Module Name: **Computational Multi-Physics**					
Module Responsibility / Lecturer	Assoc. Prof. Dr. Jost Adam				
Department, Facility	SDU, Department of Mechanical and Electrical Engineering				
Module Number		**Level**	Master	**Short Name**	
Course of Studies	Medical Microtechnology, Master				
Compulsory/elective	Compulsory	**ECTS Credit Points**	10		
Semester of Studies	2	**Semester Hours per Week**	8		
Length (semesters)	1	**Workload (hours)**	300		
Frequency	SuSe	**Presence Hours**	96		
Teaching Language	English	**Self-Study Hours**	204		
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				

Course 1: Computational Multi-Physics			
Course Number		**Short Name**	
Course Type	Lecture, project work and lab sessions	**Form of Learning**	Online supported
Mandatory Attendance	☒	**ECTS Credit Points**	10
Participation Limit	None	**Semester Hours per Week**	8
Group Size (practical training, exercises, …)	n. a.	**Workload (hours)**	300

Teaching Language	English	**Presence Hours**	96
Study Achievements („Studienleistung“, SL)	Presentation	**Self-Study Hours**	204
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-point grading scale
Learning Outcomes	Knowledge - The students can • account for the governing equations for the most common physical phenomena encountered in mechatronic systems. • account for different methods for the numerical solution of the governing equations, • critically discuss the main advantages and drawbacks of the methods • verify the results and evaluate convergence (i.e. consistency and stability) for the different methods. Skills - The students can • derive governing equations for mechatronic systems based on basic principles. • implement different methods for the numerical solution of standard partial differential equations. • check for convergence of the solutions, using standard mathematical tools such as Matlab® and Comsol®. Competences - The students can • work independently acquiring necessary skills to solve a given problem • convey the acquired knowledge and skills to an appropriate audience. • describe the mathematical model for a specific problem and document the implementation and numerical solution of the problem.		
Participation Prerequisites	Physics and mathematics at a bachelor degree level, basic numerical analysis and programming skills.		
Contents	• Description of selected physical problems within mechatronics by partial differential equations (PDEs). • Implementation and application of various numerical methods (e.g. finite-difference time-domain and finite-element methods) to general problems described by partial differential equations. • Verification, accuracy and feasibility analysis of the developed numerical solutions.		

	• Application of commercial finite element software (Comsol Multiphysics®) to general one to three dimensional problems. • Appropriate result communication and presentation.
Literature	• M. G. Larson and F. Bengzon, *“The Finite Element Method: Theory, Implementation and Application”*, Springer (2013). • Material provided in class
Remarks	None