

<b>Department</b>	SciTec
<b>Degree programme</b>	SI
<b>Module name</b>	<b>Microsystems Engineering</b>
<b>Module number</b>	<b>SciTec.2.198</b>
<b>Study and Examination Regulations</b>	ER-version 38 (of 21.03.2018), ER-version 39 (of 23.07.2019), ER-version 41 (of 16.07.2021)
<b>Compulsory/ compulsory optional/ optional module</b>	compulsory optional module
<b>Module coordinator</b>	Prof. Dr. Michael Rüb
<b>Module content</b>	<p>Definition of <u>Microsystems Engineering</u>, latest state of the art and future developments.</p> <p>Process based presentation of the Microsystems Engineering topic:</p> <p><u>Materials of Microsystem Engineering:</u> Manufacturing and properties of silicon wafers, ideal and real materials, silicon compounds</p> <p><u>Thin Film Technology:</u> Thermal deposition, CVD, sputtering</p> <p><u>Basics of Lithography:</u> Process based generic presentation of important lithography techniques</p> <p><u>Surface Micromachining:</u> Sacrificial layer technology, silicon foundries, SOI technology</p> <p><u>Clean Rooms and Yield:</u> Properties of clean rooms, effect of defects on volume yield, root causes of defects, removal of defects</p> <p><u>Volume Micromachining:</u> 3-dim patterning by anisotropic wet chemical etching</p> <p><u>LIGA:</u> x-ray lithography, galvanic deposition, moulding, examples</p> <p><u>Assembly Technology:</u> Wafer sawing, mounting techniques, reliability, bonding techniques</p> <p><u>Examples of micromechanical devices:</u> DLP chip, Acceleration and rate sensors</p>
<b>Learning objectives</b>	The students learn to know the important components of microsystems and their manufacturing techniques.
<b>Course type (lecture, seminar, exercises, practical course)</b>	2 L – 0 S – 1 E – 0 P
<b>Recommended literature</b>	<ul style="list-style-type: none"> <li>▪ Büttgenbach; Mikromechanik; Teubner-Verlag 1991</li> <li>▪ Madou; Fundamentals of Microfabrication; CRC Press 1997</li> <li>▪ Menz, Mohr; Mikrosystemtechnik für Ingenieure; VCH-Verlag 1997</li> <li>▪ Völklein, Zetterer; Einführung in die Mikrosystemtechnik; Vieweg 2000</li> </ul>
<b>Learning materials</b>	Lecture slides
<b>Method(s) of instruction/ media being used</b>	Lecture and seminar
<b>Level/ category</b>	Master (category: 2)
<b>Which semester (winter/ summer term)</b>	Winter term
<b>Which semester during the programme</b>	1
<b>Requirements for attendance, necessary knowledge</b>	Basic knowledge on physics, optics, vacuum and thin film technology
<b>Assessment (written/ oral test, paper, etc.)</b>	written examination (90 minutes)
<b>ECTS credits</b>	3
<b>Work load in:</b>	90 h of total work load, therefrom <ul style="list-style-type: none"> <li>▪ 45 h of presence at university</li> <li>▪ 45 h of self-study</li> </ul>
<b>Usability of this module</b>	Micro- and Nanotechnology
<b>Frequency of offer</b>	Every study year
<b>Duration of module</b>	1 semester
<b>Place/ room</b>	Ernst-Abbe-Hochschule Jena - University of Applied Sciences Jena
<b>Time</b>	According to schedule

Language(s)	English
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