

Georgia Institute of Technology
School of Electrical and Computer Engineering

ECE 4813 Semiconductor Material and Device Characterization



Professor: **Dr. Alan Doolittle**

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Credits: 3 lecture hours, letter, pass/ fail, audit

Prerequisites: ECE3040 (or equivalent)

Text: “*Semiconductor Material and Device Characterization*”, 3rd edition, Dieter K. Schroder.

The text is available free online to Georgia Tech Students through IEEE Explore:

<http://ieeexplore.ieee.org/xpl/bkabstractplus.jsp?bkn=5237928>

This superb text should be considered a required reference material for anyone interested in microelectronics.

Web Resources:

Official Class Web site: <http://users.ece.gatech.edu/~alan/index.html>

Note: This is the second time this class is being taught by me so the class web site will be slow to develop. Also, the web page currently lists the course number under the old number 4813 not the current number 4803A.

Office Hours: Officially: Wednesday 2:00-3:00. Most weeks I hold “open office hours” on Mondays where you can come by for help anytime that is pre-arranged (strongly recommended to insure I am there, preferably by email) or drop by unplanned (no guarantee I will be in my office). All students are strongly encouraged to consult me with any problem, academic, personal or professional!

Grading Schedule:

Grades will be based on a 100 point scale (see note on the final exam below), but bonus points will frequently be awarded. Exams will fall approximately every 5 weeks.

		Approximate Date
Exam 1	20%	~February 17 th (Monday)
Exam 2	20%	~March 12/14 th (Wednesday – Later)
Presentation	20%	~April 16 th until completed. Order selected by random lottery
Homework	2% each ~5 per term	
Final Exam*	30%	Week of April 28 th
Pop Quizzes	0.5% Bonus	As needed to insure attendance

Each homework is **ungraded** and adds a fixed 2 % (or 0%) if **ALL** (or some) assignments are **legitimately** attempted. Homework will be representative of test problems. 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.

While curving is not expected to be needed in this class, I do not curve in the traditional GT way. Bonus points are added to the final exam to allow you to receive an “earned curve”. If you do not learn the material, you can not get the benefit of a curve.

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.

Semester Syllabus

Students are *STRONGLY* encouraged to read the material *Before* the class discussion.

- **Week 1**
 - Introduction, Resistivity
- **Week 2**
 - Sheet Resistance
- **Week 3**
 - Doping Profiling
- **Week 4**
 - Series, Contact Resistance
- **Week 5**
 - Diodes
- **Week 6**
 - Threshold Voltage
 - Channel Length
- **Week 7**
 - Defects
- **Week 8**
 - MOS Charges
- **Week 9**
 - Recombination
 - Mobility
- **Week 10**
 - Charge-based
 - Probes
- **Week 11**
 - Optical
 - Electron Beam
- **Week 12**
 - Ion Beam
 - X-Rays
- **Week 13**
 - Reliability (time permitting or presentations)
- **Week 14**
 - Failure Analysis (time permitting or presentations)

Presentation Details:

It is my desire to make your presentation topic as interesting and as useful to you as possible. All topics must be unique. No topic can be shared by another student. Papers regarding topics partially covered in class should provide much more detail than what was covered in our text and class discussions. If chosen carefully, the paper can be a benefit to you and fun to put together instead of a time liability.

The topic is accepted by written (paper) on or before the first exam. Fill out and turn in the form at the end of this syllabus (in person). The topics are on a first come first claim basis and all must be unique (no joint presentations). NOTE that this is a materials and device characterization class and thus, a review of other devices is not an appropriate topic. How a material/device is grown, deposited is also an appropriate topic.

I WANT TO SEE DETAIL!!!! TELL ME WHAT YOU LEARNED! Ideally, I would like you to tell me something I do not already know. In the absence of this, (because I will likely be familiar with most topics) it should answer a “yes” to the question; “If I heard this topic from you for the first time, would I understand the topic well?”

Presentation specifications:

Length dependent on class size: Generally 10-15 minutes with details to come later (depends on the number of students in class at the presentation time).

Given in PowerPoint with both hard and electronic copies supplied to the instructor prior to your scheduled presentation. Presentation topics scheduled by random lottery order near the 2nd exam time. **REGARDLESS OF PRESENTATION TIME, ALL PRESENTATIONS WILL BE DUE SIMULTANEOUSLY AND CANNOT BE CHANGED AFTER SUBMISSION.**

Note: Reference everything, especially figures on the same slide as they appear (footnotes). Also, I may use some slides from exceptional presentations in future lecture slides.

Presentation Topic Selection Form

Name (as appears on class role): _____

I have read this syllabus and specifically have read the grading procedures: _____
(Initials)

Title of Presentation _____

Rough idea of subtopics to be included (so I know you have at least read up on the topic a little before making your selection)
