JOINT INSTITUTE
交大密西根学院

# Standard Undergraduate Course Profile

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| **COURSE NUMBER:** Ve413 | **COURSE TITLE:** Monolithic Amplifier Circuits |
| **CREDIT:** 4 | **PREREQUISITES:** Ve 311 and Ve 320 or graduate standing |
| **TEXTBOOKS/REQUIRED MATERIAL:**<br>1. Behzad Razavi, Design of Analog CMOS Integrated Circuits, 2nd edition, 2016, ISBN: 978-0072524932 | **PREPARED BY:** Chang-Ching Tu<br>**LAST UPDATED:** October 30, 2020<br>**DATE OF DISCIPLINE GROUP APPROVAL:**<br>**DATE OF UC APPROVAL:** |
| **CATALOG DESCRIPTION (No more than 100 words):**<br>Working principles and design considerations of CMOS circuits, particularly operational amplifiers with or without feedback. Main topics include: frequency response, negative feedback, operational amplifiers and stability of operational amplifiers. On the project side, as a major-design-experience (MDE) course, this course allows students to go through a complete circuit design process, from the inception of a concept, to simulation, to breadboard testing, to PCB layout and finally the demonstration of functions designed. | **COURSE TOPICS:**<br>1. Differential pair amplifiers with active current mirrors<br>2. Frequency response<br>3. Negative feedback<br>4. Operational amplifiers<br>5. Final project |

**COURSE STRUCTURE and CONTACT HOUR**: 36 hours of Lecture / 24 hours of Project / 6 hours of Discussion

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| **COURSE OUTCOMES [Student Outcomes* in brackets]** | After completing Ve413, students should be able to do the following:<br>1. Perform frequency response analysis of amplifiers, including deriving transfer functions and drawing Bode plots. [1, 2, 6]<br>2. Design multi-stage and high-gain operational amplifiers and use negative feedbacks to achieve gain desensitization, terminal impedance modification and bandwidth modification. [1, 2, 6]<br>3. Analyze amplifiers by hand-calculation and spice simulation. [1, 2, 6]<br>4. Identify the key specifications of digital/analog circuits according to their specific applications, and to implement them on spice, breadboard and PCB to meet the specifications. [1, 2, 4, 5, 6, 7] |
| **COURSE OBJECTIVES [Course Outcomes in brackets]** | 1. To teach students how to calculate parasitic capacitances of MOSFETs. [1,3]<br>2. To teach students how to use KCL/KVL, Miller effect and association of poles with nodes to derive transfer functions. [1,3]<br>3. To teach students how to analyze amplifiers with negative feedbacks using two-port models. [2,3]<br>4. To teach students how to implement high-gain operational amplifiers based on CMOS circuits. [2,3]<br>5. To teach students how to transform a circuit concept into a real product, starting from simulation, to breadboard testing, to PCB layout and finally the demonstration of functions designed. [4] |
| **ASSESSMENT TOOLS [Course Outcomes in brackets]** | 1. Homework assignments [1,2,3]<br>2. Final project [4]<br>3. Midterm exam [1,2,3]<br>4. Final exam [1,2,3] |