

## ECE 422 – CMOS Integrated Circuits I

**Catalog Description:** Analysis and design of analog integrated circuits in CMOS technology; current mirrors, gain stages, single-ended operational amplifier, frequency response, and compensation

**Credits:** 4

**Terms Offered:** Fall

**Prerequisites:** ECE 322, ECE 323 (concurrent enrollment in ECE 323 acceptable)

**Courses that require this as a prerequisite:** ECE 423, ECE 621

**Structure:** Two 100-minute lectures per week

**Instructors:** K. Mayaram (primary), U. Moon (secondary)

### Course Content:

- Introduction to mixed analog/digital microelectronics
- Operation of MOS transistors including large- and small-signal modeling
- Design of basic analog circuit building blocks using MOS transistors: simple amplifiers, differential pairs, current sources
- Design of MOS operational amplifiers with emphasis on large-signal characteristics, analysis of open loop gain, frequency response
- Frequency response of amplifiers
- Feedback amplifiers, stability, and compensation

### Measurable Student Learning Outcomes:

At the completion of the course, students will be able to...

1. **Describe** the basic operation of MOSFETs (ABET Outcome A, e, m)
2. **Analyze and design** basic MOSFET amplifier configurations and current mirrors (ABET Outcomes A, C, e, m, n)
3. **Analyze and design** single-ended MOSFET operational amplifiers (ABET Outcomes A, C, e, m, n)
4. **Design** amplifier circuits that meet certain performance specifications (ABET Outcomes A, C, e, K, m, n)
5. **Proficiently use** the circuit simulator SPICE for design and analysis of electronic circuits (ABET Outcomes A, B, C, e, K, m)
6. ECE 522 only: Study noise analysis for amplifiers

**Additional requirements for ECE 522:** Students enrolled in ECE 522 will be held to a higher standard and will be responsible for graduate-level work that will be more rigorous in both depth of study and methodology than students enrolled for ECE 422.

### Learning Resources:

- *Analysis and Design of Analog Integrated Circuits*, Gray and Meyer, John Wiley & Sons, Fourth Edition, 2001 (required)

- *Microelectronic Circuits*, A. Sedra and K. C. Smith, Oxford University Press, Fifth Edition, 2007 (optional)
- *Design of Analog CMOS Integrated Circuits*, B. Razavi, McGraw-Hill, 2001 (optional)

**Students with Disabilities:**

Accommodations are collaborative efforts between students, faculty and Services for Students with Disabilities (SSD). Students with accommodations approved through SSD are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through SSD should contact SSD immediately at 737-4098.

**Link to Statement of Expectations for Student Conduct:**

<http://oregonstate.edu/admin/stucon/achon.htm>

Revised: 5/24/07