ECE 6194.06 (Proposed): Group Studies in Micro-Electro-Mechanical Systems (MEMS) Design

Course Description

The field of micro-electro-mechanical systems (MEMS) is an interdisciplinary area that includes design and fabrication of sensors and actuators (transducers) that are capable of micron-size mechanical movements. Lectures cover a wide range of topics in design & fabrication. Projects include FE simulation of an inertial, optical, RF, or power MEMS devices as an integral part of this course.

Prior Course Number: 694
Transcript Abbreviation: MEMS Design
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Graduate standing in engineering or physics, or permission of instructor
Exclusions:
Cross-Listings:

Course Rationale: New course covering the field of micro-electro-mechanical systems (MEMS).

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

Course Goals

Become familiar with the operation principles of selected MEMS sensors and actuators
Become familiar with the MEMS fabrication processes

Get exposure to MEMS multi-physics simulation software
Master the design of a MEMS device in a group project

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Overview and motivation	1.0							
History of MEMS and commercial examples	1.0							
Miniaturization: law of scaling	2.0							
Structural mechanics, elasticity, mechanical properties of silicon, and dynamic response	6.0							
Beam theory, cantilevers, doubly clamped beams, comb-drive actuators	6.0							
Lumped modeling	2.0							
MEMS fabrication techniques	8.0							
Multiphysics modeling	4.0							
Case studies: Inertial, Optical, RF, and Power.	5.0							
Project presentations	4.0							

Representative Assignments

Homework
Read assigned papers
Perform literature review
Class presentations
Computer aided design and simulation (COMSOL Multiphysics)

Grades

Aspect	Percent
Homework assignments	25%
Midterm	30%
Design project, report, and presentation	45%

Representative Textbooks and Other Course Materials

Title	Author
Handouts	

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
**	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
*	d	An ability to function on multi-disciplinary teams.
*	e	An ability to identify, formulate, and solve engineering problems.

Course Contribution		College Outcome
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
	i	A recognition of the need for, and an ability to engage in life-long learning.
*	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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