Department	SciTec
Degree programme	SI, WT
Module name	**Micro- and Nanotechnology**
Module number	**SciTec.2.203**
Study and Examination Regulations	ER-version 38 (of 21.03.2018), ER-version 39 (of 23.07.2019), ER-version 41 (of 16.07.2021)
Compulsory/ compulsory optional/ optional module	compulsory optional module
Module coordinator	Prof. Dr. Igor Konovalov
Module content	**Lecture:** Micro- Nanotechnology: Moore´s Law, ITRS Roadmap, Top down and bottom up approach Optical Lithography: Lithography techniques, maximum pattern resolution, resist chemistry- and kinetics, resolution enhancement techniques (Immersion lithography, OPC, Phase Shift Masks, etc.) Electron Beam Lithography: Imaging process with electrons; proximity effects, limitations Next Generation Lithography: Comparison of techniques discussed in latest ITRS Roadmap, e.g. nanoimprint, EUV lithography. Device Physics, Technology and Scaling: Basic device physics, like p-n junction, MOS capacitor; scaling of MOS transistors; Link to ITRS roadmap, post-CMOS devices. Nanotechnology: Fundamental principles of nanotechnology, self-organisation, nanowires, nanotubes, outlook to nano devices **Laboratory course:** ▪ Process sequence pattern transfer (e.g. image reversal resist and lift-off) in clean room (I+II) ▪ Simulation (Device, Technology or Lithography (I+II) ▪ (Electron Beam Lithography)
Learning objectives	The student should be able to apply the latest pattern generation and transfer techniques in research and industrial production. He should be able to interpret and apply the current developments and trends in research in the field, including the emerging “bottom-up” nanotechnology.
Course type (lecture, seminar, exercises, practical course)	4 L – 0 S – 0 E – 1 P
Recommended literature	▪ Bushan; Handbook of Nanotechnology, Springer 2007 ▪ Madou; Fundamentals of Microfabrication; CRC Press 1997 ▪ Mack; Fundamental Principles of Optical Lithography, Wiley 2007 ▪ S.M. Sze; Semiconductor Devices – Physics and Technology, Wiley Interscience 1985 ▪ Zeng Cui; Micro- Nanofabrication, Technologies and Applications, Springer
Learning materials	Lectures slides, laboratory instructions
Method(s) of instruction/ media being used	Lecture and small group laboratory experiments
Level/ category	Master (category: 2)
Which semester (winter/ summer term)	summer term
Which semester during the programme	2
Requirements for attendance, necessary knowledge	Basic knowledge on microsystems engineering, physics, optics and vacuum technology
Assessment (written/ oral test, paper, etc.)	written examination (90 minutes) Successful participation in laboratory course
ECTS credits	6
Work load in:	180 h of total work load, therefrom ▪ 75 h of presence at university ▪ 105 h of self-study
Usability of this module	-
Frequency of offer	Annually
Duration of module	1 semester

Place/ room	Ernst-Abbe-Hochschule Jena - University of Applied Sciences Jena
Time	According to schedule
Language(s)	English