

HW7

MTLE-6120: Spring 2017

Due: Apr 27, 2017

1. **Kasap 5.29: Seebeck coefficient and thermal drift in semiconductor devices**

2. **Kasap 6.2: The Si *pn* junction** (estimating recombination and diffusion currents)

In answering, ‘what is your conclusion’, include your expectation for the diode ideality factor η .

Hint: you will need the diffusion constants for the carriers. Assume $D_e = 34.9 \text{ cm}^2/\text{s}$ and $D_h = 11.6 \text{ cm}^2/\text{s}$. (Diffusion constants are related to mobilities by the Einstein relation $D_{e/h} = (k_B T/e)\mu_{e/h}$) Besides that, the only other *Si*-specific properties you should need are $n_i = 10^{10} \text{ cm}^{-3}$ and $\epsilon_r = 11.7$.

3. **Kasap 6.15: Ultimate limits to device performance** (of an *n*-channel FET)

Note: for part (c), assume and justify reasonable values for the barriers. Consider tunneling to become important when tunneling probabilities $\sim 10^{-6}$.

Also, there might be a typo in the example number referenced by some editions of the book. (In mine, it says 3.10, but it should be 3.12.)