Georgia Institute of Technology  
School of Electrical and Computer Engineering  

ECE 3040 Microelectronic Circuits  

Professor: Dr. Alan Doolittle  
Office: Pettite 208  
Work: (404) 894-9884  
Email: alan.doolittle@ece.gatech.edu (by far, the best way to communicate with me).  

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

Prerequisites: ECE2030, ECE2040, Math2403, Chem1211  

Text: TWO TEXTS  
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: http://users.ece.gatech.edu/~alan/index.html  

Office Hours: Officially: Wednesdays 12:30-1:30. 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!  

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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.

<table>
<thead>
<tr>
<th>Approximate Date</th>
<th>Exam 1</th>
<th>Exam 2</th>
<th>Homework</th>
<th>Final Exam*</th>
<th>Pop Quizzes</th>
</tr>
</thead>
<tbody>
<tr>
<td>~February 8th (Wednesday)</td>
<td>20%</td>
<td>20%</td>
<td>1% each ~10 per term</td>
<td>30%</td>
<td>0.5% Bonus</td>
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<tr>
<td>~March 29th (Wednesday – Later)</td>
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<td>~April 21th (Friday)</td>
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<td>~Every 1-1.5 Weeks</td>
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<td>Week of May 1st</td>
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<tr>
<td>As needed to insure attendance</td>
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</table>

Final Exam is currently planned for April 28 (Fri) 8:00am - 10:50am.

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 Exam” worth 10% of your grade (bonus). If given, it will be given before the second exam and cover Bipolar Junction Transistor material normally covered in regular class. Materials will be covered through online lectures so as to free up more example problem time for the class lectures.

**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.

<table>
<thead>
<tr>
<th>Order</th>
<th>Topic</th>
<th>Reading Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>*Class introduction and policies</td>
<td>Handout</td>
</tr>
</tbody>
</table>
| 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 Circuit Analysis  
Diode SPICE Model  
Diode Applications | Jaeger 3.2-3.15, 13.4  
Notes  
Pierret 9.2, Notes |
| 8     | *Introduction to Bipolar Junction Transistors  
*BJT Physics  
Ebers-Moll Model | Pierret 10.1-10.6 11.1 11.1 |
| 8 cont’d | | |
| 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 |
<p>| 11    | MOSFET Small Signal Model | Notes |</p>
<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOSFET SPICE Model</td>
<td>Notes</td>
</tr>
<tr>
<td></td>
<td>Single Stage Amplifiers</td>
<td>Notes</td>
</tr>
<tr>
<td>12</td>
<td>Common Emitter Amplifier</td>
<td>Jaeger 13.6, 13.10, 13.11</td>
</tr>
<tr>
<td></td>
<td>Common Source Amplifier</td>
<td>13.9, 13.10, 13.11</td>
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<tr>
<td></td>
<td>Common Collector/Drain Amplifier</td>
<td>14.1, 14.3</td>
</tr>
<tr>
<td>13</td>
<td>Common Base/Gate Amplifier</td>
<td>Jaeger 14.1, 14.4</td>
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<tr>
<td></td>
<td>Operational Amplifier</td>
<td>Jaeger 11.1, 11.2</td>
</tr>
<tr>
<td>14</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; order Op Amp Circuits</td>
<td>Jaeger 11.3-11.4</td>
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<tr>
<td></td>
<td>Non-ideal Op Amps and Op Amp circuits</td>
<td>Jaeger 11.5</td>
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<tr>
<td></td>
<td>Op Amp Frequency Response and filters</td>
<td>Jaeger 12.1 and notes</td>
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<tr>
<td>15</td>
<td>Differential Amplifier</td>
<td>Jaeger 15.1-15.3 and notes</td>
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<td>“Fairchild” 741 Op Amp</td>
<td>Jaeger 16.8 and notes</td>
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<tr>
<td>16</td>
<td>Logic Gates and Levels</td>
<td>Jaeger 6.1, 6.2</td>
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<td>Dynamic Response</td>
<td>Jaeger 6.3</td>
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<td>Boolean Algebra</td>
<td>Jaeger 6.4</td>
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<td>NMOS Inverter</td>
<td>Jaeger 6.6-6.9</td>
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<td>CMOS Inverter</td>
<td>Jaeger 7.1-7.4</td>
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<td>Other Logic Gates</td>
<td>Jaeger 7.5</td>
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<tr>
<td>17</td>
<td>Final Exams</td>
<td>Final Exams</td>
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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.