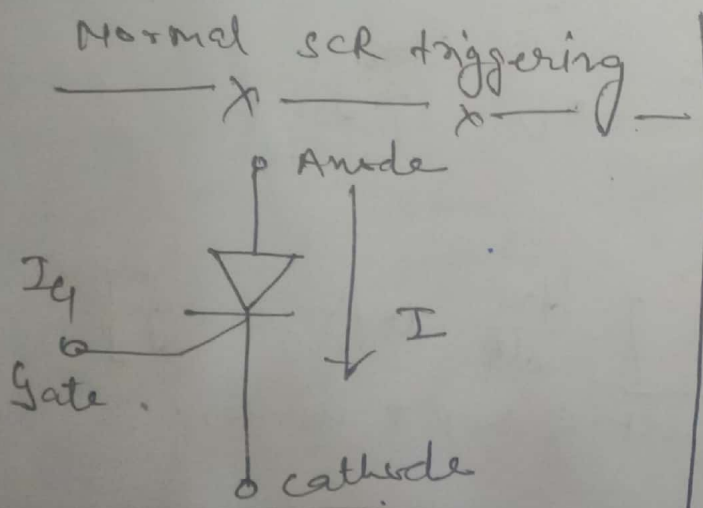
$$I_A = \frac{\alpha I_G + I_{CBO_1} + I_{CBO_2}}{[1 - (\alpha_1 + \alpha_2)]}$$

As we ↑ temperature $(\alpha_1 + \alpha_2) \to 1$, I_A current will increase and SCR will trigger.

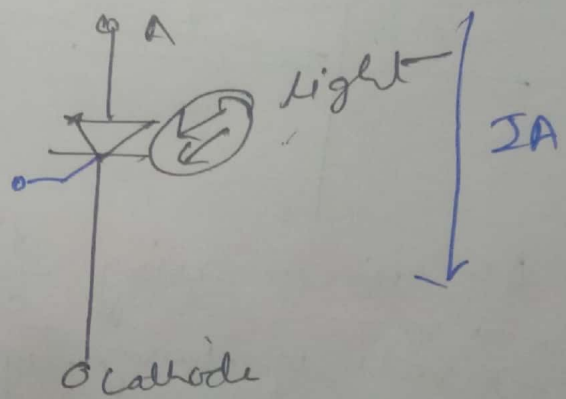
② By light triggering Method :- [Optical triggering]

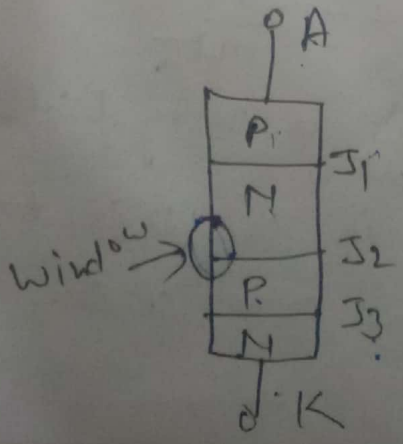
We discuss here about [LA SCR] Light Activated SCR.

Normal SCR triggering



LASCR

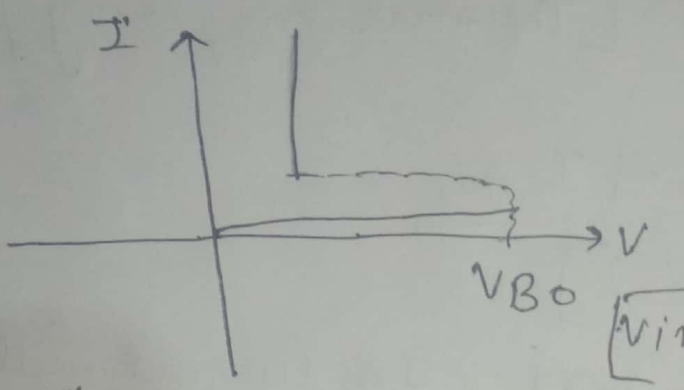




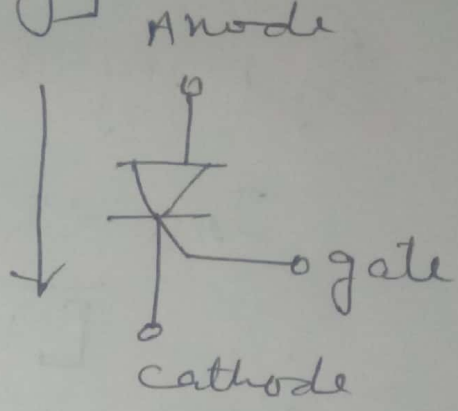
due to light coming from window at J_2 the EHPs are generated and J_2 junction diminishes, current starts flowing from Anode to Cathode

(3) By high voltage :-

[Forward voltage triggering]

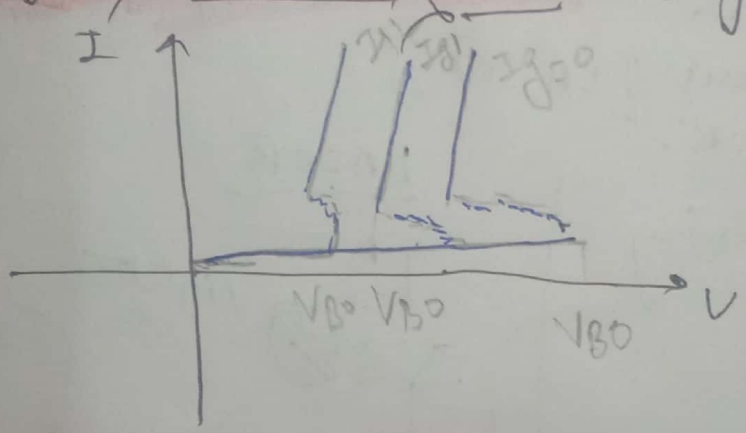


$V_{in} > V_{BO}$



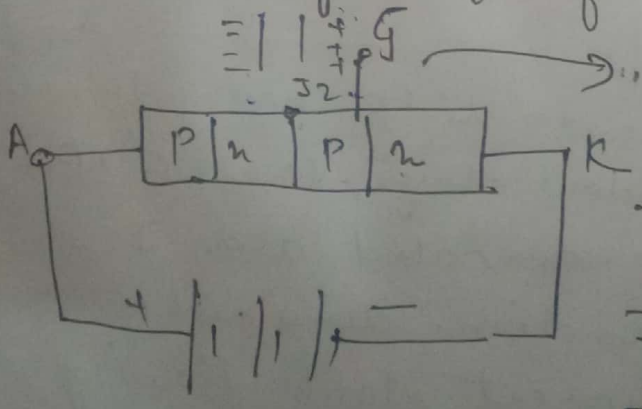
Where V_{BO} – Forward Break over voltage.

(4) By Gate Current :- [gate triggering]



(5) By increasing $\frac{dV}{dt}$ [$\frac{dV}{dt}$ triggering]

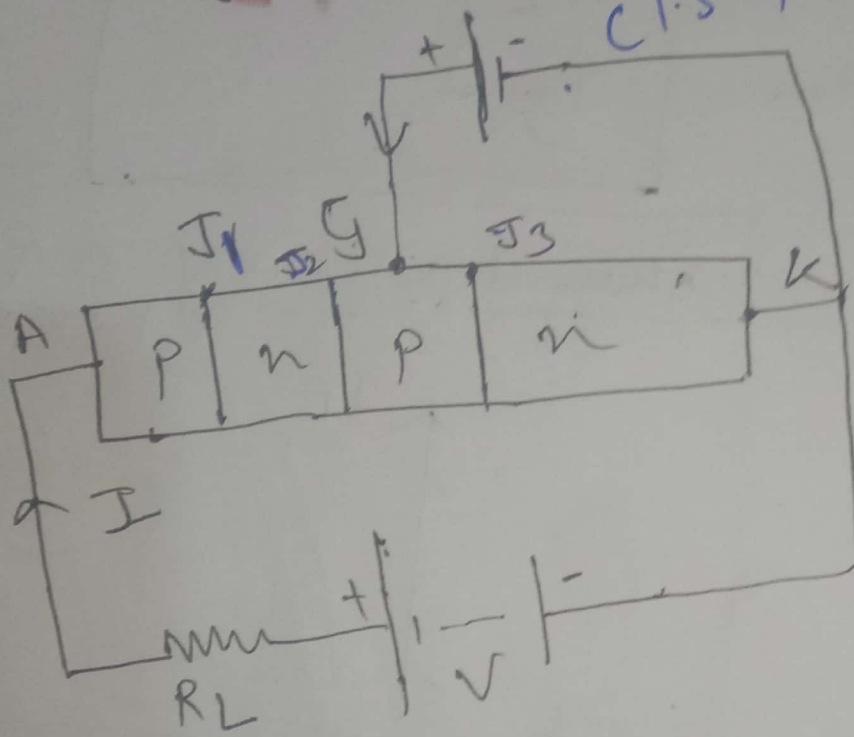
$\frac{dV}{dt}$ → rate of change of voltage WRT time.

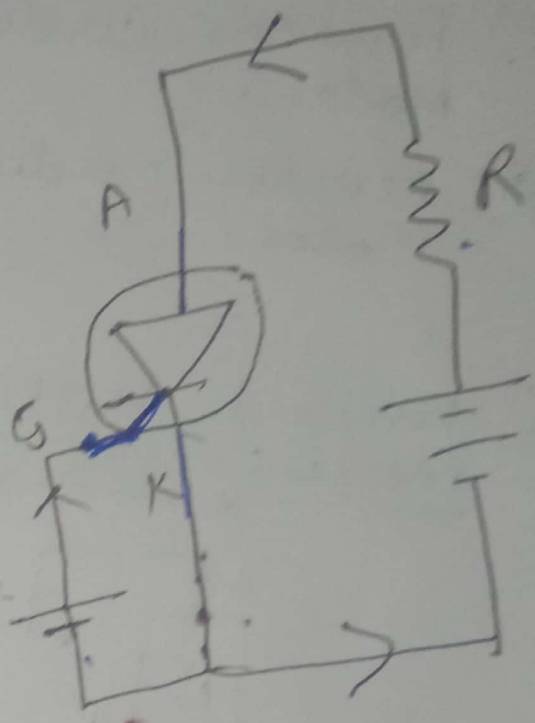


$I_c = C\frac{dV}{dt}$

If $\frac{dV}{dt}$ is very high the I_c is sufficient to turn ON SCR.

decreases. Generally SCR is turned ON by this method.





NOTE :- By applying +ve voltage at Gate terminal SCR starts conducting heavily. (typically 1.5V, 30mA)

(2) To operate SCR Junction J1, J2 and J3 should be in Fwd bias.

J1, J2, J3 } F.B.