

**ECE 656: Fall 2009**  
**Lecture 9 Homework**

- 1) For an n-type silicon resistor at  $T = 300\text{K}$  and doped to  $N_D = 10^{16}\text{ cm}^{-3}$ , determine the maximum temperature difference that can be produced by Peltier cooling. Assume an energy-independent mean-free-path for electrons so that the Seebeck coefficient is:

$$S_{3D} = \left( \frac{k_B}{-q} \right) \left( \frac{2\mathcal{F}_1(\eta_F)}{\mathcal{F}_0(\eta_F)} - \eta_F \right)$$

Assume that the heat conduction is entirely carried by the lattice, and make use reasonable numbers for the other parameters.