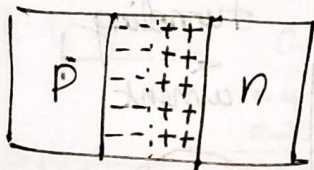


20th Dec' 2025
Sat

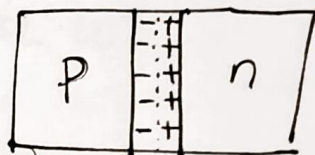
Tunnel diode

- The p & n regions are degenerately doped
- It exhibits a region of negative differential resistance
- Useful as oscillator. (high frequency)
- Degenerately doped n-type material has E_F inside the CB. whereas degenerately doped p-type material has E_F inside the VB.
- Even @ $T=0K$, degenerately doped s.c. are conductors.

p-n junction @ Zero bias

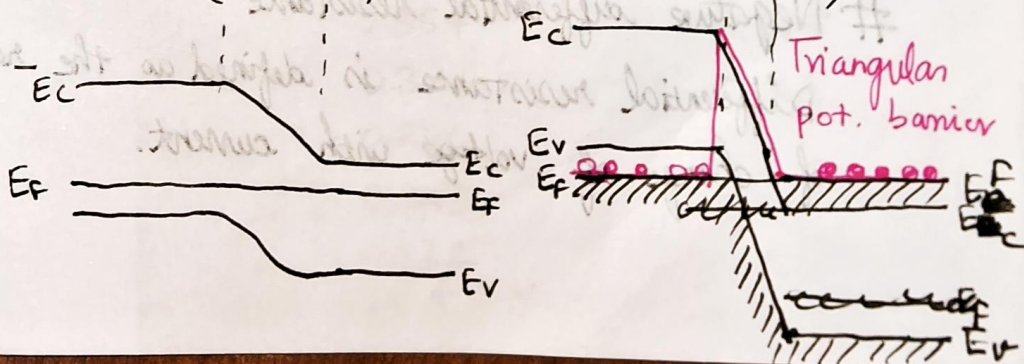


Non - degenerately doped p & n



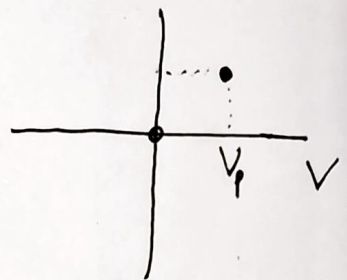
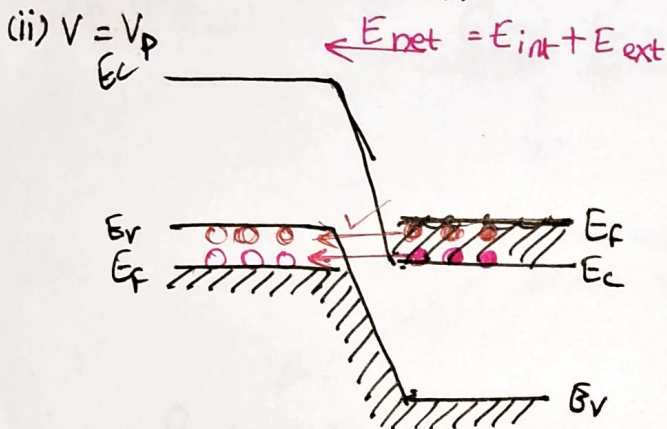
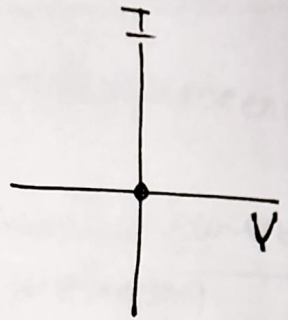
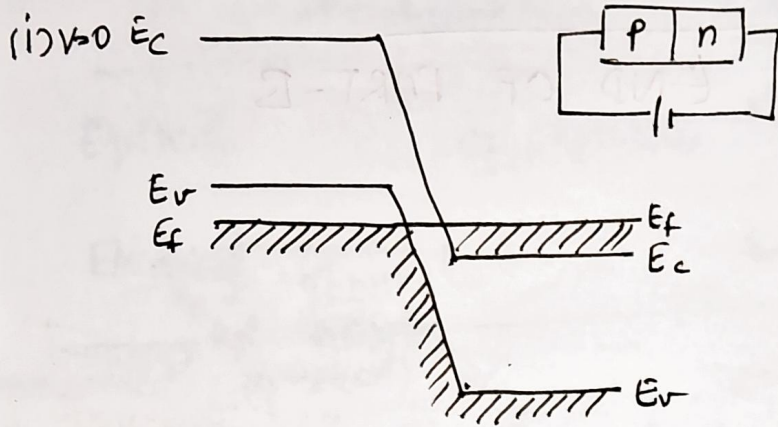
Degenerately doped p & n

- Depletion region width is of the order of $\sim 100 \text{ nm}$

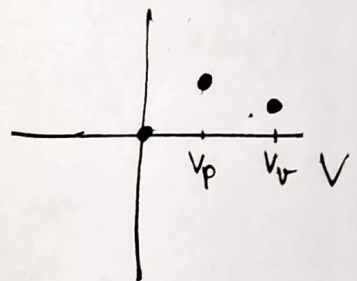
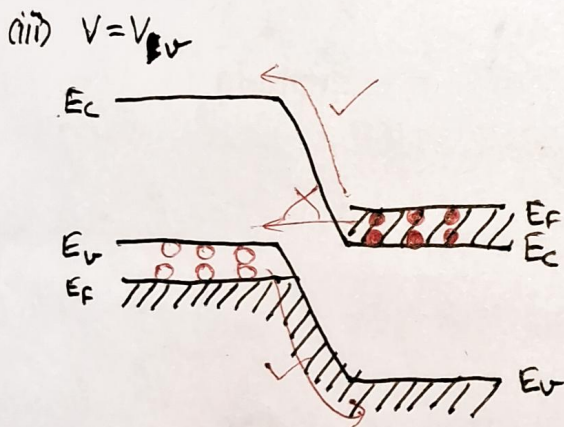


I-V characteristics of tunneling diode

Since both p & n regions are ~~and~~ having carriers even @ $T=0K$, let us study I-V characteristics @ $T=0K$.

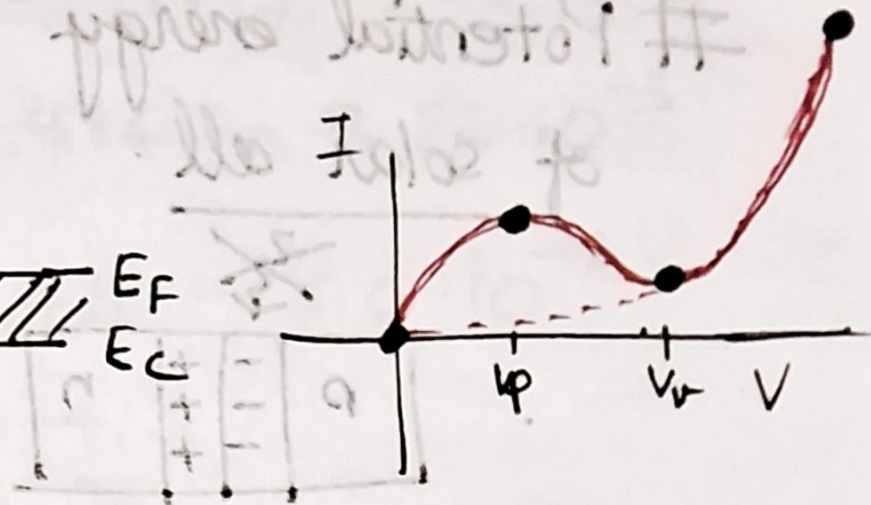
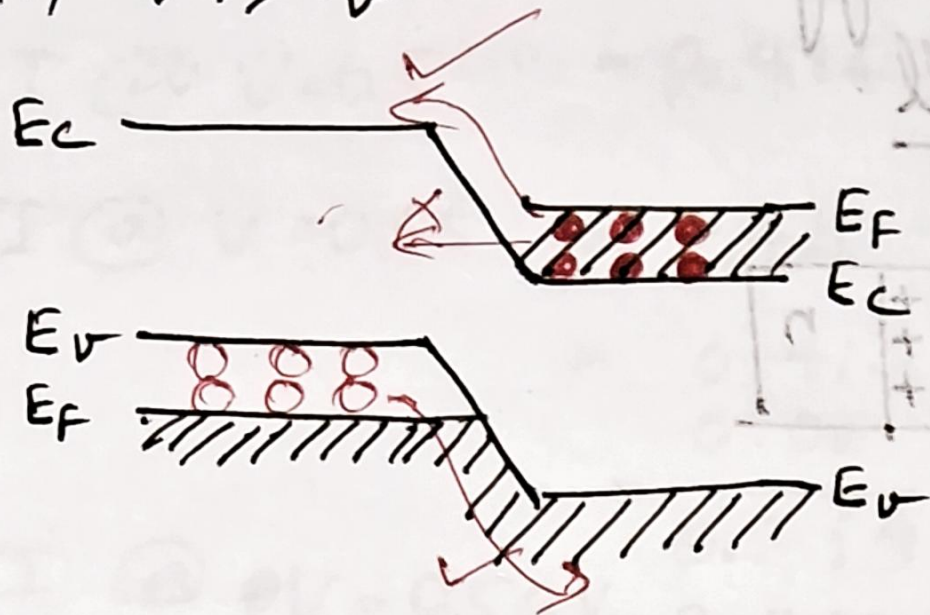


What is the wavelength of electrons at Fermi level?



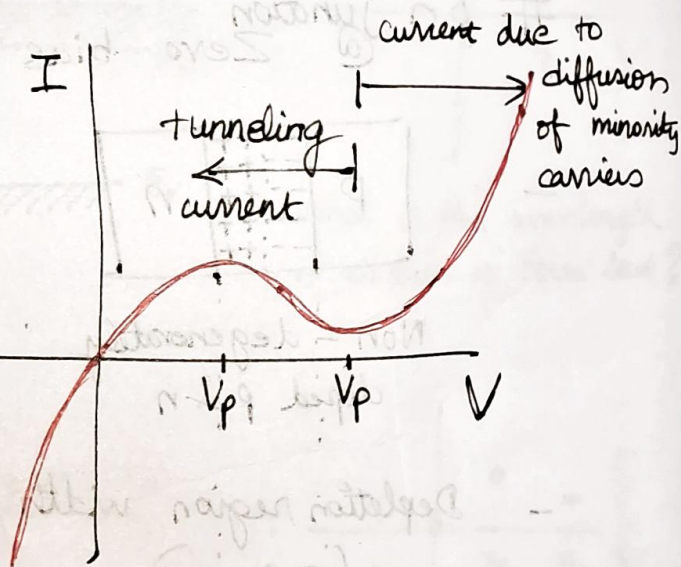
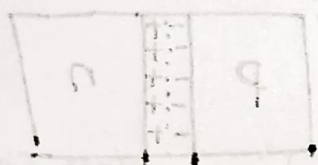
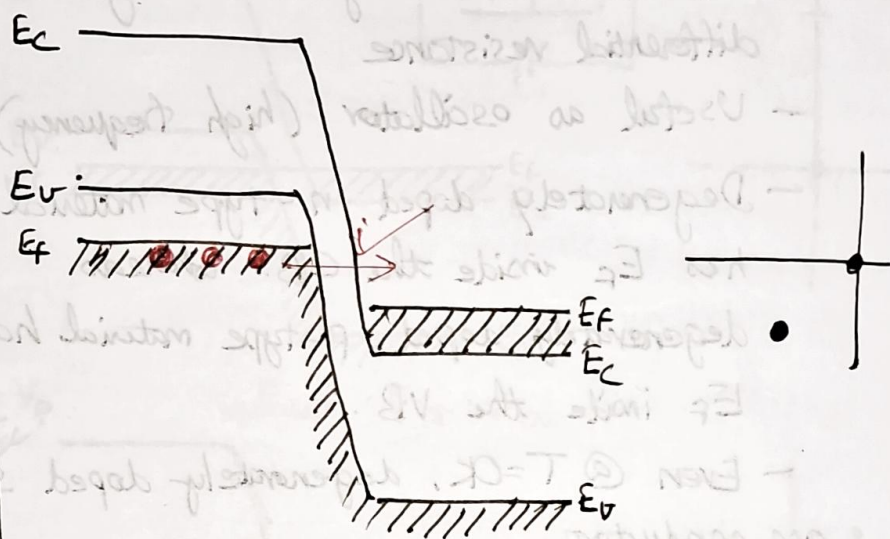
(iv) ~~$V > V_{br}$~~

(iv) $V \gg V_v$



Thus the I-V characteristics of tunneling diode is given by.

(V) $V < 0$



Negative differential resistance

Differential resistance is defined as the rate of change of voltage with current.