Lecture 10

Topic Name : Rough

Day :

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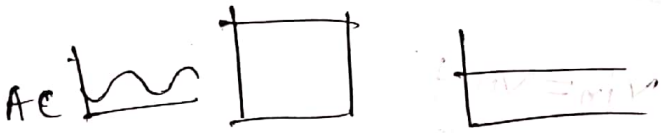
Rectifiers

short of, circuit that converts Ac signal to Dc signal.

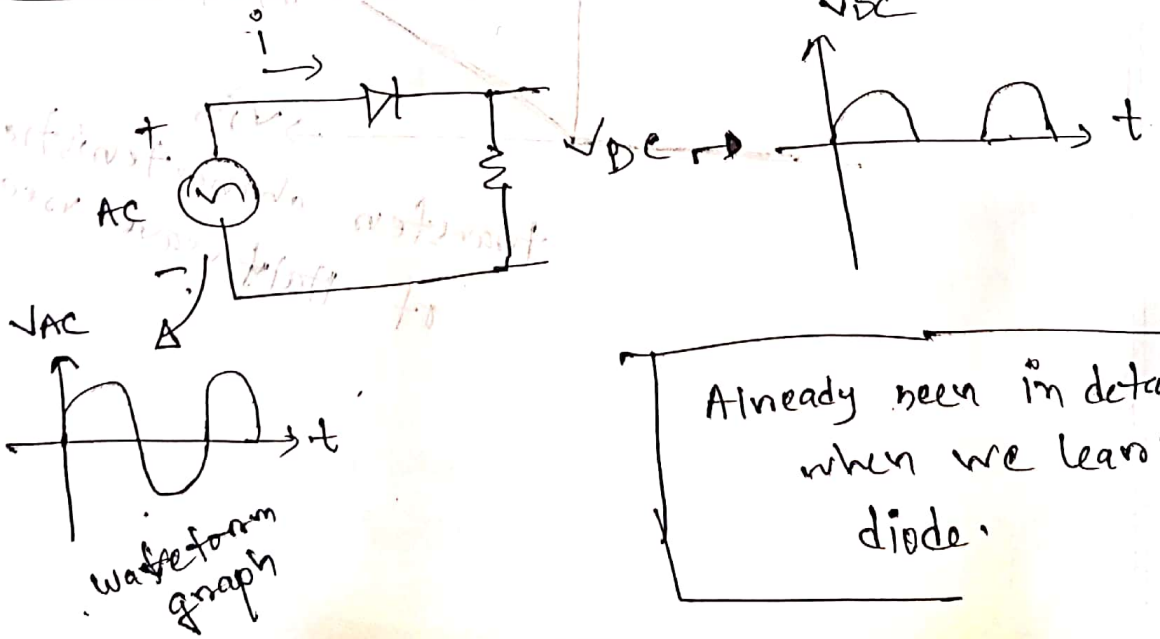


~~we can supply the~~

Two Types :

1. Halfwave rectifier
2. Fullwave rectifier.

H.W rectifier. (review of previous)



Already seen in details when we learned diode.

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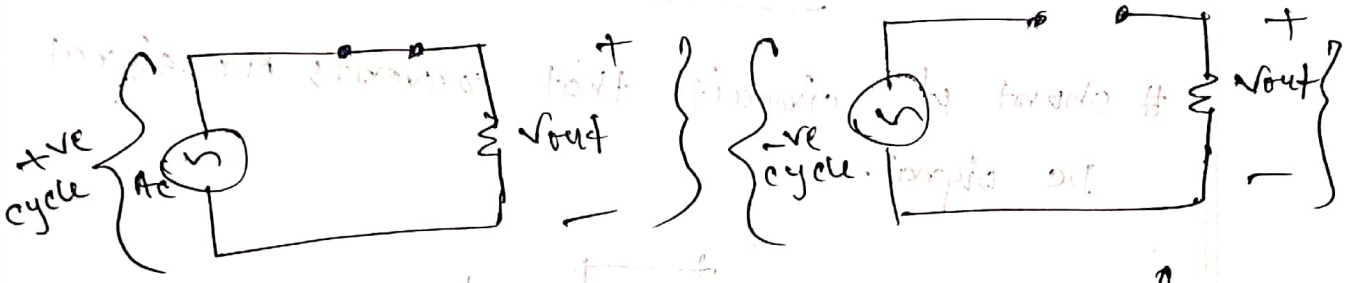
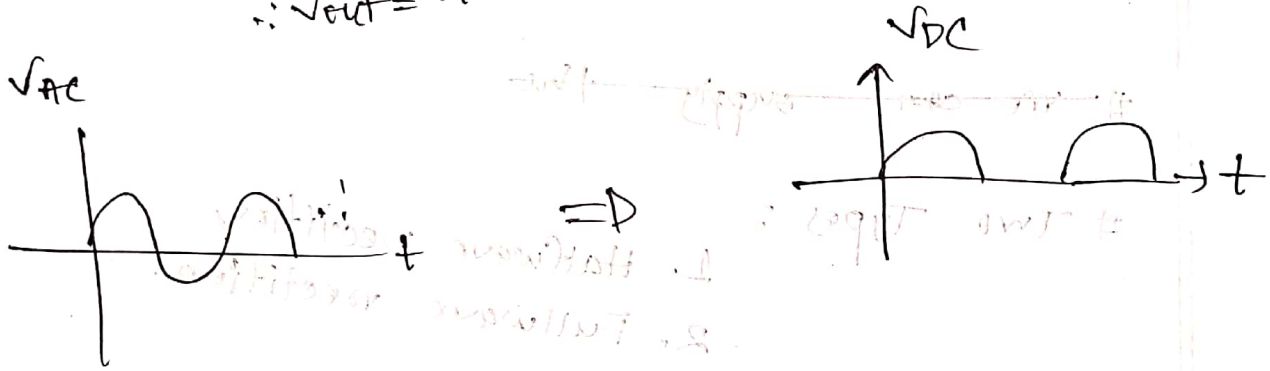
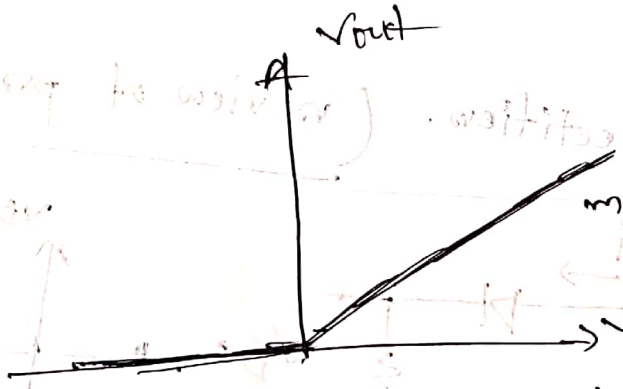


$V_{in} = V_{out}$

$\therefore V_{out} = V_{in}$

$V_{out} = 0$





transfer characteristics of Half wave rectifier.

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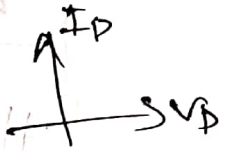
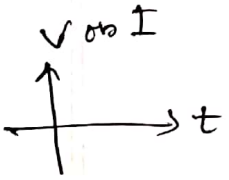
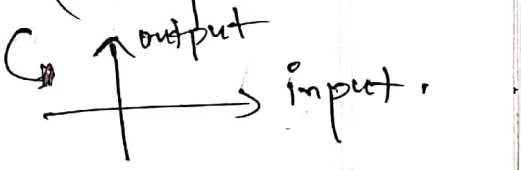
3 types of graph

1. IV graph / IV - characteristics (I_D vs. V_D) → Device → 

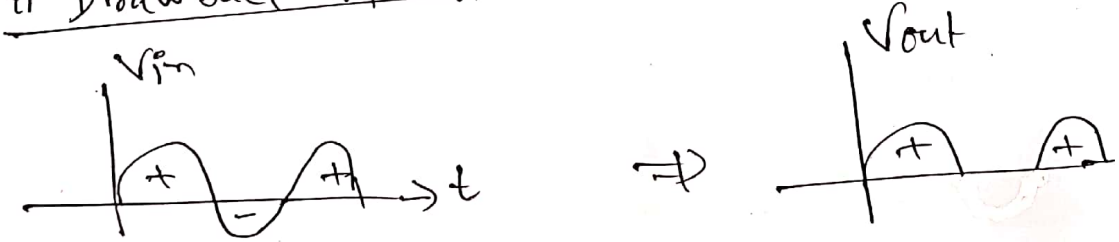
2. Waveform Graph (V, I. vs. t) → 

3. Transfer characteristics (Input vs. output)

[circuits with 2 ports]



Drawback of H.W rectifier:



loss of negative cycle voltage.

To solve this we use Full-wave rectifier. which use both positive and negative cycle.

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So Question is

Is there any power loss in H.W Rectifier?

Ans: No power loss.

Because on negative cycle current $i=0$ as well so $p=vi=0$, so No loss

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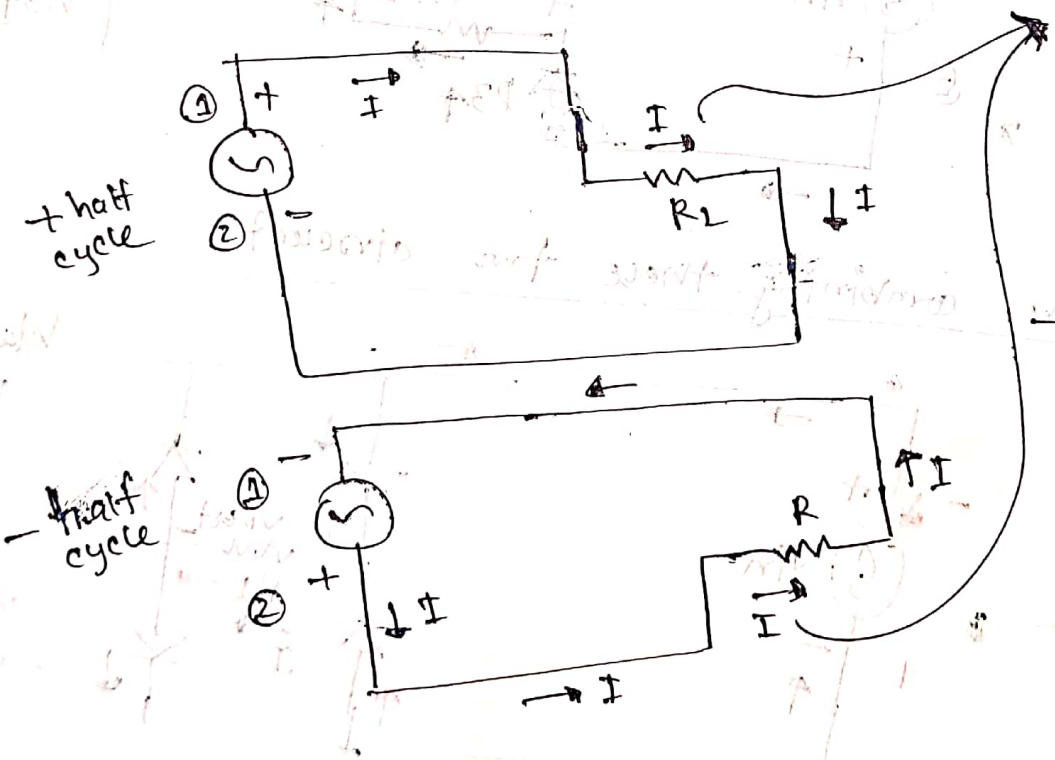
Full wave Rectifier

(F.W ")

want to utilize both positive and negative cycle of input.

[we dont want our output has 2 polarities cause DC has only 1 polarity]

Lets assume we have some AC source:



→ So for both cycle (+ve and -ve cycle) we will get current in same direction via R2 if we can achieve circuit like this

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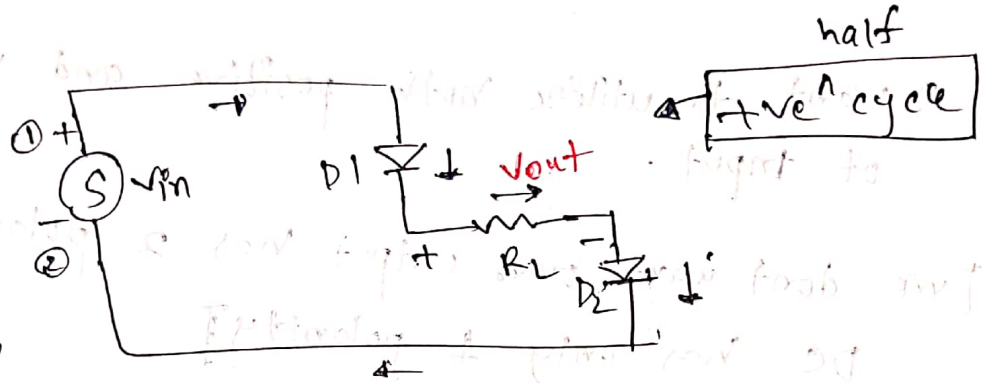
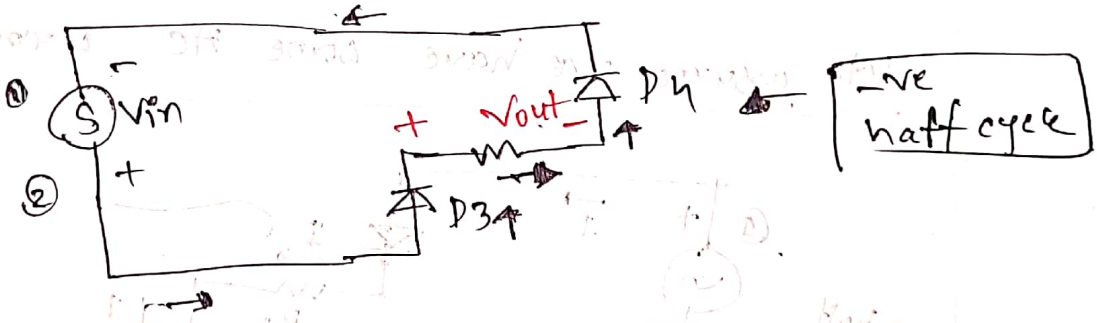
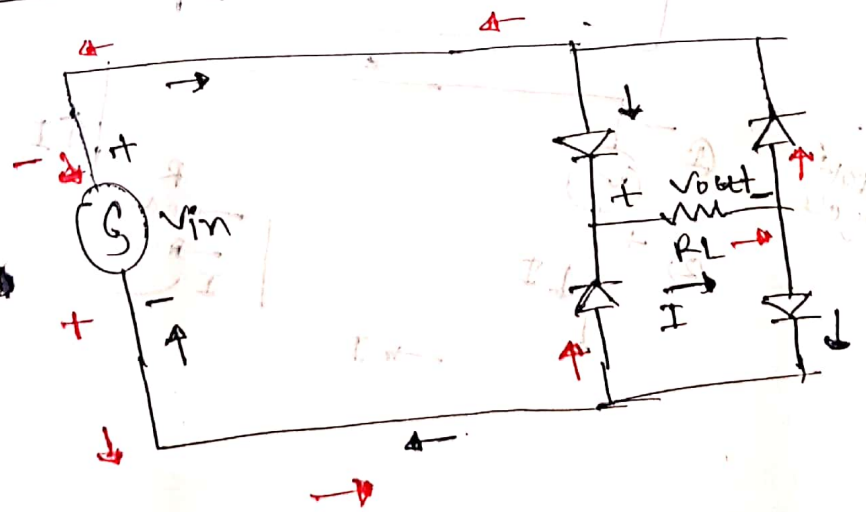
* So How can we achieve these two circuit ?





working principle of F.W.R

Now combining these two circuit :



black → positive cycle

red → negative cycle.

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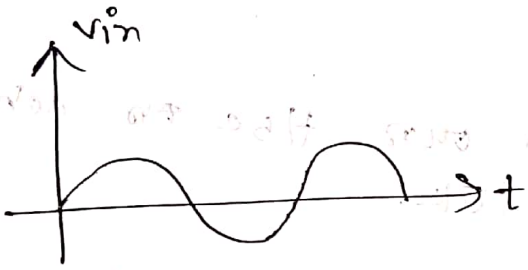
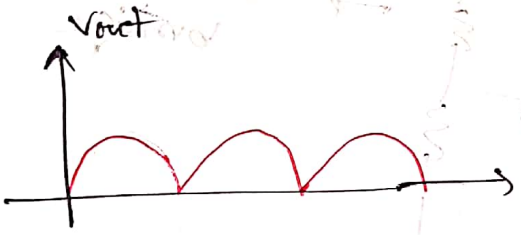
Lets try to find output of this F.W rectifier circuit.

Wave from of V_{in}

∴





Now we can use both cycle in full wave rectifier.

(#) It utilize full wave that is why its called F.W. rectifier

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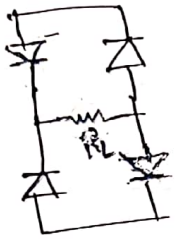
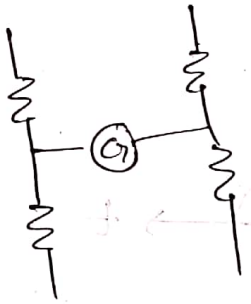
So



→ so this is actually a bridge circuit.

[we have learned in our HSC or school: resistor bridge. like:



→ wheatstone bridge

so we can actually make bridges with different type of element.

** so this full-wave rectifier also called Bridge rectifier.

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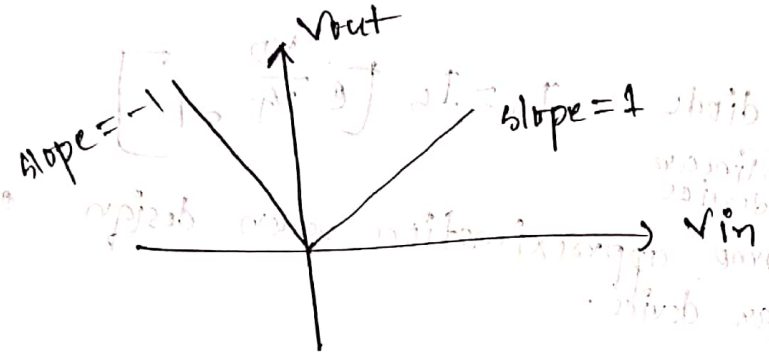
Transfer characteristic of full wave rectifier :

F.W rectifier



[when +ve cycle, $V_{out} = V_{in}$

" -ve " , $V_{out} = -V_{in}$

Here for F.W rectifier we assumption, have one

"All the diodes are ideal"

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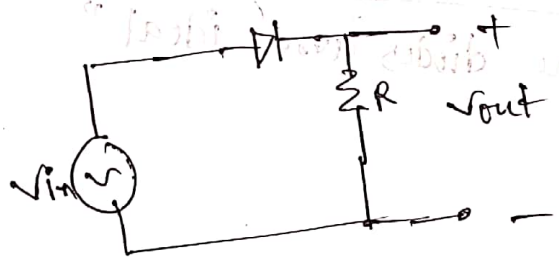
Rectifiers with REAL DIODE

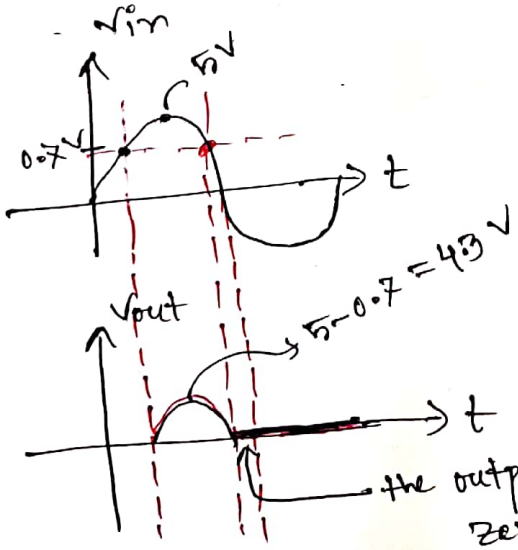
For real diode (nonlinear device) $I_D = I_S \left[e^{\frac{V_D}{V_T}} - 1 \right]$

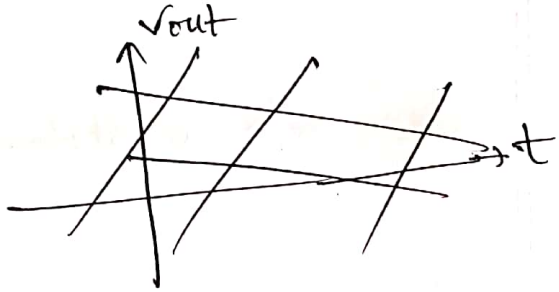
we do some approximation when design circuit with non-linear device.

** here we use CVD model, with $V_{D0} = 0.7$

H.W Rectifier with real diode :







** Here,
if $V_{in} > 0.7$
$V_{out} = V_{in} - 0.7$

as $V_i < 0.7$, $V_{out} = 0$

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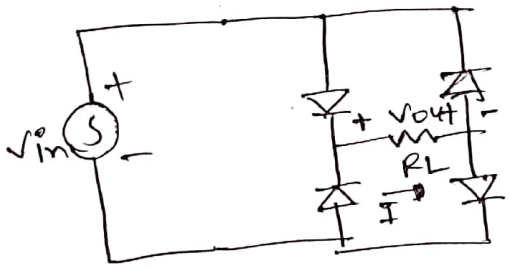
H.W. rectifine (Real diode)

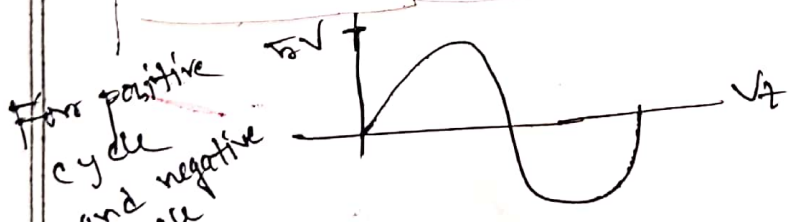
(A) peak value. $V_p = V_i - V_{Do}$

↙ input ↘ 0.7V for silicone diode

Full wave rectifier using (real diode)

~~Direct~~ +ve cycle.





Here 2 resistor.

$2 \times 0.7 = 1.4V$

$5 - 1.4V$

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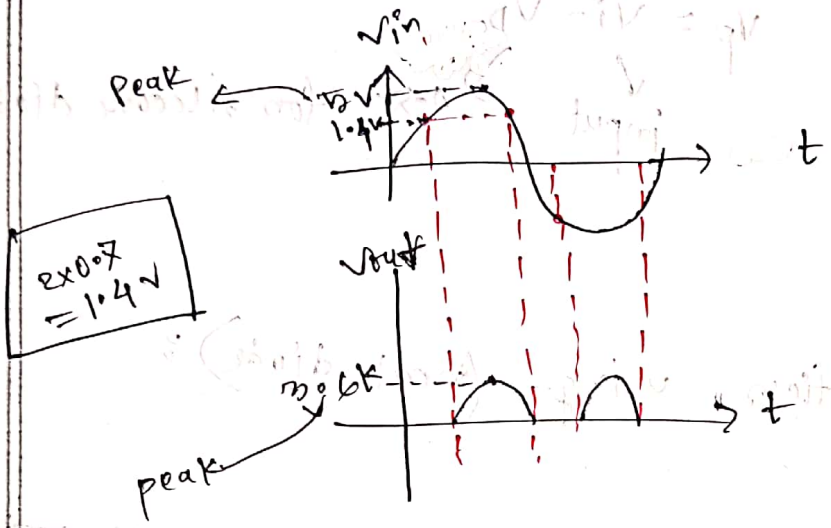
F.W rectifier circuit :



F.W rectifier

peak voltage,

$$V_p = V_i - 2V_D$$

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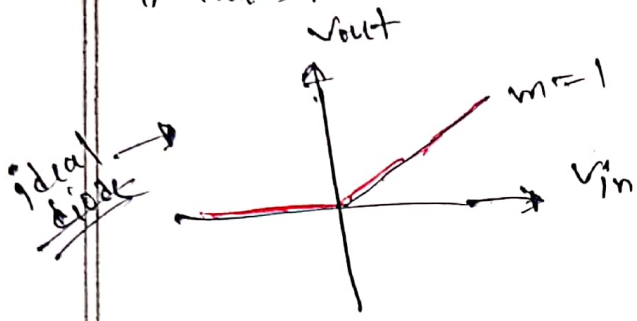
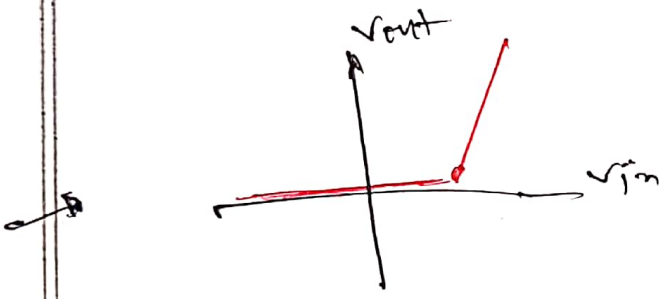
Transfer char. (Real diode)

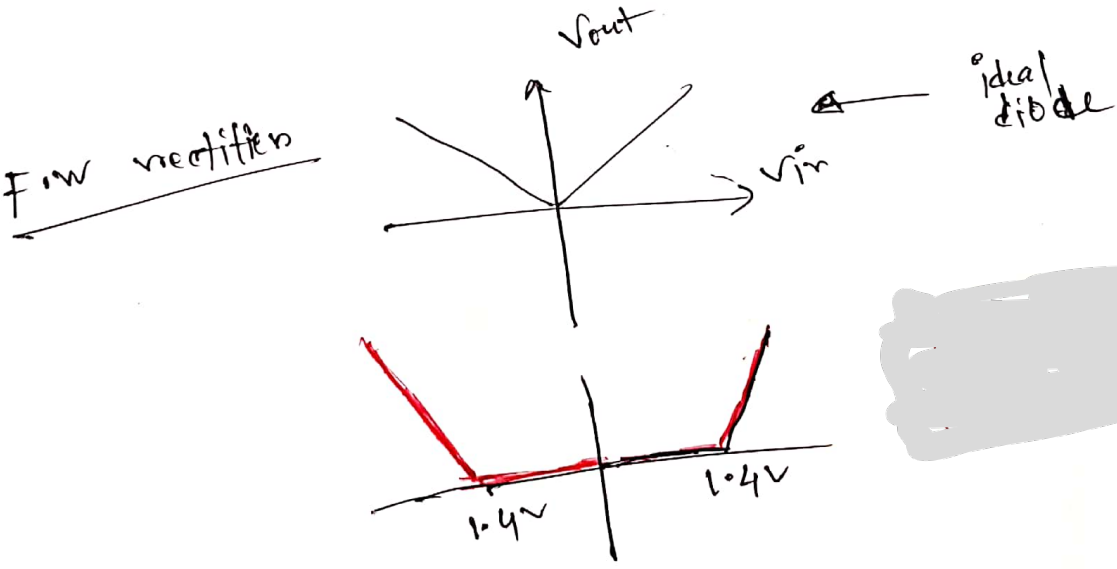


H.W rectifier



$V_{out} = V_{iout} \doteq V_{in} - 0.7f$

F.W rectifier



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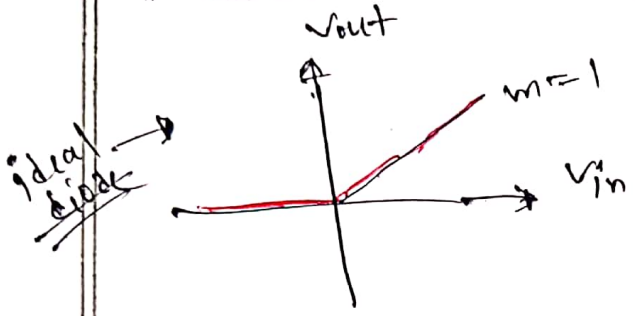
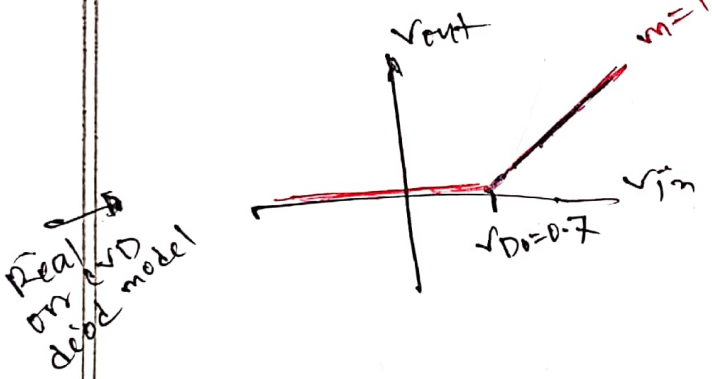
** [See slide] ** → For these transfer characteristic for better visualization

Transfer chara. (Real diode)



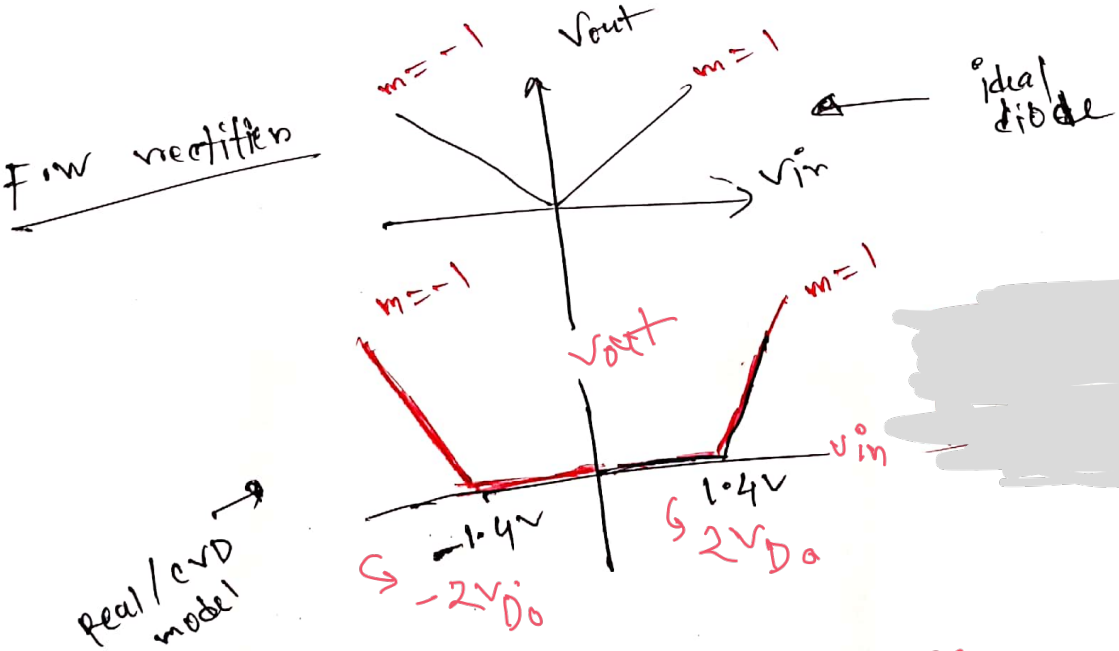
H.W rectifier



$V_{out} = V_{in} - 0.7$

$y = x - c$

FW rectifier



+ve cycle, $V_{out} = V_{in} - 1.4$

$= V_{in} - 2V_{Do}$

-ve cycle, $V_{out} = -V_{in} - 1.4$

$= -V_{in} - 2V_{Do}$