COURSE: EECS 414.**TITLE:** Introduction to MEMS. **PREREQUISITE:** Math 215 & 216 & Physics 240 or Graduate standing | **ELECTIVE**

TEXTBOOK: None. Extensive course materials available by on-line streaming (multi-institutional course with Michigan State & Michigan Tech).

CATALOG DESCRIPTION: Micro-electro-mechanical systems (MEMS), devices, and technologies. Micro-machining and microfabrication techniques, including planar thin-film processing, silicon etching, wafer bonding, photolithography, deposition, and etching. Transduction mechanisms and modeling in different energy domains. Analysis of micromachined capacitive, piezoresistive, and thermal sensors/actuators and applications. Computer-aided design for MEMS layout, fabrication, and analysis.

COURSE OBJECTIVES:

1. To teach students the properties of materials used in microfabricated devices;
2. To teach students the complete micromachining process for fabricating complete devices;
3. To teach students analysis and design of capacitive, piezoresistive, thermal sensors and actuators;
4. To teach students how to use MEMS CAD tools, and to prepare them for subsequent MEMS courses.

COURSE OUTCOMES [Program Outcomes Addressed]

1. Ability to develop a set of process steps and specs to obtain a desired microfabricated device; [3,5,11]
2. Ability to analyze device structure and performance from a given set of fabrication steps; [3,5,11]
3. Ability to analyze performance of, and develop fabrication process for, capacitive transducers;[3,5,11]
4. Ability to analyze performance of, and develop fabrication process for, piezoresistive transducers; ["]
5. Ability to analyze performance of, and develop fabrication process for, thermal transducers [3,5,11]

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

CLASS/LABORATORY SCHEDULE:
LECTURES: 2 per week @ 90 minutes.
RECITATION: 1 per week @ 60 minutes

TOPICS COVERED:

1. Semiconductor planar processing
2. IC and MEMS thin-film materials
3. Silicon wet and dry etching
4. Etch stops (electrochemical)
5. Wafer bonding (anodic, eutectic)
6. Micromachining (bulk & surface)
7. Capacitive sensors & actuators
8. Piezoresistive sensors
9. Thermal sensors & actuators

ASSESSMENT (Course outcomes)

1. Weekly problem sets [1,2,3,4,5]
2. 3 open-book exams [1,2,3,4,5]
3. CAD mini-projects [1,2,3,4,5]

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