Microtechnology and Device Fabrication

Module Name: Microtechnology and Device Fabrication

Module Number	T470030X01 T470030401 T470030101	**Level**	Master	**Short Name**	MDF
Responsible Lecturers	Associate Professor PhD Jakob Kjelstrup-Hansen				
Department, Facility	SDU, Faculty of Engineering, Mads Clausen Institute and NanoSYD				
Course of Studies	Medical Microtechnology, Master				
Compulsory/elective	Compulsory	**ECTS Credit Points**	5		
Semester of Studies	2	**Semester Hours per Week**	4		
Length (semesters)	1	**Workload (hours)**	125		
Frequency	SuSe	**Presence Hours**	48		
Teaching Language	English	**Self-Study Hours**	77		
Consideration of Gender and Diversity Issues	☒ Use of gender-neutral language (THL standard) ☐ Target group specific adjustment of didactic methods ☐ Making subject diversity visible (female researchers, cultures etc.)				
Applicability	None				
Remarks	None				

Microtechnology and Device Fabrication

Course 1: Microtechnology and Device Fabrication

Course Number	T470030X01 T470030401 T470030101	**Short Name**	MDF
Course Type	Lecture and lab exercises	**Form of Learning**	Presence
Mandatory Attendance	☒	**ECTS Credit Points**	5
Participation Limit	None	**Semester Hours per Week**	4
Group Size (practical training, exercises, …)	n. a.	**Workload (hours)**	125
Teaching Language	English	**Presence Hours**	48
Study Achievements („Studienleistung“, SL)	None	**Self-Study Hours**	77
SL Length (minutes)	n. a.	**SL Grading System**	n. a.
Exam Type	Oral exam	**Exam Language**	English
Exam Length (minutes)	20	**Exam Grading System**	7-scale grading
Learning Outcomes	The student will acquire knowledge on: • The basic components in MEMS/NEMS, their design and operational principles, as well as potential MEMS/NEMS applications. • The basic components in microfluidics, their operational principles, as well as potential applications of microfluidic systems. • The basic back-end processing and electrical characterization techniques. • The operational principles of electron beam lithography, nanoimprint lithography and focused ion beam. The student will be able to: • Select relevant process parameters based on underlying theory and/or process simulation tools. • Design a set of photolithography masks based on desired design specifications. • Use device simulation (finite element modeling) software to aid in the design process.Calculate the behavior of simple mechanical structures, e.g. cantilevers and membranes. • Design a dose pattern for EBL that includes proximity effect correction.		

	• Use standard electrical measurements techniques. The student is able to: • Choose fabrication methods suited for the fabrication of a given microsystem and specify how the various processes can be integrated in a process recipe. • Work independently in the laboratory/cleanroom.
Participation Prerequisites	Knowledge of basic microfabrication technologies
Contents	Microsystems are small systems built from a number of functional parts, for example: electronics, mechanics, optics, and/or microfluidics. All or most parts are fabricated partly or fully using microfabrication technology and they form a single entity. A hearing aid and a lab-on-a-chip are examples of such systems. In every modern car you will find a number of microsystems, for instance the air-bag accelerometer for the air bag control. The aim of this course is to make the students able to design, fabricate, and characterize microsystems. The specific topics are: • Introduction to microsystems. • Microfabrication techniques incl. process simulation. • Process integration. • Lithography mask lay-out (exercise using lay-out CAD software). • Nanolithography techniques. • MEMS and NEMS. • Microfluidics. • Back-end processing. • Characterization techniques.
Literature	
Remarks	None