TUNNEL DIODE CHARACTERISTIC

A p - n junction can be formed either by point contact or by diffusing donor impurity in p - type substrate in n - type substrate. In forward bias mode when the supply is connected such that the positive terminal of the supply is connected with p - side and the negetive terminal with the n - side the junction is called forward - biased. When the potential increased across the junction the holes are repelled from the positive end of supply and are compelled to move towards the junction. In similar way the electrons are repelled from the negetive side of the supply and drifts towards the junction. because of the acquired energy some of the holes and electrons penetrate the depletion region. This reduces the potential barrier and the width of the depletion region is reduced. as result of this more majority carriers diffuse across the junction. This results in an increased current through the p - n junction. If the concentration of donour impurity (atom) is greatly increased, the device characteristics are completly changed. This new diode was theoratically explained by L. Esaki (1958), and pronounced this phenomenon as tunneling effect. This poses a low potential barrier, and, If such diode is biased, it exhibits nearly constant conductance from almost zero potential to a value called peak voltage Vp. Increasing furthur potential (forward bias) the current suddenly drops and potetial suddenly jumps to a new value called vally voltage. The conductance is low, thus it exhibits a negative resistance region.

A tunnel diode, because of high doping level, has very small depletion layer, which reduce its reverse bias breakdown voltage almostly zero. It produce negative resistance region which makes it useful to make relaxation oscillator in vicnity of several megahertz range. Since it has vary small depletion layer thus electrones are able to tunnel through this small potential barrier at relatively low cut - off potential (less than 5mV).

V - I characteristics : The tunnel diodes are used in forward biased mode only. As shown in fig 2, from o to Vp, the current called tuunneling current, and from point Vp to Vv, it is called negative resistance region. From 0 to Vp, current Ip corroponding to voltage Vp, the slope dI/dV is near zero (exhibit very low resistance). If forward potential is increased furthur beyond Vp, the current decreases. As a consequence, the dynamic conductance g = di/dV negative. In other mean the resistance increases. At point Vv, the conductance is again near zero and beyond it the resistance becomes and remain positive as usual diode.

Experiment procedure

object : To draw the tunnel diode characteristics.

1. Connect the given main lead in power source (220Vac).

2. Keep R1 control at minimum (fully counter - clokwise). Switch on power.

3. Gradually increase supply by pot R1 to few mV (say 10mV = .010V) across diode. Note corrosponding reading across diode as V and current as I.

4. Increase the supply with the help of R1 in steps (say 10mV increament).

5. At some voltage (between 60 - 70mV) the current I, suddenly falls and V attains a new value. At the voltage V, where it happens called peak voltage or Vp and current as Ip. After it the voltage shown by Voltmeter is called vallyvoltage Vv and current as Iv.

6. Incerase voltage furthur till the current attains its previous reading. Note the voltage V as forward voltage Vf. Tabulate the observations.

7. Plot the curve between V and I, to find out the negative resistance region.

Sr No.	V	I
1	..V	..mA
2	"	"
3	"	"
4	"	"
5	"	"
6	"	"
n	"	"

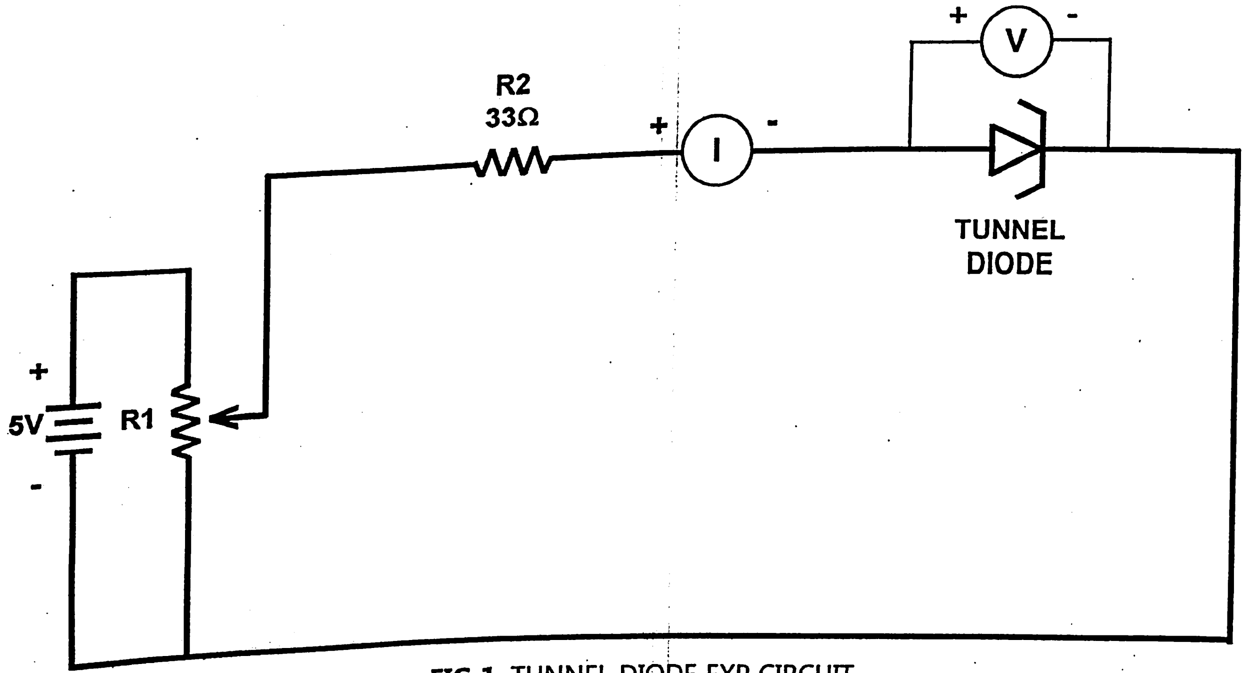

FIG 1, TUNNEL DIODE EXP CIRCUIT.

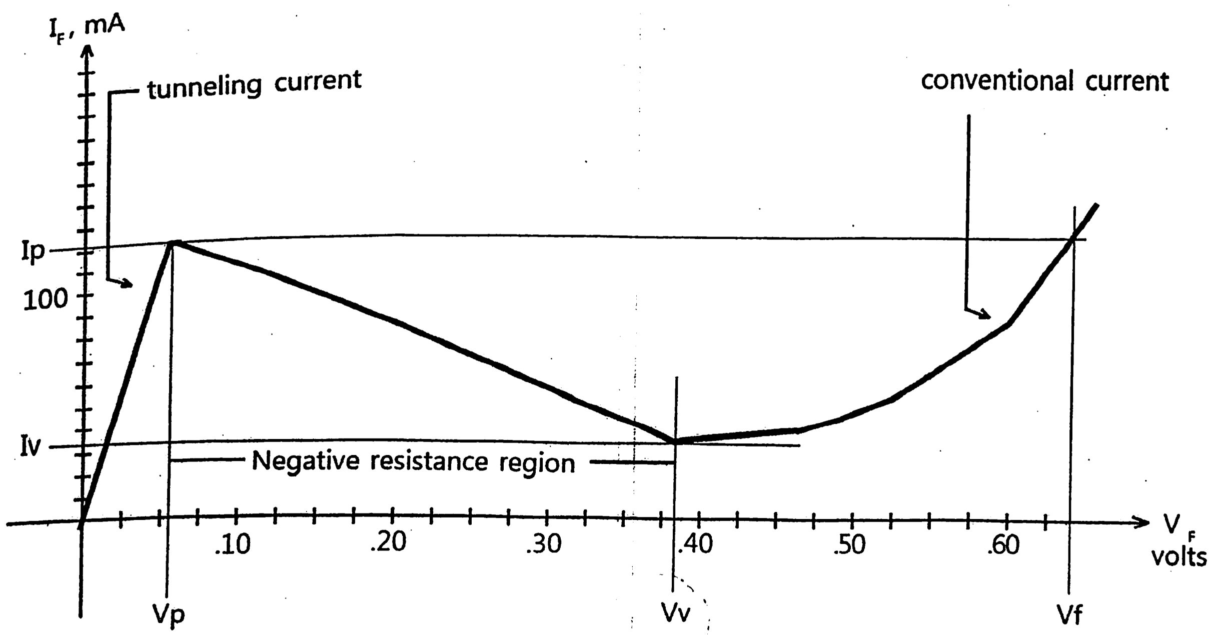

FIG 2, Typical TUNNEL DIODE (SI) charactristics.