

Course Title	Physical Principles, Design and Fabrication of MEMS				
Course Code	MME 565				
Course Type	Constrained Elective				
Level	Graduate				
Year / Semester	Spring semester				
Teacher's Name	Matthew Zervos				
ECTS	8	Lectures / week	2 X 1,5 hours	Laboratories / week	NO
Course Purpose and Objectives	<p>The purpose of this course is to provide an introduction to the physical principles, design and fabrication of micro electro mechanical systems (MEMs) thereby integrating knowledge of materials science with device processing and design.</p> <p>The objectives of MME565 is to expand and broaden the knowledge that postgraduate students have on Materials Science I and II and Chemistry for Engineers etc in the direction of MEMs with emphasis on sensors.</p>				
Learning Outcomes	<p>Upon successful completion of the course, students will</p> <ol style="list-style-type: none"> 1. Understand length scales and dimensionality 2. Know the growth methods main materials used for the fabrication of MEMs and their structural ,electrical, optical , mechanical and thermal properties 3. Grasp the methods used for top-down and bottom-up device processing. 4. Know what is surface and bulk micromachining. 5. Understand all aspects of the ubiquitous microelectromechanical cantilever 6. Know how MEMs sensors are fabricated and the physical principles of operation 7. Know how microfluidic circuits are fabricated, work and their applications 8. Understand nanoelectromechanical systems with emphasis on energy harvesting 				
Prerequisites	NO	Required	NO		
Course Content	A historical overview; relevant length scales, market analysis and motivation; simple MEMs e.g. cantilever, switches, comb drives,				

	<p>pressure sensors, transduction principles i.e., mechanical, electrostatic, thermal, piezoelectric. Fabrication of MEMs using standard integrated circuit processing technology, types of lithography, i.e., photolithography, electron beam lithography, soft lithography, thin film deposition, wet and dry etching methods. Surface and bulk micromachining, hot embossing, micro-molding. Assembly, packaging and reliability. Advanced radio frequency MEMs, Piezo MEMs, Magnetic MEMs, Biological MEMs.</p>
Teaching Methodology	<p>Lectures; Written report and Presentations by students of individual projects on topics of materials and technologies related to the course</p> <p>Communicative, Collaborative</p> <p>During the first week of the semester, the Syllabus of the course is given by the teacher, which includes information on the course content, expected learning outcomes, assessment and office hours</p>
Bibliography	<p>N. Maluf, K. Williams, An Introduction to Microelectromechanical Systems Engineering, 2004</p>
Assessment	<p>Assignments and Presentation (20%), Mid-Term Exam (30%), Final Exam (50%)</p>
Language	<p>English</p>