### EEE 5320 Bipolar Analog IC Design  
#### Very Tentative Syllabus  
#### Fall 2013

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture</th>
<th>Text Sections</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug</td>
<td>21</td>
<td>Intro, BJT operation</td>
</tr>
<tr>
<td>F</td>
<td>23</td>
<td>PN junctions, capacitance, breakdown</td>
</tr>
<tr>
<td>M</td>
<td>26</td>
<td>Transistor models</td>
</tr>
<tr>
<td>W</td>
<td>28</td>
<td>IC technologies, layout, CMOS</td>
</tr>
<tr>
<td>F</td>
<td>30</td>
<td>Small-signal models, parasitics</td>
</tr>
<tr>
<td>M</td>
<td>2</td>
<td>Labor Day (No class)</td>
</tr>
<tr>
<td>W</td>
<td>3</td>
<td>Design-oriented analysis; single-stage amps</td>
</tr>
<tr>
<td>F</td>
<td>6</td>
<td>Curr. mirror, multi-stage amps</td>
</tr>
<tr>
<td>M</td>
<td>9</td>
<td>Diff. pairs</td>
</tr>
<tr>
<td>W</td>
<td>11</td>
<td>Diff pair with active load, SPICE</td>
</tr>
<tr>
<td>F</td>
<td>13</td>
<td>Quiz 1</td>
</tr>
<tr>
<td>M</td>
<td>16</td>
<td>Quiz 1 review</td>
</tr>
<tr>
<td>W</td>
<td>18</td>
<td>Feedback intro, loop gain</td>
</tr>
<tr>
<td>F</td>
<td>20</td>
<td>Series/shunt</td>
</tr>
<tr>
<td>M</td>
<td>23</td>
<td>Port resistances</td>
</tr>
<tr>
<td>W</td>
<td>25</td>
<td>Ideal and closed-loop gains</td>
</tr>
<tr>
<td>F</td>
<td>27</td>
<td>SPICE</td>
</tr>
<tr>
<td>M</td>
<td>30</td>
<td>Loop gain in SPICE</td>
</tr>
<tr>
<td>W</td>
<td>2</td>
<td>Time-constant analysis</td>
</tr>
<tr>
<td>Oct</td>
<td>F 4</td>
<td>Quiz 2</td>
</tr>
<tr>
<td>M</td>
<td>7</td>
<td>Qz 2 solution</td>
</tr>
<tr>
<td>W</td>
<td>9</td>
<td>Frequency response</td>
</tr>
<tr>
<td>F</td>
<td>10</td>
<td>Feedback frequency response, 2nd order</td>
</tr>
<tr>
<td>M</td>
<td>14</td>
<td>Phase margin, compensation</td>
</tr>
<tr>
<td>W</td>
<td>16</td>
<td>2-stage op amp, DC</td>
</tr>
<tr>
<td>F</td>
<td>18</td>
<td>2-stage op amp transient, slew rate</td>
</tr>
<tr>
<td>M</td>
<td>21</td>
<td>2-stage op amp AC</td>
</tr>
<tr>
<td>W</td>
<td>23</td>
<td>2-stage amp discussion</td>
</tr>
<tr>
<td>F</td>
<td>25</td>
<td>Output, power stages</td>
</tr>
<tr>
<td>M</td>
<td>28</td>
<td>Current feedback op amps</td>
</tr>
<tr>
<td>W</td>
<td>30</td>
<td>Review for Quiz 3</td>
</tr>
<tr>
<td>F</td>
<td>1</td>
<td>Quiz 3</td>
</tr>
<tr>
<td>M</td>
<td>4</td>
<td>Qz. 3 solution, offset, mismatch</td>
</tr>
<tr>
<td>Nov</td>
<td>W 6</td>
<td>Offset, mismatch</td>
</tr>
<tr>
<td>F</td>
<td>8</td>
<td>Homecoming (no class)</td>
</tr>
<tr>
<td>M</td>
<td>11</td>
<td>Veterans’ Day (no class)</td>
</tr>
<tr>
<td>W</td>
<td>13</td>
<td>Noise generators</td>
</tr>
<tr>
<td>F</td>
<td>15</td>
<td>Noise in transistor circuits</td>
</tr>
<tr>
<td>M</td>
<td>18</td>
<td>Op amp noise analysis</td>
</tr>
<tr>
<td>W</td>
<td>20</td>
<td>Op amp noise analysis</td>
</tr>
<tr>
<td>F</td>
<td>22</td>
<td>Low-noise mic preamp design</td>
</tr>
<tr>
<td>M</td>
<td>25</td>
<td>Translinear circuits</td>
</tr>
<tr>
<td>W</td>
<td>28</td>
<td>Thanksgiving (no class)</td>
</tr>
<tr>
<td>F</td>
<td>30</td>
<td>Thanksgiving (no class)</td>
</tr>
<tr>
<td>M</td>
<td>2</td>
<td>VGAs, peak detectors, AGC</td>
</tr>
<tr>
<td>Dec</td>
<td>W 4</td>
<td>Quiz 4</td>
</tr>
</tbody>
</table>
Bipolar Analog Integrated Circuit Design

EEE 5320
3 Credits
Fall Semester, 2013

Catalog Description. Amplifier stages, active loads, output stages, op amps, feedback, frequency response, compensation.


References:

Prerequisites: Undergraduate course in analog circuits (EEE 3308, EEE 4306, etc.)

Course objectives: Fundamentals of design-oriented analysis of analog ICs.

Instructor: Robert M. Fox  Office Phone: (352) 392-2543  FAX: (352) 392-8381
537 Engineering Bldg.
Box 116130
Department of Electrical and Computer Engineering
University of Florida
Gainesville, FL 32611-6130
fox@ece.ufl.edu

TA: Changsok Han  Email: changsokhan@ufl.edu  Office hours: TBA
Course Website: Sakai: https://elearning2.courses.ufl.edu

Overview: The course highlights the ways designers use the advantages and work around the limitations of IC technologies. The key goal is to emphasize the fundamentals of analog integrated circuit design at the transistor level. Whenever possible we will demonstrate the concept of Design-Oriented Analysis. The course incorporates computer simulation using SPICE, and students will work on several design/simulation projects. In some projects you may work in a group.

Outline:
Transistor operation and modeling
Review of basic analog circuits
Feedback analysis
Op amp design
Noise in electronic circuits
Translinear and nonlinear circuits
Class time: 7th Period (1:55 – 2:45) Room: NEB 102

Section numbers: On-campus: 1553, UF EDGE: 7085, 7086

Office Hours: I am happy to meet with you to answer questions and discuss course or other material whenever I have time. I am in my office roughly 9:00 AM to 5 PM most days.

Circuit Simulator: LTSpice, available for free download

Grading: Quizzes: 80% HW, Projects: 20%

Disabilities Accomodations: Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation.

UF Religious Holiday Policy: “Students, upon prior notification of their instructors, shall be excused from class or other scheduled academic activity to observe a religious holy day of their faith. No major test, major class events or major university activity should be scheduled on a major religious holiday. Professors and university administration shall not penalize students who are absent from academic or social activities because of religious observance. Students shall be permitted a reasonable amount of time to make up material or activities covered in their absence.”

To excuse religious holidays, students need to give the instructor a 1 week notice prior to the specific holiday.

UF Counseling Services: Resources are available on-campus for students having personal problems or lacking clear career and academic goals. The resources include:
- University Counseling Center, 301 Peabody Hall, 392-1575, Personal and Career Counseling.
- SHCC mental Health, Student Health Care Center, 392-1171, Personal and Counseling.
- Center for Sexual Assault/Abuse Recovery and Education (CARE), Student Health Care Center, 392-1161, sexual assault counseling.
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

Software Use: All faculty, staff and student of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.
Honesty Policy

All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is a reminder to uphold your obligation as a UF student and to be honest in all work submitted and exams taken in this course and all others.

Simply, you are not allowed to cheat or to tolerate cheating. The University’s detailed honesty policy, which I follow, can be found at http://www.dso.ufl.edu/judicial/. The rules you are expected to follow are listed on that web page. Please go to the site and read the material for students. You should also familiarize yourself with the procedures to be followed by faculty members, which also include students’ rights to dispute allegations of dishonesty.

Specifically for my class: you may consult with other students on homeworks or projects. In fact, some projects and homeworks will be assigned to be worked on in groups. However, solutions or reports that you turn in as your own must be your work alone. For example, in a simulation project assigned to you alone, you must create your own computer files and run your own simulations. For group projects, solutions from a group must list only those students who actually contributed to the work.

Attendance

Since the class is taped, you may get by without coming to class. I hope you’ll come to class whenever you can. Students watching the course video depend on the in-class students to ask questions that they can’t ask.

Make-Up Opportunities

I work very hard to create exams, so it is very hard for me to create an extra exam just for you. If you have a University-approved excuse and arrange for it in advance, a make-up exam will be allowed. Job interviews, weddings, family reunions and away football games are examples of events that are not University-approved.

Grading

The TA will usually grade homeworks. I’ll ask him to grade pretty leniently. I’ll grade the quizzes. We have so many grades now that I usually assign a letter grade for each part plus an overall letter grade. The grades are averaged using the weighting factors listed above, and your grade will be determined by that average. I’ll try to keep you informed how you stand.

Typically the average grade for students who are still participating by the end of the semester is around a 3.1, between B and B+. It depends on how much you as a group learn, so I guess you could say there’s a “curve.”
Homework

Typically, I assign about one homework per week. Usually the homework solutions are due at the start of the next lecture. I go over the solution and release a written solution at the beginning of the lecture. Similar procedures apply for quiz solutions.

Homework/quiz procedures for on-campus students

On-campus students turn in their homework before the start of class. Students should turn in paper solutions to the front of the class before class starts. (Electronic submissions prior to that time are also acceptable.) Any on-campus solutions turned in more than a few minutes late are ineligible to receive full credit. (How much credit is assigned for work turned in late will be up to me and the TA.)

Once the homework solutions have been graded (usually within a few days), the TA will put them in alphabetical order, and I will pass the stack of graded papers back to you in class.

Please do not look at other people's grades. It seems trivial, but it could be considered a violation of US Federal privacy laws that a student could see another student's grade. **If you feel that your privacy might be violated by this procedure, let me know**, and we will hold your papers out of the stack of papers to be returned.

Many of you use several different names. The solutions will be in alphabetical order, based on the "LAST NAME" that UF's computer uses for you. Please put THAT NAME on your paper so we can put it in proper alphabetical order. That way you should be able to quickly find your paper in the stack of returned papers.

Homework procedures for online students

Now, for EDGE students, other procedures apply. Please turn your solutions by email to me and to the TA. PDF, MS Word, MS Excel, and possibly other formats are acceptable. As soon as the TA or I see that you have turned in an assignment, we'll send you an email with links to the solution videos (in several formats). The email will also contain a .pdf file of the homework solution. Grading info for the homework will follow within a few days.

Timing issues for online students

EDGE policy is that quizzes and homeworks should be graded and returned within one week after you turn them in. We usually do much better than that. On the other hand, EDGE policy is that you should not fall more than one week behind real time.

In principle I'm not worried about exactly when you turn in the assignments, as long as it's less than one week behind real time. However, you can't progress in the class (watch all of the videos) until you've turned in the homework.

Of course, one of the nice things about taking this course online is that if family or work issues force you to take an extra day or two, then you have that freedom. In effect, you have a "buffer" that you can use to allow some "slack." If you fall behind more than a few days, you get in danger of losing touch with the class, so you should avoid that. If you get a whole week behind, then you've lost your "buffer". Please let me know if you're going to be more than a few of days behind, and then you need to catch up as soon as you can to restore your flexibility.

The one-week limit applies to quizzes as well, with the same strong suggestion not to fall that far behind.