Modulhandbuch (Module Handbook): Mechatronics & Robotics 90 CP MA

Nr. No.	Sem.	Ver.	Modul Module	Lehrende(r) Lecturer	Fakultät Faculty
Obligatotry module 1. Semester					
1	1	0	Automation Control MERO	Bachmann	ET
2	1	1	Mechanical Problems in Mechatronics MERO/ MA MB	Behn	MB
3	1	0	Development of Mechatronic Systems MERO	Roth	MB
4	1	1	Sensor Sytems MERO	Knechtel	ET
Elective module 1. Semester: 2 to be chosen from 5					
5	1	1	German Language I MERO	Petschauer	ZfF
6	1	0	Communication Systems MERO	Roppel	ET
7	1	1	Rapid Control Prototyping MERO	Schrödel	MB
8	1	0	Vibration Engineering MERO	Kolev	MB
9	1	1	Workshop Mechatronics I MERO	Bachmann	ET
Obligatory module 2. Semester					
10	2	0	Systemstheory MERO	Bachmann	ET
11	2	1	Design of Robot Workplaces MERO/ MA MB	Huxholl	MB
12	2	0	Digital Signal Processing for Engineering Applications MERO	Roppel	ET
13	2	0	Robotic Vision MERO	Schweigel	ET
Elective module 2. Semester: 2 to be chosen from 5					
14	2	1	German Language II MERO	Petschauer	ZfF
15	2	0	Applied Physics Master MERO	Rödel	MB
16	2	1	Workshop Mechatronics II MERO	Roth	MB
17	2	0	Aspects of production planning and work design MA MERO	Löser	MB
18	2	0	Tribology in micromechanics (Tim) MA MERO	Dorner-Reisel	MB
Compulsory module 3. Semester					
19	3	0	Master Thesis MA MERO	Studienorganisation	MB
20	3	0	Colloquium Master Thesis MA MERO	Studienorganisation	MB

Scheme

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Modulname Modulname	**Automation Control MERO**	201
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Silvio Bachmann (Modulverantwortung)	
Qualifikationsziele Qualification goals	Students understand structure and functionality of flexible automation systems. You learn design methods for such technical systems and solutions and could practice it in development process. Lesson is divided in Technical information 40 % Method knowledge 50 % System competence 10 %	
Modulinhalte Module contents	Parts - Introduction - Project management - Methods in development processes - Process analyzing - Sensors and actors - Automation devices - Software Development - Communication in Automation - SCADA - Decentral structures - Integration of robots	
Lehrformen Forms of teaching	Vorlesung (4 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Basic knowledge in system control	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Script	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Written examination 120 min.	
Semester Semester	1	
Häufigkeit des Angebots Frequency of the offer	winter semester	

Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Obligatotry module 1. Semester
Besonderes Peculiarity	

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Modulname Modulname	**Mechanical Problems in Mechatronics MERO/ MA MB**	236
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. habil. Carsten Behn (Modulverantwortung)	
Qualifikationsziele Qualification goals	On completion of this course, the students will be able to apply their fundamental bachelor knowledge in mechanics to higher problems with focus on mechatronics. They should characterize and understand vibration problems of 2d-objects to derive their natural frequencies and other vibration properties. Furthermore, they will be able to apply energy methods to special fields in Elasticity and Dynamics to describe fundamental problems which arise in Mechatronics.	
Modulinhalte Module contents	• Repitition: Beam Vibrations • Bending and vibrations of 2d-objects: plates and shells • Approximation tools from Mechanics • Energy methods in Elasticity: Theorems of Castigliano and Menabrea • Periodically forced vibrations using Fourier transformation • Nonlinear vibrations and analyses • Foundation and isolation of machines	
Lehrformen Forms of teaching	Vorlesung (2 SWS) Seminar (2 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Good knowledge in Mathematics and Technical Mechanics (Elasticity, Dynamics) on a bachelor level would be great.	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Hibbeler: Engineering Mechanics - Statics, Pearson, 2015. Hibbeler: Engineering Mechanics - Dynamics, Pearson, 2016. Dresig/Holzweißig: Dynamics of Machinery - Theory and Ap-plications, Springer, 2010. Den Hartog: Mechanical Vibrations, McGraw-Hill, 2003. Weaver/Timoshenko/Young: Vibration Problems in Enginee-ring, Wiley, 2013.	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Angew. Kunststofftechnik 90 CP M.Eng., Master Maschinenbau 90 CP M.Eng., Mechatronics & Robotics 90 CP M.Eng.	

Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	written exam 120min. Remark: There is the possibility to take an oral eximination in case of the third attempt, but the student has to apply for.	
Semester Semester	1	
Häufigkeit des Angebots Frequency of the offer	anually in winter semester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Obligatotry module 1. Semester	
Besonderes Peculiarity		

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Modulname Modulname	**Development of Mechatronic Systems** **MERO**	218
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr. Stefan Roth (Modulverantwortung)	
Qualifikationsziele Qualification goals	Methods and processes for product development of mechatronic systems from idea to realization by design. Introduction of tools and basics of project management.	
Modulinhalte Module contents	Introduction into product development method, i.e. guideline VDI 2221 „Development of Technical Products and Systems”: design phases from idea of concept to realisation, creativity tools for design solving Development of mechatronic systems according VDI guideline 2208 “Design Methodology for Mechatronic Systems”: Specification and Verification/Validation of mechatronic systems using the V-model approach Specification management and requirements engineering Risk based solution approach for product by method of risk analysis Basics of project management techniques	
Lehrformen Forms of teaching	Vorlesung (2 SWS) Übung (2 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	none	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	G. Pahl, W. Beitz: Engineering Design: A Systematic Approach, VDI Guideline 2221 - Development of Technical Products and Systems VDI Guideline 2208 - Design Methodology for Mechatronic Systems literature in the field of project management	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Oral Exam	
Semester Semester	1	

Häufigkeit des Angebots Frequency of the offer	Sommersemester
Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Obligatotry module 1. Semester
Besonderes Peculiarity	

HOCHSCHULE SCHMALKALDEN
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Modulname Modulname	**Sensor Sytems MERO**	220
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Roy Knechtel (Modulverantwortung)	
Qualifikationsziele Qualification goals	The students get to know the theoretical foundation of and some practical insight in intelligent sensors systems. Especially they learn about the physical of sensor principles, the realization and application of sensor systems. Sensor systems are the combination of one or more physical sensors with signal conditioning electronics to address complex measurement, control and/or decision tasks. Beside the sensors itself, methods for sensor signal combination (data fusion) and processing (filtering, artificial intelligence) are focus of this module. The lecture conveys: professional competence 40% method competence 15% system competence 40% social competence 5%	
Modulinhalte Module contents	1. Introduction: the role of sensors systems for technical solutions in mobile devices, cars and traffic, industry, medical applications and more 2. Sensors Systems: Function, Realization, Application: 2.1 Integrated Pressure Sensor 2.2 Inertial Sensor Units 2.3 MEMS Microphones 2.4 Infrared Sensors (radiation-based temperature measurement) 2.5 Time of Flight sensors and LIDAR 3. Sensor data processing 3.1 FFT and Filtering 3.2 Data Fusion 3.3 Artificial Intelligence for Sensor Systems 4. Detailed exercises (analysis and application) related to 2 examples of sensor systems	
Lehrformen Forms of teaching	Vorlesung (3 SWS) Übung (1 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Master student in electrical engineering or mechatronics engineering.	

Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	1. ‘Sensors and measurement systems’, Walther Lang, Aalborg : River Publishers, [2019] 2. ‘Microsensors, MEMS and smart devices’, Julian W. Gardner et. al., John Wiley & Sons, Ltd, [2001]	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 15 h + Vorbereitung 60 h = 75 Stunden = 2.5 Credit Punkte presence 15 h + preparation 60 h = 75 hours = 2.5 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	written examination 120 min	
Semester Semester	1	
Häufigkeit des Angebots Frequency of the offer	annualy in winter semester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Obligatotry module 1. Semester	
Besonderes Peculiarity		

HOCHSCHULE SCHMALKALDEN
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Modulname Modulname	**German Language I MERO**	250
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Ramona Alina Petschauer (Modulverantwortung)	
Qualifikationsziele Qualification goals	The course aims to build up the students' ability to communicate in everyday situations. Upon completion of this course the students will be able: • to introduce themselves, make short, simple statements about themselves, their family, living conditions, leisure time or studies, understand and use familiar everyday expressions. • to hold simple conversations about everyday life and personal interests or events in a slow and clear way. • to understand short, simple texts on familiar concrete topics using common everyday language. • to write simple messages and short texts, such as invitations or short replies, which refer to themselves or in which they ask for and pass on information.	
Modulinhalte Module contents	The course provides basic knowledge of German and is oriented towards the language competence level A1.1 of the Common European Framework of Reference for Languages (CEFR). The course trains all four language skills (speaking, listening, reading and writing) and covers: • lexis on simple topics such as: introducing oneself and others, family and friends, leisure time, living conditions, appointments, daily routine, basic technical terms; • grammar structures such as article and noun declension in the nominative and accusative case, verb forms in the present tense, word order in statements and in interrogative clauses, comparison of the adjectives, imperative, negation, verbs with separable particles; • phonetics exercises.	
Lehrformen Forms of teaching	Übung (4 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	No prior knowledge of German	

Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Lecture script	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	written examination (120 min)	
Semester Semester	1	
Häufigkeit des Angebots Frequency of the offer	anually in winter semester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Elective module 1. Semester: 2 to be chosen from 5	
Besonderes Peculiarity		

HOCHSCHULE SCHMALKALDEN
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Modulname Modulname	**Communication Systems MERO**	209
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Carsten Roppel (Modulverantwortung)	
Qualifikationsziele Qualification goals	You understand basic principles of digital communication systems and their key parameters. You know how to use error correcting schemes. You know the basics of the design and implementation of communication systems, and you are able to develop and test typical algorithms with MATLAB. You know technologies to implement sensor networks.	
Modulinhalte Module contents	1. Introduction 2. Signal Transmission (Impulse Response and Convolution, Frequency Response) 3. Digital Baseband Transmission 4. Digital Modulation (ASK, PSK, QAM) 5. Channel Codierung (Blockcodes, Convolutional Codes) 6. Sensor Networks	
Lehrformen Forms of teaching	Vorlesung (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Basic knowledge in electrical engineering, digital signal processing and MATLAB/Simulink is recommended.	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Proakis, J. G., Manolakis, D. G.: Digital Signal Processing. Pearson Prentice Hall, 4th ed., 2007. Proakis, J. G., Salehi, M.: Digital Communications. McGraw-Hill, 5. Aufl., 2008 Roppel, C.: Grundlagen der Nachrichtentechnik. Hanser Verlag, 2018 Stewart, R. et al.: Software Defined Radio using MATLAB & Simulink and the RTL-SDR. Strathclyde Academic Media, 2015.	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1

Leistungsnachweis Performance record	Written examination 120 min.
Semester Semester	1
Häufigkeit des Angebots Frequency of the offer	winter semester
Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Elective module 1. Semester: 2 to be chosen from 5
Besonderes Peculiarity	

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Modulname Modulname	**Rapid Control Prototyping MERO**	235
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Frank Schrödel (Modulverantwortung)	
Qualifikationsziele Qualification goals	Students shall understand the fundamentals as well as current trends of applied automation technology in the context of modern robotic applications. A special focus of the lecture is on utilizing the rapid control prototyping for drive systems and robotic applications. The theoretical lecture content is applied and intensified by utilizing various robotic applications in the lab and in the lecture. Students shall be able to select and synthesize suitable robotic and automation concept (incl. measuring devises, controller and drives) for given problems.	
Modulinhalte Module contents	• Fundamentals and Application Areas of Automation Technology (incl. Industry 4.0) • Fundamentals of Stationary Industrial Robots (Notation, Selection Criteria, Classification, Robot Programming) • Robot Kinematics (Fundamentals, Forward and Backward Transformation) • Sensor Functions, Sensor Types and Measurement Errors • Fundamentals of Electric Drives • Process Models for Engineering (Rapide Control Prototyping) and Introduction to System Dynamic Modelling and Identification • System Simulation and Validation • Fundamentals of PLC Basics and BOOLean Algebra • Fundamentals of Event Discrete Systems and Petri Nets • Controller Design and Outlook on Modern Control Engineering Methods	
Lehrformen Forms of teaching	Vorlesung (4 SWS) Übung (1 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Bachelor Study in Mechan. Eng. or similar Knowledge/experience in Mechanics, Mechan. Design, Electrical Eng., Automation Technology	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes		
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	

Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 75 h + Vorbereitung 75 h = 150 Stunden = 5.0 Credit Punkte presence 75 h + preparation 75 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	written examination 120 min	
Semester Semester	1	
Häufigkeit des Angebots Frequency of the offer	anually in winter semester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Elective module 1. Semester: 2 to be chosen from 5	
Besonderes Peculiarity		

HOCHSCHULE SCHMALKALDEN
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Modulname Modulname	**Vibration Engineering MERO**	214
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. habil Emil Kolev (Modulverantwortung)	
Qualifikationsziele Qualification goals	This course covers the basics of vibration technology. The students should be able to handle the vibration behaviour of mechanical systems analytically and to detect and understand vibration phenomena in practice.	
Modulinhalte Module contents	1. Introduction to the Vibration Theory 2. Damped Systems with free behaviour, 3. Geometrically non-linear Oscillators, 4. Forced, damped vibrations, Excited states of the harmonic oscillator, 5. Multi−Body Systems, Chain−Oscillators, 6. Vibration absorber, 7. Continuum Mechanics: longitudinal, torsional and bending vibrations of bars, 8. Critical number of revolutions.	
Lehrformen Forms of teaching	Vorlesung (2 SWS) Übung (2 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Mathematics, Dynamics	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Script of Lecturers: bilingual: German−English Technical Mechanics, Fachbergriffe im deutschen und englischen Kontext, S. Kessel/D. Fröhling, B.G. Teubner Stuttgart, Leipzig, ISBN 3-519-06378-6	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Written examination 120min	
Semester Semester	1	

Häufigkeit des Angebots Frequency of the offer	anually in winter semester
Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Elective module 1. Semester: 2 to be chosen from 5
Besonderes Peculiarity	

HOCHSCHULE SCHMALKALDEN
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Modulname Modulname	**Workshop Mechatronics I MERO**	237
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Silvio Bachmann (Modulverantwortung)	
Qualifikationsziele Qualification goals	Exercise and project work in development of a microcontroller based electronic control unit for mechatronic systems	
Modulinhalte Module contents	1. Thermal calculation of the heat sink and the casing for the electronic control unit 2. Design of a printed circuit board as main board for all components of the electronic control unit 3. Programming of the microcontroller in C 4. Test 5. Design of a casing for the electronic control unit	
Lehrformen Forms of teaching	Vorlesung (1 SWS) Praktikum (3 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Basic knowledge in electrical engineering, microcontrollers, programming in C	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	- Fischer: Teaching materials	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	written report + oral presentation of workshop project	
Semester Semester	1	
Häufigkeit des Angebots Frequency of the offer	winter semester (Once per academic year)	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Elective module 1. Semester: 2 to be chosen from 5	

Besonderes Peculiarity	

HOCHSCHULE SCHMALKALDEN
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Modulname Modulname	**Systemstheory MERO**	205
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Silvio Bachmann (Modulverantwortung)	
Qualifikationsziele Qualification goals	Students understand basic concepts and methods of Systemtheory. You learn analyzing and describing methods for systems including processes and signals. Lesson is divided in Technical information 40 % Method knowledge 50 % System competence 10 %	
Modulinhalte Module contents	Parts - Introduction - Applicability - Signals and Definition - Signal Analyzing and Modeling - Process Description - Process Models - Process Analyzing - Applications	
Lehrformen Forms of teaching	Vorlesung (3 SWS) Übung (1 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Basic knowledge in system control	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Script	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Written examination 120 min.	
Semester Semester	2	
Häufigkeit des Angebots Frequency of the offer	summer semester	

Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Obligatory module 2. Semester
Besonderes Peculiarity	

HOCHSCHULE SCHMALKALDEN
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Modulname Modulname	**Design of Robot Workplaces MERO/ MA MB**	223
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr. Lutz Huxholl (Modulverantwortung)	
Qualifikationsziele Qualification goals	The students gain knowledge of the structure of robot workplaces and understand the requirements that are to be fulfilled. They know the essential elements of workplaces and will be able to design robot workplaces themselves. Using practical examples, they know possible solutions for various automation tasks.	
Modulinhalte Module contents	Based on fundamentals such as components and kinematics it is shown, which selection criteria are relevant and how a robot workstation is structured. The various application areas such as handling, picking, palletizing, welding and mounting are explained and illustrated using examples. The module gives an overview about the different robot positioning systems such as tracks, gantries, head- and tailstocks and turntables. In addition, safety aspects are part of the module: This includes both data security and functional safety.	
Lehrformen Forms of teaching	Vorlesung (3 SWS) Übung (1 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation		
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Hesse, S.; Malisa, V.: Robotik, Montage, Handhabung (2016) Hesse, S.: Grundlagen der Handhabungstechnik (2016) Mason, M.: Mechanics of Robotic Manipulation (2001) Siegert, H.-J.; Bocionek, S.: Programmierung intelligenter Roboter (1996) Weber, W.: Industrieroboter (2017)	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Master Maschinenbau 90 CP M.Eng., Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record		

Semester Semester	2
Häufigkeit des Angebots Frequency of the offer	Yearly in summer semester
Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Obligatory module 2. Semester
Besonderes Peculiarity	

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname Modulname	**Digital Signal Processing for Engineering Applications MERO**	204
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Carsten Roppel (Modulverantwortung)	
Qualifikationsziele Qualification goals	You know basic principles of digital signal processing (DSP). In particular, you understand the sampling theorem and its effect on analog signals, and you know applications of different ADC types. You know how to describe discrete-time signals and systems in the time domain based on the impulse response and in the frequency domain based on the transfer function. You know the basics of the design and implementation of digital filters and you are able to use filter design tools. You can design signal processing algorithms for spectral analysis and signal conditioning.	
Modulinhalte Module contents	1. Introduction 2. Sampling und Quantization (Sampling Theorem, Quantization, ADC Parameters and Types) 3. Discrete-Time Signals and Systems (Impulse Response and Convolution, Fourier-Transform of Discrete-Time Signals, Discrete Fourier-Transform (DFT), the z-Transform) 4. Digital Filters (Finite Impulse Response (FIR) Filter, Infinite Impulse Response (IIR) Filter) 5. Engineering Applications: Spektral Analysis, Conditioning of Sensor Signals	
Lehrformen Forms of teaching	Vorlesung (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Basic knowledge in electrical engineering, signals and systems and programming in C is recommended	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Chassaing, R.: DSP Applications using C and the TMS320C6x DSK. Wiley, 2002. Grüningen, D. Ch. v.: Digitale Signalverarbeitung. Hanser Verlag, 2004. Oppenheim, A. V., Schaffer, R. W.: Discrete-time signal processing. Prentice-Hall, 1999 (deutsche Ausgabe: Zeitdiskrete Signalverarbeitung, Pearson Studium, 2004). Proakis, J. G., Manolakis, D. G.: Digital Signal Processing. Pearson Prentice Hall, 4th ed., 2007. Roppel, C.: Grundlagen der Nachrichtentechnik. Hanser Verlag, 2018.	
Lehrbriefautor Textbook author	keiner	

Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Written examination 120 min.	
Semester Semester	2	
Häufigkeit des Angebots Frequency of the offer	summer semester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Obligatory module 2. Semester	
Besonderes Peculiarity		

Modulname Modulname	**Robotic Vision MERO**	219 MERO
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Maria Schweigel (Modulverantwortung)	
Qualifikationsziele Qualification goals	The students get to know the theoretical foundations of computer vision under consideration of issues of mobile robotics. Especially they lean about physics of light and color, means how a picture is generated, transforming coordinate systems, formation of an image, feature extraction and vision based control. All theoretical knowledge will be demonstrated on examples by using Vision Modul of Matlab. In the practice part students will apply theoretical knowledge by solving exercises and working on own vision project using Matlab. The lecture conveys: professional competence 45% method competence 30% system competence 20% social competence 5%	

Modulinhalte Module contents	Part I: lecture 1. Introduction: Development of Robotic, application examples, Definition robotic, sensors, Why Vision in robotics?, Autonomous robotics and AI, Ethics 2. Coordinate systems and transformations: Mathematical representation of a robot, Rotation Matrix, Transformation Matrix, Center of Rotation, Perspective Projection Geometry 3. Physics of Light and color: Photometry, Colorimetry, Problems in RV because of light and color 4. Image Formation: Perspective projection, Camera calibration, Types of wide-view cameras 5. Image processing: Histogram, Monadic operations, Diadic Operations, Spatial Operations (Smoothing, Edge detection, Template Matching), Mathematical Morphology, Shape Changing 6. Image feature extraction: Classification, Representation, Features (Boundary Box, Moments, Shape, Charakter recognition, Line features, Point features (Harris-Stephens Edge Detection, SIFT - Scale-invariant feature transform, SURF - Speeded Up Robust Feature) 7. Multi Vision and Vision-Based Control: Multi vision (Correspondence, Geometry of Stereo Vision), Photogrammetry, Visual servoing (Position-Based Visual Servo, Image-Based Visual Servo) Part II: practice Computer Vision with Vision Modul of Matlab
Lehrformen Forms of teaching	Vorlesung (2 SWS) Praktikum (2 SWS)
Voraussetzungen für die Teilnahme Requirements for participation	Technical education, matriculation
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	1. ‘Vision Based Autonomous Robot Navigation’, Chatterjee, Rakshit, Singh, Springer 2013 2. ‘Robotics – Vision and Control‘, Peter Corke, Springer 2017
Lehrbriefautor Textbook author	keiner
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points

ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Name of Examination: Robot Vision oral Exam, 20 minutes Accepted aid: Script, notes	
Semester Semester	2	
Häufigkeit des Angebots Frequency of the offer	summer term	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Obligatory module 2. Semester	
Besonderes Peculiarity		

Modulname Modulname	**German Language II MERO**	251
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Ramona Alina Petschauer (Modulverantwortung)	
Qualifikationsziele Qualification goals	The course aims to improve the students' ability to communicate in everyday situations. Upon completion of this course the students will be able: • to understand and use everyday expressions as well as simple and concrete sentences. • to hold simple conversations about everyday life and personal interests or events in a slow and clear way. • ask and answer simple questions, make and respond to simple statements on very familiar topics. • to understand short, simple texts on familiar concrete topics using common everyday language. • to write simple messages and short texts, such as letters, emails or short replies, in which they ask for and pass on information.	
Modulinhalte Module contents	The course provides basic knowledge of German and is oriented towards the language competence level A1.2 of the Common European Framework of Reference for Languages (CEFR). The course trains all four language skills (speaking, listening, reading and writing) and covers: • lexis on simple topics such as: work, going shopping, cooking and eating, weather, travelling, at the doctor's, technical terms; • grammar structures such as article and noun declension in the nominative, accusative and dative case, modal verbs, past tense, future tense, main and subordinate clauses; • phonetics exercises.	
Lehrformen Forms of teaching	Übung (4 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Basic knowledge of German	

Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Lecture script	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Written examination 120 min	
Semester Semester	2	
Häufigkeit des Angebots Frequency of the offer	anually in summer semester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Elective module 2. Semester: 2 to be chosen from 5	
Besonderes Peculiarity		

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Modulname Modulname	**Applied Physics Master MERO**	232
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr. Christian Rödel (Modulverantwortung)	
Qualifikationsziele Qualification goals	This module deals with special physical effects and laws that are of fundamental importance for mechatronic controls and measurement data acquisition. By participating in the course, the students gain in-depth knowledge of optics, laser technology, acoustics and sound technology.	
Modulinhalte Module contents	Wave optics (electromagnetic waves, spectrum, interference, temporal coherence, standing waves, resonance, longitudinal waves, propagation of light in matter, dispersion, reflection, refraction, total internal reflection, diffraction) Geometrical Optics (basic imaging rules, mirrors, thin lenses, thin lens combinations, Oblique-ray-method, concept of principal planes, optical instruments) Lasers (laser principles, light amplification, gain profile and longitudinal modes, resonators, transverse modes, generation of short pulses, frequency doubling, Gaussian beam properties, beam quality, non-Gaussian beams, application-relevant laser parameters and their measurement) Basics of acoustics, sound level and rating, distance measurement with ultrasound	
Lehrformen Forms of teaching	Vorlesung (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Basic knowledge of wave physics and geometrical optics	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Not yet available	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1

Leistungsnachweis Performance record	Written exam 120 min
Semester Semester	2
Häufigkeit des Angebots Frequency of the offer	anually in summer semester
Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Elective module 2. Semester: 2 to be chosen from 5
Besonderes Peculiarity	

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Modulname Modulname	**Workshop Mechatronics II MERO**	238
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr. Stefan Roth (Modulverantwortung)	
Qualifikationsziele Qualification goals	Design and realisation of mechatronic systems	
Modulinhalte Module contents	Exercise in development of mechatronic system with focus on mechanical solution approach Based on solution guideline for development of mechatronic systems, i.e. VDI 2221 or 2208 (V-Model), the student hast to work out the design of simple mechatronic systems, e.g. positioning systems, robotic solutions, etc.. The conceptual idea has to be realised with means of mechanical processing like rapid prototyping processing or alternatively conventional production methods. Fundamental elements of the development process for mechatronic systems, namely specification of requirements, implementation, verification and corresponding documentation are trained by the workshop.	
Lehrformen Forms of teaching	Vorlesung (1 SWS) Übung oder Projekt (3 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	Workshop Mechatronics I	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	G. Pahl, W. Beitz: Engineering Design: A Systematic Approach, VDI Guideline 2221 - Development of Technical Products and Systems VDI Guideline 2208 - Design Methodology for Mechatronic Systems	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1

Leistungsnachweis Performance record	Assignment (written report + oral presentation) of workshop project
Semester Semester	2
Häufigkeit des Angebots Frequency of the offer	summer semester
Dauer Duration	1 Semester
Art der Lehrveranstaltung Type of course	Elective module 2. Semester: 2 to be chosen from 5
Besonderes Peculiarity	

Modulname Modulname	**Aspects of production planning and work design MA MERO**	258
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. Carsten Löser (Modulverantwortung)	
Qualifikationsziele Qualification goals	Utilization of methods and contents from different engineering disciplines as methodical foundation for the planning of the industrial production (parts manufacturing and assembly) and the work design Familiarization with diverse tasks of the production planning including project management, work preparation and the design of work and workplaces Getting to know the structure and functionality of ERP-systems Understanding of the necessary principles and consolidation of the knowledge on practical examples	
Modulinhalte Module contents	• methodical planning and design of manufacturing processes, work preparation, technology and times • application of project management methods and tools • overview of the development and use of Enterprise Resource Planning (ERP) and production planning methods • use of different software, e.g. SAP S/4HANA®, as examples for more in-depth study • consideration of occupational physiology, ergonomic aspects and influencing factors of the working environment for the design of processes and workplaces • raising awareness of occupational safety issues	
Lehrformen Forms of teaching	Vorlesung oder Übung (4 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	none	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	Lecture and Exercise (4 SWS) Blackboard, slides, beamer, demonstration, exercises	
Lehrbriefautor Textbook author	keiner	

Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	Written exam 120 minutes	
Semester Semester	2	
Häufigkeit des Angebots Frequency of the offer	annualy in summer semester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Elective module 2. Semester: 2 to be chosen from 5	
Besonderes Peculiarity		

Modulname Modulname	**Tribology in micromechanics (Tim) MA MERO**	257
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Prof. Dr.-Ing. habil Annett Dorner-Reisel (Modulverantwortung)	
Qualifikationsziele Qualification goals	Motion is everywhere: Industrial parts, like production machines, powertrain components in automotive or airplane applications, environmental or energy technologies, micromechanical systems or mechatronics & robotics. Energy is dissipated due to friction and wear causes reduction of performance. Not only, active control of systems loss outputs, such as those through friction and wear will have significant beneficial economic and ecologic consequences, but smart systems can be embedded in a great variety of machines and mechanisms. So called “Tribotronics” can be considered as active mechano-sensation and human-machine interfacing. Basic knowledge of tribology, wear and friction is teached in the course as well as fundamentals of coatings and thin films technologies. Nanomaterials, like Fullerenes, nanotubes and graphene properties and smart materials are mentioned with emphasis to their tribological and tribotronic properties. The essential importance of surface design (i.e. roughness, patterning) is presented. The smaller a device, the bigger the importance of the surface. Bio-devices, MEMS (microelectromechanical systems) catalytic surfaces, surfaces interacting with living matter like cells or self-assembling monolayers are already on their way to practical application. Students can recommend methods for surface engineering by treatments and coatings with thin or thick films according the practical demands. The course places great emphasis on micro- and nanostructure of special coatings, smart effects as well as on trends in technology.	
Modulinhalte Module contents	Tribology, tribotronics and selected coatings/films for adjusted applications including smart effects and human-machine interactions are explained. The software Cambridge Engineering Selector CES (company ANSYS) is available (Hybride synthesizer) for designing coatings or other hybride materials.	
Lehrformen Forms of teaching	Vorlesung (2 SWS) Praktikum (2 SWS)	
Voraussetzungen für die Teilnahme Requirements for participation	basic knowledge of material science and chemistry	

Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	• Mang, T., K. Bobzin, T. Bartels, Industrial Tribology: Tribosystems, Friction, Wear and Surface Engineering, Lubrication, WILEY:VCH Verlag GmbH & Co. KGaA, Weinheim, 2011 • Glavatskih, S., E. Höglund, Tribotronics-Towards active tribology, Tribology International 41 (2008) 934-939. https://doi.org/10.1016/triboint.2007.03.001 • Zhang, C., T. Bu, J. Zhao, G. Liu, H. Yang, Z. Wang, Tribotrinics for active mechanosensation and self-powered microsystems, Advanced Functional Materials (2019) 1808114. https://doi.org/10.1002/adfm.201808114 • Hu, W., C. Zhang, Z. L. Wang, Recent progress in piezotronics and tribotronics, Nanotechnology 30 (2020) 4 042001. https://doi.org/10.1088/1361-6528/aaeddd	
Lehrbriefautor Textbook author	keiner	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte presence 60 h + preparation 90 h = 150 hours = 5.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	5.00 5/90	1
Leistungsnachweis Performance record	written Examen (120 min), Prüfungsvorleistung: Testat	
Semester Semester	2	
Häufigkeit des Angebots Frequency of the offer	annualy in summer semester 1 Semester	
Dauer Duration		
Art der Lehrveranstaltung Type of course	Elective module 2. Semester: 2 to be chosen from 5	
Besonderes Peculiarity		

Modulname Modulname	**Master Thesis MA MERO**	1920 MERO
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Fakultät Maschinenbau Studienorganisation (Modulverantwortung)	
Qualifikationsziele Qualification goals	The final thesis is a module achievement in which the students should show that they are able to work independently on a individual problem from mechatronics or robotics according to scientific methods within the given deadline. Because the master's degree in particular attests to the students knowledge and skills at a high scientific level, special qualification objectives of the master's thesis are: -the systematic search and investigation of international literature on the current state of research in relation to the subject. -building on this the presentation and application of sophisticated theories and models for scientific analysis of the problem, -if necessary, the execution of an independent engineering study or empirical investigation as well as their evaluation and derivation of the developments of new perspectives of the topic. The student should also prove, that he is able to learn and appropriate new methods to solve the engineering problem. The results of the work have to be defended during a final presentation (colloquium). Results of the work are the written thesis with appendices of drawings,drafts, measurements and tests, programming source textes.	
Modulinhalte Module contents	The frame conditions for the thesis are determined in the course regulations in §17 and §18. The topic of the master thesis should come from a company or external scientific institution. Preferably it should be related to the focus either mechanical or electrical engineering. The student is responsible for the search itself. The topic must be approved by the supervisor. Teamwork is possible under considaration of §17/5	
Lehrformen Forms of teaching	Selbständige betreute Arbeit	
Voraussetzungen für die Teilnahme Requirements for participation	successful completion of the exams in at least 10 modules (50ECTS-CP, §17/3)	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes		
Lehrbriefautor Textbook author	keiner	

Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload Workload/Total workload		
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	27.00 27/90	1
Leistungsnachweis Performance record		
Semester Semester	3	
Häufigkeit des Angebots Frequency of the offer	Winter- und Sommersemester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Compulsory module 3. Semester	
Besonderes Peculiarity		

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Modulname Modulname	**Colloquium Master Thesis MA MERO**	1921 MERO
Modulverantwortlicher/ Modulverantwortliche Module responsibility	Fakultät Maschinenbau Studienorganisation (Modulverantwortung)	
Qualifikationsziele Qualification goals	The students should accompany the processing of the Master's Labour and building on the methodological and social skills acquired of Master's degree programme with the principles of scientific work and the presentation of the results. The design principles of scientific papers should be implemented in a concrete, unambiguous and transparent manner. Knowledge and experience in the evaluation of concepts, Project results, design services, planning variants and other scientific and technical work acquired. Skills and experience for presentation Practice-related work results are gradually built.	
Modulinhalte Module contents	Classification of a task in an operational environment and Assignment to engineering sub-disciplines. Content and quantitatively optimal delimitation of a given Problem. Possibilities of extraction and practical Presentation of necessary data and data collections. Selection and transparent use of valuation methods as well as variants of the presentation of work results with the Selection of the individually optimal method. Training of the problem-solving and conversational skills, the style of speech and Conflict behavior. Personal time management and optimization of personal presentation.	
Lehrformen Forms of teaching	Kolloquium	
Voraussetzungen für die Teilnahme Requirements for participation	87 Credit Punkte aus Modulen (Master-Studiengang)	
Literatur/multimediale Lehr- und Lernprogramme Further readings/Learning programmes	entsprechend des zu bearbeitenden Themas	
Lehrbriefautor Textbook author	individuelle Kolloquiumsvorbereitung; Konsultationen	
Verwendbarkeit Usability	Mechatronics & Robotics 90 CP M.Eng.	

Arbeitsaufwand/Gesamtworkload Workload/Total workload	Selbsstudium 90 h = 90 Stunden = 3.0 Credit Punkte presence 60 h + preparation 90 h + independent work 90 h = 90 hours = 3.0 credit points	
ECTS und Gewichtung der Note in der Gesamtnote ECTS and weighting in overall grade	3.00 3/90	1
Leistungsnachweis Performance record	Mündliche Prüfung (min. 30 Minuten, max. 60 Minuten), gegliedert nach Vortrag und Diskussion, (benotet)	
Semester Semester	3	
Häufigkeit des Angebots Frequency of the offer	bedarfsweise, sowohl im Winter- als auch im Sommersemester	
Dauer Duration	1 Semester	
Art der Lehrveranstaltung Type of course	Compulsory module 3. Semester	
Besonderes Peculiarity		

Faculties
Electrical Engineering
Mechanical Enginering

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Scheme Mechatronics and Robotics (M.Eng.)

Mechatronics & Robotics (M.Eng.)

	ECTS	V	Ü	L	Σ	ECTS	PV
Pflichtmodule 1. Semester					**24 (25)***	20	
Automation Control	5	4					
Mechanical Problems in Mechatronics	5	2		2			
VDI 2206 - Development of Mechatronic Systems	5	2	2				
Sensor Systems	5	3	1				
Wahlpflichtmodule 1. Semester: 2 aus 5 zu wählen						10	
German Language I	5		4				
Rapid Control Prototyping*	5	4	1				T
Vibration Engineering	5	2	2				
Workshop Mechatronics I (Preperation)	5	1		3			
Communication Systems	5	3		1			T
Pflichtmodule 2. Semester					**24**	20	
Systemtheory	5	3	1				
Design of Robot Workplaces	5	2	2				T
Robotic Vision	5	2		2			
Digital Signalprocessing for Engineering Application	5	3		1			T
Wahlpflichtmodule 2. Semester: 2 aus 4 zu wählen						10	
German Language II	5		4				
Applied Physics	5	3		1			N
Aspects of Production Planning and Work Design	5	4					
Tribology in Micromechanics	5	2		2			T
Workshop Mechatronics II (Finalization)	5					30	
Pflichtmodule 3. Semester							
Master Thesis	27						
Kolloquium	3						