Analog Electronics

Syllabus overview :-

Marks in Gate.

- EC/IN → 10-12 Marks
- EE → 6-8 Marks

(1) Diode Family

- 1.1 Clipper circuit
- 1.2 Clamper circuit
- 1.3 C/s of Diode
- *** 1.4 Zener diode regulator
- 1.5 Rectifier and Filter.

(2) Transistor Family

- 2.1 Biasing
- 2.2 Region.
- 2.3 Current mirror circuit.

(3.) op-Amp & its Application.

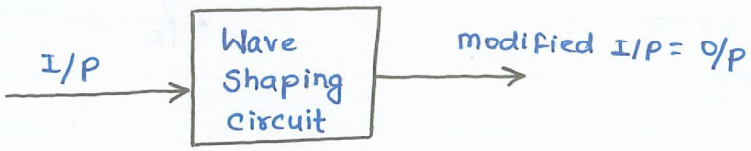
(4.) BJT & MOSFET Amplifier

- → EE (Basic Discussion)
- → EC/IN (Details Discussion)

(5.) Feed Back Amplifier & Oscillator

CHapter - 1 Diode Family

CHapter - 1 Clipper circuit



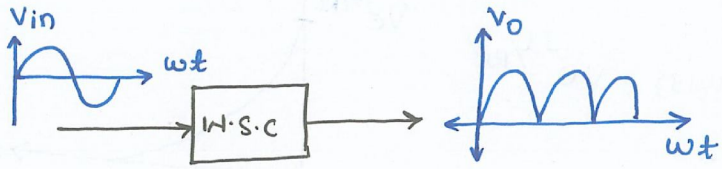
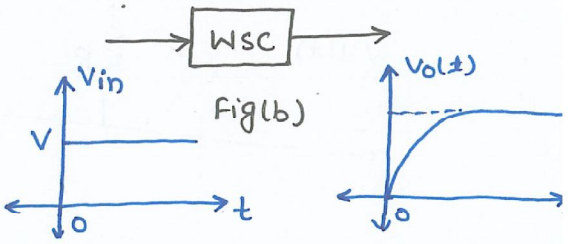


Fig (a)



Fig(b)

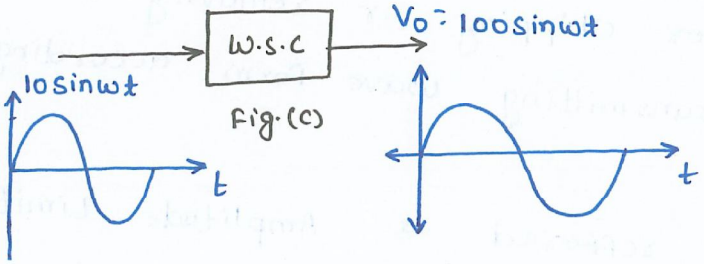


Fig.(c)

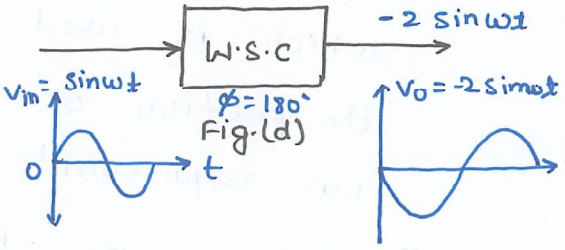
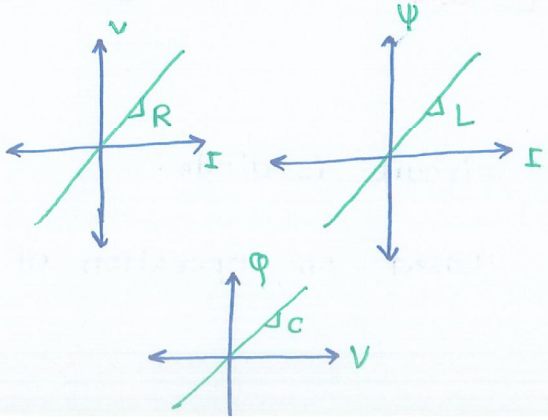


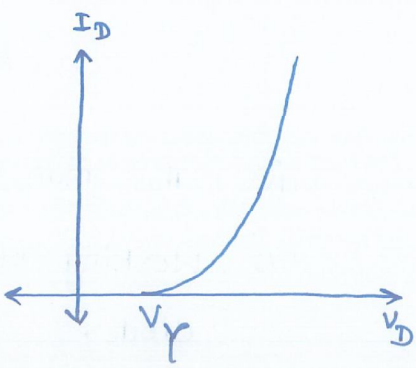
Fig.(d)

Wave Shaping circuit

- **Linear W.SC**
  - Eg:- R, L, C , RC LPF, RC HPF

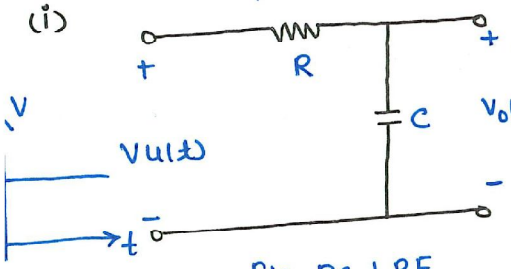


- **Non Linear W.S.C**
  - Eg :- Diode , Transistor



Example of Linear W.S.C

(i)



$V_o(t) = V(1 - e^{-t/RC})$

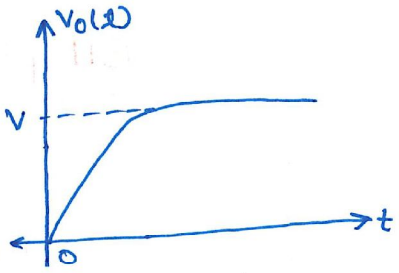
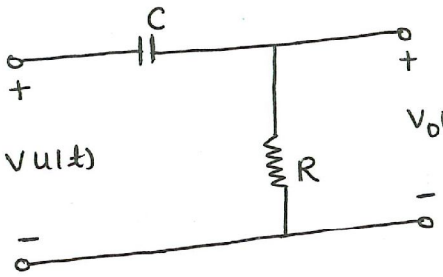
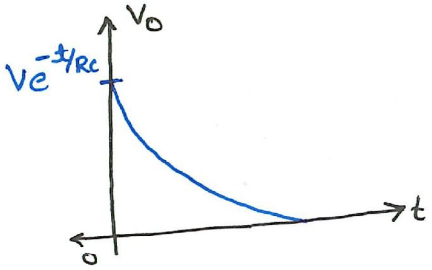


Fig RC LPF

(ii)



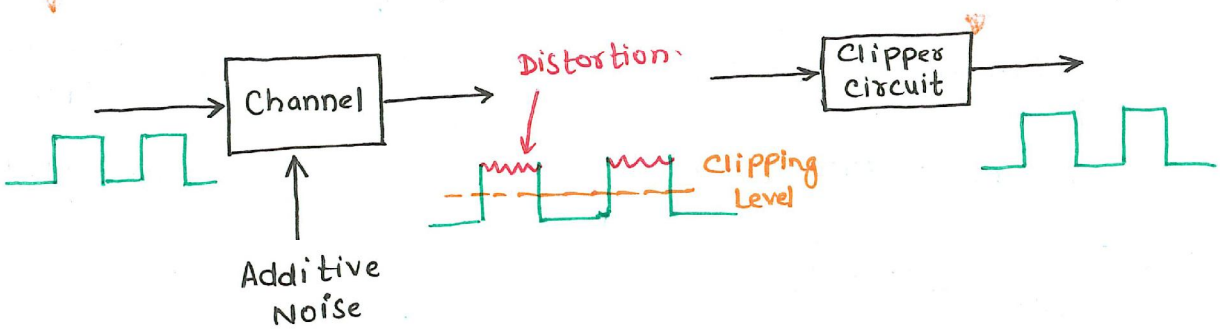
$V_o(t) = Ve^{-t/RC}$



→ (i) Clipper circuit is non Linear wave shaping crt. which is used for clipping or removing some of the portion of transmitting wave form according to our requirement.

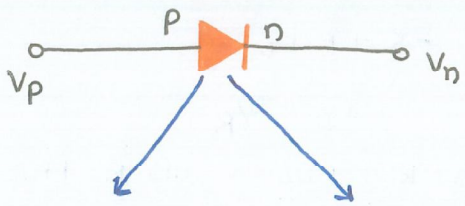
(ii) Clipper crt. is reffered as Amplitude Limiter or selector circuit.

(iii) Clipper circuit can be used for eleminating the effect of noise in digital communication.



(iv) The main Element in clipper circuit is diode.

(v) Working of clipper circuit is Based on operation of diode.



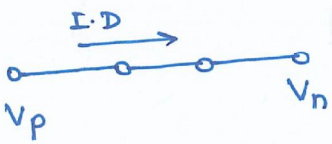
$V_p > V_n$ → Forward Biased → Ideal diode / Practical diode

$V_n > V_p$ → Reverse Biased → Ideal / Practical.

Forward Biased

Ideal Diode

ON / S.C / FB

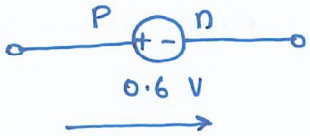


V_D = 0 volt

I_D > 0 Amp.

Practical diode.

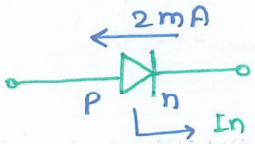
V_γ = 0.6 volt (Assume)



I_D from P to n.

I_D > 0 Amp.

Fig. FB/ON



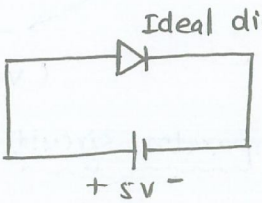
In diode current flow in only P to n.

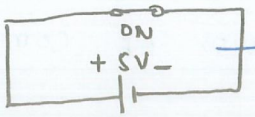
Fig. Not possible.

→ Possibility

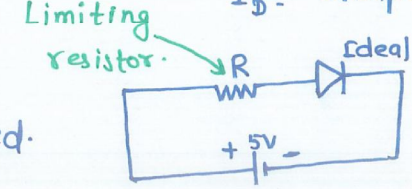
D = OFF

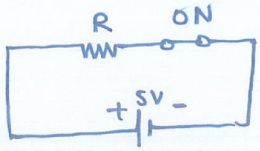
I_D = 0 Amp.

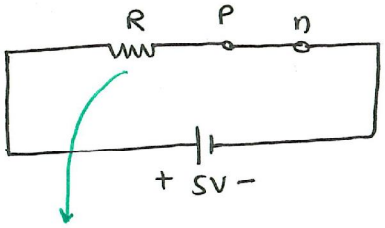




→ KVL violated.







$-5 + R I_D = 0$

$I_D = 5/R$

(i) $R = 1\,\Omega$ $I_D = 5\,A$.

(ii) $R = 1\,K\Omega$ $I_D = 5\,mA$

(iii) $R = 1\,M\Omega$ $I_D = 5\,\mu A$.

- In this case, the value of Resistor can't change behavior of Diode.

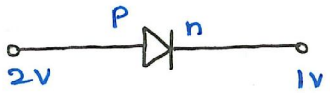


Fig (a)

→ Forward Biased [2V]

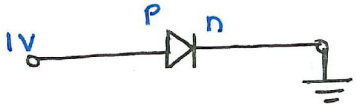
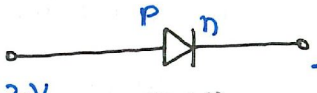


Fig (b)

→ Forward Biased [1V]

Fig (c)

→ Forward Biased [2V & -3V]



-2V (higher Neg. potential)

Fig (d)

Lower Neg. potential

→ If Both value are Negative then higher Negative potential deside the Diode operation.

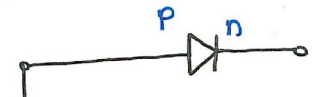


Fig (e)

FB [-0.5V]

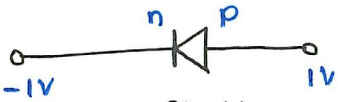


Fig (b).

F-B [Both -1V & 1V]

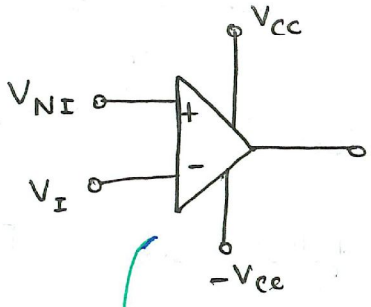
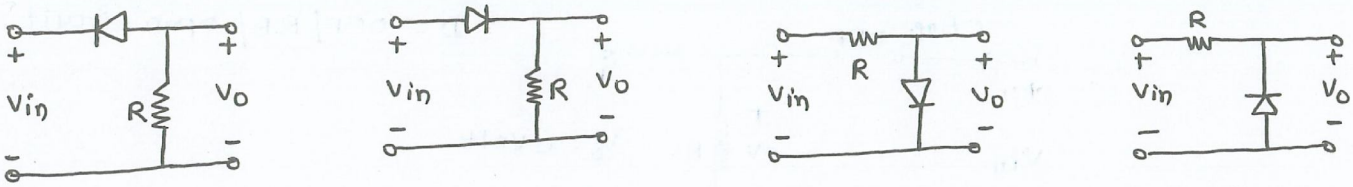


Fig Comparator circuit

In Comparator magnitude decide the behavior of comparator.

Basic Clipper Circuit

- Series Clipper circuit
  - Positive S.C.C.
  - Negative S.C.C
- Shunt Clipper circuit.
  - Positive Shunt clipper
  - Negative shunt Clipper



(i) In series clipper ckt. diode is connected in series with Input.

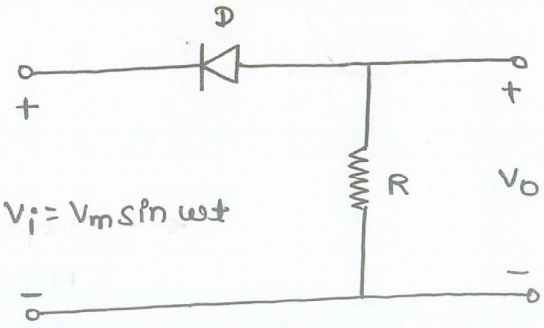
(ii) In shunt clipper ckt. diode is connected in shunt with output.

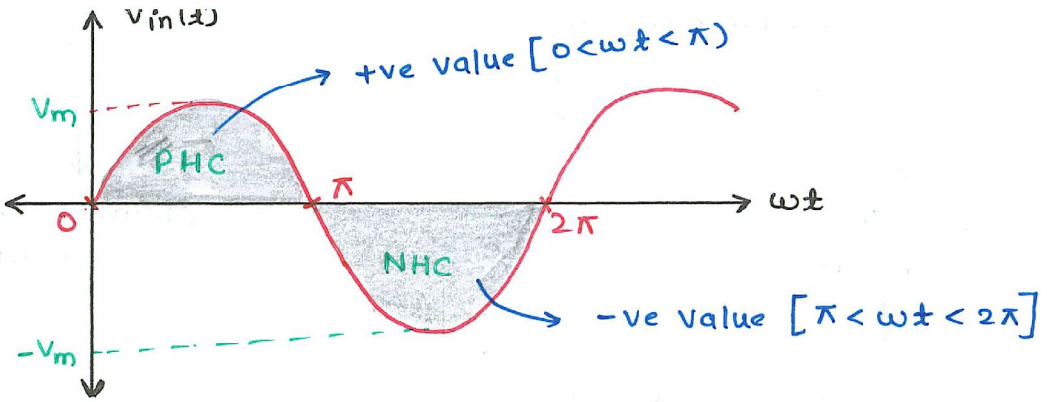
(iii) In positive clipper ckt. we remove maximum Positive portion of transmitted waveform.

(iv) In Negative clipper ckt we remove maximum Negative portion of transmitted wave form.

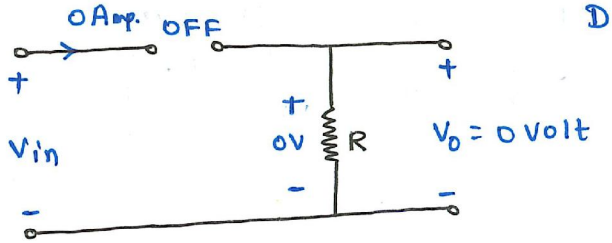
Key point :- IF their is NO Information about Diode then we will consider Ideal diode.

(1.) **Posivite series Clipper circuit :-**





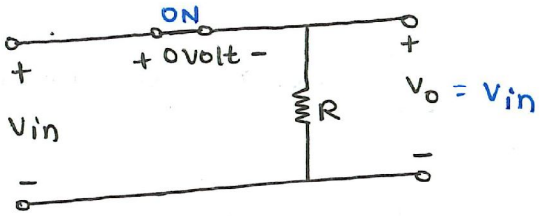
Case - 1 During PHC $[0 < \omega t < \pi]$

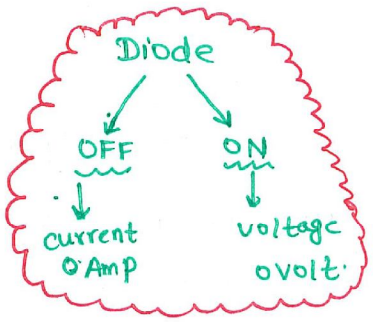


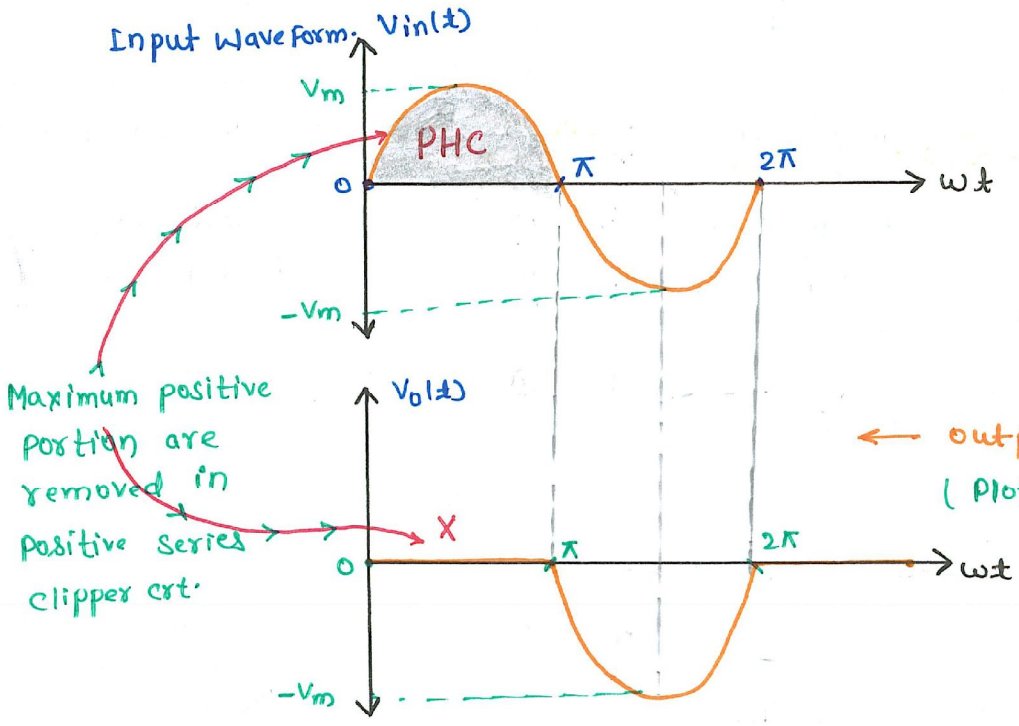
D = OFF / RB / open circuit

Case - 2 During NHC $[\pi < \omega t < 2\pi]$

D = ON / FB / Short circuit



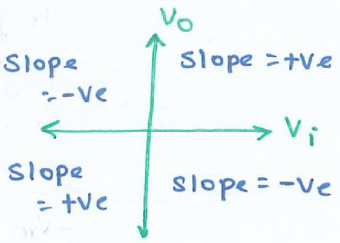




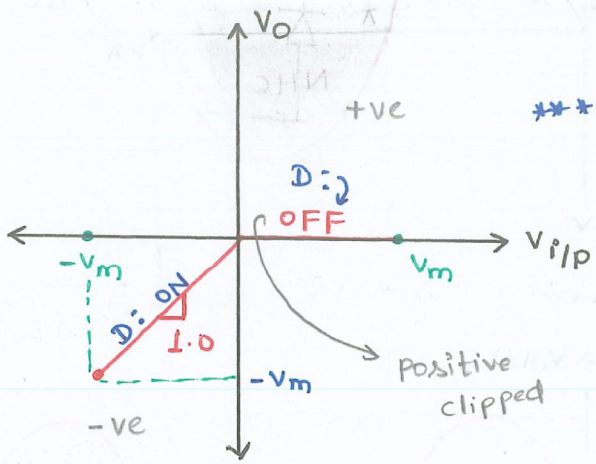
← output Wave form.
(Plot b/w output voltage & time domain)

Transfer Characteristics

- output voltage Vs Input voltage is reffered as Transfer Characteristics.



IF O/p follow I/p then graph always in 1st & 3rd quadrant.



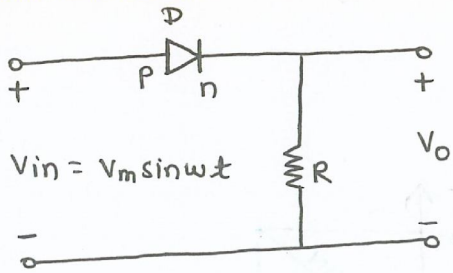
NHC

$V_o = V_i$

$y = mx$

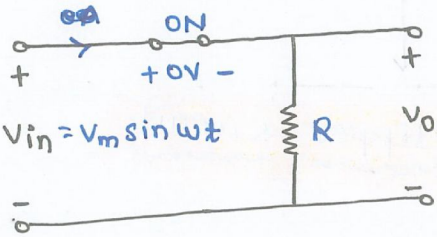
Slope = +1

(2) Negative Series Clipper circuit



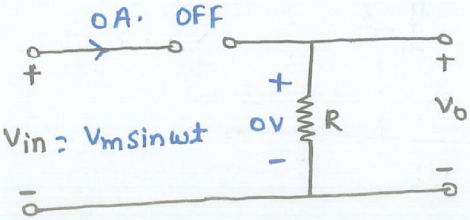
Case - 1 During PHC $[0 < \omega t < \pi]$

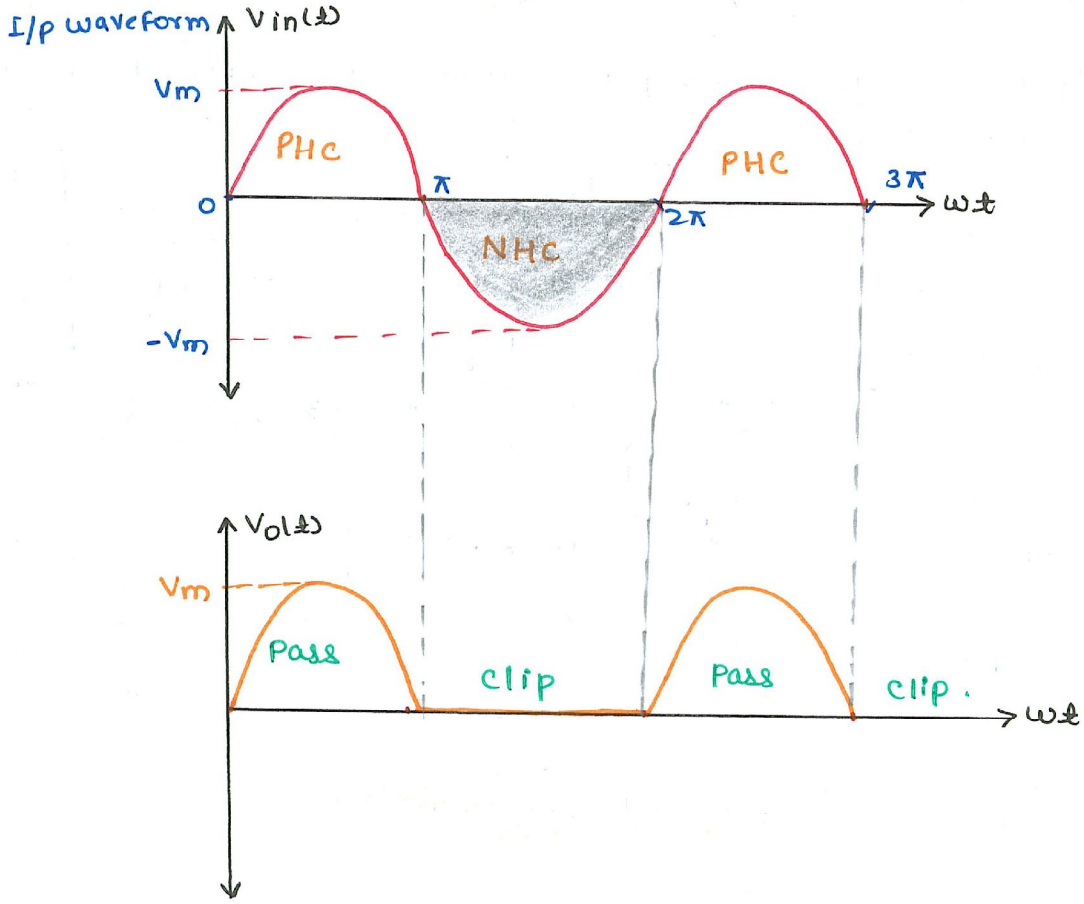
D = FB/ ON/ Short Circuit



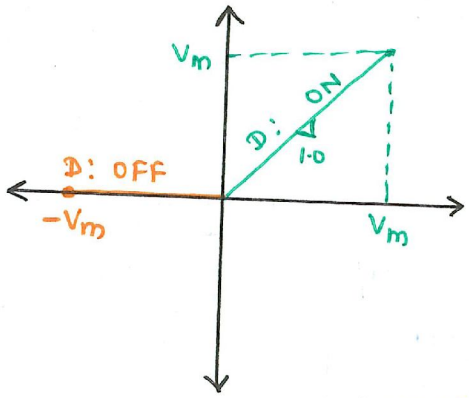
Case - 2 During NHC $[\pi < \omega t < 2\pi]$

D = RB/ OFF/ open circuit.





Transfer characterstics :-



(3) Positive Shunt clipper circuit