ECE 6451 Fall 2017	Schedule: 3:10 pm Tu, Th (may be some exceptions—check class schedule)
Instructor: Prof. David Citrin	email (best way to contact me): david.citrin@ece.gatech.edu
Office Hours: By appointment	Cell (emergencies only!) +1 404 717 3085

Objectives:
• To introduce the physical basis of the operation of electronic devices.

Text: *The Physics of Semiconductors with Applications to Optoelectronic Devices,* Kevin F. Brennan, Cambridge University Press, 1999. **Note: I do not strongly recommend you buy this book unless you really like it. There are many good books that cover most of the course material. I will post notes on T-Square and give references to other sources where appropriate.**

Prerequisites: Basic knowledge of linear algebra and differential equations. An exposure to modern physics and solid-state physics helpful, but not required.

Grading policy:
Homework and quiz policy:
Problems will be assigned at regular intervals; they are not graded. Solutions will be made available. The problem sets are **essential** as these will provide that practice that will lead to mastery of the subject matter. Students who do not work diligently on the problem sets will not be able to do well on quizzes!

There will be two in-class quizzes as given tentatively in the schedule below. The quizzes will be heavily drawn from problems given in the homeworks. Thus, mastery of homework problems is likely to translate into high quiz grades.

Each quiz will concentrate on material covered between specified cutoffs (TBA)—typically from the cutoff from the previous quiz, but will nonetheless be comprehensive. That is, while the emphasis will be as described above, knowledge of material that came before in the course will be required to do well on the quizzes and there may be specific questions or parts of questions that focus on earlier work.

The final project serves as the final exam for the course. The final project will take the form of a research proposal. That is, you will need to propose to carry out a research project that has not been done before. It will have to be feasible, relevant, and important; you will have to provide the justification why someone should pay for the work! It will have a written component and a presentation. **More information will be contained in a separate handout.** The tentative dates are below.

NOTE: The final project may be due during dead week. Presentations may be scheduled during dead week.

The course grade will be computed according to the following weights:
Each quiz (2): 30 %
Final project: 40 %

Failure to take a quiz may result in a grade of zero unless you present **written documentation** that you have a valid excuse and that I accept the excuse. Unless the excuse is related to an obviously unforeseen emergency, this documentation must be presented one week prior to the quiz or a grade of zero may result.

Class Attendance Policy:
While attendance is not likely to be taken on a routine basis, students are expected to attend lectures and be engaged with the class. Class attendance is the easiest way I know of to attain a first attempt at an understanding of the material. (Of course, this has to be supplemented by working homework problems and other practice.)

Academic Conduct:

Students in this class are expected to abide by the Georgia Tech Honor Code and avoid any instance of academic misconduct, including but not limited to:

- Possessing, using, or exchanging improperly acquired oral or written information in the preparation of a quiz or the final project.
- Submission of material that is substantially identical to that created or published by another individual, except as noted below.
- False claims of performance or work that has been submitted by the student.

Be sure to report observed instances of violations of the Honor Code! Remember, the Honor Code is about honor. Apart from devaluing your own work, the work of your classmates, and the Georgia Tech degree, Violations of the Honor Code carry significant penalties, here at Tech, and for life. Do you want to be labeled as having cheated? The trustworthiness of engineering and science (as well as the reliability and safety of products!) relies on the basic honesty of engineers and scientists. Students may work in groups on the final project as will be discussed in a future handout, though each must student make a good-faith effort to contribute to the group. Each student must also write up and turn in his/her work to integrate the knowledge.

Further information concerning materials and other aids allowed in quizzes will be given later.
See the Georgia Tech Honor Code for further information or ask instructor.

Communications:
You are responsible for all announcements (which may include information about the homework, quizzes, and the final project) made in class. Quizzes will likely strongly reflect material covered in class. If you miss class, do not ask me what was covered. Handouts may also be distributed from time to time in class; it is your responsibility to obtain information from classmates if you are not present when information is given or materials are distributed. I may also email the class various information. The alias for the class corresponds to the list of those students registered for the course. Thus, if you are not getting emails, you are probably not registered. (Wait until I announce in class that I am emailing information. This will probably happen toward the end of the first week of class.) It is your responsibility to save emails containing information about the class.

Notes, problem sets, solutions, and various other useful information will be posted at T-Square.

The best way to contact me is via email (put "ECE6451" in the subject line), briefly immediately after class (but another class may need the room), office hours, or by appointment.

Miscellaneous:
Cell phones, pagers, and similar devices must be turned off in class.

Why are you here??
• Solid-state materials are the basis of a wealth of technologies. As educated people, we should know what is going on!
• All electric, electronic, and optoelectronic devices operate through the motion of electrons (or other charged particles – ionic conductors, plasmas, gaseous electronics) in materials. As scientists and engineers, we have to know the basics.
• Circuits are everywhere! How do they work?
• The technological developments that have led to the miniaturization of devices and their extremely high speed have led to technological revolutions in your lifetime. Be part of the technology revolution!
• This may be the first time you really see the uncanny ability of mathematics to describe the physical universe. It is beautiful!

What do you have to do??
• Come to class.
• Master the concepts.
• Do the problem sets.
• Master problem solving.

• Avoid the cookbook approach to the above.
• Keep up with the material covered in lectures.
• Read the lecture notes and the book.
• Come to office hours.
• Keep an open mind.
• Ask questions.

Topics (as time permits):
Tentative Outline of Topics
I. Quantum Mechanics
1. Basic Concepts, Chap. 1, Sec. 1.1-1.7
2. One-Dimensional Problems, Chap. 2, Sec. 2.1-2.6
3. Approximative Methods, Chap. 4, Sec. 3.1-3.3

II. Statistical Mechanics
A. Equilibrium, Chap. 5, Sec. 5.1-5.8
B. Nonequilibrium, Chap. 6, Sec. 6.1-6.2
III. Solid State, Chap 7, Sec. 7.3, Chap. 8, Sec. 8.1-8.5
(Note: Chapter numbers refer to Brennan's book; however, the material will be provided in the class notes posted on T-Square. Material is also covered in many books on device physics.)

Tentative Syllabus – Specific Dates will be added soon

Class	Day	Date	Notes
1			NO CLASS
2			
3			
4			
5			
6			
7			
8			Quiz 1
9			
10			
11			Final project outline due
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			Quiz 2
26			Final Draft Written Research Proposal due
27			Presentations
28			Presentations
29			Presentations