THEVENIN'S THEOREM can be generalized to any two terminal network of resistors \( (Z_R = R) \), inductors \( (Z_L = j\omega L) \) and capacitors \( (Z_C = -\frac{1}{j\omega C}) \) is equal to a single complex impedance in series with a single signal source.

**Exercise:** You have a temperature sensor and controller. It stops working. Tell me what ordinary laboratory equipment you could use to replace it. Divide into terms of \( Z \) and start thinking.

**Basics of Diodes:**

- **Zener**
- **Tunnel**

1. Current flows (almost) only one way.
2. Voltage drop is (almost) constant.

**Use slope of \( V-I \) curve (= Dynamic Impedence)**

**Example:**

\[
\begin{align*}
V_{\text{IN}} & \quad W \quad V_{\text{OUT}} \\
R & = 300 \Omega \\
\text{Diode: in 47.33}
\end{align*}
\]

\( V_{\text{IN}} \) varies from 15 to 20 volts. How much does \( V_{\text{OUT}} \) vary?

(a) What is maximum current through diode?

- Look up Zener voltage (= 5.1 volt)
- \( I_{\text{max}} = \frac{20 - 5.1}{300} \approx 50 \text{ mA} \)

(b) What is dynamic impedance at 20V? 7.0 \( \Omega \)

\[
\Delta V = R_{\text{dyn}} \Delta I \\
\Delta I = 17 \text{ mA} \text{ between 15V and 20V.}
\]