Spring 2017, ESE 311: Analog Integrated Circuits

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Office Hours: Tues, Thurs, 3-5 PM, 247 Light Eng.

Prerequisites: ESE 372, Electronics

Description: Engineering design concepts applied to electronic circuits; basic network concepts, computational analysis and design technique; models of electronic devices; biasing and compensation methods; operational amplifiers designed by conventional and computer-aided techniques.

Lectures: 128 Chemistry, Mon, Wed, 2:30-3:50 PM

Textbook (required): B. Razavi, Fundamentals of Microelectronics, 2nd ed., 2013, Wiley& Sons, ISBN-13: 978-1118520970, ISBN-10: 1118520971

Additional reading (recommended): B. Razavi, Design of Analog CMOS Integrated Circuits, 2nd ed., 2016, McGraw Hill, ISBN-13: 978-0072524932, ISBN-10: 0072524936

Grading: 10 homeworks (10 pts), 5 simulation assignments (5 pts), 2 quizzes (4 pts), project (15 pts), test 1 (10 pts), test 2 (20 pts), final exam (30 pts), portfolio (6 pts)

Topical outline:

1. **MOSFET and BJT parameters**: fabrication technology of integrated circuits, - 10%

2. **Single-ended amplifiers**: biasing, active load, frequency response, Miller's theorem, cascode amplifier - 20%

2. **Differential amplifiers**: differential pairs with active load, differential gain, common-mode gain, common-mode rejection ratio, non-ideal characteristics, frequency response - 30%

3. **Negative feedback:** four basic feedback topologies, loop gain, stability and pole location, frequency compensation - 20%

4. **Operational Amplifiers**: OpAmp architectures, two-stage and folded cascode amplifiers, DC and small signal parameters, frequency response, slew rate - 20%

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Any suspected instance of academic dishonesty will be reported to the Academic Judiciary. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at http://www.stonybrook.edu/uaa/academicjudiciary/

ESE311 Spring 2017: Tentative schedule (rev.)

Mondays HWs due	Wednesdays Simulations Quizzes	Topics
Lect. 1 1/23	Lect. 2 1/25	MOSFET and BJT characteristics. Gain of the basic cell. Comparison of the MOSFET and BJT gain stages. Current sources and sinks.
Lect. 3 1/30, HW1	Lect. 4 2/1	Current Mirrors. Biasing with voltage and current sources. Loading with current sources/sinks. Current Mirrors. Common-source (CS) stage with source degeneration. Common-Gate (CG) stages.
Lect. 5 2/6, HW2	Lect. 6 2/8, Quiz1	MOSFET Cascode current source. Cascode amplifier. Current steering.
Lect. 7 2/13, HW3	Lect. 8 2/15, Quiz2	Differential pairs with resistive, current source and current mirror loads. Large signal range. DC gain: differential, common mode, CMRR. 2-stage OpAmp.
Lect. 9 2/20, HW4	Lect.10 2/22	Analysis and design of CS, CG stages and cascode amplifiers. Common-drain configuration (source follower). Common-emitter, common-base and common-collector stages. Improved BJT current sources
Review1 2/27, HW5	**Test 1** **3/1**	Problem solving and Test 1
Lect. 11 3/6	Lect. 12 3/8, Sim1	MOSFET capacitances. Transition frequency. Frequency response: Poles and zeros of transfer functions. Low-pass filter, CS stage. Miller's theorem.
Lect. 13 3/20, HW6	Lect. 14 3/22, Sim2	Frequency response of CG stage and Cascode amplifiers
Lect. 15 3/27, HW7	Lect. 16 3/29	Frequency response: differential gain, common-mode gain, CMRR in stages with resistive and current mirror loads
Lect. 17 4/3, HW8	Lect. 18 4/5, Sim3	2-stage CMOS OpAmp: frequency response of differential gain, frequency compensation, transient response.
Review 2 4/10, HW9	**Test 2** **4/12**	Review, problem solving and Test 2
Lect. 19 4/17	Lect. 20 4/19, Sim4	Four basic feedback topologies. Loop gain, stability and pole location, frequency compensation (review)
Lect. 21 4/24, HW10	Lect. 22 4/26, Sim5	Regulated cascode amp. Folded cascode OpAmp: DC and small-signal analysis, frequency and transient responses, slew rate
Lect. 23 5/1, HW11	Review 3 5/3, Project	Review and problem solving