Homework Assignment 1  
Due: Thursday, September 6, 2001

Problems:

P1-2. Consider diodes with unity emission coefficients and negligible series resistance. Determine the reverse saturation current for

a) a p-n junction which exhibits a voltage drop of 0.7 V at a forward current of 1 mA; and  
b) a Schottky diode which exhibits a voltage drop of 0.3 V at a forward current of 1 mA.

P1-3. Suppose a diode has a unity emission coefficient. Determine the change in the forward bias voltage which will cause a ten-fold increase in the forward current.

P1-4. Consider a Si p⁺-n junction at 300 K with \( N_a = 10^{18} \, \text{cm}^{-3} \) and \( N_d = 10^{16} \, \text{cm}^{-3} \). The junction area is \( 10^{-5} \, \text{cm}^2 \). Determine

a) the built-in potential;  
b) the zero-bias depletion width; and  
c) the zero-bias depletion capacitance.

P1-6. Consider the p-n junction shown. \( T = 300 \text{K} \). The junction area is \( 10^{-5} \, \text{cm}^2 \).

![Figure P1-6](image)

The material parameters are as follows:

\[ \begin{align*}  
p-Si & \quad n-Si  
N_a & = 10^{15} \, \text{cm}^{-3} \quad N_d = 10^{18} \, \text{cm}^{-3}  
D_n & = 25\text{cm}^2\text{s}^{-1} \quad D_p = 8\text{cm}^2\text{s}^{-1}  
\tau_n & = 20\text{ns} \quad \tau_p = 3\text{ns}  
\end{align*} \]

a) Determine the reverse saturation current.  
b) Determine the bias voltage at a forward current of 1 mA, assuming the emission coefficient is unity.