

ECE 656: Fall 2011
Lecture 10 Homework
Due Wednesday, September 21, 2011

- 1) Begin with the current equations in the form

$$\Delta V = RI - S\Delta T$$

$$I_Q = -\pi I - K_e \Delta T,$$

and derive the bulk transport equations:

$$\mathcal{E}_x = \rho J_x + S \frac{dT_L}{dx}$$

$$J_x^q = \pi J_x - \kappa_e \frac{dT}{dx}$$

- 2a) Work out the Seebeck coefficient for a 3D semiconductor assuming that the mfp, λ_0 is independent of energy and show that the result is:

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

- 2b) Use the result of problem 2a) to show that

$$\Delta_n = \langle E \rangle - E_C = 2k_B T_L$$