ECEn 450, Winter 2009
Homework #2
Due January 20, 5:00 pm

From the text Semiconductor Devices, Physics and Technology, do the following problems:

Chapter 2, problems 1, 4, 6

Chapter 12, problems 1, 3

Also complete the following problems:

2.1 Consider a three-dimensional cubic lattice with a lattice constant equal to a. (a) Sketch the following planes: (i) (100), (ii) (110), (iii) (310), and (iv) (230). (b) Sketch the following directions: (i) [100], (ii) [110], (iii) [310], and (iv) [230].

2.2 The lattice constant of a simple cubic cell is 0.563 nm. Calculate the distance between the nearest parallel (a) (100), (b) (110), and (c) (111) planes.

2.3 Identify two crystalline directions in a cubic crystal which are perpendicular to
(a) the [100] direction
(b) the [111] direction

NOTE: The cosine of the angle θ between two arbitrary directions, $[h_1k_1l_1]$ and $[h_2k_2l_2]$, in a cubic crystal is

$$\cos(\theta) = \frac{h_1h_2 + k_1k_2 + l_1l_2}{\left[\left(h_1^2 + k_1^2 + l_1^2\right)\left(h_2^2 + k_2^2 + l_2^2\right)\right]^{1/2}}$$

Consequently, for two directions to be perpendicular, $\cos(\theta) = 0$ and one must have $h_1h_2+k_1k_2+l_1l_2 = 0$.