Semiconductor.

p-type -

Holes

$I_h >> I_e$

Holes are Majority Carriers

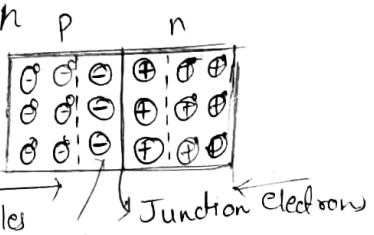
n-type -

electron

$I_e << I_h$

electrons are Majority Carriers.

★ P&n



V_B = Barrier potential

V_B = 0.7 V (Si)

★ Rectifier

— AC Voltage Converted to DC Voltage.

— output Contains Some AC Component.

— Remained AC Component is Ripples.

— Ripples is Removed by using filter Circuit.

— Output of filter is almost pure DC current.

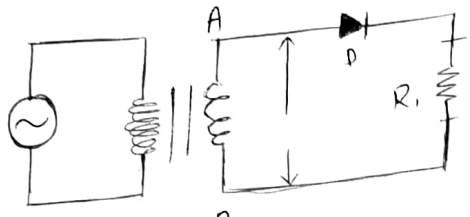
— Voltage Regulator Restricts 'V' to desired Values.

★ Rectification ⟶ Conversion of AC Voltage to DC Voltage.

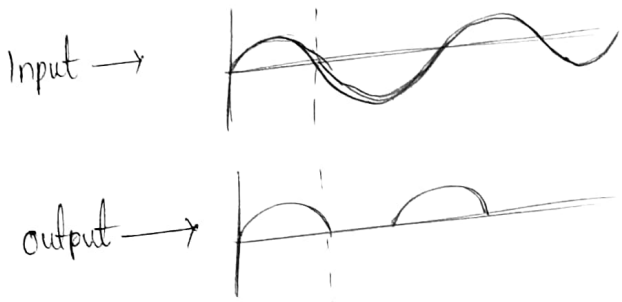
★ Rectifier ⟶ Device Converting AC Voltage to DC Voltage.

① Half Wave Rectifier

P-n Junction diode

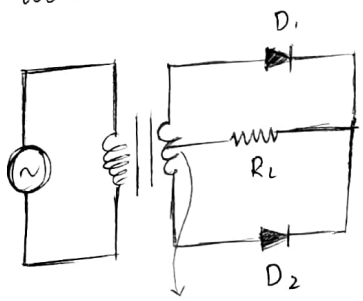


In first Half D Conducts and in Second half D doesn't Conduct. As Diode Doesn't Conduct in Reversed Biase mode.



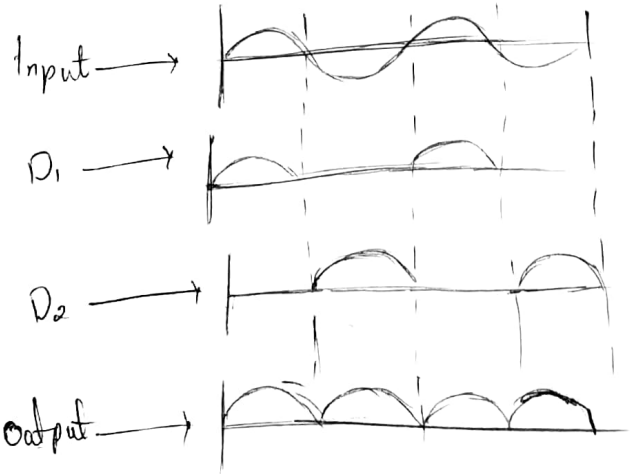
Discontinous
Unidirectional

② Full Wave Rectifier



- For the first half D_1 will Conduct D_2 doesn't
- For Second half D_2 Conducts and D_1 doesn't.

- Centre tapped Secondary Coil
- acts as Common Cathode



Continous and Unidirectional.

Advantages of Full Wave Rectifier.

1.) Rectification takes place in both the cycles of the AC Input.
2.) Efficiency of a full Wave Rectifier is higher than half wave rect.
3.) The ripple in a full wave Rectifier is less than that in a half wave Rectifier.

★ Ripple Factor.

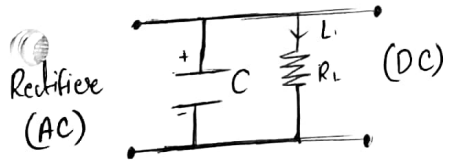
— The Ratio of Root mean (rms) Value of the AC Component to the Value of the DC Component in the Rectifier output.

$$\text{Ripple factor} = \frac{\text{r.m.s Value of A.C Component}}{\text{r.m.s Value of D.C Component}}$$

★ Filter Circuit

— Removes the Remaining AC Component from the output of Rectifier.

★ A Capacitor filter



— Capacitor get's Charged at the peak Value.
— And Whenever the Voltage drops the Capacitor provides its Stored Charge.
— Due to which the AC Component Reduces.

★ Zener Diode:

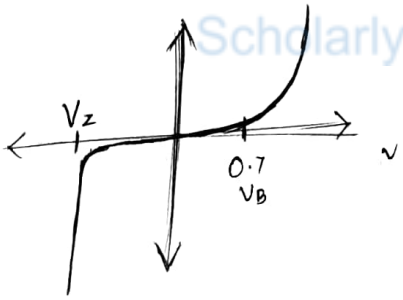
It is a Special type of Diode which works in Reversed biased Mode.

★ Zener Breakdown / Junction Breakdown.

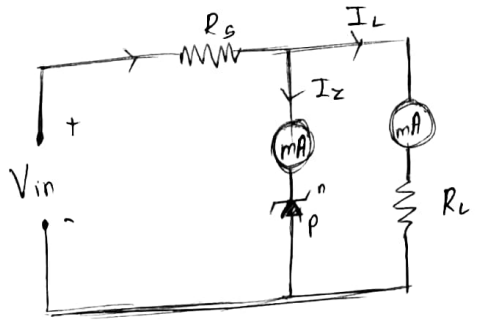
— If Voltage more than Barrier potential Breakdown occurs and Current flo
— Zener diode is a Special P-n Junction diode which is Heavily Doped.
— Always Connected Reversed Biased.
— Always in parallel with load.
— Initialy Very Small is flowing but if we Increase the Input Voltage the depletion layer breakdown occurs and No. Holes and Electrons Increase.

★ Zener diode Characteristics

— After Breakdown Current Flow Increases



★ Zener Diode as Voltage Regulator.



— Output Voltage is Always Constant
— Whenever more Current flows Zener diode absorbs excess Current.

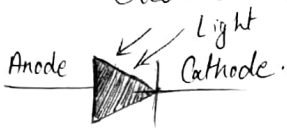
★ Applications of Zener Diode.

① Used when Constant Voltage Required.

② It has many applications like :- Voltage Regulator, Fixed refn. Voltage provider etc.

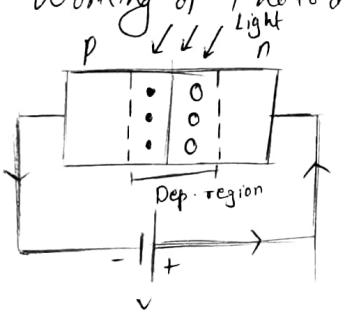
★ Photo Diode

Special p-n junction diode which Converts light Energy to Electrical Energy.



— generates Current when Exposed to light.
— Also Called photodetector or a photo Sensor.
— It operates in Reverse Biase mode.

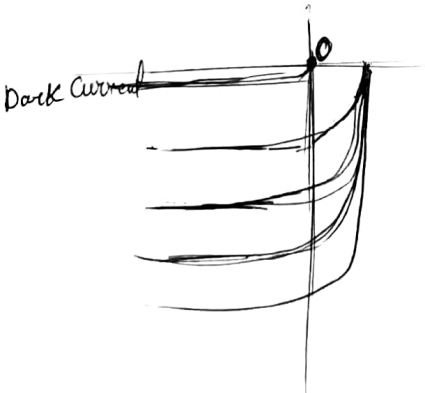
★ Working of Photo diode.

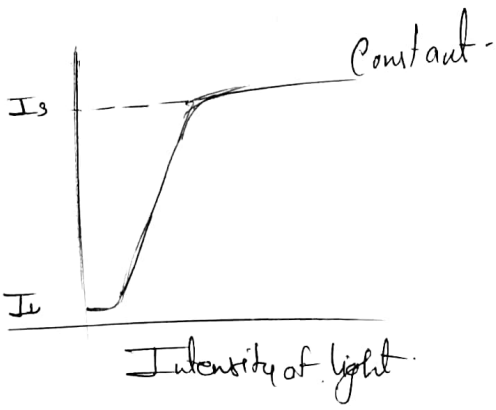


— light falls on the depletion Region.
— Then it Breaks the Bond.
— No. Holes & electrons are generated and Current Flows.

Dark Current - Very Small Currents flows when No light is there.

★ I-V Characteristics of photo diode.



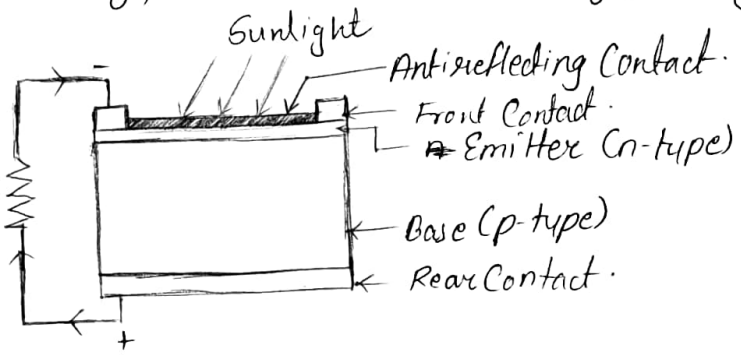


★ Applications of Photo diode

— Counters and Switches.
— Burglar alarm
— Fiber optics
— and many more.

★ Solar Cell / photo Voltaic Cell

— Converts Solar Energy into Electrical energy using Solar Cells.



- n-type is kept Small so that light Comes Inside Quickly

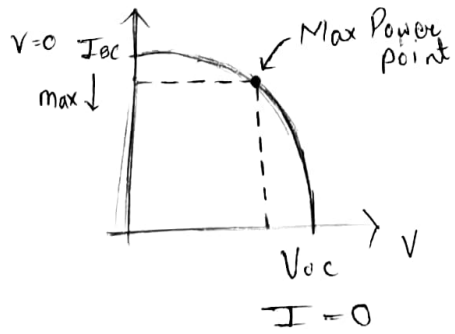
— Antireflecting Coating absorbs only the Visible light and radiation like I.R are Reflected so that the diode doesn't heat up.

— As Sunlight Enters it Breaks bond and Create electron-hole pair

— holes Come down and electrons go up and a potential difference is Created.

— As load Resistance gets Connected the Current Starts flowing.

★ V-I Characteristics of Solar Cell



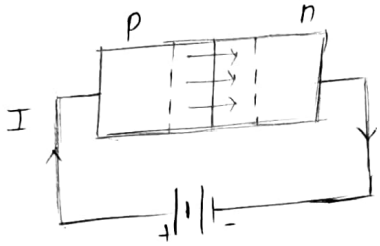
★ Uses of Solar Cell

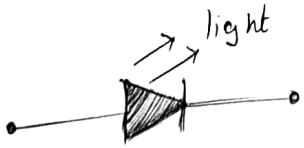
① Used for Charging batteries during day

② Calculators, Satelite, Traffic Signal, lux meter and etc

★ Light Emitting Diode / LED

— Always Contected in Forward bias.





— When electro-hole pair will Start merging they will Emit light

★ I-V Charecristics of LED.

★ Advantages of LED

① Energy efficient

② Long lasting.

③ Rugged.

④ No warm up period.

⑤ Excellent Color

⑥ Environment Friendly

⑦ Controllable

★ Disadvantages of LED.

① Hazardous blue light

② Temperature dependence

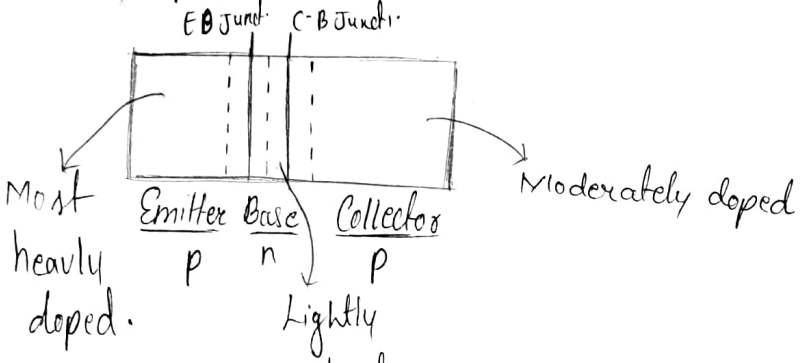
③ Voltage Sensitive.

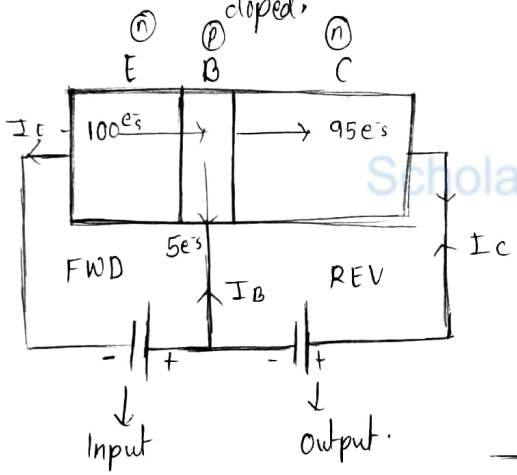
④ hight Initial Cost

★ Bipolar Junction Transistor (BJT)

Junction transistor is a Semiconductor device having two junctions and three terminals. The current in a transistor is carried by both the electrons and the holes, Hence it is called bipolar junction transistor.

① n-p-n transistor.

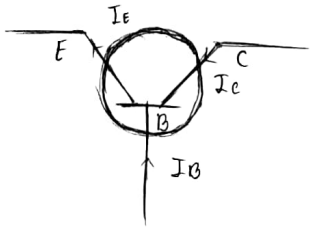




Common Base Configuration.

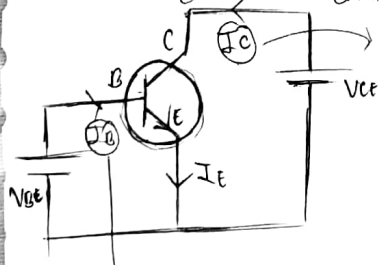
$$I_E = I_B + I_C$$

V. Small.



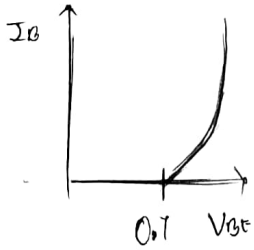
For p-n-p the direcn will be opposite.

★ Common Emitter (CE) Confign.

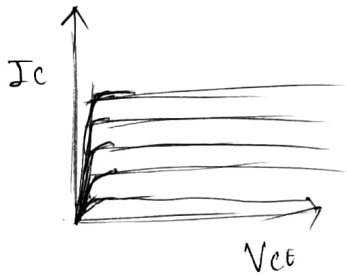


$$\beta = \frac{I_C}{I_B} \qquad \alpha = \frac{I_C}{I_E}$$

• Input Characteristics.

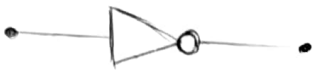


• Output Characteristics



ogic Gates

Same as Maths One (1 = True, 0 = False)



Not Gate.

OR Gate

AND Gate.

NAND Gate.
(Take it like Negation of AND)

NOR Gate
(Negation of OR)

NAND
NOR
} Universal Gates

Exclusive OR/X-OR Gate.

A	B	$\bar{A}$	$\bar{B}$	$\bar{A} \cdot B + A \cdot \bar{B}$
0	0	1	1	0
0	1	1	0	1
1	0	0	1	1
1	1	0	0	0