



## Course Syllabus: Introduction to MEMS - EE 205

<b>Division</b>	Computer, Electrical and Mathematical Sciences & Engineering
<b>Course Number</b>	EE 205
<b>Course Title</b>	Introduction to MEMS
<b>Academic Semester</b>	Fall
<b>Academic Year</b>	2019/2020
<b>Semester Start Date</b>	08/25/2019
<b>Semester End Date</b>	12/10/2019
<b>Class Schedule</b> (Days & Time)	01:00 PM - 02:30 PM   Sun Wed

### Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Jurgen Kosel	jurgen.kosel@kaust.edu.sa	+966128084360	3219, 3, Ibn Sina (bldg. 3)	Office hours: Sun. 9am - 10am

### Teaching Assistant(s)

Name	Email
Mohammed Asadullah Khan	mohammedasadullah.khan@kaust.edu.sa

### Course Information

<b>Comprehensive Course Description</b>	<p>The main part of the course is theory lectures. In addition there will be laboratory presentations and software seminars.</p> <p><b>Theory lectures:</b> Scaling, silicon, lithography, bulk micromachining, surface micromachining, beams, noise in MEMS, accelerometer</p> <p><b>Laboratory presentations</b> Lithography, Plasma tools, bulk micromachining, surface micromachining</p> <p><b>Software seminars:</b> Intellisuite</p>
<b>Course Description from Program Guide</b>	<p>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.</p>
<b>Goals and Objectives</b>	<p><b>Understand the benefits and consequences of scaling.</b></p> <p><b>Understand properties and crystallography of Si.</b></p> <p><b>Explain the concept of lithography.</b></p> <p><b>Design masks.</b></p> <p><b>Understand bulk micromachining.</b></p> <p><b>Know the basic methods of surface micromachining.</b></p> <p><b>Explain the concept of beams.</b></p> <p><b>Understand noise in MEMS.</b></p>

<b>Required Knowledge</b>	<b>Fundamentals of Electrical Engineering, Chemical Engineering, Material Science and Mechanical Engineering.</b> <b>Electronic circuits knowledge.</b>
<b>Reference Texts</b>	Marc Madou: "Fundamentals of Microfabrication"
<b>Method of evaluation</b>	<b>30.00%</b> - Course Project(s) <b>70.00%</b> - Quiz(zes)
<b>Nature of the assignments</b>	<p>Software project:</p> <ul style="list-style-type: none"> <li>-Every student (group) develops a research proposal for a microsystem.</li> <li>-After approval by the instructor, the students will carry out the design and simulation of the microsystem in Intellisuite.</li> <li>-A final report in form of an IEEE research manuscript has to be prepared and submitted to the instructor together with the design and simulation files.</li> <li>-At the end of the semester, there will be oral presentations of the projects.</li> <li>-The grade for the project will depend on the quality of the proposal, the simulation model and results, the presentation and the report.</li> <li>-An introduction to Intellisuite will be given during the lecture. Beyond that, students are expected to get familiar with the software on their own to an extend required to finish the project.</li> </ul>
<b>Course Policies</b>	<ul style="list-style-type: none"> <li>-Students are supposed to attend all lectures.</li> <li>-Attendance at quizzes/exams is mandatory</li> <li>-A missed quiz/exam counts as 0% unless a medical report (emergency) is produced.</li> <li>-Quiz: In case of an excused miss a quiz will not count towards the average. If more than one quiz is missed, a replacement quiz needs to be taken as soon as possible after the original quiz date.</li> </ul>
<b>Additional Information</b>	

## Tentative Course Schedule

*(Time, topic/emphasis & resources)*

<b>Week</b>	<b>Lectures</b>	<b>Topic</b>
1	Sun 08/25/2019 Wed 08/28/2019	Introduction Microsystems Overview
2	Sun 09/01/2019 Wed 09/04/2019	Scaling Lithography
3	Sun 09/08/2019 Wed 09/11/2019	Lithography L-edit
4	Sun 09/15/2019 Wed 09/18/2019	Intellisuite Intellisuite
5	Sun 09/22/2019 Wed 09/25/2019	Saudi National Day Lithography
6	Sun 09/29/2019 Wed 10/02/2019	Micro/Nano Fabrication Micro/Nano Fabrication
7	Sun 10/06/2019 Wed 10/09/2019	Micro/Nano Fabrication Silicon
8	Sun 10/13/2019 Wed 10/16/2019	Beams Accellerometers
9	Sun 10/20/2019 Wed 10/23/2019	Noise in MEMS Noise in MEMS
10	Sun 10/27/2019 Wed 10/30/2019	Lab Lab
11	Sun 11/03/2019 Wed 11/06/2019	Lab Accellerometer
12	Sun 11/10/2019 Wed 11/13/2019	Noise in MEMS Noise in MEMS
13	Sun 11/17/2019 Wed 11/20/2019	Accellerometer Accellerometer
14	Sun 11/24/2019 Wed 11/27/2019	Intellisuite Characterization
15	Sun 12/01/2019 Wed 12/04/2019	Intellisuite Intellisuite
16	Sun 12/08/2019	Student presentations Student presentations

### Note

The instructor reserves the right to make changes to this syllabus as necessary.