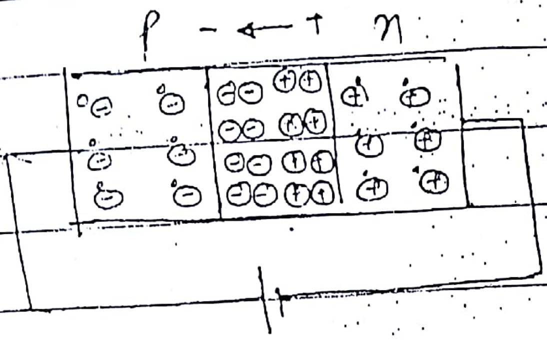
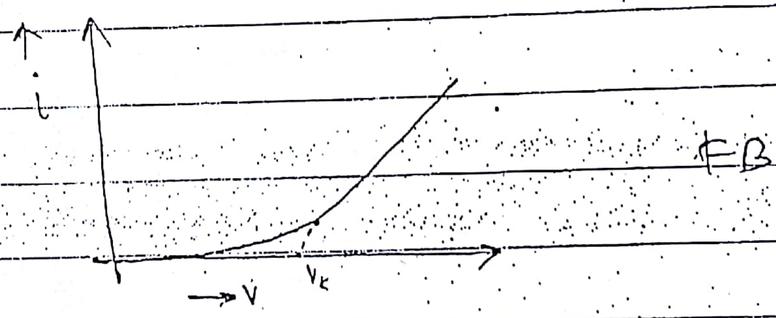
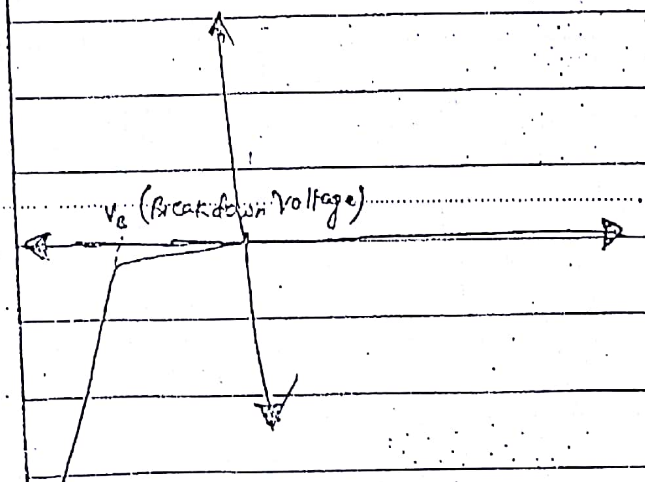
Bunk Pages

31-oct-17



PN junction can be set either as FB (forward biased) or Reversed Biased (RB)

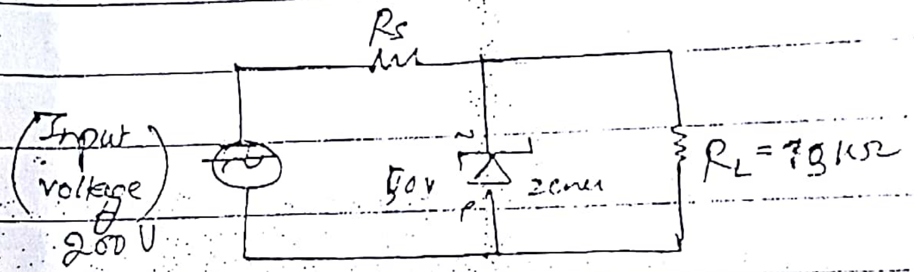




Zener diode: is a heavily doped PN junction connected a reversed biased.

* It acts as a voltage stabliser
* It can be used across the load to maintain the constant voltage
* In order to protect Electronic device from Input voltage fluctuation Zener diode is used

$= 10\,k\Omega$



$V = iR$

$$i = \frac{V}{R} = \frac{200}{10 \times 10^3} = 20\,mA \;?\; 15\,mA$$

$$\text{if } i = \frac{100}{15\,k\Omega}$$

$$i_L' = \frac{150}{15 \times 10^3} = 10\,mA$$

$$i = i_L + i_z$$

$$i_z = 10\,mA$$

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If voltage is 300 V

$$i = \frac{300}{10 \times 10^3} = 30 mA$$

Zener Voltage Stablisation Circuit :

* The Input voltage fluctuation would be observed by series resistor.
* Whereas Input current fluctuation are observed by Zener diode

as a result, the voltage acting across load and current flowing through a load remains constant. This is how Zener diode protects the load from Input Voltage fluctuations

Bijpolar Junction Transistors:

* BJT is a device prepared by using two pN junctions. It is basically used in Oscillators and amplifiers
* BJT are of two types : npn & pnp
* In BJT, we have three components : emitter, base, collector

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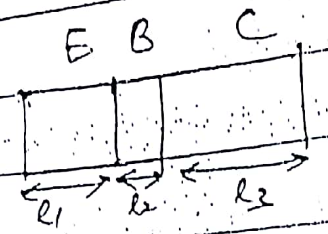
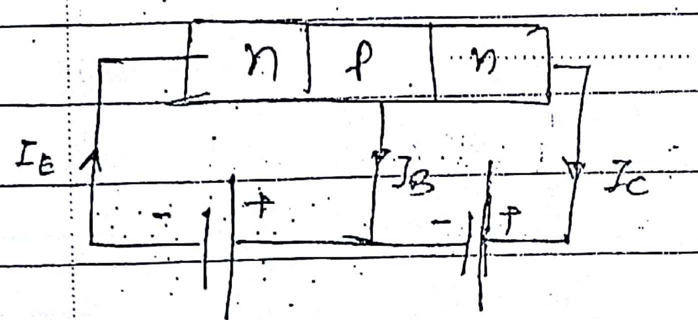


$\{ l_3 > l_1 > l_2 \}$

* Emitter is doped heavily.
* base is doped very lightly.
* Collector is doped moderately

* In BJT — Emitter – Base junction is always connected in FB
  Collector – Base junction is always connected in RB

* Transistor means Transfer of resistance. a Transistor can transmit current or can drive current from low resistance to high ~~to~~ resistance terminal.
* As a result, signal ~~or~~ voltage would be amplified.

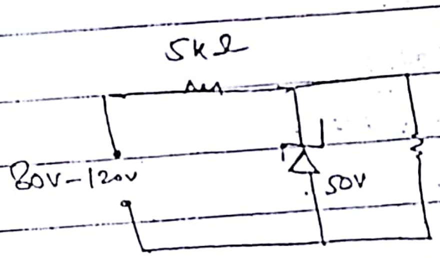


$$\boxed{I_E = I_B + I_C}$$

BJT can be used as voltage & power amplifier

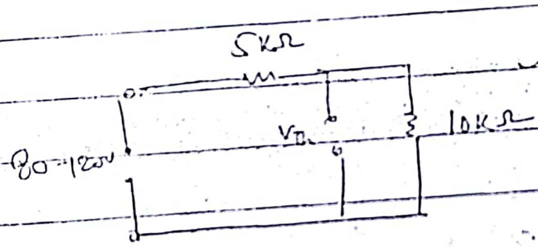
2/Nov/17

Q. Calculate min & max current that can pass through Zener diode connected in the below diagram?



$$i_{min} = \frac{80-50}{5k\Omega} = 6mA$$

$$i_{max} = \frac{120-50}{5k\Omega} = 14mA$$



$$i = \frac{80}{15k\Omega} = \frac{80}{15} \times 10^{-3} A$$

Check yourself

$$\boxed{i = 5.33 mA}$$

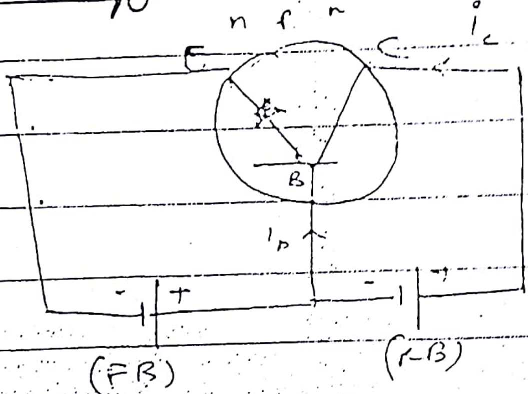
$$V_{Th} = i \times 5k\Omega$$

$$\{V_{Th} = 26.6V\}$$

$i = \frac{120}{15\,K\Omega} = 8\,mA$

$V_{Th} = 8 \times 5 = 40\,V$

Common Base configuration :



$I_E = I_B + E_C$

$$\boxed{R_i = \frac{V_{BE}}{i_E}}$$

$$\boxed{R_o = \frac{V_{BC}}{i_C}}$$

for Common Base configuration:

current amplification factor:

$$\boxed{\alpha = \frac{\Delta I_C}{\Delta I_E}}$$

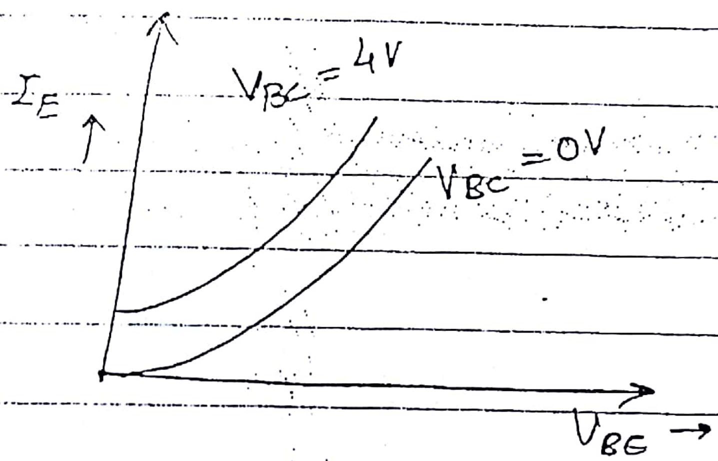
We know

$\Delta I_C < \Delta I_E$

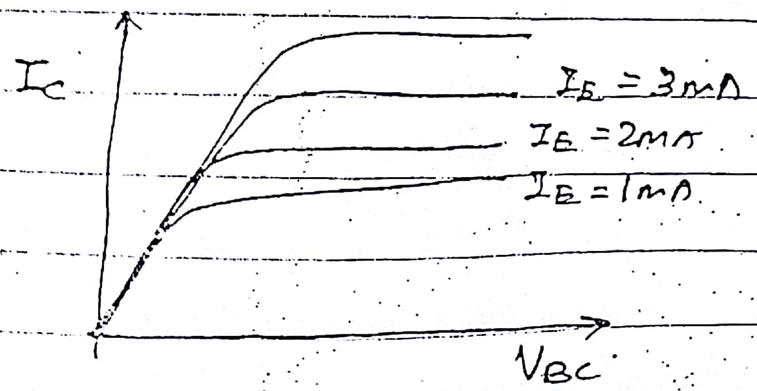
$\therefore \alpha < 1$

usually, $\alpha \rightarrow$ 0.9 to 0.998.

* I/P characterstics in Common Base configuration:



* O/P characterstic Curve for Common Base Config.



* I_C Value is majorly dependent on I_E and very less of V_{BC}

*(Needs correction)

Q. A common Base Config transistor amplifier has an input resist of 20 kΩ and output resistance of 100 kΩ. The collector load is 1 kΩ if signal of 500 mV is applied b/w emitter and Base then find the voltage amplification in this common Base config. amplifier? (Current amplification factor $\alpha \approx 1$)

$R_i = 20\ \Omega$

$R_o = 100\ k\Omega$

$V_{EBE} = 500\ mV$

$R_O = 1\ k\Omega$

$$\boxed{i_{BE} = \frac{500 \times 10^{-3}}{20} = 25\,mA}$$

$i_{BC} \approx 25\,mA$

$V_{BC} = i_{BC} \times 100\ k\Omega$

$= 25\,mA \times 100 \times 10^3$

$V_{BC} = \underline{2500\ V}$ $\quad 25 \times 10^{-3} \times 1000 = 25$

$\alpha = \frac{V_{BC}}{V_{BE}} = \frac{\cancel{2500}\ 5}{\cancel{500} \times 10^{-3}} = \frac{25000}{500 \times 10^{-3}}$

$\alpha = \cancel{5000}\ 50$

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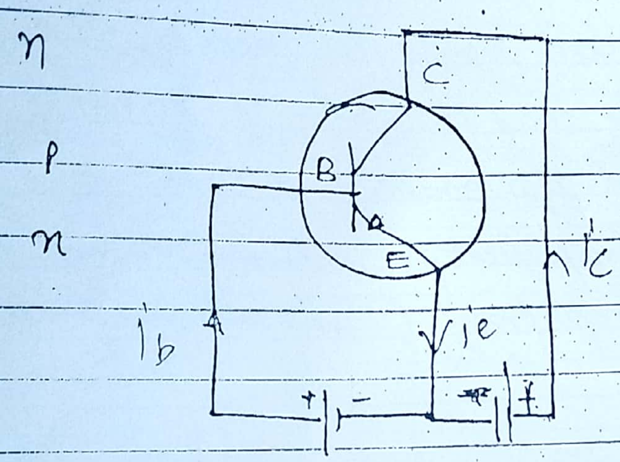
* Common-Emitter Configuration:



* In Common emitter config, the current amplification factor is denoted by 'β'.

$$\boxed{\beta = \frac{\Delta I_C}{\Delta I_B}}$$

$\beta > 1$

{usually, β → 20 to 500}

Relⁿ b/w α & β:

$$\beta = \frac{\Delta I_C}{\Delta I_B} \qquad \alpha = \frac{\Delta I_C}{\Delta I_E}$$

$$I_E = I_B + I_C$$

$$\Delta I_E = \Delta I_B + \Delta I_C$$

$$\boxed{\Delta I_B = \Delta I_E - \Delta I_C}$$

$$\beta = \frac{\Delta I_c}{\Delta I_E - \Delta I_c}$$

$$\beta = \frac{\frac{\Delta I_c}{\Delta I_E}}{1 - \frac{\Delta I_c}{\Delta I_E}}$$

$$\boxed{\beta = \frac{\alpha}{1-\alpha}}$$

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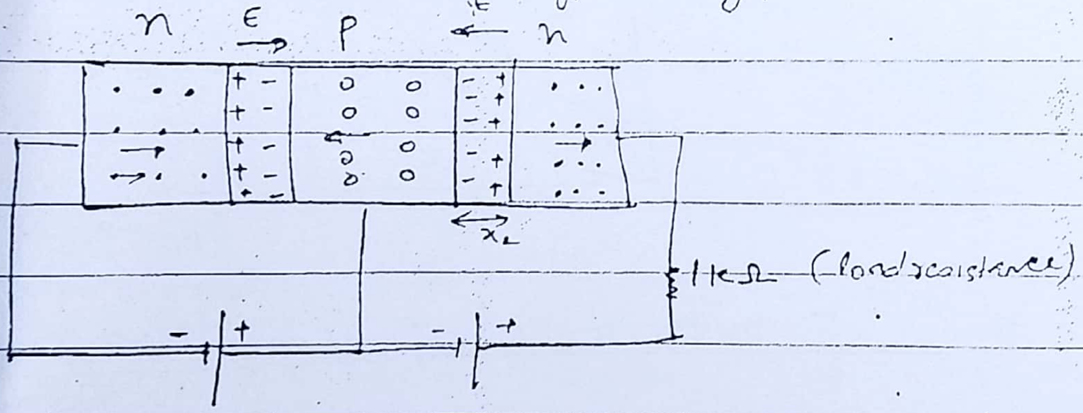
R_i is input resistance - resistance offered to e^- by pot^n barrier.



Collector
* x_2 increases as Base emitter junction size increases

$i_{BE} = \frac{V}{R} = \frac{500\,mV}{20}$

$i_{BE} = 25\,mA$

$\alpha = \frac{\Delta I_c}{\Delta I_E}$

e^- cannot facing any resistance by Base-Collector junction because $\vec{E}$ is in opposite direction ⇒ attracting e^-

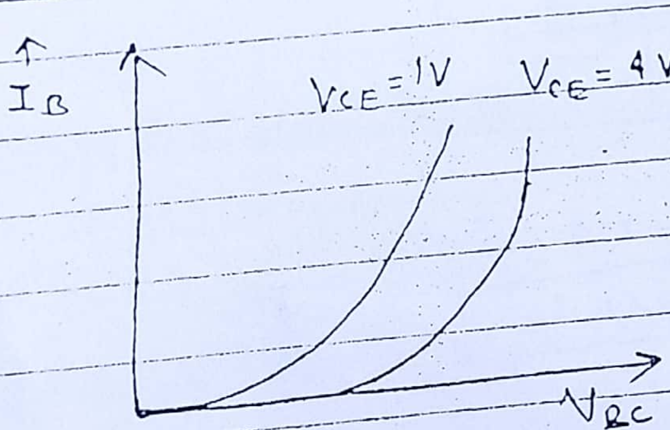
$V_{BC} = i_{BC} R_L$ $\quad (i_{BC} = i_{EB})$

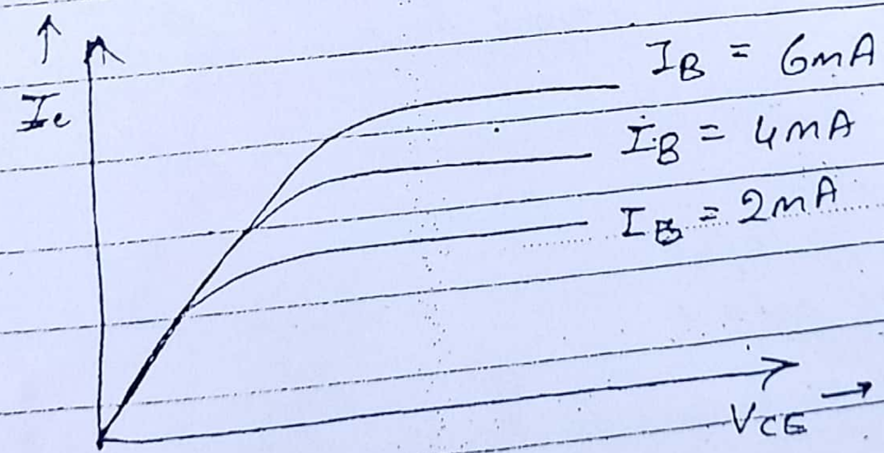
$= 25mV \times 10^3$

$V_{BC} = 25V$

* Voltage amplification factor $= \dfrac{V_{BC}}{V_{EB}} = \dfrac{25}{500 \times 10^{-3}} = 50$

* Common ~~Collector~~ emitter configuration / characteristics:





* → BJT
# → FET

Field effect Transistors (FET) :

* disadvantages of BJT :

* BJT input Impedance is low (BJT – low impedance)
* Noise will be very high. (High Noise)
  {fluctuations produced in current, Voltage & power}
* Input impedances has its own effect

(FET – high input impeda

FET have high input impedance and low Noise (low Noise)
* BJT is a current controlled device, that is output Current is ~~[illegible]~~ controlled by input current {BJT is current control device}
  {FET is voltage controlled device}
FET is a Voltage current device. That is o/p Characteristics Are controlled by voltage but not current.

* BJT we have npn or pnp (two type of charge carriers holes and
# In FET, We have current is due to one type of charge carrier.

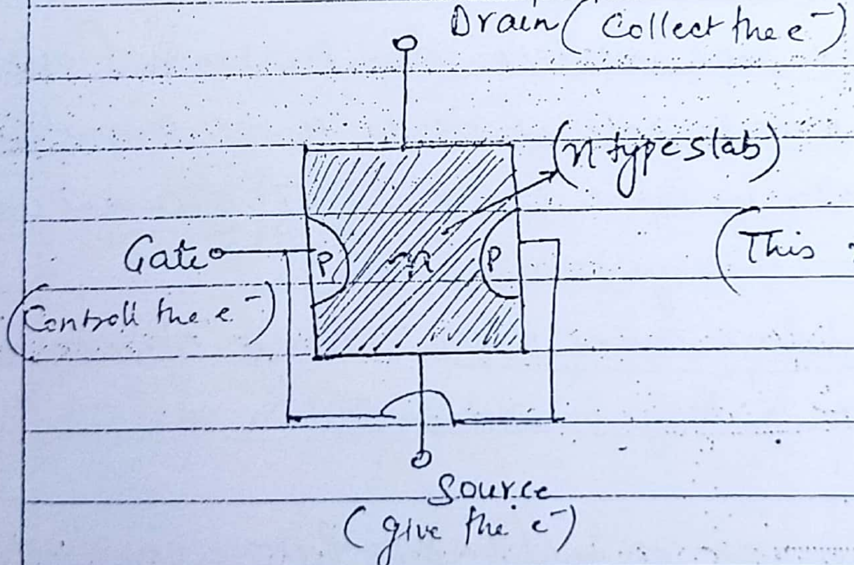
Types of FET :

(2) MOSFET

(1) JFET
(Junction Field effect Transistor)

(1) n-channel JFET

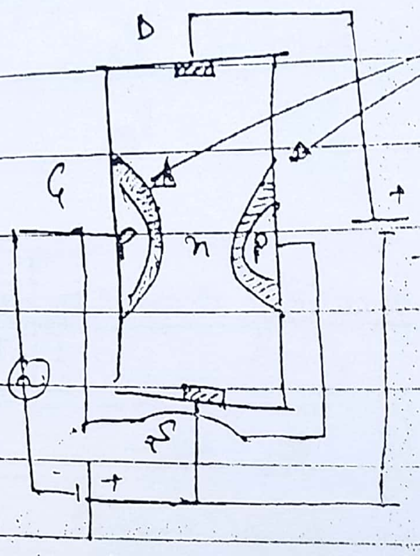
(2) p-channel JFET



(This n channel JFET)

* Source - Gate is Connected in Reversed Biased.

Working condition of FET:



explore this

*

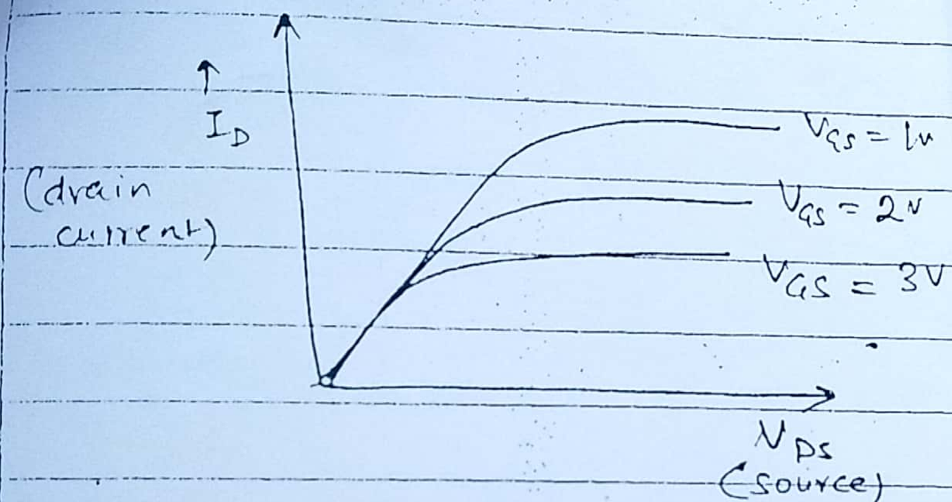
{ If this placed here then It will be the cause for change in I_D }

Here, An important factor is that $\boxed{I_d = I_s}$

* Once both the pot^n barrier increase touch each other, then $\therefore I_d = 0$.

* G-S is input
* S-D is output
* FET can be used as amplifier (do yourself)

* Output charachterstic curves:



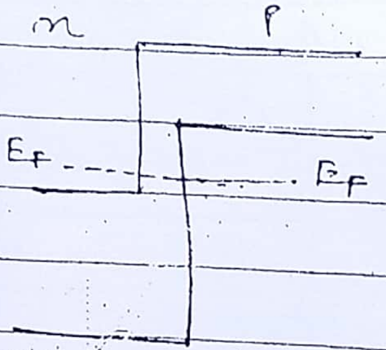
* Difference B/w BJT & FET:

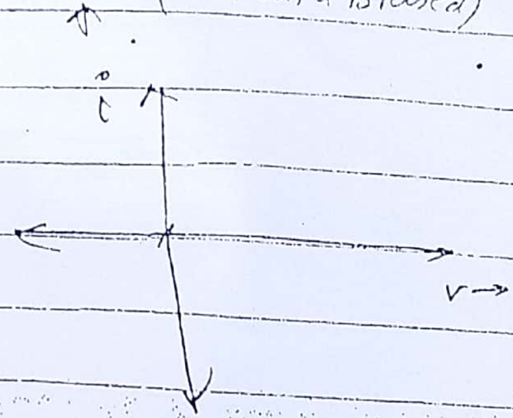
BJT	FET
* Two types of charge carrier	* There is only one type of charge carrier
* low Input impedance	* High input impedance
* current Controlled device	* voltage controlled device
* Noise is high	* Noise is less for FET

Tunnel diode:

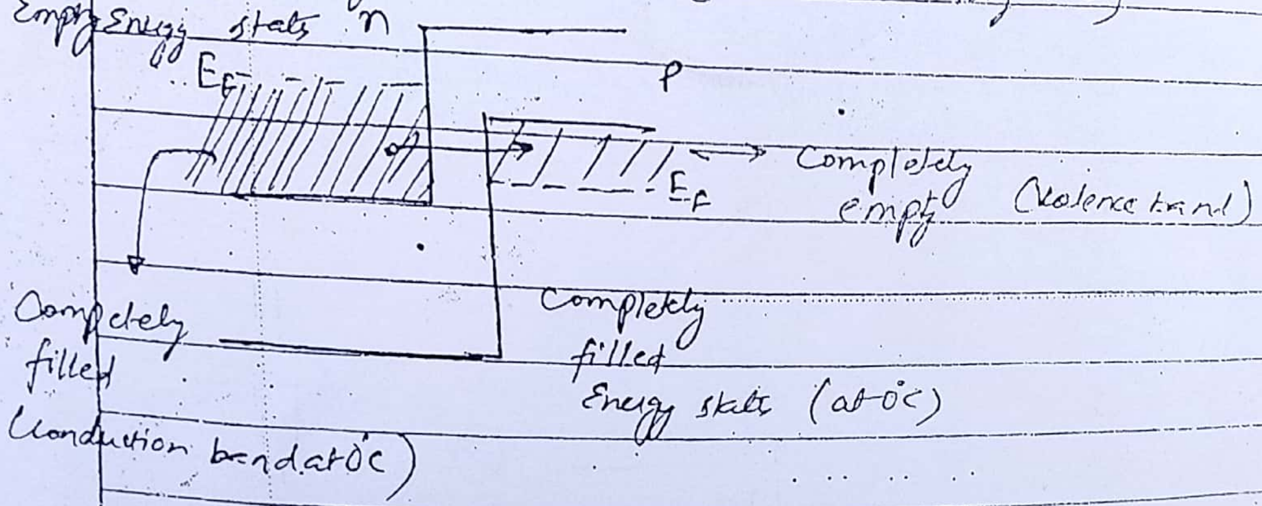
In earlier days, people used to use this in oscillating circuits.

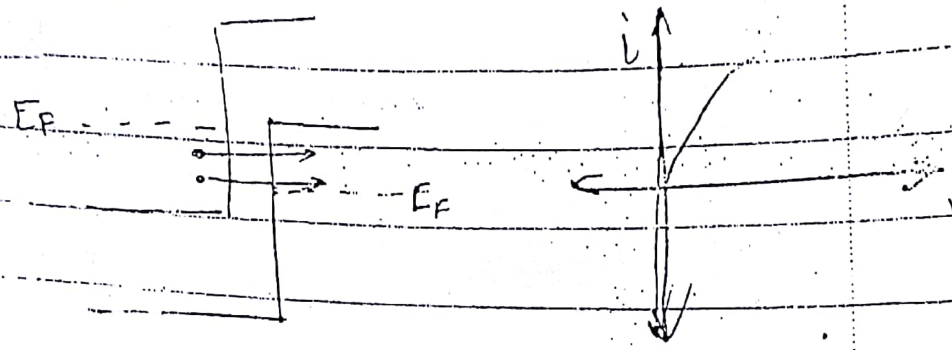
(Forward Biased)

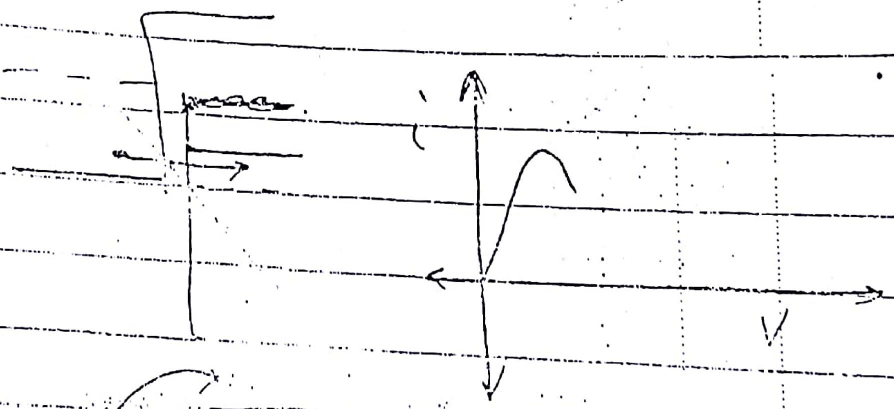


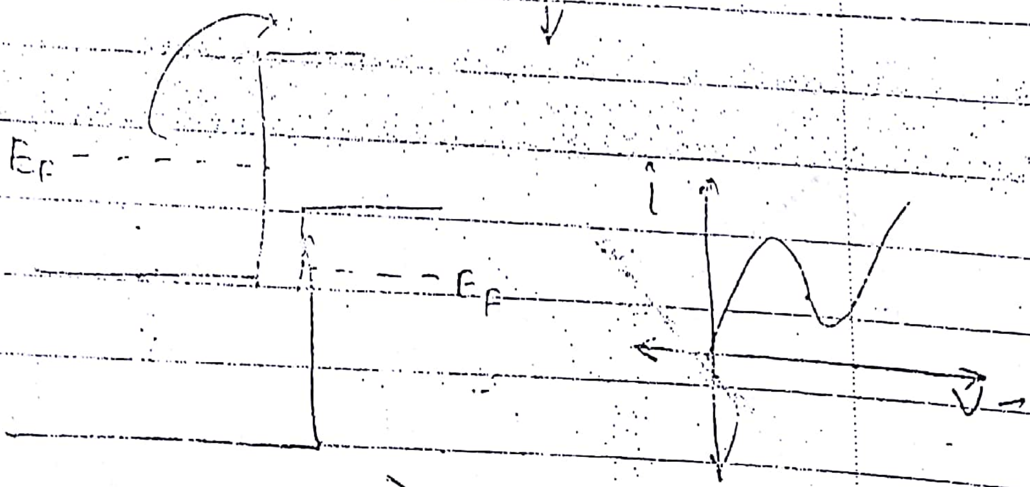


When forward bias is applied, then there is shift in fermi energy level of the material (we are observing at 0°)




E_F
E_F
i
V


i
V


E_F
E_F
i
V

Bunk Pages

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Important topics :

* Postulates of free e^- Theory
* Advantages and disadvantages

* derive density of states function
* fermi - distribution function, its significance
  (it gives you occupancy of energy states by e^-)

* problems Related to fermi function
* Carrier conc. in Intrinsic Semiconductors
* Intrinsic Carrier concentration derivation.
* Intrinsic fermi level position w.r.t mid gap energy
* Electrical conduc. in terms of intrinsic
* [illegible] of $n_i^2 = np$
* [illegible] & non-[illegible] (Short notes)
* problems on compensating semiconductor
* Eq^n of holes conc. in compensated n & p type Sem
* drift & diffusion process
* variation of fermi level with Temp
* hall effect
* graded impurity distribution in Semiconductor
* Built in pd. [illegible] of pn junction
* Breakdown mechanism of pn junction: Avalanche, Zener
* Tunnel diode
* Zener diode
* BJT I/P & O/P Measurement