ECE 607 - Fundamentals of Solid State Electronics I

Department of Electrical and Computer Engineering
University of Massachusetts at Amherst
Fall 2011

Instructor : Prof. Alfred P. DeFonzo (121 Marcus, defonzo@ecs.umass.edu)

Day & Time: MWF 11:15-12:05

Place: Marston rm 220

Office Hours: MW 121 Marston 10-11

Course Goals

To learn the principles of quantum mechanics

To understand critical distinctions between classical and quantum mechanics

To give insight into the role of information in quantum mechanics

To understand the structure of quantum mechanics in its most contemporary form and demonstrate it in application to particular problems.

To provide a foundation for further work and study in solid-state electronics, nanoelectronics, optical and quantum electronics, communication, computation systems and other areas relevant to ECE that require or can benefit from a background in quantum mechanics as well as relate it to a broader view of ECE in general.

Topics:

1 Laws and States in Physics

2 Double Slit Experiment, Uncertainty

3 Vector Review, Basis, Dyads, Spaces.

4 Operators, Observables, Dirac delta, Hermitian, Anti-Hermitian

5 Probabilities, Momentum, Slit Experiment

6 Wave Function, Fourier transform, Polarized Photon

7 Photon Polarization, Circular, Angles, Hermitian, Probability

8 Photon Elliptical Polarization, Phase change, Unitary operator

9 Time evolution, Unitary, Hamiltonian, Schrodinger

10 Schrödinger Derivation, Commutators, Poisson brackets, BlackBody Radiation

11 Harmonic Oscillator, Creation, Annihilation Operators

12 Advanced Topics (time permitting) : Entanglement , Stat Mech , Density Matrix

Course Materials

The course is based on lectures and notes, parts of which draw heavily from Sakurai and Susskind (recommended but not required, see in reference list below)

Grading: Participation 50%; Assignments %50

Useful Reference Texts

L. Ballentine, *Quantum Mechanics: A Modern Development*, World Scientific, 1998.
C. Cohen-Tannoudji, B. Diu, and F. Laloe, *Quantum Mechanics; Vol. 1&2*, Wiley, 1977.
C.J. Isham, *Lectures on Quantum Theory*, Imperial College Press, 1995.

M. LeBellac, *Quantum Physics*, Cambridge, 2006.
R.L. Liboff, *Introductory Quantum Mechanics*, Addison Wesley
J.J. Sakurai , Modern Quantum Mechnanics (2nd Edition) n=n
R. Shankar, *Principles of Quantum Mechanics*, Plenum Press, 1994.
L. Susskind , Lectiures in Quantum Mechanics, Stanford 2009
J.J. Sakurai , Modern Quantum Mechnanics (2nd Edition) n Addison Wesley 2010
C.L. Tang, *Fundamentals of Quantum Mechanics: For Solid State Electronics and Optics*, Cambridge, 2005.

Subject to revision at Instructors Discretion