Electronic Devices

**Lecture 8
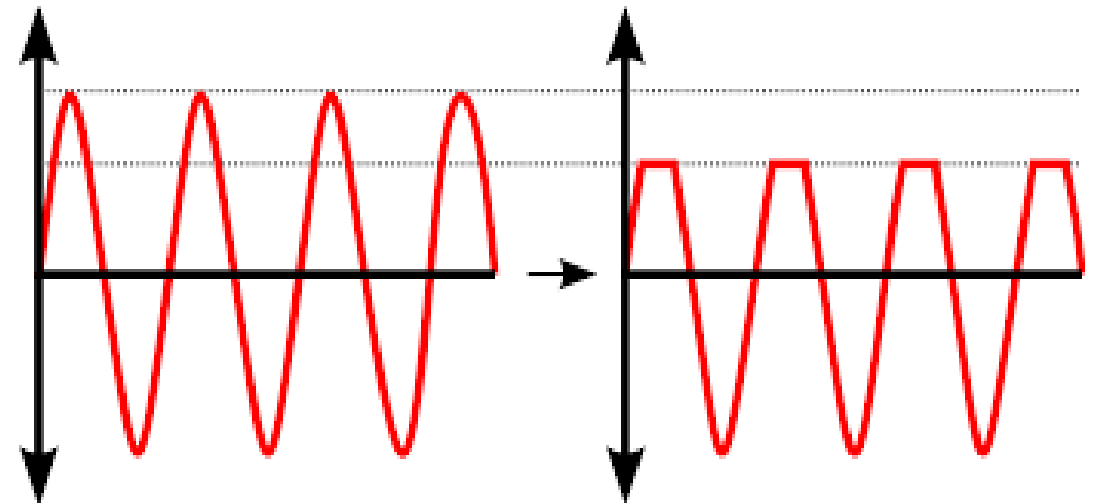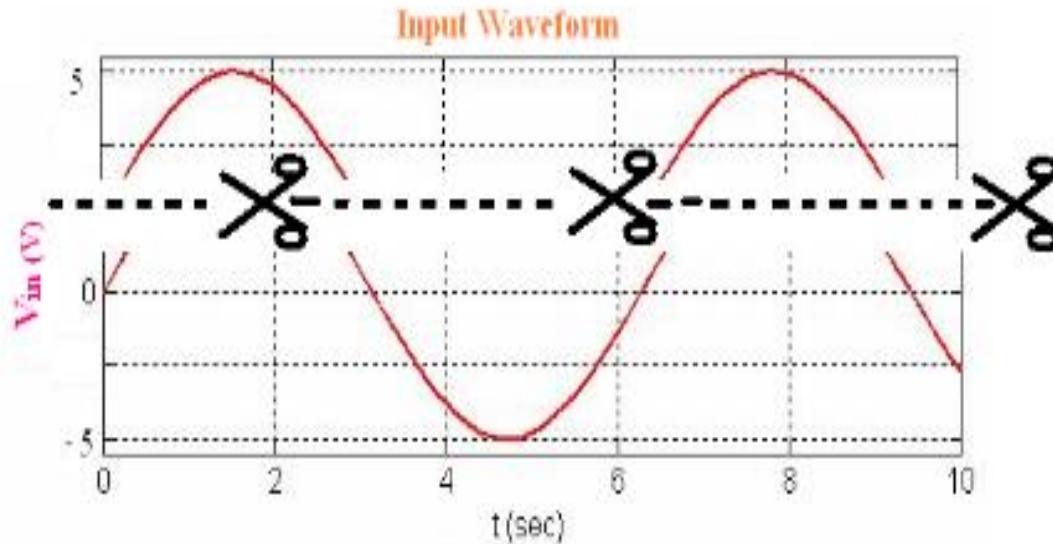P–N Junction**

Dr. Roaa Mubarak

Diode Applications
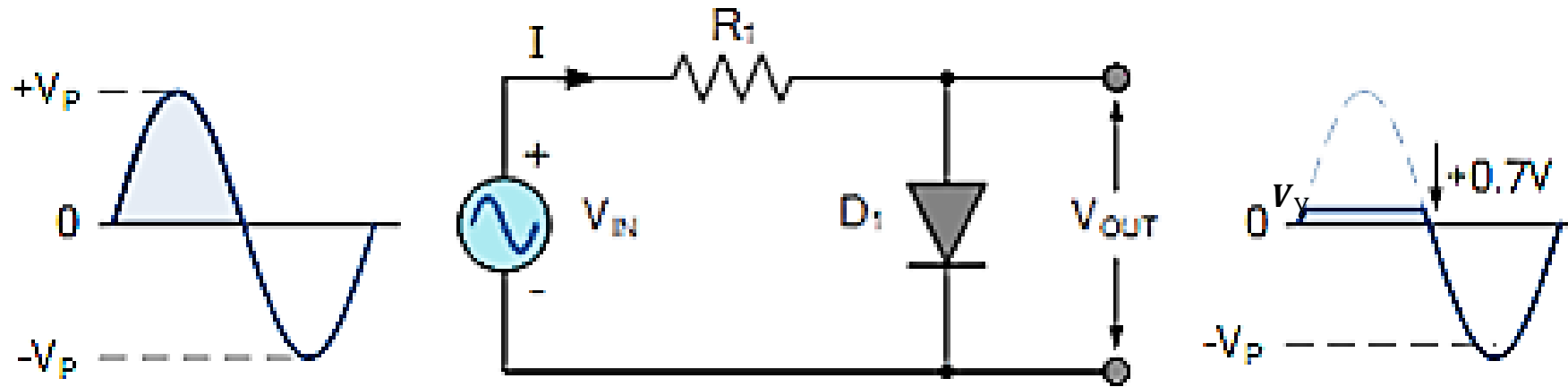
- Rectifying
- **Clipping**
- Clamping

Clipping

- It used in wave shaping, limit or " clip" signal portions.
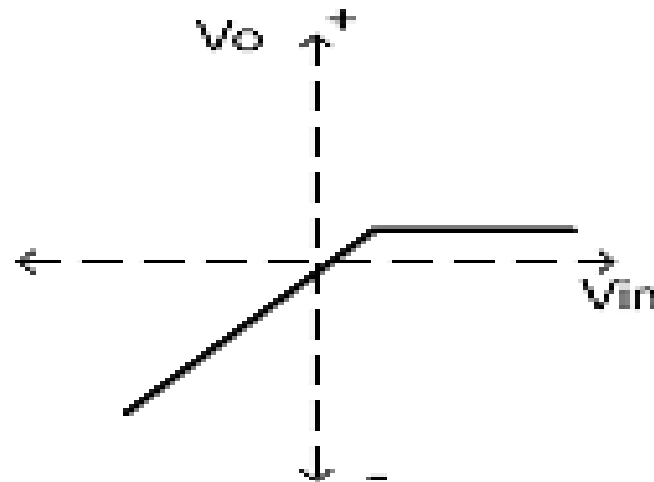- Eliminate signal portions that are above or below a specified level.
- **Application:**

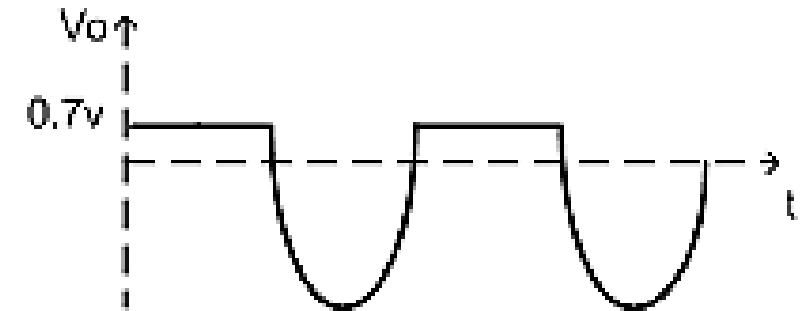Limit input voltage to an electronic circuit to prevent component damage.

Clipping

- Vs > V_γ → D is ON → Vo= V_γ
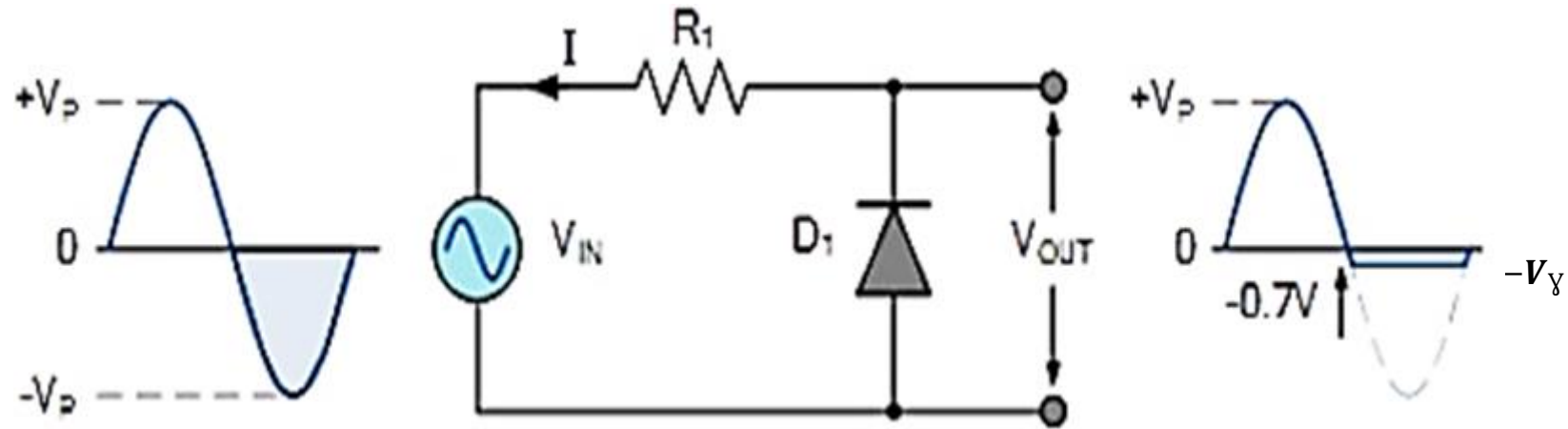- Vs < V_γ → D is OFF → Vo= Vs

Transfer characteristics

Output Waveform

Clipping

- Vs $> -V_\gamma \rightarrow$ D is FF $\rightarrow$ Vo=Vs
- Vs $< -V_\gamma \rightarrow$ D is ON $\rightarrow$ Vo= $-V_\gamma$
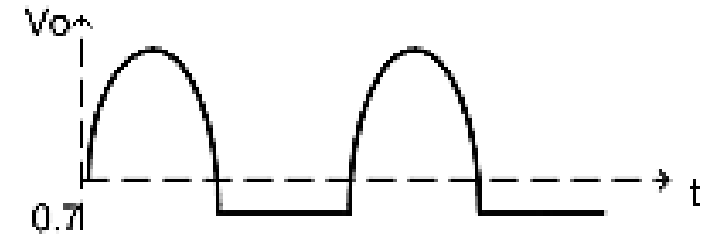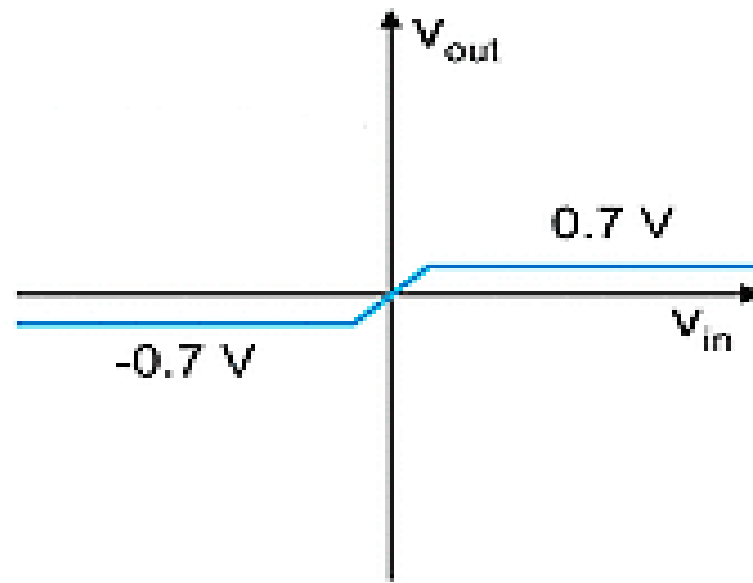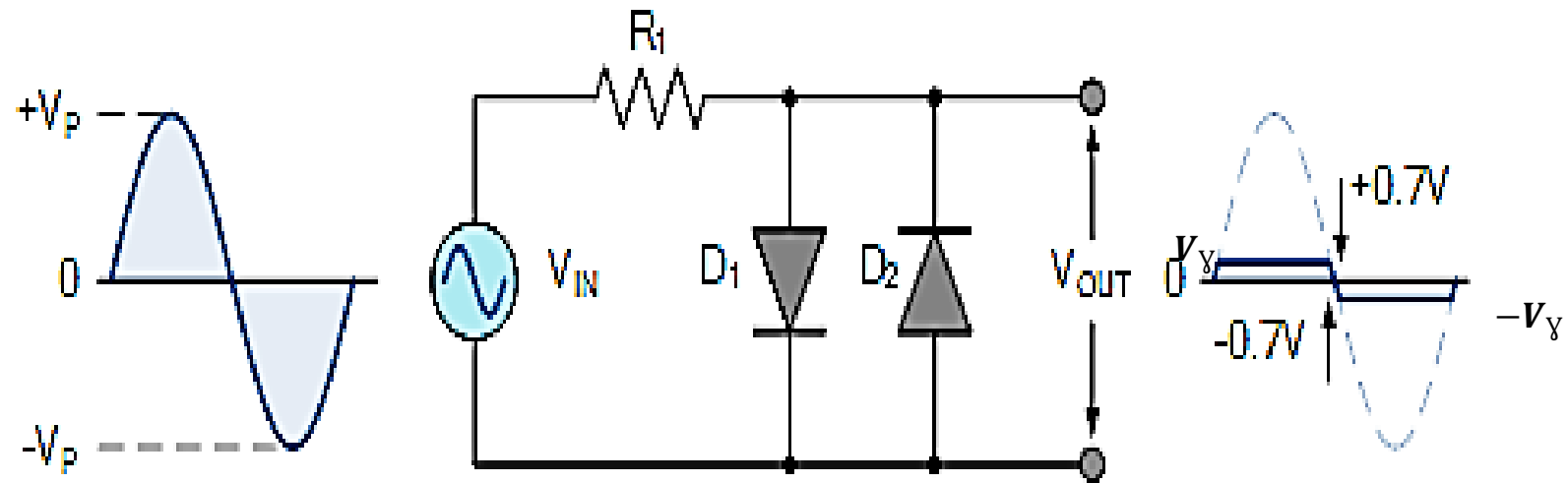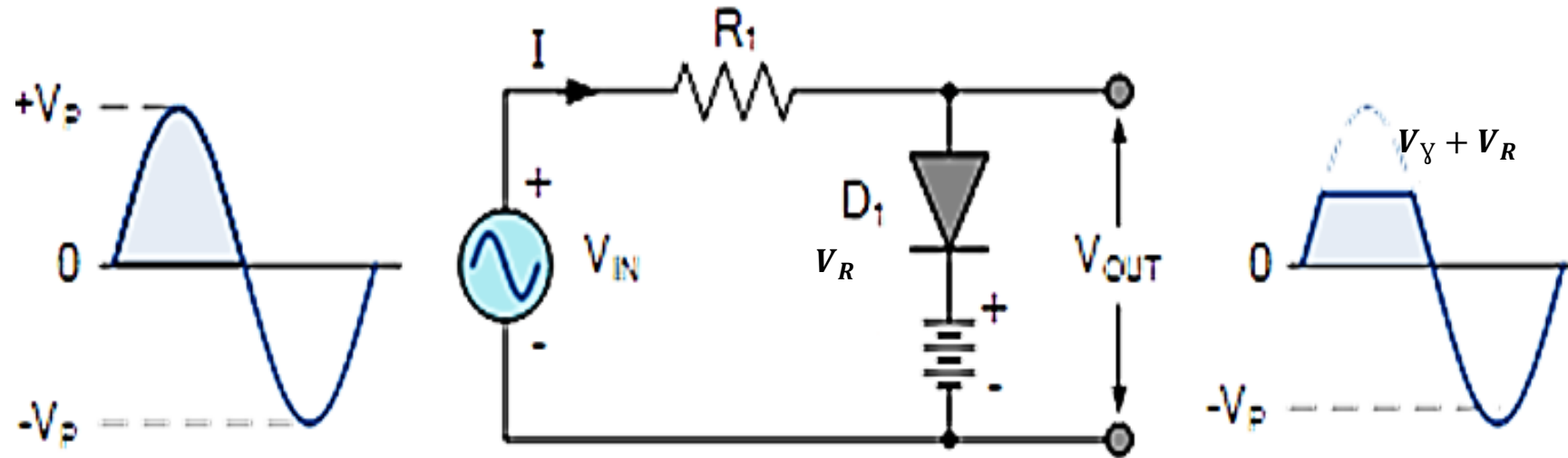

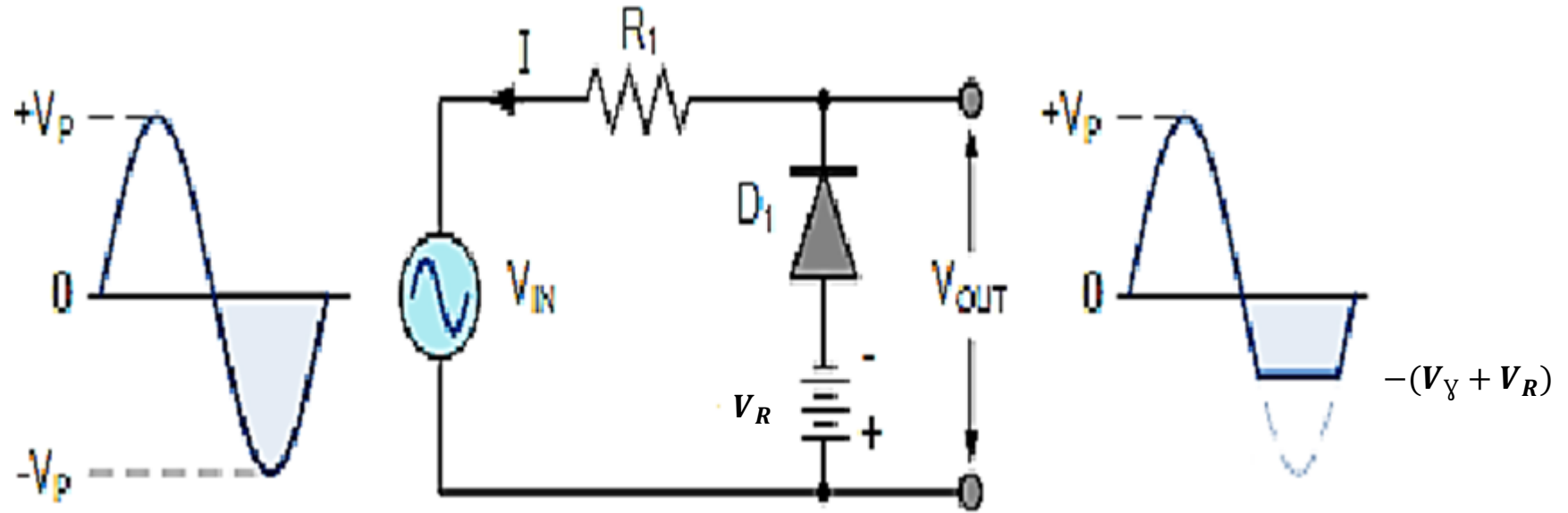Output Waveform
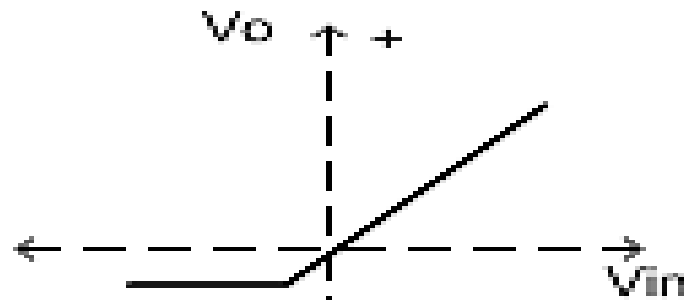
Transfer characteristics
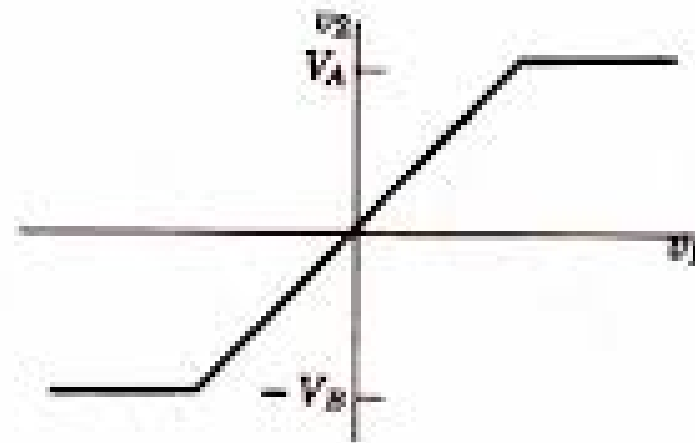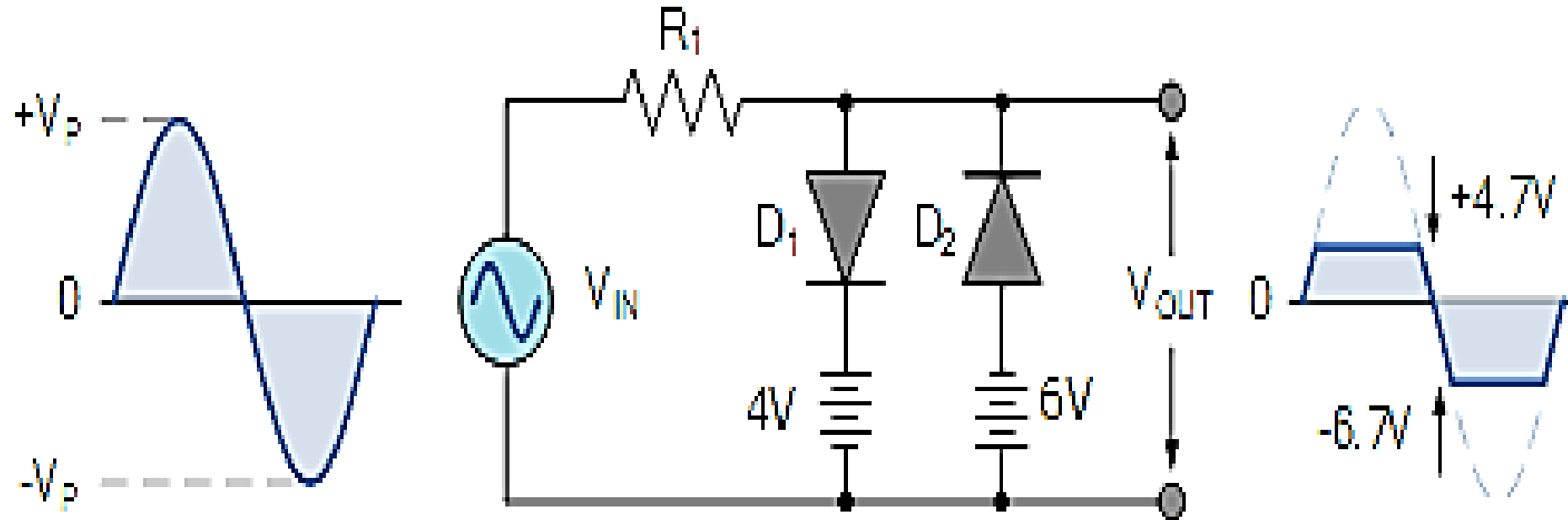
Clipping

Transfer characteristics

Clipping

- Vs > $V_\gamma + V_R$ $\longrightarrow$ $D\ ON$ $\longrightarrow$ Vo $= V_\gamma + V_R$
- Vs < $V_\gamma + V_R$ $\longrightarrow$ $D\ OFF$ $\longrightarrow$ Vo $=$ Vs

Clipping

- Vs $< -(V_\gamma + V_R) \longrightarrow$ *D ON* $\longrightarrow$ *Vo = -(V_\gamma + V_R)*
- Vs $> -(V_\gamma + V_R) \longrightarrow$ *D OFF* $\longrightarrow$ *Vo = Vs*

Clipping

Transfer characteristics
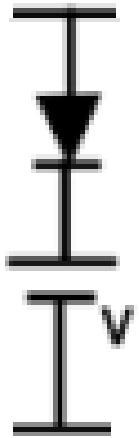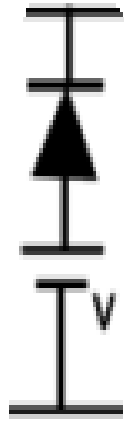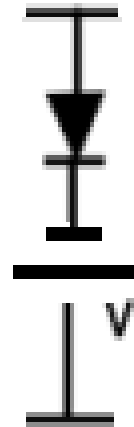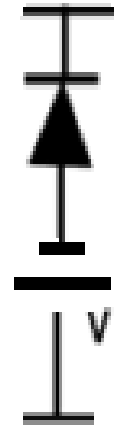
Clipping

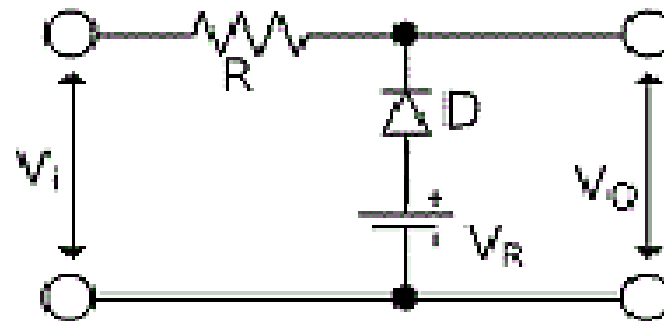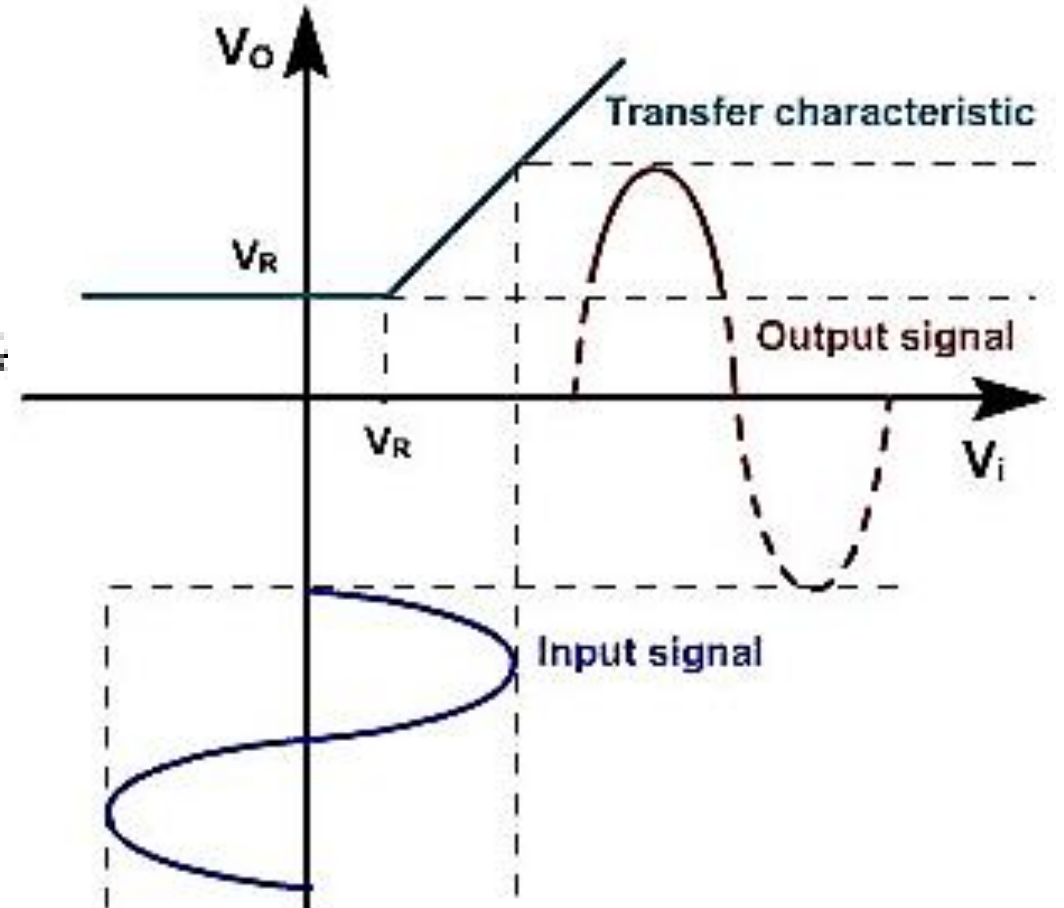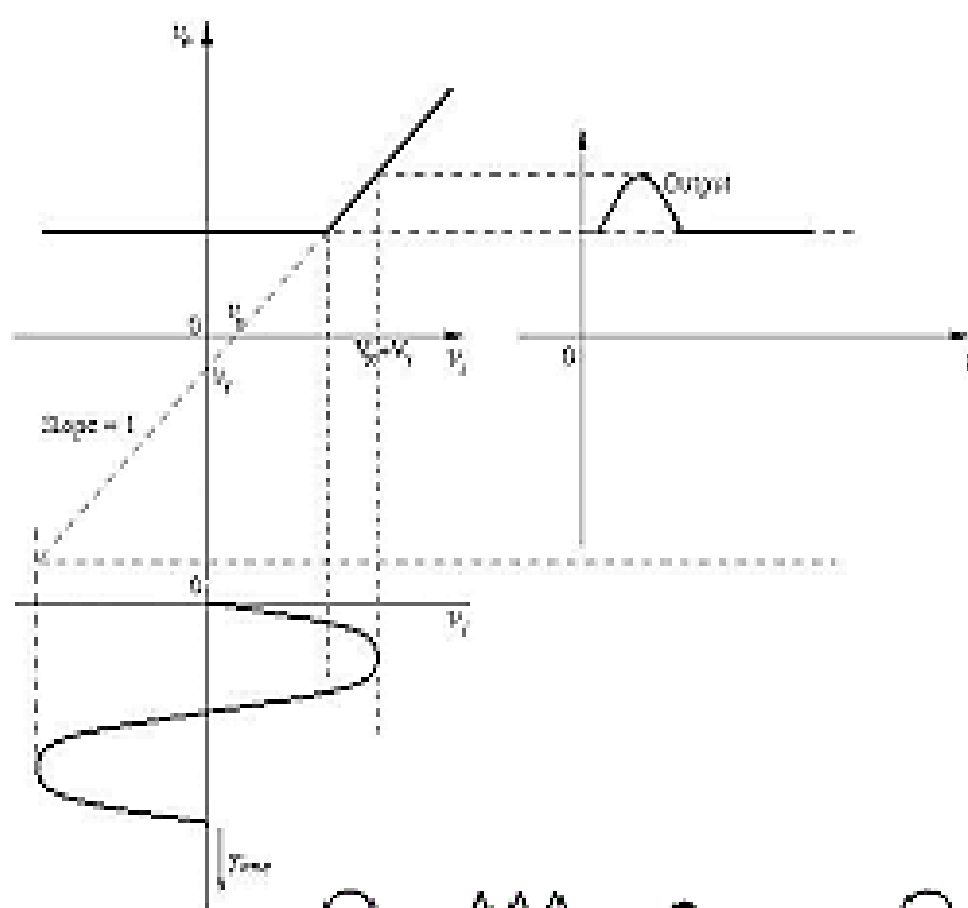$$V_\gamma + V \qquad -V_\gamma + V \qquad V_\gamma - V \qquad -V_\gamma - V$$

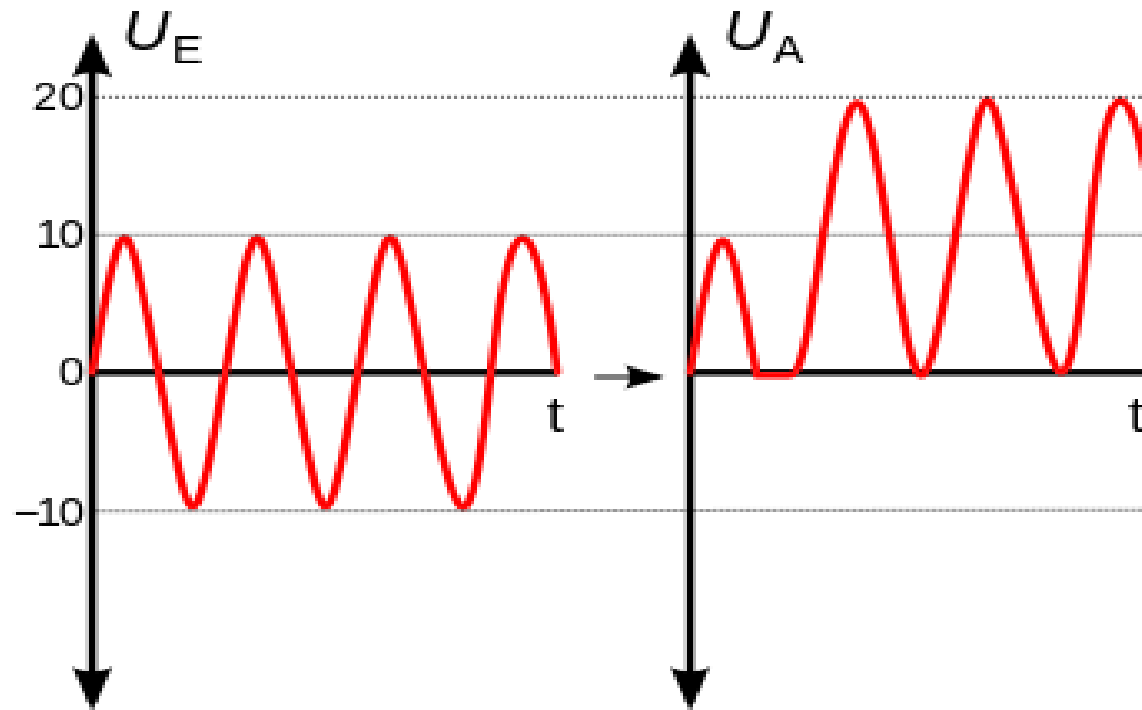# Clipping

Diode Applications

- Rectifying
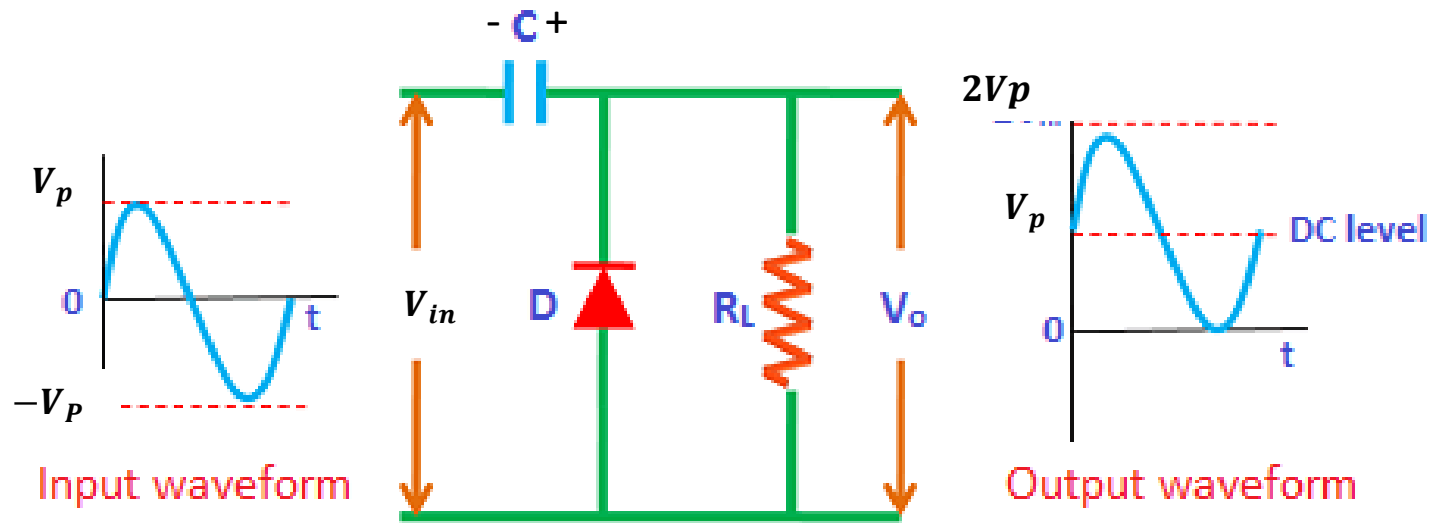- Clipping
- **Clamping**

Clamping

- Shift the entire signal voltage by a DC voltage level.
- **Application:**

Restoring lost DC level in signal from transmission (e.g. Television signal)
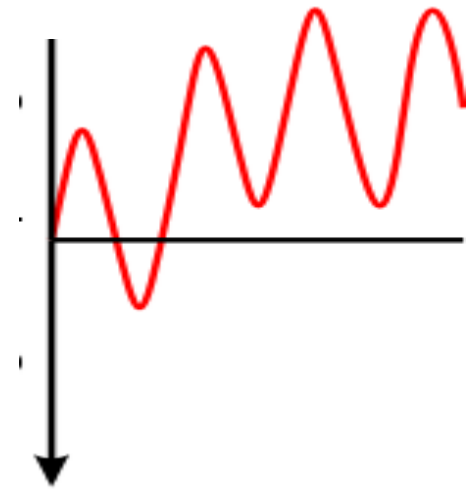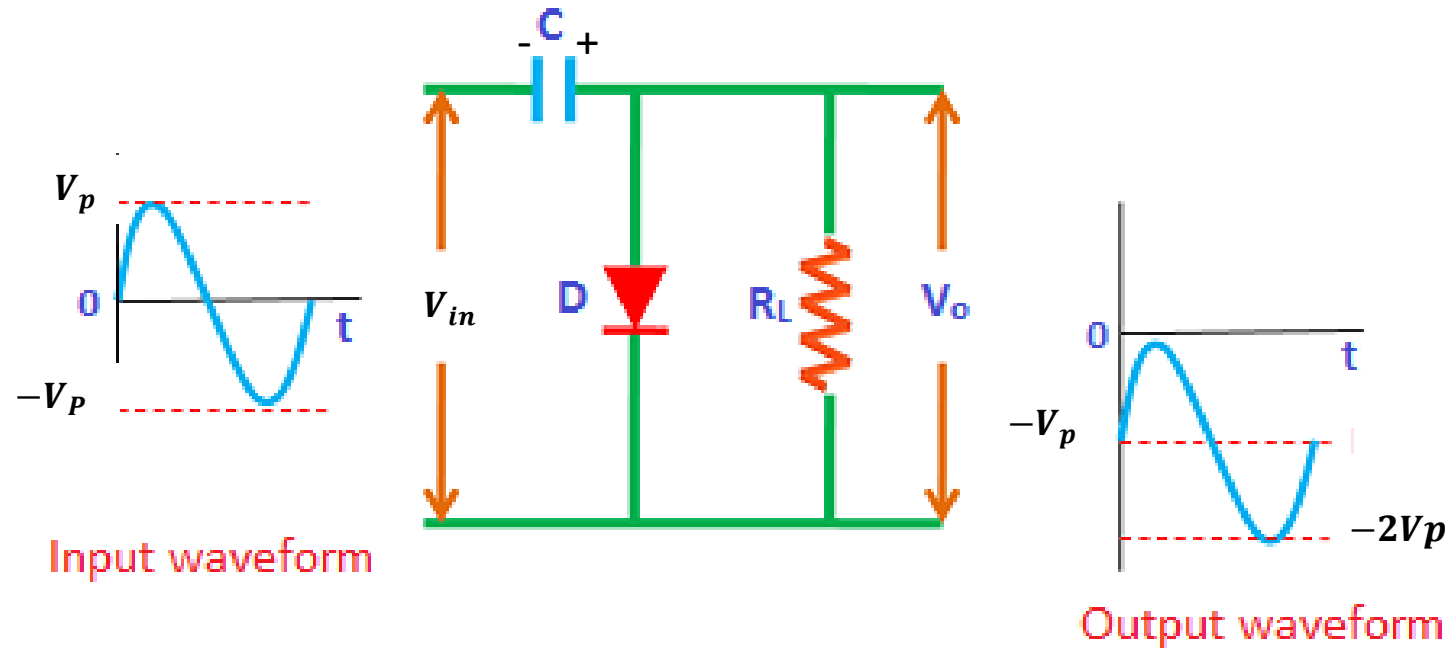
Clamping

Input waveform

Output waveform

(Negative half cycle) D ON " short circuit" → Vc = Vp

(positive half cycle) D OFF " open circuit" → Vo = Vin + Vc

Vo = Vin + Vp

Clamping

Input waveform

Output waveform

(Positive half cycle) D ON " short circuit" → Vc = -Vp

(Negative half cycle) D OFF "open circuit" →Vo = Vin + Vc → Vo = Vin -Vp

Clamping

Input waveform

Output waveform

$V_c = V_p + V_R$

$V_o = V_{in} + V_c$ $V_o = V_{in} + V_p + V_R$

Clamping

Input waveform

Output waveform

$$Vc = -(Vp + VR)$$

$$Vo = Vin + Vc \qquad Vo = Vin - (Vp + VR)$$

Clamping

Input waveform

Output waveform

Vc = Vp -VR

Vo = Vin +(Vp- VR)

Input waveform

Output waveform

Vc = -Vp +VR

Vo = Vin +(-Vp+ VR)