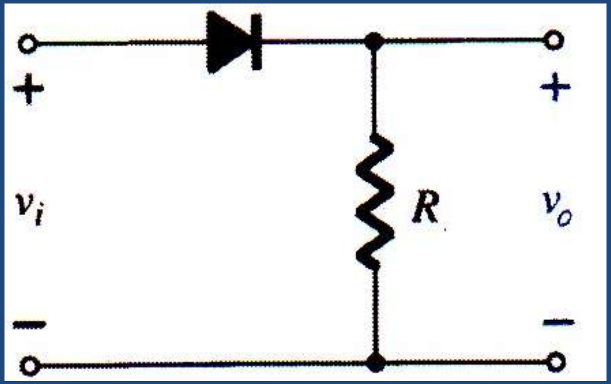
Diode Applications

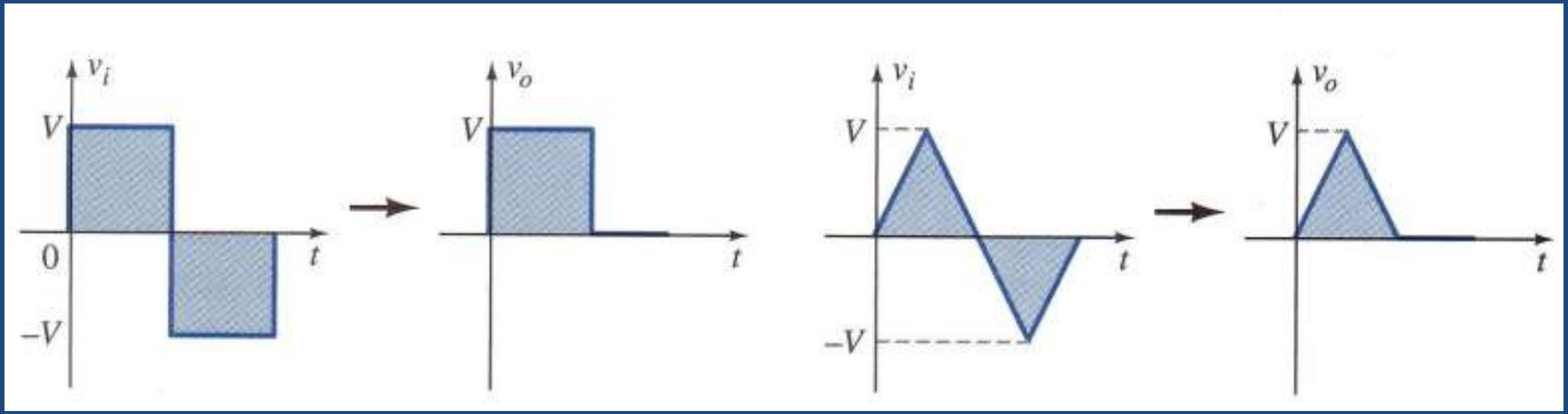
Clippers (Limiters)

Diode Clipping Circuits

- Used in various circuit configurations to clip signal waveforms
- Always remember is that in the forward direction the voltage across a diode will always be limited to approximately 0.7V for silicon and 0.3 for Germanium
- In the reverse direction the diode behaves like an open circuit

CLIPPER (Limiter) :Series diode



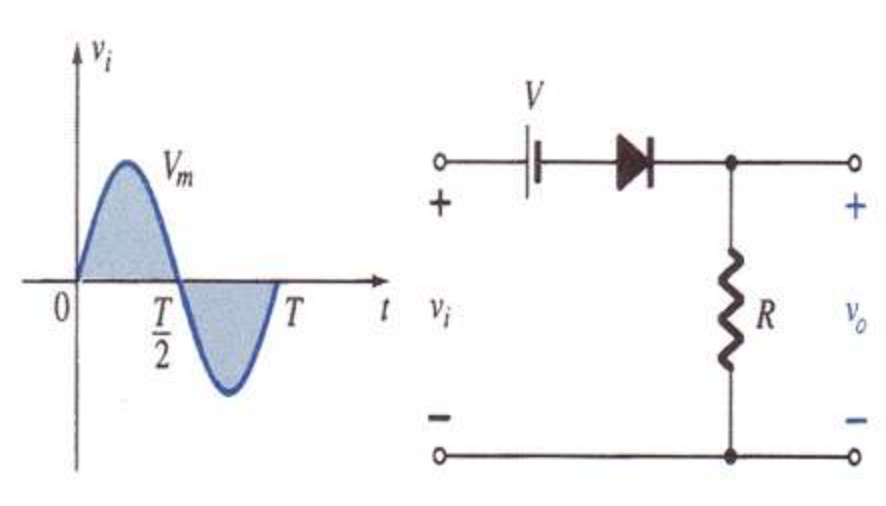


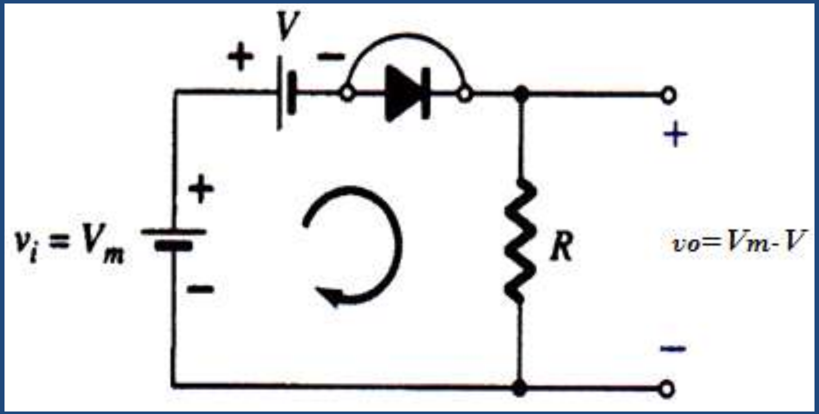
CLIPPER (Limiter) :Series diode

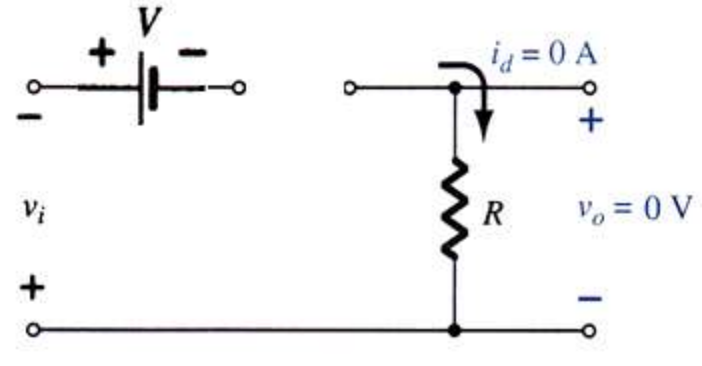
- **Steps for analysis**:

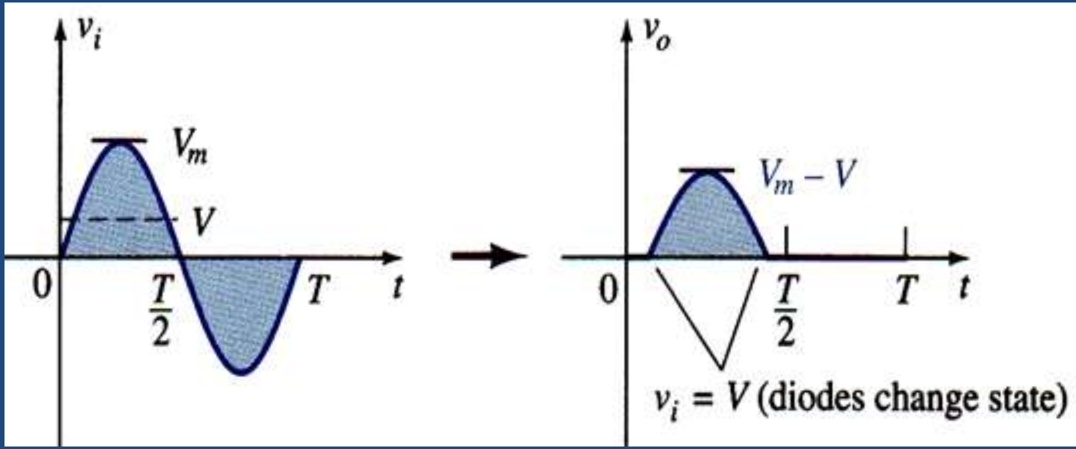
1. Note direction of the diode and the applied voltage levels
2. Determine the applied voltage that will cause a change in state for the diode.
3. Be continually aware of the defined terminals and polarity of v_o
4. It can be helpful to sketch the input signal above the output at instantaneous values of the input.

CLIPPER (Limiter) :Series diode



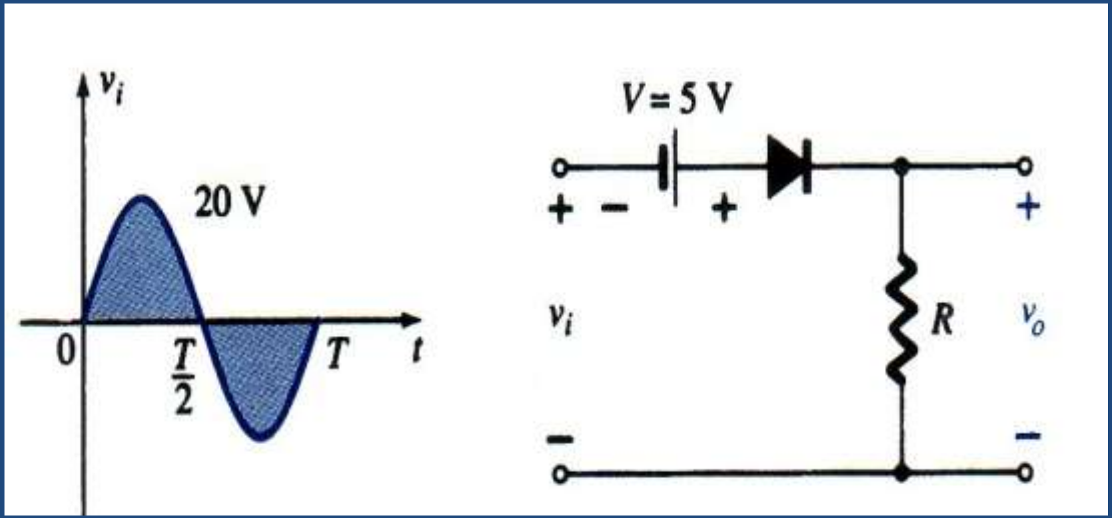


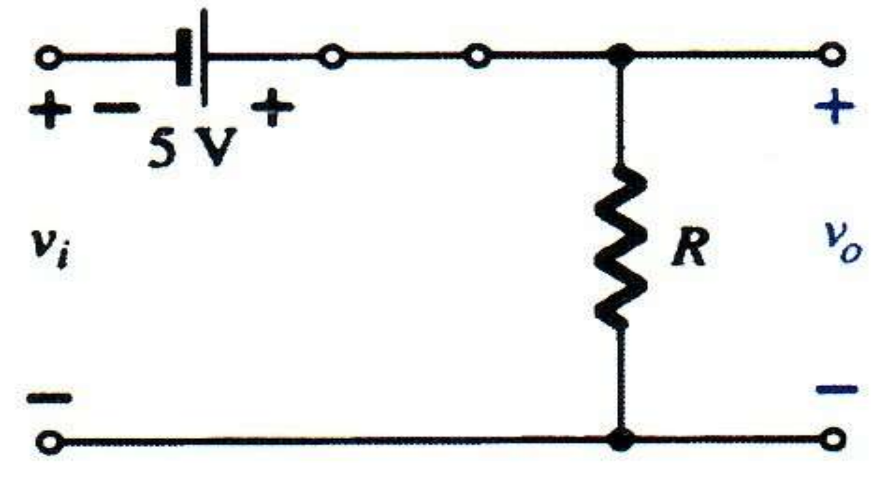




CLIPPER (Limiter) :Series diode

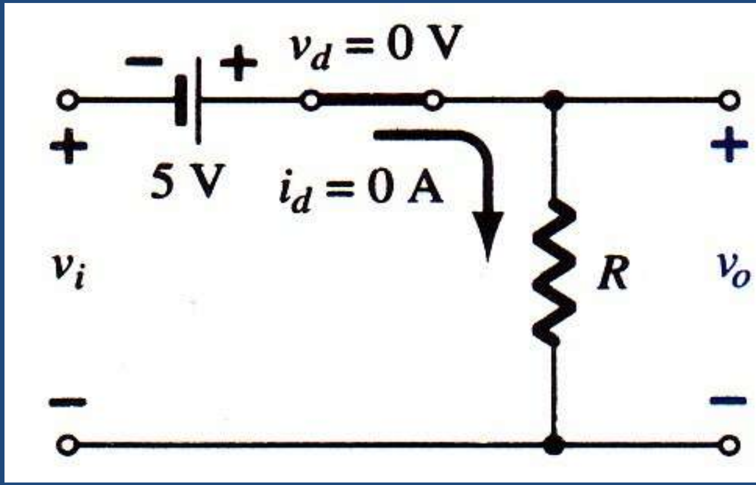
- Example 2.20





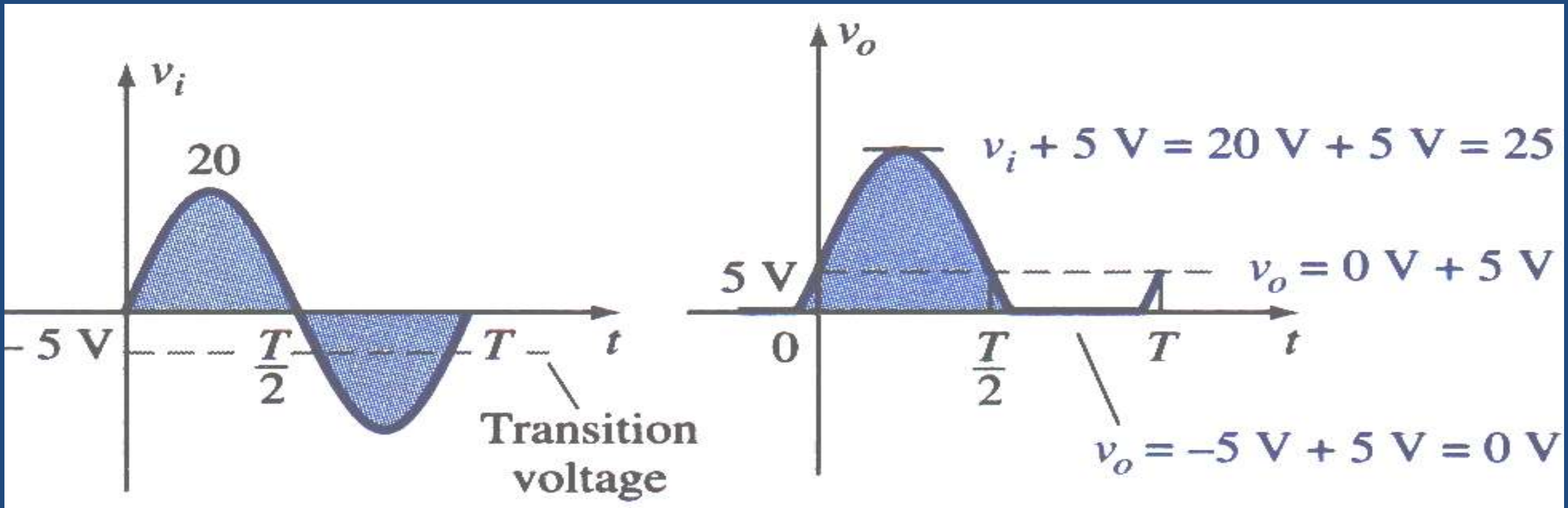
Make a mental sketch of the response of the network based on the direction of the diode and the applied voltage levels

CLIPPER (Limiter) :Series diode

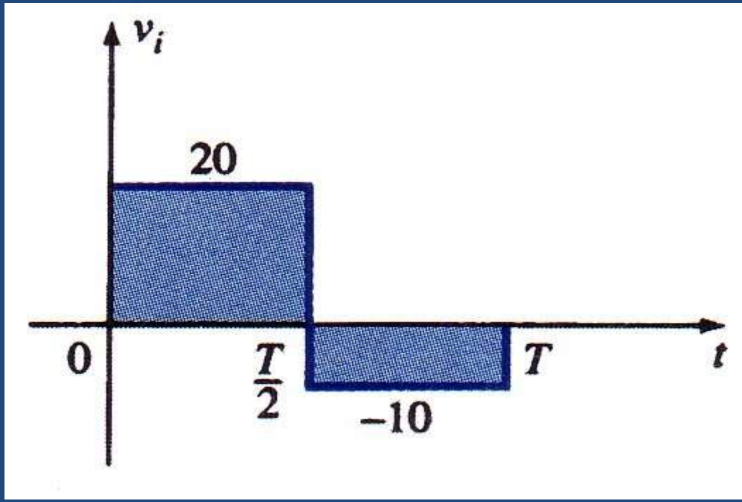


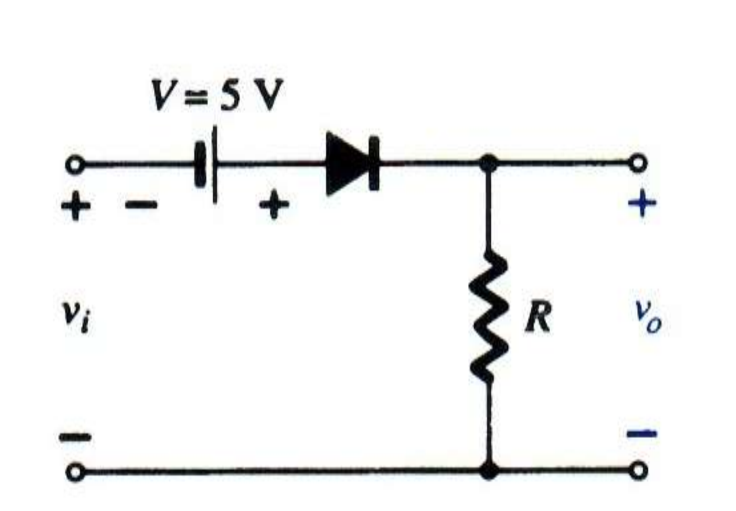
- Determine the applied voltage that will cause a change in state for the diode.

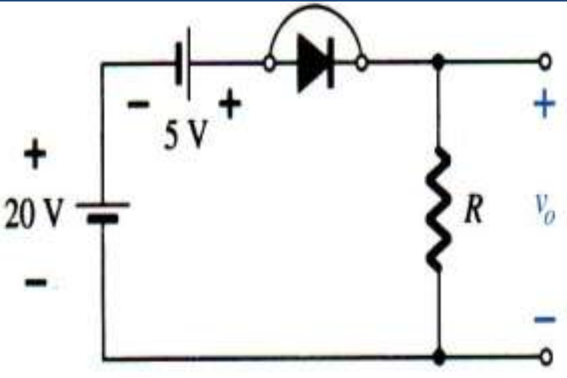
$$v_i \geq -5V$$
$$v_0 = v_i + \mathrm{V}$$



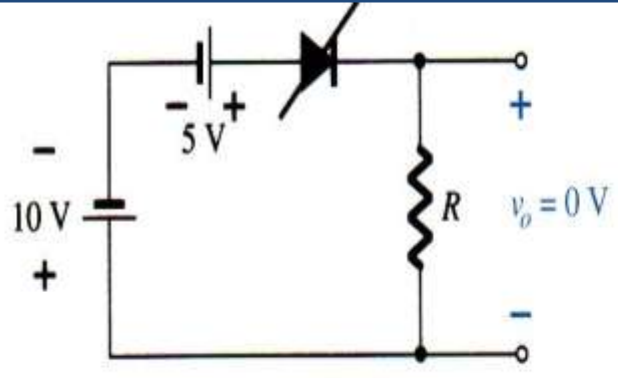
CLIPPER (Limiter) :Series diode
Example 2.21



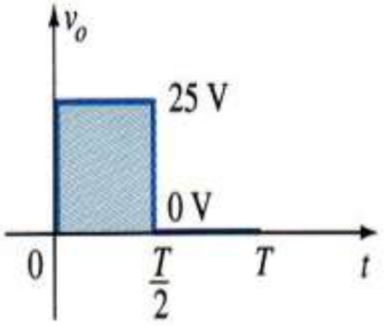




vo at vi = +20 V.

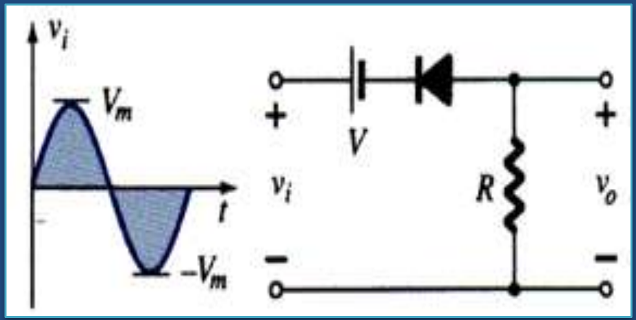


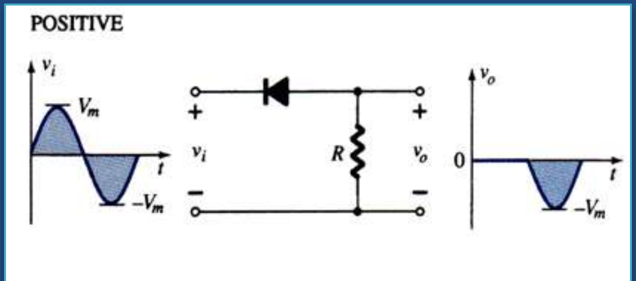
vo at vi = −10 V.



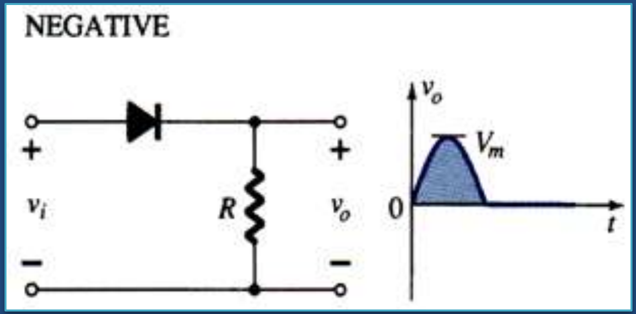
Sketching vo

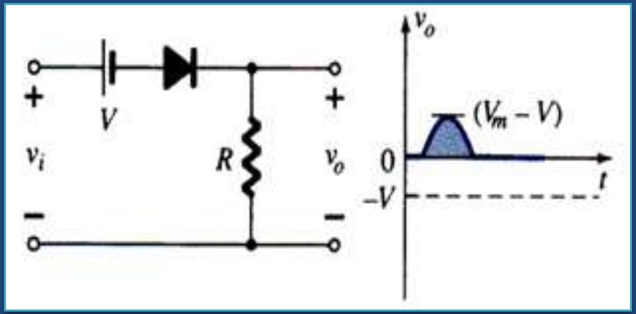
CLIPPER :Series diode

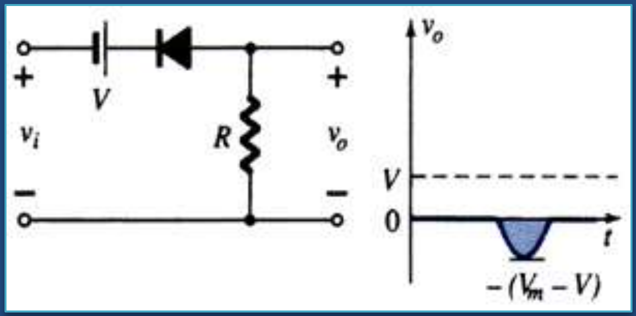


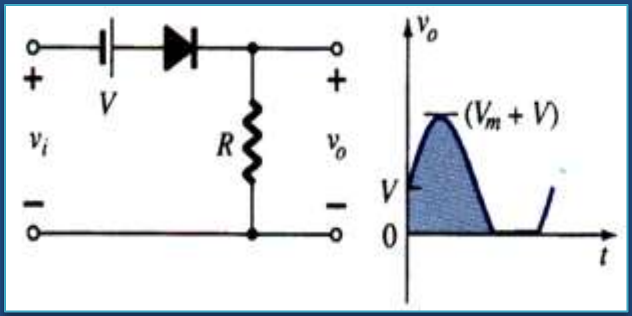


Biased Series Clippers (Ideal Diodes)

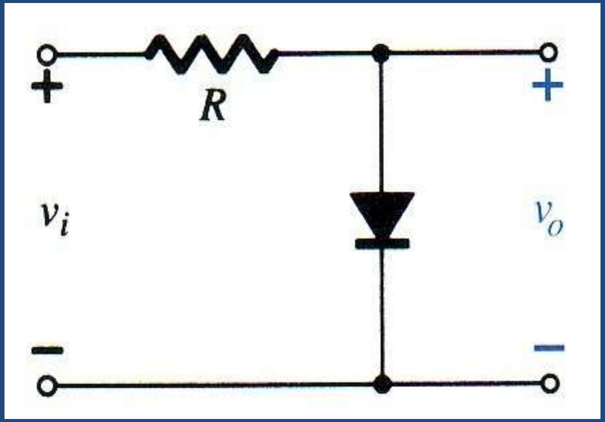


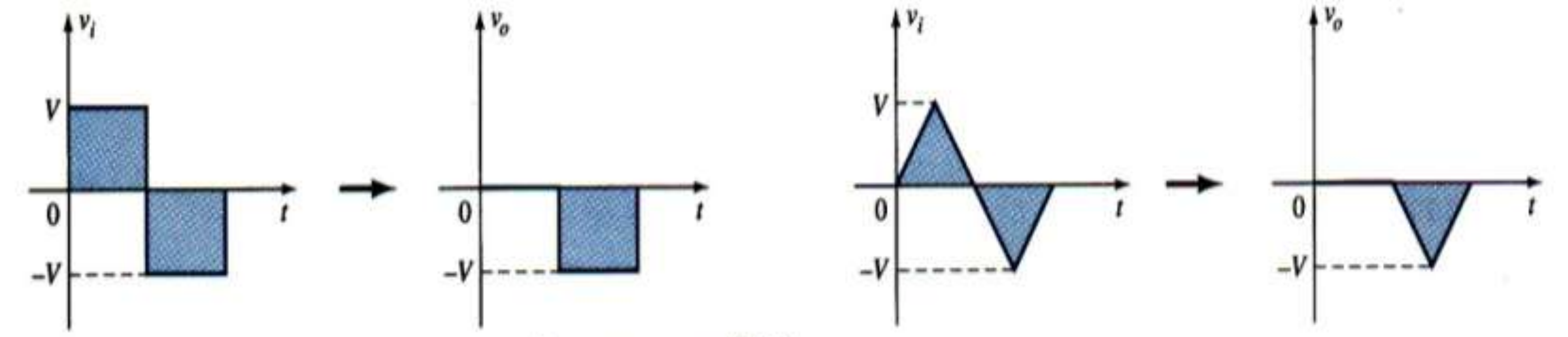






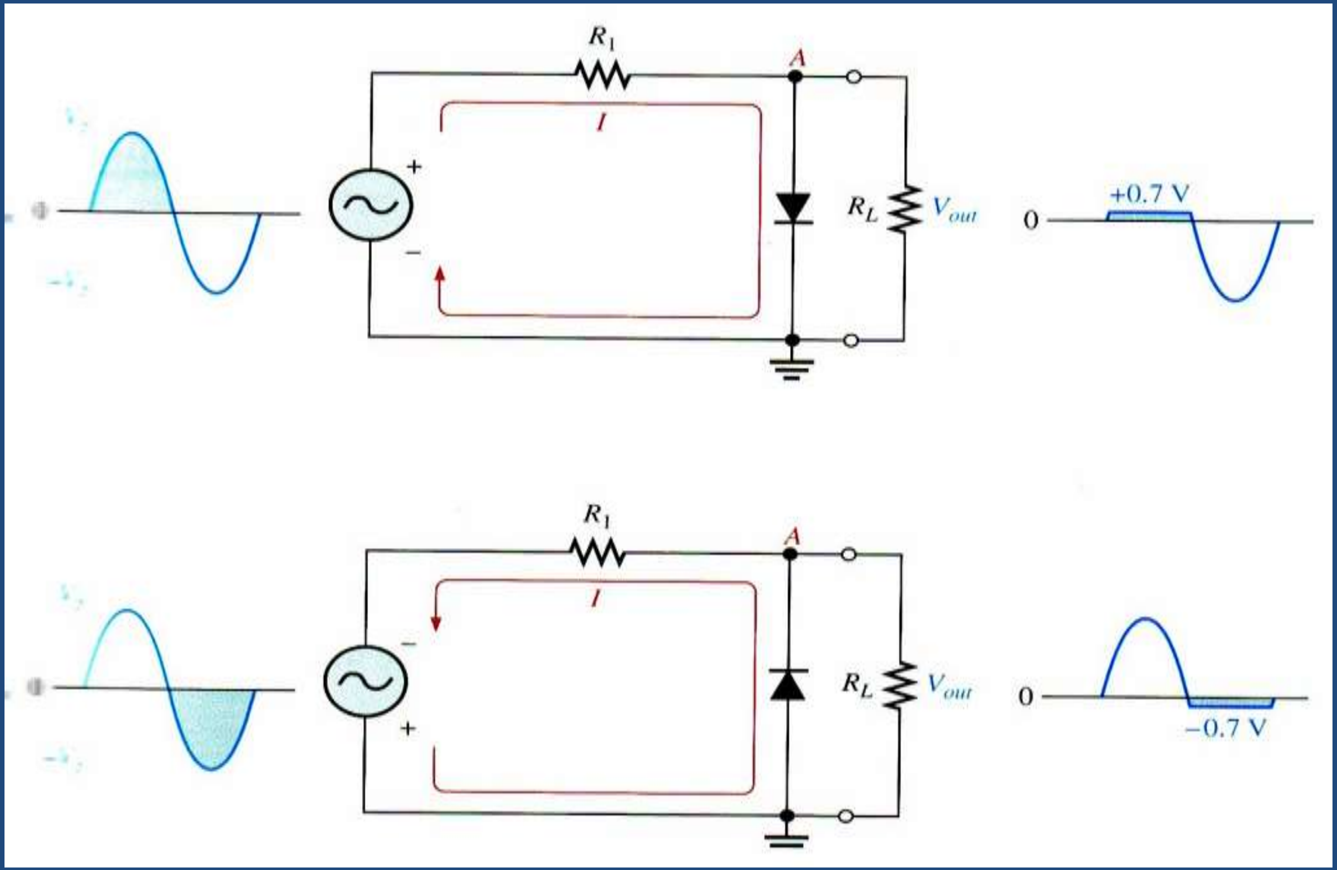
CLIPPER (Limiter) :Parallel diode



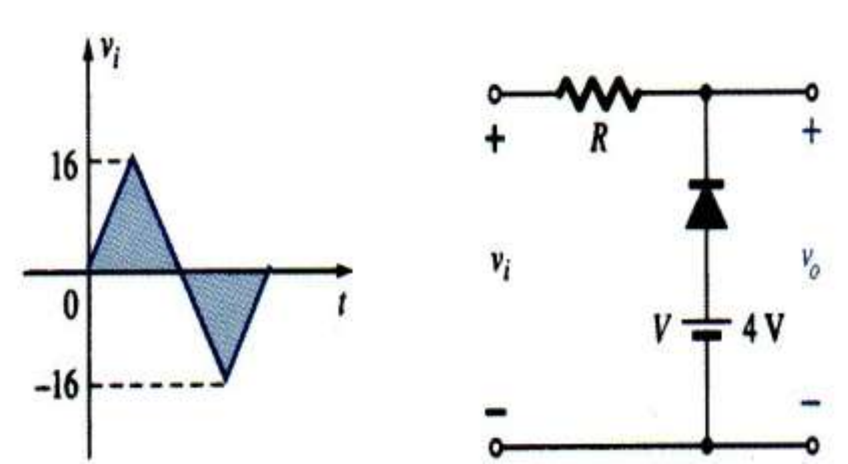


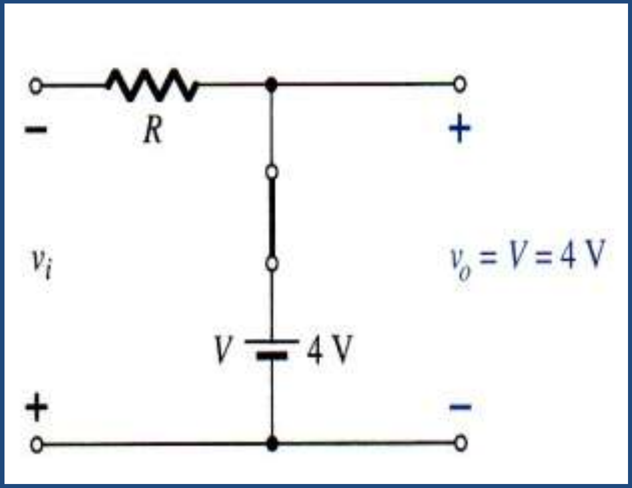
Response to a parallel clipper.

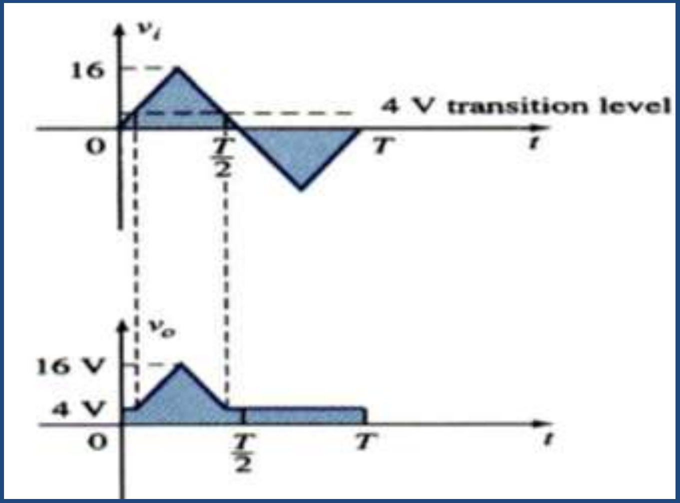
CLIPPER (Limiter) :Parallel diode



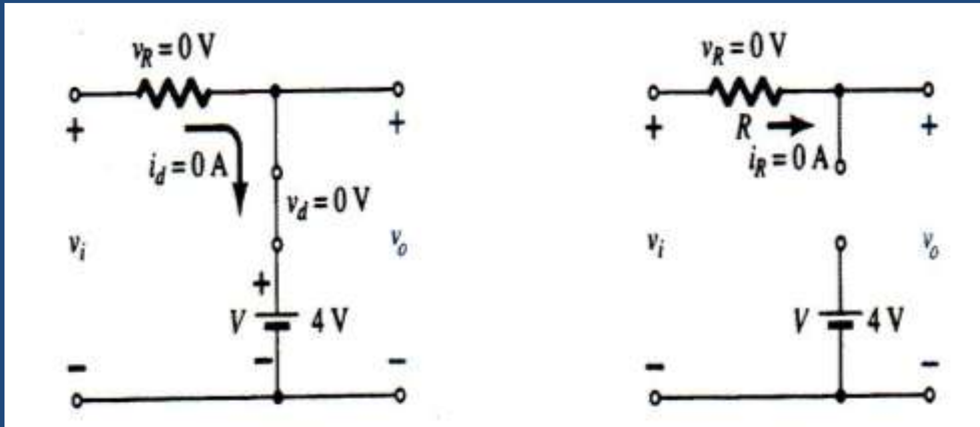
CLIPPER :Parallel diode
Example 2.22





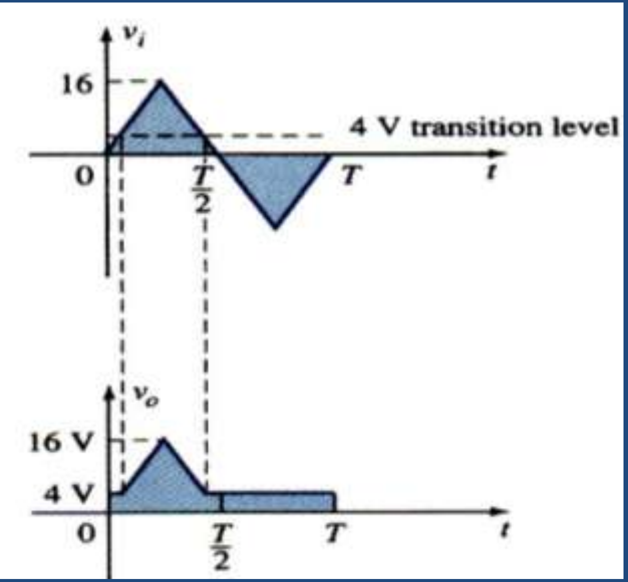


CLIPPER :Parallel diode



Determining the transition level

Determining v_o

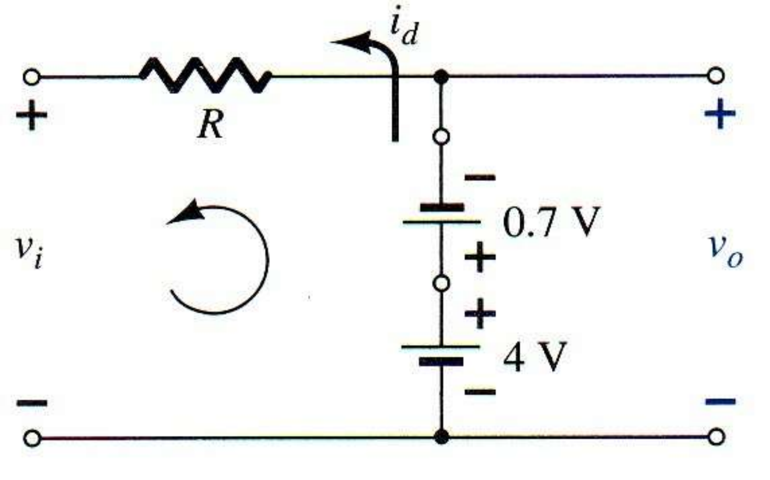


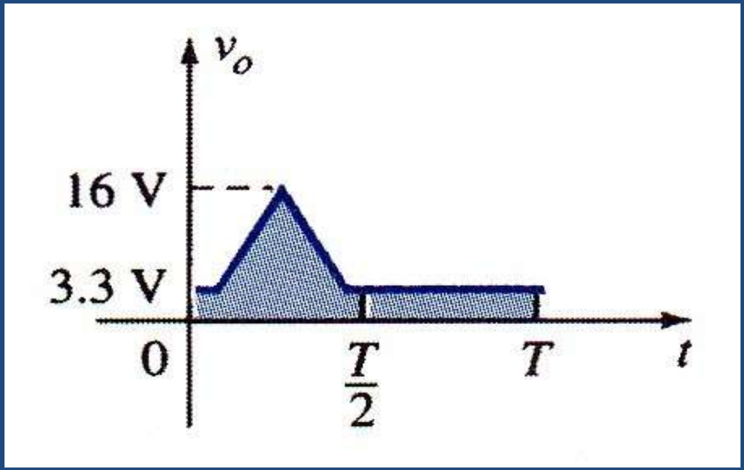
$$v_i = V$$

$$V_0 = V_i$$

CLIPPER :Parallel diode
Example 2.23

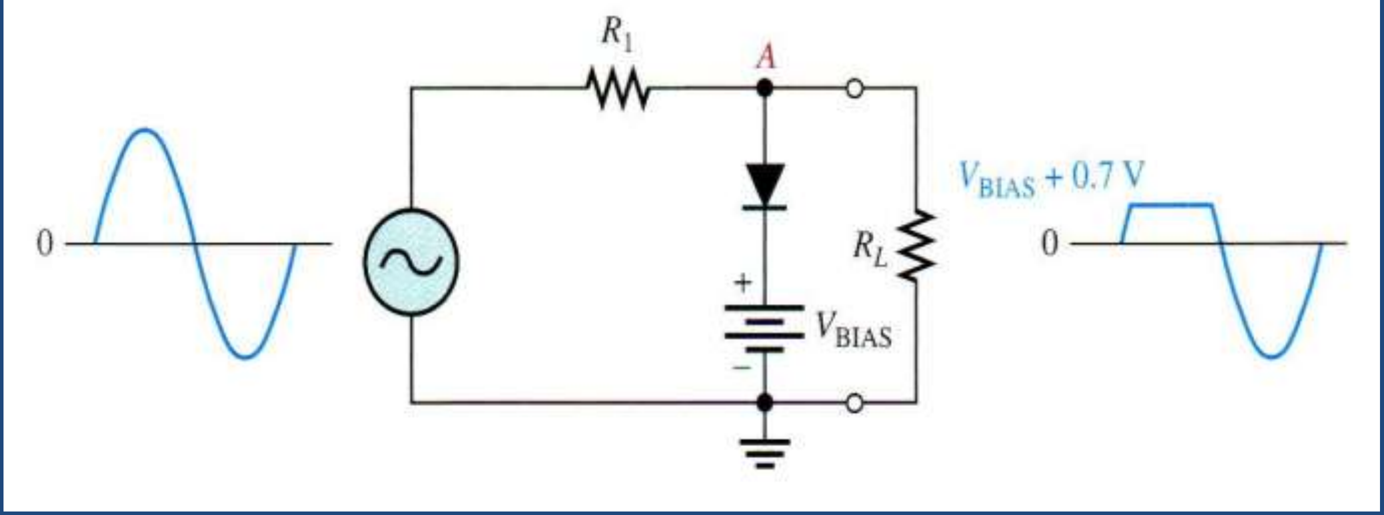
- Determining *vo* the transition levels of the network
- For Input voltage less than 3.3 V the diode will be in the on state



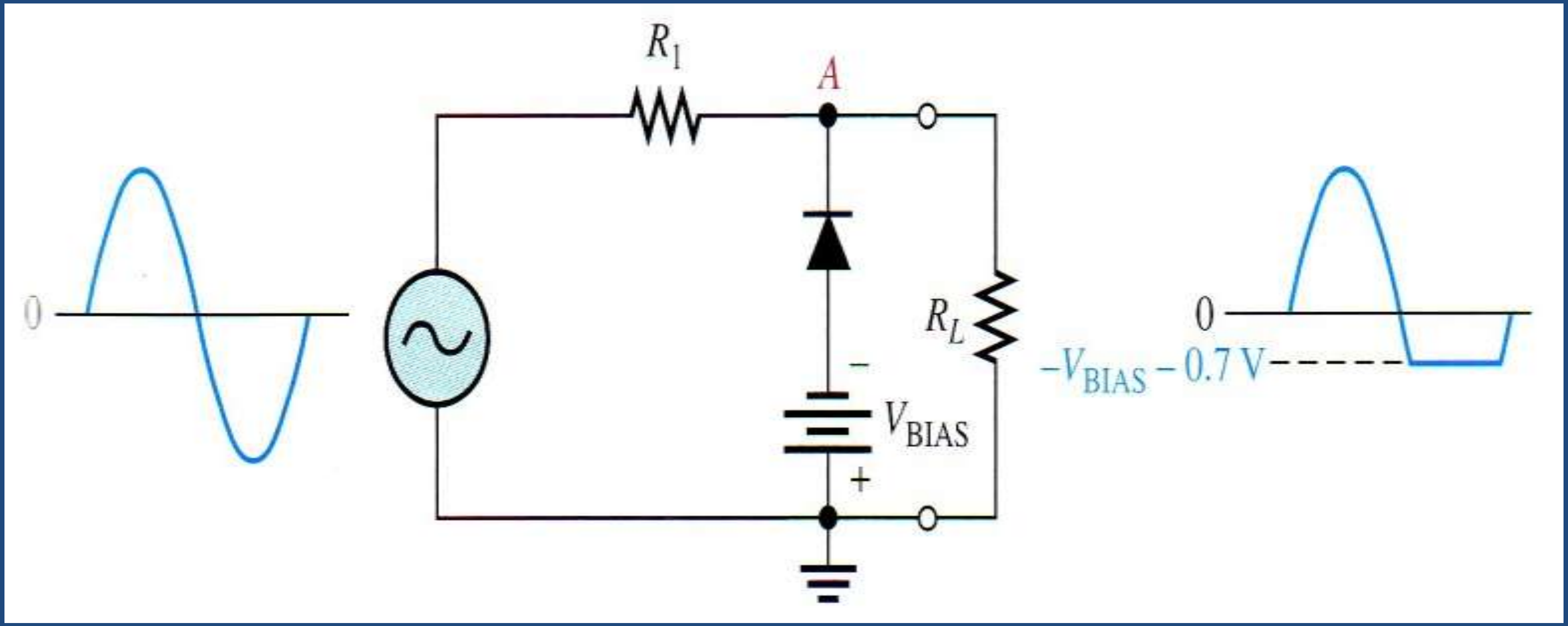


$$v_0 = 4 - 0.7V = 3.3$$

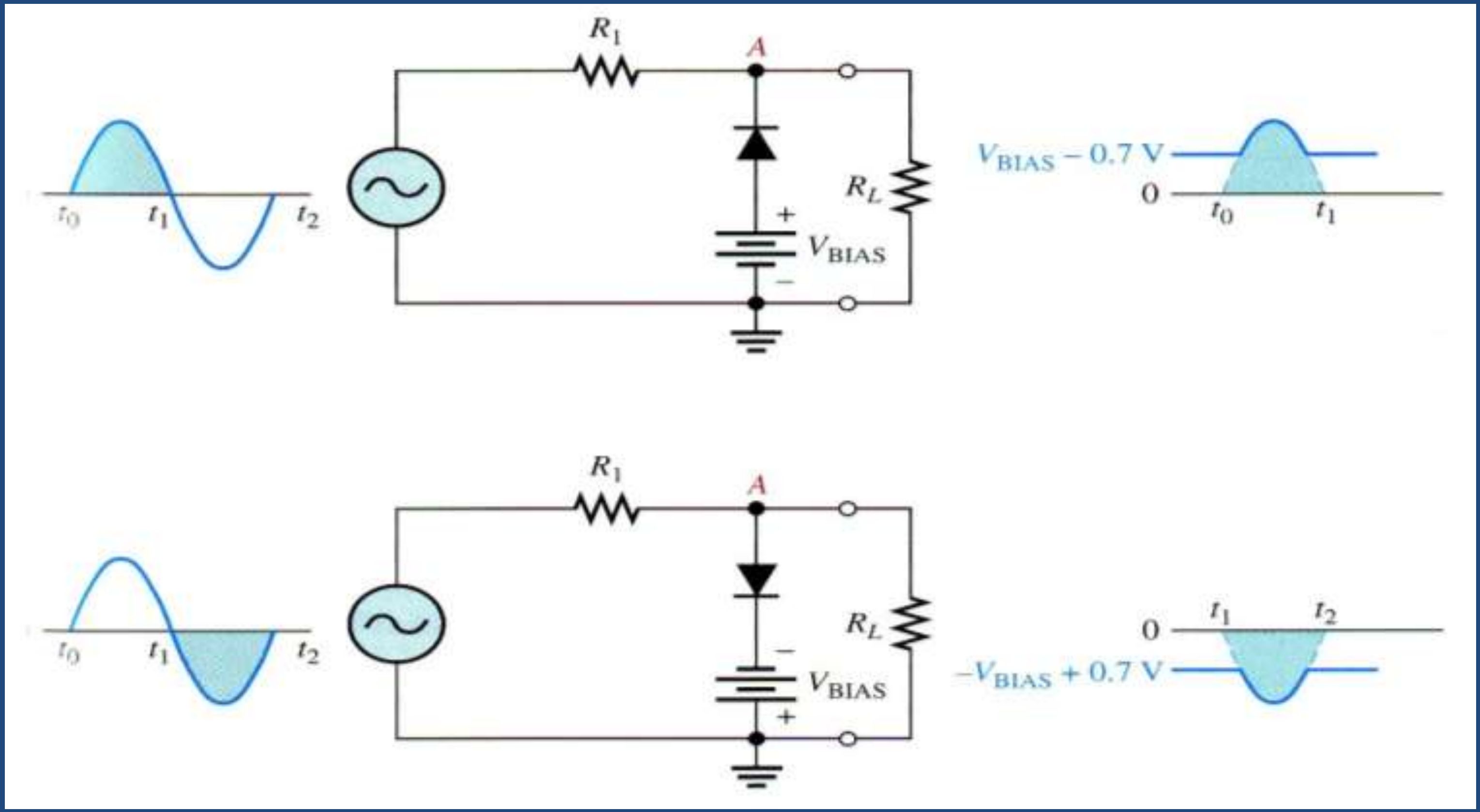
Positive limiter



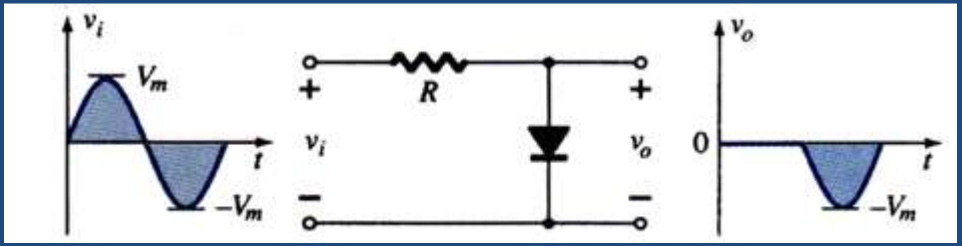
Negative limiter

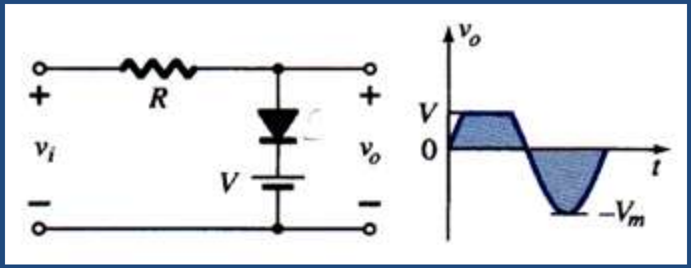


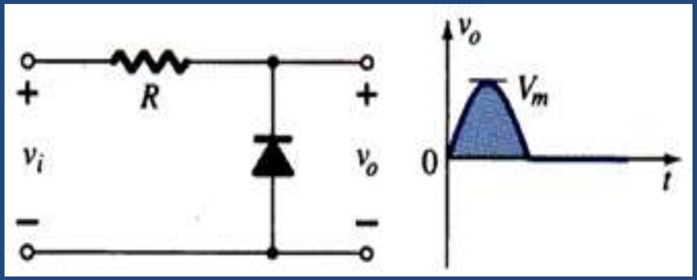
Biased Limiter

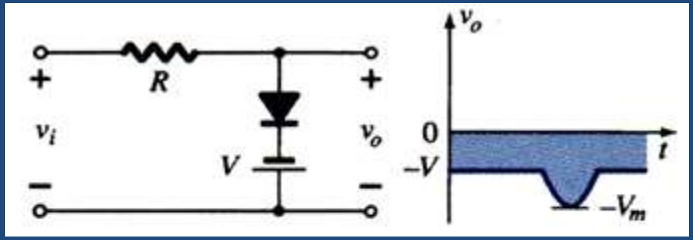


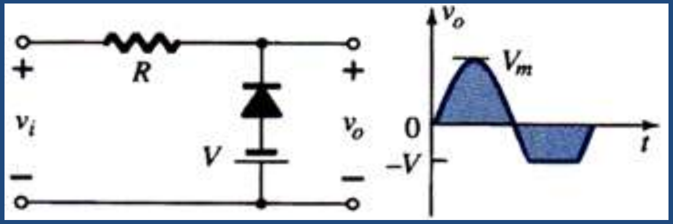
CLIPPERS :Parallel diode

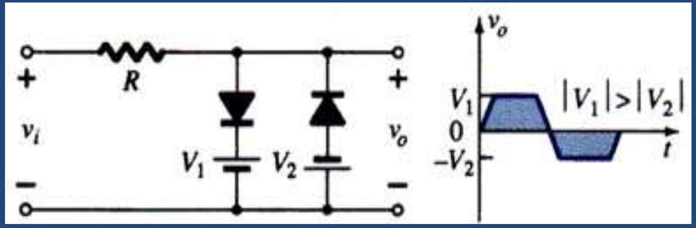


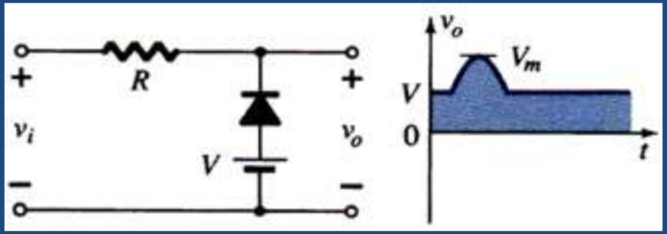




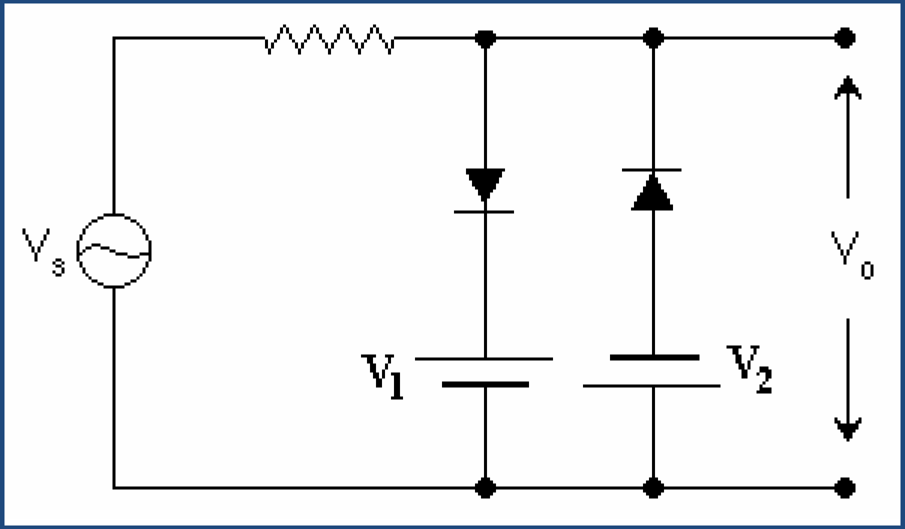


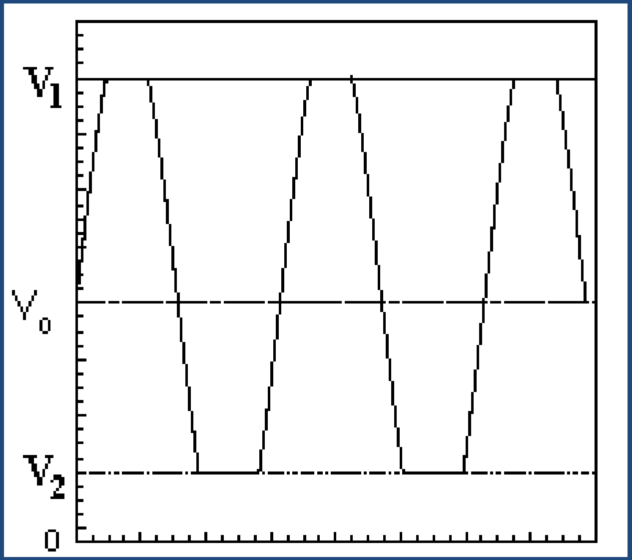






Clippers





Notice that the dc sources V_1 and V_2 are reverse biasing the diodes in each branch.

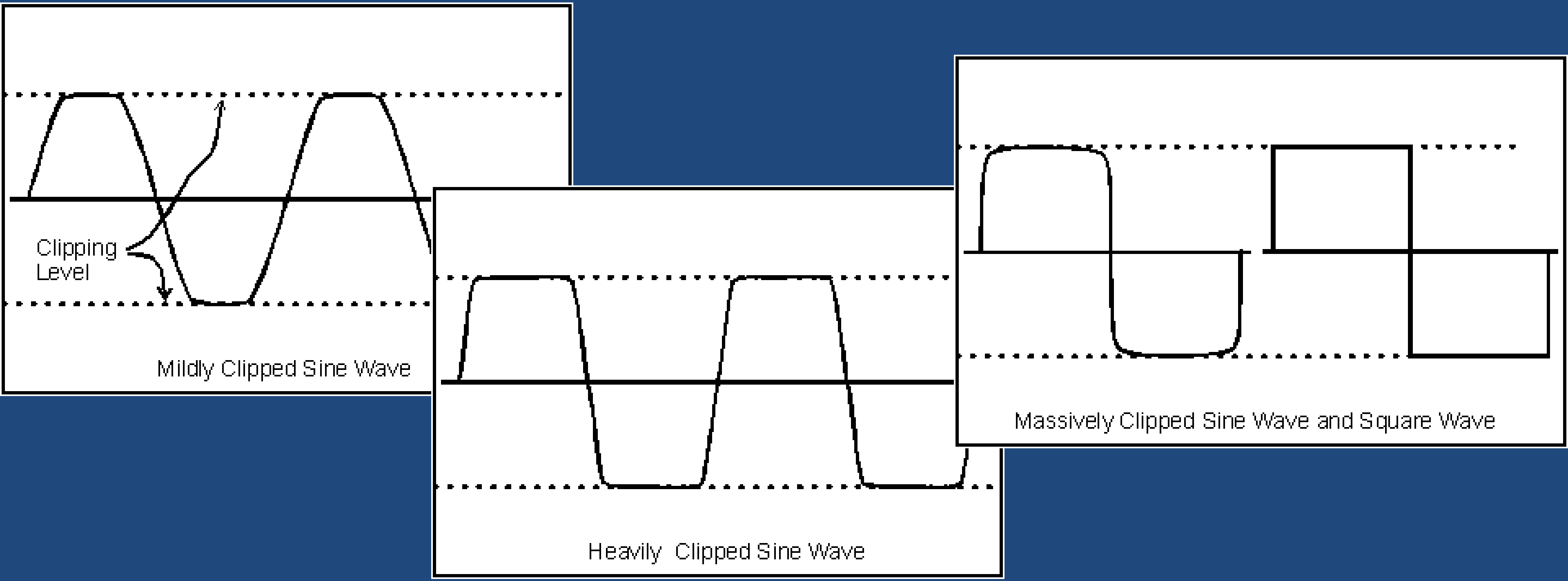
Clockwise half cycle - V_S flows to the output until it becomes equal to V_1. At that point diode 1 can conduct, another path is found, and any voltage above V_1 goes through the first diode branch.

Counter Clockwise half cycle - V_S flows to the output until it becomes equal to V_2. Excess voltage flows then through diode 2.

Output is “clipped” at V_1 and V_2.

Special Clipper

- If $V_1 = V_2$ and $V_S >> V_1$, then you can make a good square wave output.



Other Clipper Uses

- Surge protection
- Noise reduction