COURSE: EECS 413. **TITLE:** Monolithic Amplifier Circuits. **PREREQUISITES:** EECS 311 or Graduate standing. **ELECTIVE**

TEXTBOOK: Razavi, Design of Analog CMOS Integrated Circuits, McGraw-Hill

CATALOG DESCRIPTION: Analysis and design of BJT and MOS multi-transistor amplifiers. Feedback theory and application to feedback amplifiers. Stability considerations, pole-zero cancellation, root locus techniques in feedback amplifiers. Detailed analysis and design of BJT and MOS integrated operational amplifiers. Lectures and laboratory.

COURSE OBJECTIVES:

1. To teach students the fundamentals of analog/mixed-signal (analog & digital) circuit design;
2. To teach students to use commercial design tools for schematic entry, simulation, and layout (the tools and process technology [Cadence] are close to the state of the art for analog design; some designs will be fabricated through the MOSIS IC prototyping service [www.mosis.org]);
3. To prepare students for higher-level courses in analog & RF circuits, and analog-digital conversion

COURSE OUTCOMES [Program Outcomes Addressed]

1. An ability to design and simulate amplifiers, and to measure their characteristics in lab; [1,2,3,5,11]
2. An ability to design and lay out an unclocked CMOS comparator to meet specs; [1,2,3,5,11]
3. An ability to design a high-gain or multistage op-amp to meet full design constraints; [1,2,3,5,11,13]
4. An ability to present design project results both orally and in IEEE-style reports; [4,7]

PROGRAM OUTCOMES ADDRESSED: 1,2,3,4,5,7,11
PROFESSIONAL COMPONENT ADDRESSED: 13
PREPARED BY: Andrew E. Yagle on Nov. 19, 2004

CLASS/LABORATORY SCHEDULE:
LECTURES: 3 per week @ 50 minutes.
LABORATORY: 1 per week @ 3 hours.

TOPICS COVERED:

1. Basic MOS device physics
2. Single-stage & difference amplifier
3. Operational amplifiers & feedback
4. Switched capacitor circuits
5. Mismatch & short channel effects
6. Layout & packaging of circuits

ASSESSMENT (Course outcomes)

1. Weekly problem sets [1,2,3]
2. 2 mid-term exams [1,2,3]
3. 2 project reports [1,2,3,4]; main project includes: IEEE-style report; formal group oral presentation; design competition between groups.

COURSE DESCRIPTION: University of Michigan, College of Engineering, ELECTRICAL ENGINEERING PROGRAM