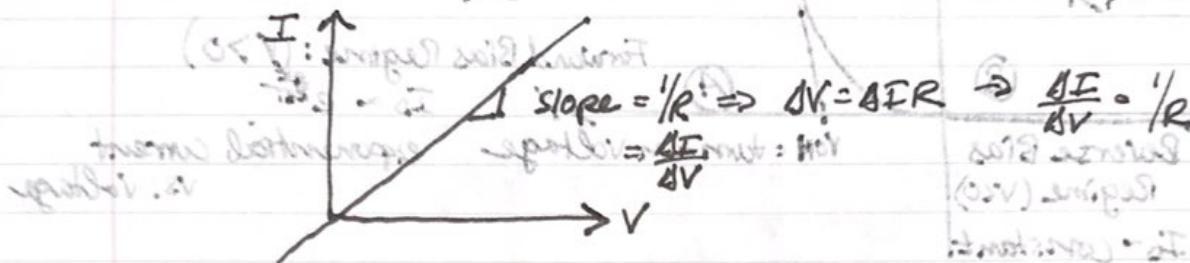


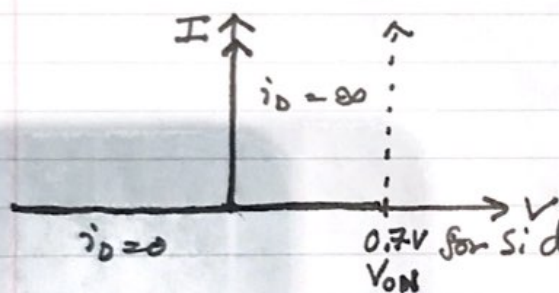
Intro to ECSE Class 11: Diodes 10/3/22

Current-Voltage Characteristics

1) Resistor



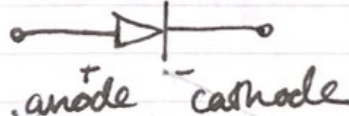
2) Diode (ideal)



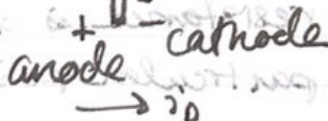
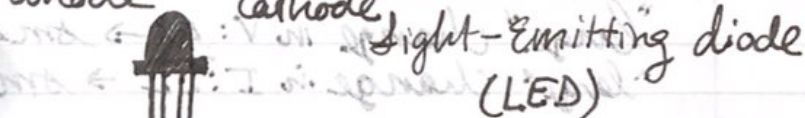
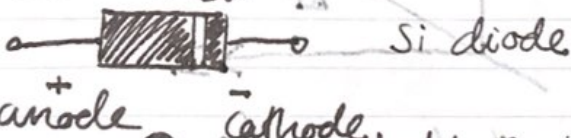
$$I = \begin{cases} 0 & V \leq 0 \\ \infty & V > 0 \end{cases}$$

ideal turn on voltage (V_{ON})

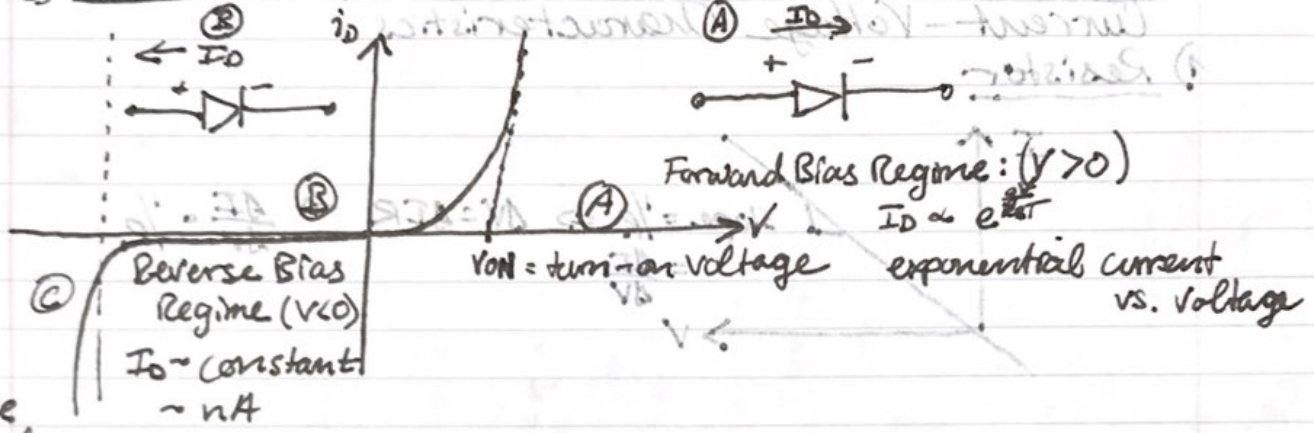
→ Circuit Symbol:



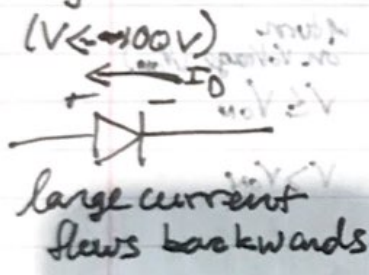
Actual Devices:



3) Real Diode

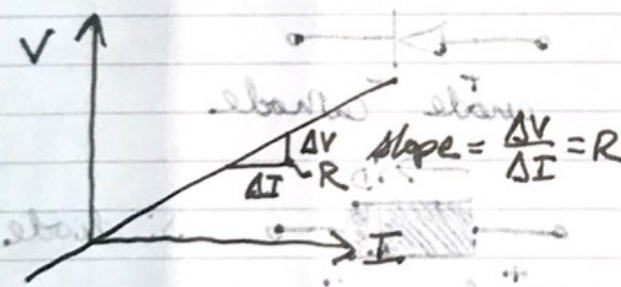


Reverse Breakdown Regime



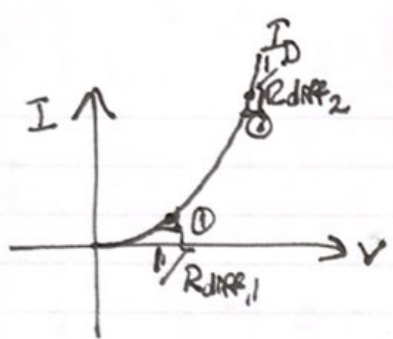
4) Differential Resistance

Via Ohm's Law = $R = \frac{\Delta V}{\Delta I}$



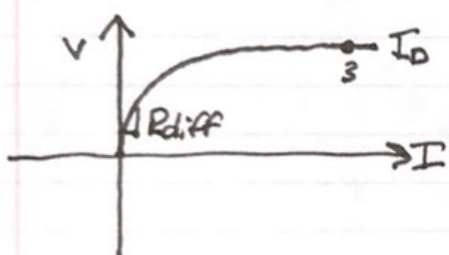
"large" change in $V: \Delta V \rightarrow$ small change $dV = R_{diff}$
 "large" change in $I: \Delta I \rightarrow$ small change dI

Differential resistance is a local value, only valid at a particular point on the IV curve



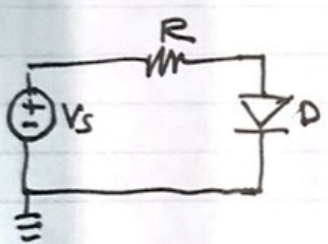
① measure a small change in current by a small change in voltage around point ①
 $\rightarrow R_{diff,1} = \frac{dV_1}{dI_1} \rightarrow$ differential R

② same as ①, but different value of R_{diff} @ V₁



$R_{diff@3} = \frac{dV}{dI} = \frac{\text{small}}{\text{large}} = \text{low R}$

5) Current-limiting Resistor



- Why use one?
- Current heats up the diode
 ↳ large current leads to a lot of heat → changes diode behavior and can damage the diode
- R limits current to limit diode heating