EE 505 – Nanostructures: Fundamentals and Applications

Fall 2013 **Prof. Carmen S. Menoni**

Homework #1

Due Date: September 19 before 10:30 AM by email

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Conceptual questions (from textbook) – 10 points each

1. C1
2. C3
3. C6
4. C7
5. Explain which are the similarities and dissimilarities between electrons in a crystal and an electromagnetic field propagating in free space.
6. Explain using the concept of confinement what is a quantum well, a quantum wire and a quantum dot.

Problems

1. (10 points) (10 points) The ionization energy of the hydrogen atom in its ground state is E_{ion}=13.6 eV. Calculate the frequency and wavelength of the electromagnetic radiation that just ionizes the atom.
2. (60 points) Solve Schroedinger's equation for a rectangular finite potential (page 29 of notes). Calculate the probability density for the n=1 to n=3 confined states. Plot the probability density versus x. Please use MATLAB, MATHCAD or similar programs to do this.