

ECE 2201 Q & A

Q: How do you find  $I_S$  and  $n$  using lab data?

A:

1. Choose two data points ( $V_{D1}$ ,  $I_{D1}$ ) and ( $V_{D2}$ ,  $I_{D2}$ ) from your data and plug them into the approximate form of Shockley's diode equation as shown.

$$I_{D2} \cong I_S e^{V_{D2} / nV_T} \quad \text{Eq. 1.0}$$

$$I_{D1} \cong I_S e^{V_{D1} / nV_T} \quad \text{Eq. 2.0}$$

2. Take the ratio of these two equations to make  $I_S$  drop out:

$$\frac{I_{D2}}{I_{D1}} = e^{\frac{1}{nV_T}(V_{D2} - V_{D1})} \quad \text{Eq. 3.0}$$

3. Solve for  $n$ :

$$n = \frac{(V_{D2} - V_{D1})}{\ln\left(\frac{I_{D2}}{I_{D1}}\right)V_T} \quad \text{Eq. 4.0}$$

NOTE: Equation 4.0 can be used to solve for  $n$ , given two data points.  
Assume  $V_T \approx 25\text{mV}$  ( $T = 20\text{C}$  or  $68^\circ\text{F}$ )

4. Using Eq. 1.0 or Eq. 2.0 you can then solve for  $I_S$ .