10/19/06

ECE 495N, Fall'07 MSEE B010, MWF 330P – 420P

Fundamentals of Nanoelectronics

Note: Exam II on Monday Nov.5 in class.

All exercises, page numbers refer to

S.Datta, Quantum Transport: Atom to Transistor, Cambridge (2005)

HW#6: Due Monday Oct.30 in class. Please turn in a copy of your MATLAB codes for Problem 2. These should be your own, not cut and paste from the text.

Problem 1: In class we have seen that an infinitely long linear 1-D lattice (lattice constant: a) with a Hamiltonian

$$H = \begin{bmatrix} \varepsilon & t & 0 & 0 & \cdots \\ t & \varepsilon & t & 0 & \cdots \\ 0 & t & \varepsilon & t & \cdots \\ & \cdots & \cdots & \cdots & \end{bmatrix}$$

has a dispersion relation $E(k) = \varepsilon + 2t\cos ka$ where $-\pi < ka < +\pi$ (1)

Do the same problem using a unit cell of ***two*** atoms (instead of one) and show that

$E(k) = \varepsilon \pm 2t\cos ka$ where $-\pi/2 < ka < +\pi/2$ (2)

Are (1) and (2) equivalent? Explain.

Problem 2: Exercise E.6.5, Page 154

Problem 3: Consider a uniform one dimensional wire with periodic boundary conditions having an E(k) relationship $E = Bk^4$. Find the density of states as a function of energy.