Module Design Engineering

Module Name: Design Engineering

Module Number	**X4M 1700**	Level Master	Short Name DE
Responsible Lecturers	Prof. Dr.-Ing. Stephan Klein, Dr. Christian Damiani		
Department, Facility	THL, Applied Natural Sciences		
Course of Studies	Biomedical Engineering, Master		
Compulsory/elective	Elective	ECTS Credit Points	8
Semester of Studies	1	Semester Hours per Week	8
Length (semesters)	1	Workload (hours)	240
Frequency	WiSe	Presence Hours	100
Teaching Language	English	Self-Study Hours	140
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	Biomedical Engineering		
Remarks	The students shall acquire consolidated knowledge of physical, electrical, and mechanical principles of medical products. The students shall independently cope with a defined problem in medical technology. The students shall be enabled to contribute to the development of medical products according to relevant standards. The students shall know about development processes in medical technology and manage these processes according to their professional experience. The students shall be able to present results of their work adequately.		

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Module Design Methodology

Course 1: Design Methodology, Lecture

Course Number		Short Name	DML
Course Type	Lecture	Form of Learning	Presence
Mandatory Attendance	☐	ECTS Credit Points	2
Participation Limit	None	Semester Hours per Week	2
Group Size (practical training, exercises, …)	None	Workload (hours)	60
Teaching Language	English	Presence Hours	25
Study Achievements („Studienleistung“, SL)	None	Self-Study Hours	35
SL Length (minutes)	n. a.	SL Grading System	n. a.
Exam Type	Oral exam in group	Exam Language	English
Exam Length (minutes)	60	Exam Grading System	One-third Grades
Learning Outcomes	The students know about the phases of product development considering the mechanical construction. They can structure a development process according to VDI guidelines and can apply the most important methods of problem solving. Knowledge about lecturer´s current research projects		
Participation Prerequisites	Knowledge in machine elements and mechanical design		
Contents	• Introduction (mechanical design in medical technology, importance of development for quality of products) • The design process (VDI-guideline 2221, phases in the process, methods of problem solving, development of concepts, selection and evaluation of solutions) • The designer (characteristics of good problem solvers, presenting, sketching) • Embodiment design (basic principles “simple, clear and save”, stiffness in design, design of bearings, design for primary shaping manufacturing, rapid prototyping • Tolerances (ISO-tolerancing system)		
Literature	Pahl, G., Beitz, W., Feldhusen, J., Grote, K.-H.: Engineering Design: A systematic approach. 3rd ed. Springer 2007 Hales, Chr., Shayne, G.: Managing Engineering Design. 2nd ed. Springer 2004		

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	Ullmann, D.: The Mechanical Design Process. 3rd ed. McGraw Hill Zenios, St., Makower, J., Yock, P.: Biodesign. Cambridge University Press 2010 Hand-out from lecturer
Remarks	None

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Course 2: Design Methodology, Project

Course Number		Short Name	DMP
Course Type	Lab	Form of Learning	Presence
Mandatory Attendance	☒	ECTS Credit Points	2
Participation Limit	20	Semester Hours per Week	2
Group Size (practical training, exercises, …)	n. a.	Workload (hours)	60
Teaching Language	English	Presence Hours	25
Study Achievements („Studienleistung“, SL)	Graded project-report and presentation	Self-Study Hours	35
SL Length (minutes)	n. a.	SL Grading System	One-third Grades
Exam Type	n. a.	**Exam Language**	n. a.
Exam Length (minutes)	n. a.	**Exam Grading System**	n. a.
Learning Outcomes	The activities and methods presented in the lecture shall be trained and applied to real research projects. The students can apply the presented methods and evaluate their benefits and limits.		
Participation Prerequisites	Lab attendance		
Contents	The students work in groups of four to six on tasks coming from research projects in the lab. Other projects are formulated by external partners, usually companies. The students can use a CAD-System (solid works, solid edge) for doing the design. Tasks are taken from lecturer´s current research projects.		
Literature	see lecture		
Remarks	None		

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Module Material Science

Course 3: Material Science, Lecture

Course Number		Short Name	MS
Course Type	Lecture	Form of Learning	Presence
Mandatory Attendance	☐	ECTS Credit Points	4
Participation Limit	n. a.	Semester Hours per Week	4
Group Size (practical training, exercises, …)	n. a.	Workload (hours)	120
Teaching Language	English	Presence Hours	50
Study Achievements („Studienleistung“, SL)	None	Self-Study Hours	70
SL Length (minutes)	n. a.	SL Grading System	n. a.
Exam Type	Written exam	**Exam Language**	English
Exam Length (minutes)	90	**Exam Grading System**	One-third Grades
Learning Outcomes	The students know about the most important mechanical and thermodynamical characters of metal, polymers, synthetics, and the most common materials in the area of medical technology. Knowledge about lecturer´s current research projects		
Participation Prerequisites	Basic knowledge in mathematics and physics		
Contents	• Introduction to materials and matter • Atomic bonds and structures • Defects in crystals • Diffusion in solids, solidification • Phase diagrams • Thermal treatments of materials • Mechanical Properties of solids • Fracture, fatigue, creep • Wear and abrasion, corrosion • Overview metals, metals in medical technology • Overview polymers, polymers in medical technology • Overview ceramics, ceramics in medical technology		
Literature	W.D. Callister, Jr.: Material Science and Engineering, an Introduction. 7th edition, John Wiley and Sons, Inc. (2007). Askeland, D.: The Science and Engineering of Materials. Thomson Learning (2006)		

	Schackelford, J., F.: Introduction to Material Science for Engineering, Prentice Hall (1996)
Remarks	None