Georgia Institute of Technology
School of Electrical and Computer Engineering

ECE 3040 Microelectronic Circuits

Professor: Dr. Alan Doolittle

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Credits: 4 lecture hours, letter, pass/ fail, audit

Prerequisites: ECE2030, ECE2040, Math2403, Chem1211

Text: ***TWO TEXTS***
Microelectronic Circuit Design, 5th edition Richard C. Jaeger
Semiconductor Device Fundamentals, Robert F. Pierret
Some students find helpful:
Schematic Capture using Microsim Pspice for Windows, Herniter (or current 3043 text)

Web Resources:
Official Class Web site: https://alan.ece.gatech.edu/index_files/ECE3040index.htm
Note: Some use of Canvas and Piazza will be available mainly for student to student communications but assume email and the class website trump any Canvas/Piazza postings.

Office Hours: Officially: Thursdays 2:25-3:25. Most weeks I hold "open office hours" MWTh 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! *During COVID limited times, I will substitute in office hours for Teams sessions. See class discussion for details as the COVID situation is fluid throughout the semester. I will generally be available after class as well.*

Special COVID Considerations Should that Be Necessary: While ***we are not planning on having any special Covid restrictions at class start***, adapting the course to the COVID-19 situation may be necessary at some point. If that happens, this section of the course will go into hybrid mode. Depending on enrolled class size the class will be divided into two groups to maintain physical distancing and each group will attend classes in person once a week on the designated day while the rest of the class is watching the broadcast from the class. These groups will be communicated via email and assignments posted on the class web site. The class will make limited use of the CANVAS system. You are encouraged to attend the in-person class sessions unless you have a compelling reason not to do so. Assignments, homework as well as exams will be assigned through the course website http://alan.ece.gatech.edu/index_files/ECE3040index.htm , email and submitted digitally via

email (or Canvas in some very limited cases with the instructors directions). Design projects may be substituted for some exams and will also be submitted digitally. Alternatively, depending on the pandemic severity at the time, exams 2 and 3 may be given during in-class experiences. Open book take home exams may be substituted for any exam given the COVID situation. Depending on the pandemic situation at the time, the final exam may be either in class or may use the Honorlock digital proctoring system which requires the students to have access to a webcam, microphone, and reliable Internet connection. ***All these Covid preparations are only backup plans and will only be instituted should the pandemic situation change during the semester.***

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Important Note About ECE3040:

All professors and past students recognize this course as a VERY fast paced class. To do well in this class, all students will have to devote many hours to reading, working examples, homework, etc... beginning on day one. If you fall behind, it will be very difficult to catch up! Devote time to this class!

Previous analysis indicated that regular class attendance, and doing all homework problems is the key to getting an "A" in this class. Example: For one recent class, of the people who attempted all homework problems, 66% got A's and 25% got B's. **If you choose to "cheat" on the homework by not doing the work yourself, you are only hurting yourself!**

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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%	~September 20th (Wednesday)
Exam 2	20%	~October 25th (Wednesday – Later)
Exam 2	20%	~November 13th (Monday)
Homework	1% each ~10 per term	~Every 1-1.5 Weeks
Final Exam*	30%	Friday, December 8th 2:40 PM- 5:30 PM
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 **legitimately** 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 10 homework assignments are made, all those above 10 will be counted as bonus points (a good way to raise your grade a couple of points). If less than 10 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. This is a way for you to raise your grade and implements an "earned curve" meaning - if you understood the material even at the last second, you deserve to get your grade "curved" up. Using bonus points on the final exam gives these students opportunities to raise their score. If a student did not learn the material, they should not

benefit from a curve and thus, since they cannot answer these bonus point questions, they will not benefit from a curve.

*This semester I may give an additional "Bonus Project" worth 10% of your grade (bonus). If given, it will be given around the second exam.

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 ~33% of points will be easily obtained by students that attended class. Everyone is expected to get an "A" on these problems.
2.) The second ~33% of points will be obtained by students who understood all text, class work and homework, but will require deeper thought. Most classes will average a "B- or C" 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".
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 cannot 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.

Academic Integrity
Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. For information on Georgia Tech's Academic Honor Code, please visit http://www.catalog.gatech.edu/policies/honor-code/ or http://www.catalog.gatech.edu/rules/18/. Any student suspected of cheating or plagiarizing on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or http://disabilityservices.gatech.edu/, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. See http://www.catalog.gatech.edu/rules/22/ for an articulation of some basic expectation that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Fall/Winter Semester Syllabus (Summer semester coverage is accelerated)

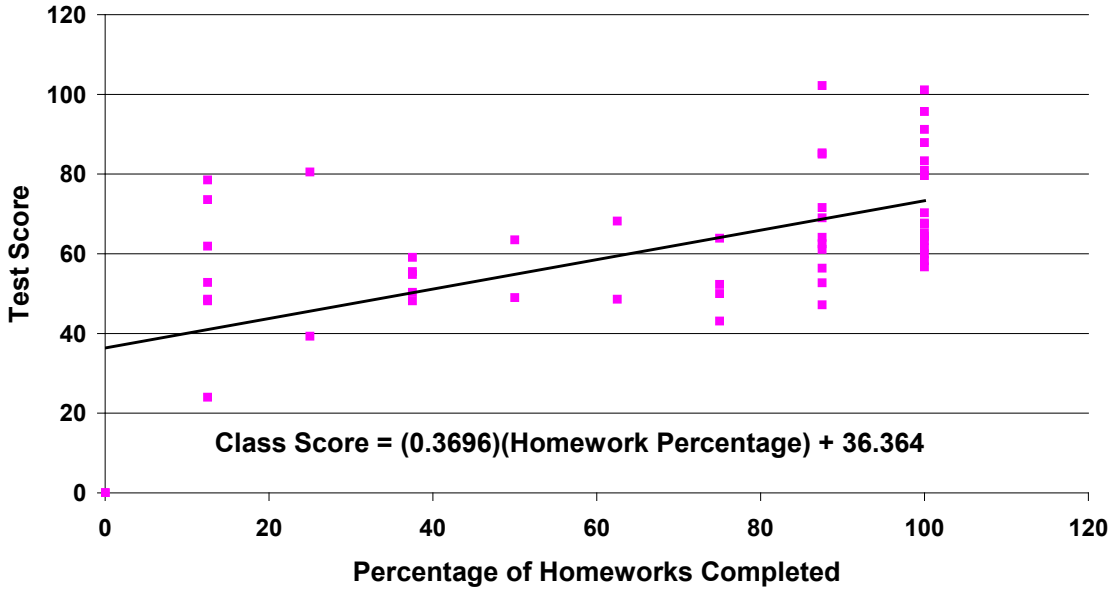
Dates should be considered flexible

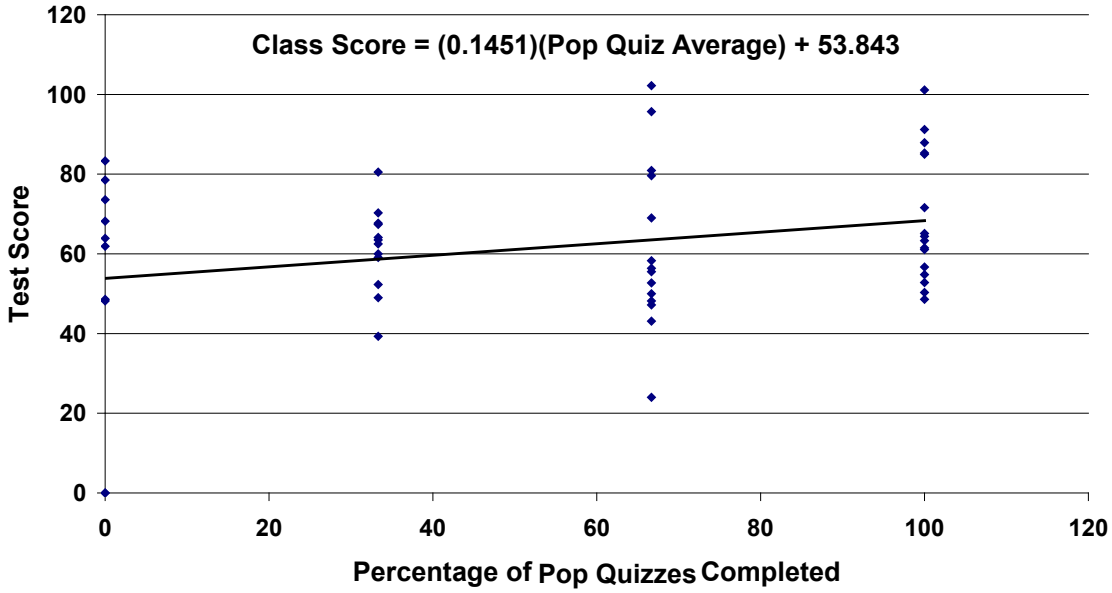
Students are ***STRONGLY*** encouraged to read the material ***Before*** the class discussion. An asterisk indicates reduced class coverage compared to previous years due to reduction in class time from 4.5 hours to 4 hours per week.

Order	Topic	Reading Material
1	*Class introduction and policies	Handout
2	*Semiconductor materials *Crystal structures *Semiconductor materials	Pierret 1.1, 1.2, 1.4, 2.1, and 2.2
3	Carrier Properties State and Carrier Distributions Equilibrium carrier concentrations	Pierret 2.3 2.4, 2.5, 2.6
4	Drift Diffusion Generation/Recombination	Pierret 3.1 3.2 3.3
5	Generation/Recombination Equations of State Introduction to p-n junctions	Pierret 3.3 3.4 5.1
6	p-n Junction Electrostatics Ideal Diode	Pierret 5.2 6.1
7	p-n Junction Small Signal Model p-n Junction Large Signal Model Diode Circuits Diode SPICE Model Diode Applications	Jaeger 3.2-3.15, 13.4 Notes Pierret 9.2, Notes

Order	Topic	Reading Material
8 8 cont'd	*Introduction to Bipolar Junction Transistors *BJT Physics Ebers-Moll Model	Pierret 10.1- 10.6 11.1 11.1
9	BJT Small Signal Model BJT SPICE Model Metal Oxide Semiconductor Capacitor	Jaeger 13.5-13.6 Notes Pierret 16.2, 16.3
10	MOSFET Basics MOSFET Device Physics MOSFET Small Signal Model	Pierret 17.1-17.2 Jaeger 4.1-4.10, Notes Jaeger 13.7
11	MOSFET Small Signal Model MOSFET SPICE Model Single Stage Amplifiers	Notes Notes Notes
12	Common Emitter Amplifier Common Source Amplifier Common Collector/Drain Amplifier	Jaeger 13.6, 13.10, 13.11 13.9, 13.10, 13.11 14.1, 14.3
13	Common Base/Gate Amplifier Operational Amplifier	Jaeger 14.1, 14.4 Jaeger 11.1, 11.2
14	1st order Op Amp Circuits Non-ideal Op Amps and Op Amp circuits Op Amp Frequency Response and filters	Jaeger 11.3-11.4 Jaeger 11.5 Jaeger 12.1 and notes
15	Differential Amplifier "Fairchild" 741 Op Amp	Jaeger 15.1-15.3 and notes Jaeger 16.8 and notes
16	~~Logic Gates and Levels~~ ~~Dynamic Response~~ ~~Boolean Algebra~~ ~~NMOS Inverter~~ ~~CMOS Inverter~~ ~~Other Logic Gates~~	~~Jaeger 6.1, 6.2~~ ~~Jaeger 6.3~~ ~~Jaeger 6.4~~ ~~Jaeger 6.6-6.9~~ ~~Jaeger 7.1-7.4~~ ~~Jaeger 7.5~~
17	Final Exams	Final Exams

Homework and class attendance is VERY Important!
Statistics for Fall 2001:





Statistically, if you did all 8 homework sets, you raised your score by 36 Points! The top 11 out of 50 grades performed 7.6 out of 8 homework's.