UC DAVIS
Advanced Analog Circuit Design
Course Outline

EEC211 (CRN 43545)  Professor Spencer
Winter 2011  2041 Kemper Hall
TTh 9:00-10:20 123 Wellman  752-6885
Office hours: F 1:10-2:30 2041 Kemper Hall  email: spencer@ece
(please don’t email technical questions)

Required Texts:  Thomas H. Lee, The Design of CMOS Radio-Frequency Integrated Circuits. 2nd Ed. Cambridge, UK: Cambridge University Press, 2004 – This text is on two-hour reserve at the physical sciences library
R.R. Spencer, Noise in Electronic Devices, Circuits, and Systems, Jan. 2003 (provided in class)

Suggested Reference Texts: (roughly in descending order of usefulness for this course – all except Weiner & Spina are on 2-hour reserve at the physical sciences library)
D.D. Weiner and J.F. Spina, Sinusoidal Analysis and Modeling of Weakly Nonlinear Circuits; Van Nostrand Reinhold, 1980 (this book is out of print, but can still be found through used book sellers and is the best book I have found on the Volterra series!)

Prerequisites:  EEC210 (or consent of the instructor) & a course in probability theory

Objectives:  After taking this course you should understand:
1) The origin of noise in electronic systems
2) How to analyze transistor-level circuits with noise sources present
3) The definition and use of Noise Figure, Noise Factor, and Noise Temperature
4) How to design circuits to minimize equivalent input noise
5) How to find the Noise Figure of cascaded networks
6) How to analyze distortion in memoryless electronic circuits and systems
7) How to analyze distortion in circuits with memory using the Volterra series
8) How noise and distortion affect communication systems – intercept points, spurious-free dynamic range, phase noise
9) The basic operating principles and tradeoffs involved in the design of mixers, RF low-noise amplifiers and oscillators
10) The tradeoffs involved in choosing transmitter & receiver architectures

Homework:  Assignments will be made as appropriate during the quarter and will be posted on the course website. Solutions will be available on the website (when you click on
a link to see a solution, you will be asked for a login name and password, the login name is eec211 and the password is volterra, both are case sensitive).

**Oral Report:** Each student will present an oral report to the class on a topic chosen by the student and approved by the Professor. The presentation format will be like a short paper at an IEEE conference (12 minutes plus 3 minutes for questions) and will be graded by the other students as well as the Professor. The paper is usually based on a journal article relevant to the course, but other material may be used.

**Grading:** There will be two open-book exams (a midterm and a final), and the oral report. The weighting used for the final course grade will be: homework 20%, exams 25% each, report 30%.

### EEC211 Class Schedule - Winter 2011

*(this schedule is approximate – so you will need to adjust your reading based on where we are in class)*

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<tr>
<th>Date</th>
<th>Day</th>
<th>Topic</th>
<th>Reading</th>
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<tr>
<td>6</td>
<td>Th</td>
<td>Noise bandwidth. Non-equilibrium noise sources: shot noise.</td>
<td>Spencer – §3.1, Lee §11.3</td>
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### Distortion Analysis:

- **Why study distortion?**
  - Lee §12.6

### Desensitization and blocking.

  - Lee §12.6-12.7

### Midterm

- This covers all material up through lecture on 2/3. This exam will be a 2-hour take-home exam that you pick up from the department office on Monday, Tuesday or Wednesday so that you can attend the ISSCC if you want to.

### Translinear principle (TLP).

- Finish linearization techniques. More sophisticated approach to power series.

### Start Volterra series analysis.

### More Volterra series analysis with examples.

### Alternate notation (operator notation).

  - Lee Chap. 13


### Phase-locked loops.

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<td>17</td>
<td>Th</td>
<td>10:30 AM - 12:30 PM Final Exam</td>
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