Diode Clippers

→ The ckt with which the waveform is shaped by removing (or clipping) a portion of the i/p signal without distorting the remaining part of the alternating waveform is called a clipper.

→ Clipping circuits are also referred to as voltage (or current) limiters, amplitude selectors, or slicers.

→ There are four categories of clippers (i) positive clipper (ii) negative clipper (iii) biased clipper (iv) combination clipper

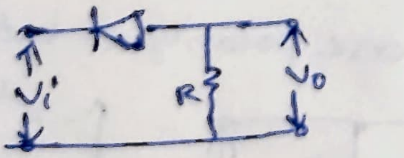
Positive clipper

→ In series positive clipper, when the i/p voltage is +ve, the diode does not conduct & acts as an open ckt, hence the +ve half cycle does not appear at the o/p, i.e., +ve half cycle is clipped off.

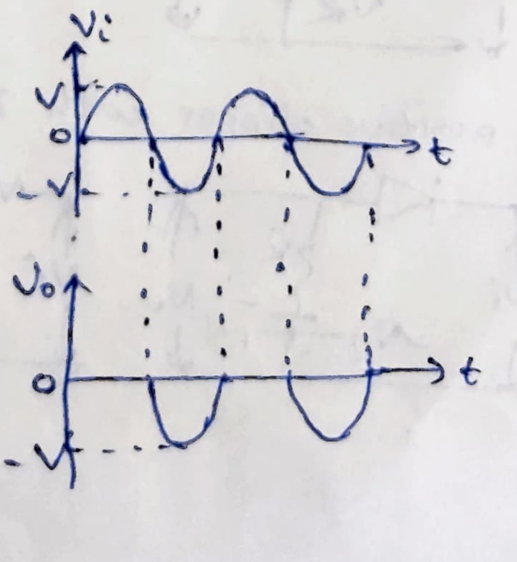
→ When the i/p signal is -ve, the diode conduct & acts as a closed switch, -ve half cycle appears at the o/p

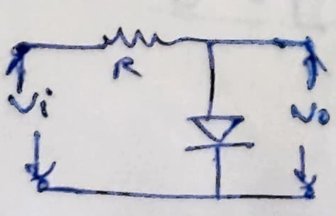
→ In shunt positive clipper, when i/p voltage is +ve, diode conducts & acts as short ckt & hence there is zero signal at the o/p, i.e., +ve half cycle is clipped off.

→ When the i/p signal is -ve, diode does not conduct & acts as an open switch, -ve half cycle appears at the o/p.



series positive clipper

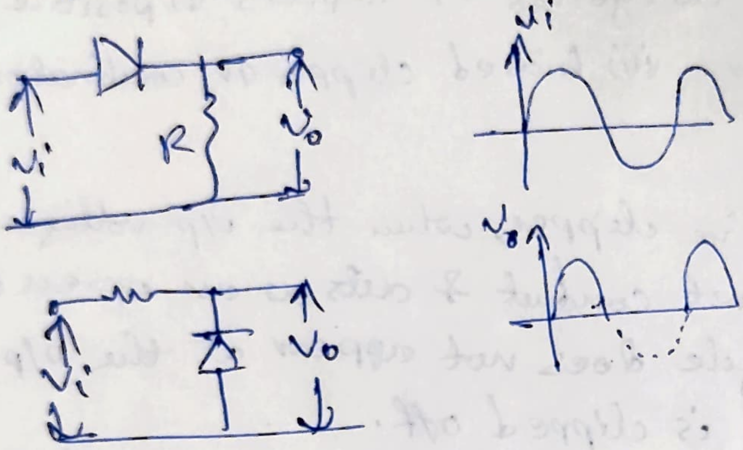




Negative Clipper

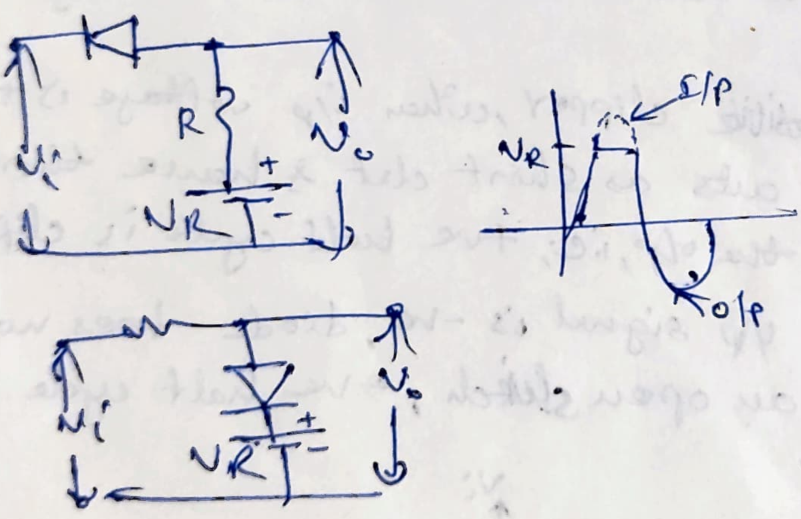
→ In the series negative clipper, during the +ve half cycle of the i/p signal, the diode conducts & acts as a short-ckt & hence the +ve half cycle of the i/p signal will appear at the o/p.

→ During the -ve half cycle of the i/p signal, diode does not conduct & acts as an open ckt. The -ve half cycle will not appear at the o/p, i.e., -ve half cycle is clipped off.

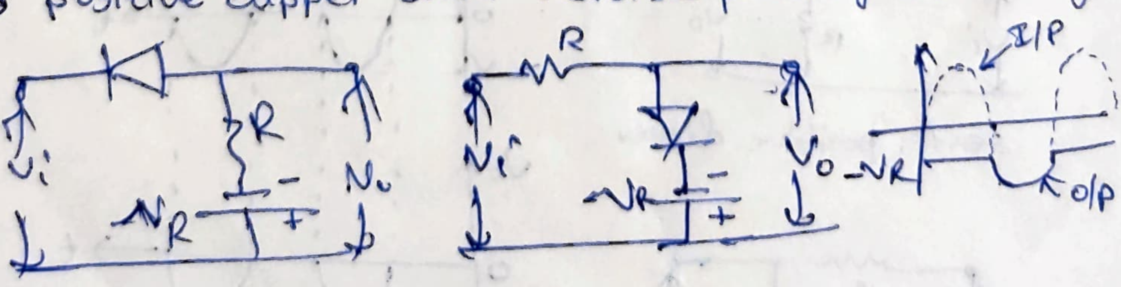


Biased Clipper

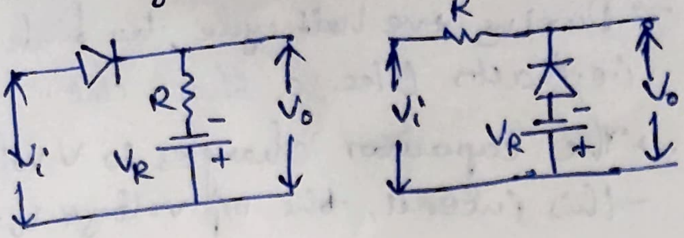
a) Biased positive clipper

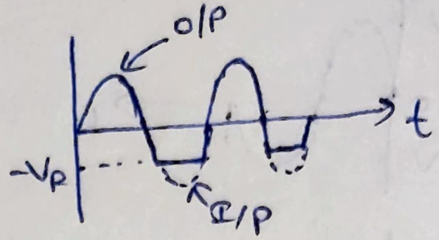


b) Biased positive clipper with reverse polarity of battery VR

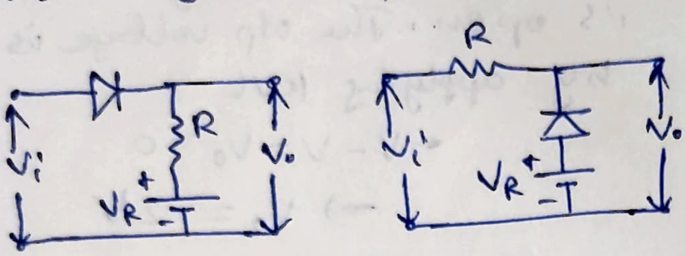


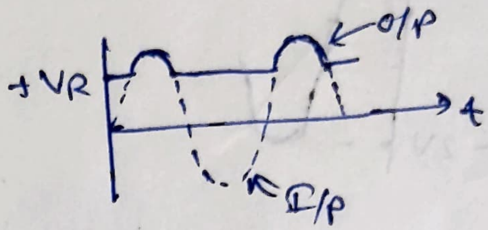
c) Biased negative clipper



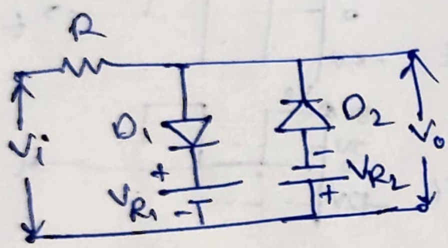


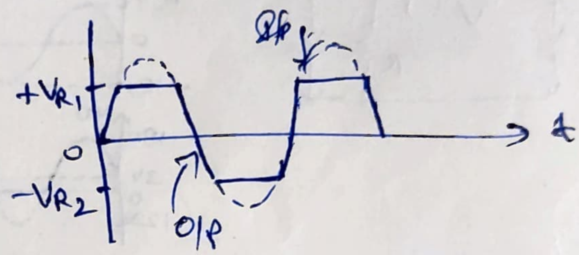
d) Biased negative clipper with reverse polarity of battery V_R



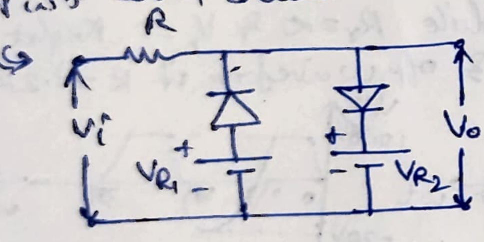


Combination clipper

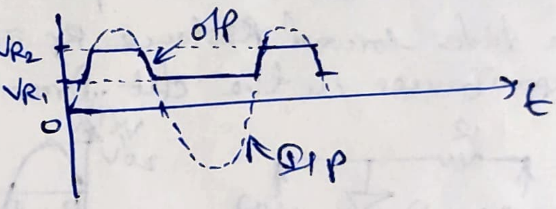




Two level slicer



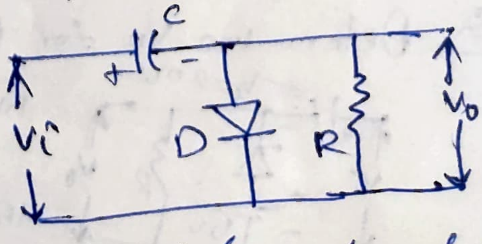
$V_{R_2} > V_{R_1}$



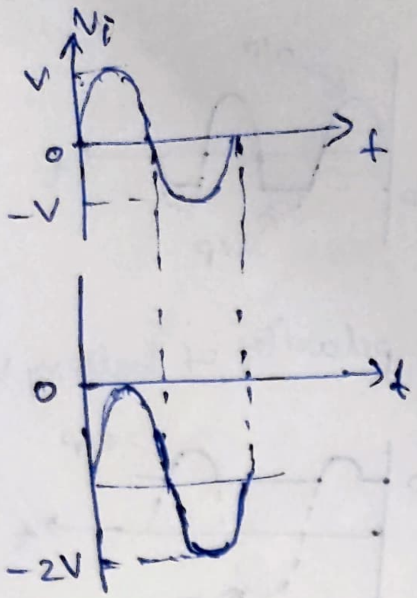
Clampers

Clamping n/w shifts (clamps) a signal to a different d.c. level, i.e., it introduces a dc level to an ac signal. Hence, the clamping n/w is also known as d.c. restorer.

→ The clamping n/w has circuit components like a diode, a capacitor & a resistor.



The time const. for the ckt $\tau = RC$ must be large so that the voltage across the capacitor does not discharge significantly when diode is not conducting.



→ During +ve half cycle, the diode conducts, i.e; it acts like a short ckt.

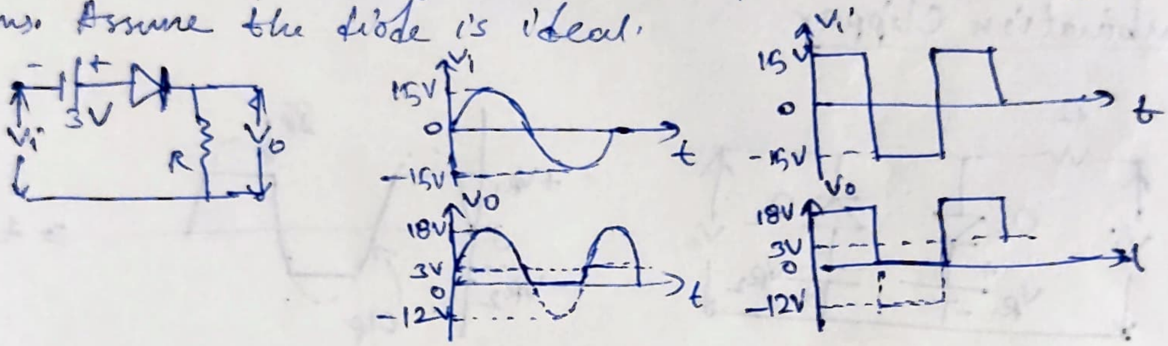
→ The capacitor charges to V volts. During this interval, the o/p voltage $V_0 = 0$ V

→ During -ve half cycle, the diode is open. The o/p voltage is found by applying KVL

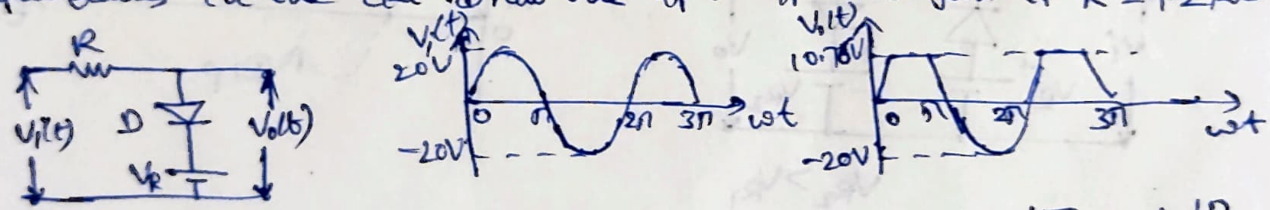
$$-V - V - V_0 = 0$$

$$\Rightarrow V_0 = -2V$$

Q. Determine the o/p waveform for the i/p sinusoidal & square wave forms. Assume the diode is ideal.



Q. In the diode positive peak limiting ckt. $V_R = 10V$, $V_i(t) = 20\sin 2\pi ft$ & the diode forward resistance $R_f = 100\Omega$ while $R_r = \infty$ & $V_r = 0$. Neglect all capacitances in the ckt. Draw the i/p & o/p waveform if $R = 1.2k\Omega$

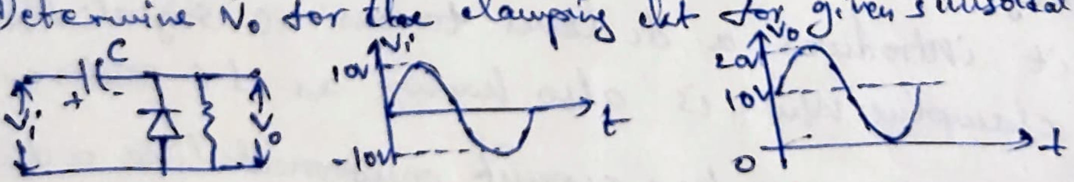


$$V_o(t) = (V_i(t) - V_R)\frac{R_f}{R_f + R_f} + V_R$$

$$V_o(t)_{max} = 10 \times \frac{100}{100 + 1200} + 10$$

$$= \frac{10}{13} + 10 = 10.76\,V$$

Q. Determine V_o for the clamping ckt for given sinusoidal i/p signal



Q. Determine Vo for the n/w