Georgia Institute of Technology

School of Electrical and Computer Engineering

ECE6451: Introduction to Microelectronic Theory

Syllabus Fall 2005

Introduction:

Understanding semiconductor devices is critical in designing and improving many types of systems. ECE6451 will give you an understanding of the most fundamental aspects of semiconductor materials and provide the mathematical formulation for understanding how advanced devices work. ECE 6451 has no official prerequisite other than a semiconductor undergraduate courses, and it is assumed that you are already familiar to some degree with the material up to and including energy bandgaps and energy band diagrams.

Instructor:

Office: Pettite 209

Work: 404 894-9884 **Home**: 770-707-1302 (before 9 PM unless an emergency)
Email: alan.doolittle@ece.gatech.edu (by far, the best way to communicate with me).

Textbook

The textbook is:

- Kevin F. Brennan, "The Physics of Semiconductor Devices", Cambridge University Press
- Notes: The Brennan text is one of the most thorough reference books available with detailed derivations of many important topics. However it offers little background and introductory material and is sometimes short on perspective. Thus, class notes will be used extensively to augment the text. Reading assignments will be assigned in class and students are expected to have read this material before the next class period. The text is a good place to start with difficulties in homework assignments and many home work assignments will come from the text.

Web Resources:
Official Class Web site (6451 portion is under development):
http://users.ece.gatech.edu/~alan/index.html

Office Hours: Officially: Mondays 2-3. Most weeks I hold "open office hours" on Mondays where you can come by for help anytime that is pre-arranged (preferably by email). ***All students are strongly encouraged to consult me with any problem!***

Grading Schedule:

Grades will be based on a 100 point scale, but bonus points will frequently be awarded. Exams will fall approximately every 5-7 weeks.

		Approximate Date
Exam 1	30%	~September 28th (Wednesday)
Exam 2	30%	~November 21th (Monday)
Homework	~2% each ~5-6 per term	~Every 2-3 Weeks
Final Exam*	30%	Week of December 12th (currently 8AM Dec. 16th)
Pop Quizzes	0.5% Bonus	As needed to insure attendance

Each homework is ***ungraded*** and adds a fixed 1 % (or 0%) if ***ALL*** (or some) assignments are attempted. Homework will be representative of test problems (see later statistics for proof). Previous analysis has shown a relationship of (Increased Test Score) ~ =26 x (Percentage of Homework Attempted)! If more than 5 homework assignments are made, all those above 5 will be counted as bonus points (a good way to raise your grade a couple of points). If less than 5 are assigned, bonus points will be awarded to all to raise the homework contribution to 10%.

*Final exams often have many bonus points, thus accounting for as much as 35-40% of your overall grade ***IF*** all bonus points are attempted.

The declared value of the final exam is $6000 (but of course is not for sale). As such participation in the attempted theft of the exam constitutes felony theft. Receipt of any information about the exam constitutes felony theft by receiving.

Exam Design and Grading:

Exams will cover all material assigned as reading, homework and discussed in class.
Each exam will be designed with the following approach:

1.) The first 1/3 of points will be easily obtained by students that attended class. Everyone is expected to get an A on these problems.
2.) The second 1/3 of points will be easily obtained by students who understood all class examples and homework. Most classes will average a B on these problems.
3.) The remaining points will challenge all students in the class. Most classes will average a C-D on these problems.
The overall average for most classes will be a C to B but the grading will likely be a 3.5 average.

What is Expected of Students

All students are required to follow the academic honor codes established by Georgia Tech.
All students are expected to be respectful of other students.
All students are responsible for materials covered in and/or assigned in class REGARDLESS of whether they attended class.
I strongly prefer an interactive class. Let me know if you do or do not understand what is being lectured. Ask questions!

Instructor Commitment to the Student.
While statistics always result in some students who will perform poorly in this class, no student will perform poorly due to lack of access to the instructor. To that end, I will make every reasonable provision possible to insure your success in this class. Students are strongly encouraged to seek help from this instructor with any problem, academic, personal or otherwise. Students are also strongly encouraged to supply the instructor with constructive criticism regarding all aspects of class activity. Such criticism (even/especially that considered negative) will be greatly appreciated.

The following is an anticipated schedule of topics. However, as this is a course under development, topical coverage is at best suggested.

	Topic	Reading Material
1	Class introduction and policies	Notes
2	Semiconductor materials Review of Classical Mechanics and the Need for Quantum Mechanics	Brennan Chapter 1 Notes
3	Postulates of Quantum Mechanics	Brennan Chapter 1 Notes
4	Wave properties and position vs momentum space	Brennan Chapter 1 Notes
5	Schrödinger Equation: Exact Solutions in 1D and 1D Energy Bandgaps	Brennan Chapter 2.1-2.6 Notes
6	Schrödinger Equation: Exact Solutions in 3D.	Brennan Chapter 3.1-3.3 Notes
7	Approximation Methods for non-exact solutions	Brennan Chapter 4.1-4.4 Notes
8	Time-independent perturbation theory	Brennan Chapter 4.1-4.4 Notes
9	Time-dependent perturbation theory	Brennan Chapter 4.1-4.4 Notes
10	Statistical Mechanics (Equilibrium and Non-Equilibrium)	Brennan Chapter 5.1-5.8 & 6.1, 6.2 Notes
11	Solids State Physics Bonding and crystalline formation	Brennan Chapter 7.3, 8.1-8.5 Notes