

Schema Mechatronics Robotics (M.Eng.)

Mechatronics & Robotics (M.Eng.)

	ECTS	V	Ü	L	Σ	PV
Pflichtmodule 1. Semester					24	
Automation Control	5	4		0		
Vibration Engineering	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						
German Language I	5	4				
Digital Signalprocessing for Engineering Application	5	3		1		T
Rapid Controll Prototyping	5	4	1			T
Mechanical Problems in Mechatronics	5	2	2			
Workshop Mechatronics I (Preperation)	5	1		3		
Pflichtmodule 2. Semester						
System Theory	5	3	1			
Design of Robot Workplaces	5	2	2			T
Communication Systems	5	3	1			T
Robotic Vision	5	2	2			
Wahlpflichtmodule 2. Semester: 2 aus 4 zu wählen					24	
German Language II	5	4				
Applied Physics	5	3		1		N
Quality Management	5	4				
Workshop Mechatronics II (Finalization)	5	1		3		
Pflichtmodule 3. Semester						
Master Thesis	27					
Kolloquium	3					

Modulhandbuch: Mechatronics & Robotics 90 CP MA

Nr.	Sem.	Ver.	Modulbezeichnung	Lehrende(r)	Fakultät
Compulsory module 1. Semester					
1		0	Automation Control MERO	Bachmann	ET
2	1	0	Vibration Engineering MERO	Kolev	MB
3	1	0	Development of Mechatronic Systems MERO	Roth	MB
4	1	1	Sensor Systems MERO	Knechtel	ET
Compulsory elective module 1. Semester: 2 to be chosen from 5					
5	1	1	German Language I MERO	Petschauer	ZfF
6	1	0	Digital Signal Processing for Engineering Applications MERO	Roppel	ET
7	1	1	Rapid Control Prototyping MERO	Schrödel	MB
8	1	1	Mechanical Problems in Mechatronics MERO	Behn	MB
9	1	1	Workshop Mechatronics I MERO	Bachmann	ET
Compulsory module 2. Semester					
10	2	0	System Theory MERO	Bachmann	ET
11	2	1	Design of Robot Workplaces MERO	Huxholl	MB
12	2	0	Communication Systems MERO	Roppel	ET
13	2	0	Robotic Vision MERO	Schweigel	ET
Compulsory elective module 2. Semester: 2 to be chosen from 4					
14	2	1	German Language II MERO	Petschauer	ZfF
15	2	1	Design of Robot Workplaces MERO	Huxholl	MB
16	2	0	Applied Physics Master MERO	Studienorganisation	MB
17	2	0	Quality Management Master MERO	Huxholl	MB
18	2	1	Workshop Mechatronics II MERO	Roth	MB
Compulsory module 3. Semester					
19	3	0	Master Thesis MA MERO	Studienorganisation	MB
20	3	0	Colloquium Master Thesis MA MERO	Studienorganisation	MB

Modulname	Automation Control MERO	201
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Silvio Bachmann	
Qualifikationsziele	<p>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.</p> <p>Lesson is divided in</p> <p>Technical information 40 %</p> <p>Method knowledge 50 %</p> <p>System competence 10 %</p>	
Modulinhalte	<p>Parts</p> <ul style="list-style-type: none"> - 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	Vorlesung (4 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge in system control	
Literatur/multimediale Lehr- und Lernprogramme	Script	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written examination 120 min.	
Semester	Fachsemester	
Häufigkeit des Angebots	winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 1. Semester	
Besonderes		

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Modulname	Vibration Engineering MERO	214
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. habil Emil Kolev	
Qualifikationsziele	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	<ol style="list-style-type: none"> 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	Vorlesung (2 SWS) Übung (2 SWS)	
Voraussetzungen für die Teilnahme	Mathematics, Dynamics	
Literatur/multimediale Lehr- und Lernprogramme	Script of Lecturers: bilingual: German–English Technical Mechanics, Fachbegriffe im deutschen und englischen Kontext, S. Kessel/D. Fröhling, B.G. Teubner Stuttgart, Leipzig, ISBN 3-519-06378-6	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written examination 120min	
Semester	1 Fachsemester	
Häufigkeit des Angebots	anually in winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 1. Semester	
Besonderes		

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Modulname	Development of Mechatronic Systems MERO	218
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr. Stefan Roth	
Qualifikationsziele	Methods and processes for product development of mechatronic systems from idea to realization by design. Introduction of tools and basics of project management.	
Modulinhalte	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	Vorlesung (2 SWS) Übung (2 SWS)	
Voraussetzungen für die Teilnahme	none	
Literatur/multimediale Lehr- und Lernprogramme	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	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Oral Exam	
Semester	1 Fachsemester	
Häufigkeit des Angebots	Sommersemester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 1. Semester	
Besonderes		

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Modulname	Sensor Sytems MERO	220
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Roy Knechtel	
Qualifikationsziele	<p>The students get to know the theoretical foundation of and some practical insight in intelligent sensors systems.</p> <p>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.</p> <p>The lecture conveys: professional competence 40% method competence 15% system competence 40% social competence 5%</p>	
Modulinhalte	<ol style="list-style-type: none"> 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: <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 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	Vorlesung (3 SWS) Übung (1 SWS)	
Voraussetzungen für die Teilnahme	Master student in electrical engineering or mechatronics engineering.	
Literatur/multimediale Lehr- und Lernprogramme	<ol style="list-style-type: none"> 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] 	

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Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 15 h + Vorbereitung 60 h = 75 Stunden = 2.5 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	written examination 120 min	
Semester	1 Fachsemester	
Häufigkeit des Angebots	jährlich im Wintersemester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 1. Semester	
Besonderes		

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Modulname	German Language I MERO	250
Modulverantwortlicher/ Modulverantwortliche	Ramona Alina Petschauer	
Qualifikationsziele	<p>The course aims to build up the students' ability to communicate in everyday situations. Upon completion of this course the students will be able:</p> <ul style="list-style-type: none"> • 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	<p>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:</p> <ul style="list-style-type: none"> • 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	Übung (4 SWS)	
Voraussetzungen für die Teilnahme	No prior knowledge of German	
Literatur/multimediale Lehr- und Lernprogramme	Lecture script	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	

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ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	written examination (120 min)	
Semester	1 Fachsemester	
Häufigkeit des Angebots	anually in winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory elective module 1. Semester: 2 to be chosen from 5	
Besonderes		

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Modulname	Digital Signal Processing for Engineering Applications MERO	204
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Carsten Roppel	
Qualifikationsziele	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	<ol style="list-style-type: none"> 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	Vorlesung (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge in electrical engineering, signals and systems and programming in C is recommended	
Literatur/multimediale Lehr- und Lernprogramme	<p>Chassaing, R.: DSP Applications using C and the TMS320C6x DSK. Wiley, 2002.</p> <p>Grüningen, D. Ch. v.: Digitale Signalverarbeitung. Hanser Verlag, 2004.</p> <p>Oppenheim, A. V., Schaffer, R. W.: Discrete-time signal processing. Prentice-Hall, 1999 (deutsche Ausgabe: Zeitdiskrete Signalverarbeitung, Pearson Studium, 2004).</p> <p>Proakis, J. G., Manolakis, D. G.: Digital Signal Processing. Pearson Prentice Hall, 4th ed., 2007.</p> <p>Roppel, C.: Grundlagen der Nachrichtentechnik. Hanser Verlag, 2018.</p>	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	

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ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written examination 120 min.	
Semester	1 Fachsemester	
Häufigkeit des Angebots	winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory elective module 1. Semester: 2 to be chosen from 5	
Besonderes		

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Modulname	Rapid Control Prototyping MERO	235
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Frank Schrödel	
Qualifikationsziele	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 devices, controller and drives) for given problems.	
Modulinhalte	<ul style="list-style-type: none"> • 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 (Rapid 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	Vorlesung (4 SWS) Übung (1 SWS)	
Voraussetzungen für die Teilnahme	Bachelor Study in Mechan. Eng. or similar Knowledge/experience in Mechanics, Mechan. Design, Electrical Eng., Automation Technology	
Literatur/multimediale Lehr- und Lernprogramme		
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	written examination 120 min	

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Semester	1 Fachsemester
Häufigkeit des Angebots	anually in winter semester
Dauer	1 Semester
Art der Lehrveranstaltung	Compulsory elective module 1. Semester: 2 to be chosen from 5
Besonderes	

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Modulname	Mechanical Problems in Mechatronics MERO	236
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. habil. Carsten Behn	
Qualifikationsziele	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	<ul style="list-style-type: none"> • 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 <ul style="list-style-type: none"> • Periodically forced vibrations using Fourier transformation • Nonlinear vibrations and analyses • Foundation and isolation of machines 	
Lehrformen	Vorlesung (2 SWS) Seminar (2 SWS)	
Voraussetzungen für die Teilnahme	Good knowledge in Mathematics and Technical Mechanics (Elasticity, Dynamics) on a bachelor level would be great.	
Literatur/multimediale Lehr- und Lernprogramme	Hibbeler: Engineering Mechanics - Statics, Pearson, 2015. Hibbeler: Engineering Mechanics - Dynamics, Pearson, 2016. Dresig/Holzweißig: Dynamics of Machinery - Theory and Applications, Springer, 2010. Den Hartog: Mechanical Vibrations, McGraw-Hill, 2003. Weaver/Timoshenko/Young: Vibration Problems in Enginee-ring, Wiley, 2013.	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1

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Leistungsnachweis	written exam 120min. Remark: There is the possibility to take an oral examination in case of the third attempt, but the student has to apply for.
Semester	1 Fachsemester
Häufigkeit des Angebots	anually in winter semester
Dauer	1 Semester
Art der Lehrveranstaltung	Compulsory elective module 1. Semester: 2 to be chosen from 5
Besonderes	

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Modulname	Workshop Mechatronics I MERO	237
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Silvio Bachmann	
Qualifikationsziele	Exercise and project work in development of a microcontroller based electronic control unit for mechatronic systems	
Modulinhalte	<ol style="list-style-type: none"> 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	Vorlesung (1 SWS) Praktikum (3 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge in electrical engineering, microcontrollers, programming in C	
Literatur/multimediale Lehr- und Lernprogramme	- Fischer: Teaching materials	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	written report + oral presentation of workshop project	
Semester	1 Fachsemester	
Häufigkeit des Angebots	summer semester (Once per academic year)	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory elective module 1. Semester: 2 to be chosen from 5	
Besonderes		

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1	16/04/21	Stud.IP-MVV-Admin	Studiendekan	1 von 1

Modulname	System Theory MERO	205
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Silvio Bachmann	
Qualifikationsziele	<p>Students understand basic concepts and methods of Systemtheory. You learn analyzing and describing methods for systems including processes and signals.</p> <p>Lesson is divided in Technical information 40 % Method knowledge 50 % System competence 10 %</p>	
Modulinhalte	Parts - Introduction - Applicability - Signals and Definition - Signal Analyzing and Modeling - Process Description - Process Models - Process Analyzing - Applications	
Lehrformen	Vorlesung (3 SWS) Übung (1 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge in system control	
Literatur/multimediale Lehr- und Lernprogramme	Script	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written examination 120 min.	
Semester	2 Fachsemester	
Häufigkeit des Angebots	summer semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 2. Semester	
Besonderes		

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Modulname	Design of Robot Workplaces MERO	223
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr. Lutz Huxholl	
Qualifikationsziele	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	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	Vorlesung (2 SWS) Übung (2 SWS)	
Voraussetzungen für die Teilnahme		
Literatur/multimediale Lehr- und Lernprogramme	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	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis		
Semester	2 Fachsemester	
Häufigkeit des Angebots	Yearly in summer semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 2. Semester Compulsory elective module 2. Semester: 2 to be chosen from 4	
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Modulname	Communication Systems MERO	209
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Carsten Roppel	
Qualifikationsziele	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	<ol style="list-style-type: none"> 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	Vorlesung (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge in electrical engineering, digital signal processing and MATLAB/Simulink is recommended.	
Literatur/multimediale Lehr- und Lernprogramme	<p>Proakis, J. G., Manolakis, D. G.: Digital Signal Processing. Pearson Prentice Hall, 4th ed., 2007.</p> <p>Proakis, J. G., Salehi, M.: Digital Communications. McGraw-Hill, 5. Aufl., 2008</p> <p>Roppel, C.: Grundlagen der Nachrichtentechnik. Hanser Verlag, 2018</p> <p>Stewart, R. et al.: Software Defined Radio using MATLAB & Simulink and the RTL-SDR. Strathclyde Academic Media, 2015.</p>	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written examination 120 min.	
Semester	2 Fachsemester	
Häufigkeit des Angebots	winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 2. Semester	
Besonderes		

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Modulname	Robotic Vision MERO	219 MERO
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Maria Schweigel	
Qualifikationsziele	<p>The students get to know the theoretical foundations of computer vision under consideration of issues of mobile robotics. Especially they learn 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 Module of Matlab. Students will apply theoretical knowledge by solving exercises.</p> <p>The lecture conveys: professional competence 45% method competence 30% system competence 20% social competence 5%</p>	
Modulinhalte	<p>Module content</p> <ol style="list-style-type: none"> 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) 	
Lehrformen	Vorlesung (2 SWS) Praktikum (2 SWS)	

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Voraussetzungen für die Teilnahme	Technical education, matriculation	
Literatur/multimediale Lehr- und Lernprogramme	1. 'Vision Based Autonomous Robot Navigation', Chatterjee, Rakshit, Singh, Springer 2013 2. 'Robotics - Vision and Control', Peter Corke, Springer 2017	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Name of Examination: Robot Vision oral Exam, 20 minutes Accepted aid: Script, notes	
Semester	2 Fachsemester	
Häufigkeit des Angebots	Sommersemester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 2. Semester	
Besonderes		

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Modulname	German Language II MERO	251
Modulverantwortlicher/ Modulverantwortliche	Ramona Alina Petschauer	
Qualifikationsziele	<p>The course aims to improve the students' ability to communicate in everyday situations. Upon completion of this course the students will be able:</p> <ul style="list-style-type: none"> • 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	<p>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:</p> <ul style="list-style-type: none"> • 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	Übung (4 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge of German	
Literatur/multimediale Lehr- und Lernprogramme	Lecture script	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	

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ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written examination 120 min	
Semester	2 Fachsemester	
Häufigkeit des Angebots	anually in summer semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory elective module 2. Semester: 2 to be chosen from 4	
Besonderes		

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Modulname	Applied Physics Master MERO	Mero2
Modulverantwortlicher/ Modulverantwortliche	Fakultät Maschinenbau Studienorganisation	
Qualifikationsziele	Not yet available	
Modulinhalte	Not yet available	
Lehrformen	Vorlesung (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme	Not yet available	
Literatur/multimediale Lehr- und Lernprogramme	Not yet available	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written exam 120 min	
Semester	2 Fachsemester	
Häufigkeit des Angebots	anually in summer semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory elective module 2. Semester: 2 to be chosen from 4	
Besonderes		

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Modulname	Quality Management Master MERO	Mero1
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr. Lutz Huxholl	
Qualifikationsziele	The students learn the basics of quality management. After finishing the course, they shall be able to accompany and/or lead quality management projects within a company. In particular, they should be enabled to identify and assess risks, develop measures to reduce risks, and generally embed risk-based thinking in a company. After completing the lecture, students will be able to apply error prevention techniques based on common quality standards and they will be able to initiate appropriate measures when quality incidents occur.	
Modulinhalte	<p>The content of the lecture includes the basics of quality management, a selection of quality tools and their application in practice.</p> <p>Based on the cross-industry standard ISO 9001, requirements for quality management systems are explained and aspects that are required for the successful management of industrial companies are considered. Documentation also plays a role here: so-called relief evidence can be used to defend against claims for damages, which means that the Product Liability Act is also part of this lecture in excerpts.</p> <p>The practical part is the link between the standard and the company practice. Topics such as leadership, target indicators, complaint management, escalation procedures, lessons learned, control of nonconforming parts, product and process changes, deviation and concession and other relevant topics are covered here.</p>	
Lehrformen	Vorlesung (4 SWS)	
Voraussetzungen für die Teilnahme	(none)	
Literatur/multimediale Lehr- und Lernprogramme	Masing, W , Handbuch Qualitätsmanagement, Carl Hanser Verlag, München Wien Linß, G, Qualitätsmanagement für Ingenieure, Fachbuchverlag Leipzig Pfeifer, Tilo, Praxisbuch Qualitätsmanagement, Carl Hanser Verlag, München Wien	
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	

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ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Written exam 120 min	
Semester	2 Fachsemester	
Häufigkeit des Angebots	anually in summer semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory elective module 2. Semester: 2 to be chosen from 4	
Besonderes		

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Modulname	Workshop Mechatronics II MERO	238
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr. Stefan Roth	
Qualifikationsziele	Design and realisation of mechatronic systems	
Modulinhalte	<p>Exercise in development of mechatronic system with focus on mechanical solution approach</p> <p>Based on solution guideline for development of mechatronic systems, i.e. VDI 2221 or 2208 (V-Model), the student has to work out the design of simple mechatronic systems, e.g. positioning systems, robotic solutions, etc..</p> <p>The conceptual idea has to be realised with means of mechanical processing like rapid prototyping processing or alternatively conventional production methods.</p> <p>Fundamental elements of the development process for mechatronic systems, namely specification of requirements, implementation, verification and corresponding documentation are trained by the workshop.</p>	
Lehrformen	Vorlesung (1 SWS) Übung oder Projekt (3 SWS)	
Voraussetzungen für die Teilnahme	Workshop Mechatronics I	
Literatur/multimediale Lehr- und Lernprogramme	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	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	5.00 5/90	1
Leistungsnachweis	Assignment (written report + oral presentation) of workshop project	
Semester	2 Fachsemester	
Häufigkeit des Angebots	Sommersemester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory elective module 2. Semester: 2 to be chosen from 4	
Besonderes		

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Modulname	Master Thesis MA MERO	1920 MERO
Modulverantwortlicher/ Modulverantwortliche	Fakultät Maschinenbau Studienorganisation	
Qualifikationsziele	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> -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. <p>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).</p> <p>Results of the work are the written thesis with appendices of drawings,drafts, measurements and tests, programming source textes.</p>	
Modulinhalte	<p>The frame conditions for the thesis are determined in the course regulations in §17 and §18.</p> <p>The topic of the master thesis should come from a company or external scientific institution.</p> <p>Preferably it should be related to the focus either mechanical or electrical engineering.</p> <p>The student is responsible for the search itself. The topic must be approved by the supervisor.</p> <p>Teamwork is possible under considaration of §17/5</p>	
Lehrformen	Selbständige betreute Arbeit	
Voraussetzungen für die Teilnahme	successful completion of the exams in at least 10 modules (50ECTS-CP, §17/3)	
Literatur/multimediale Lehr- und Lernprogramme		
Lehrbriefautor	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload		

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ECTS und Gewichtung der Note in der Gesamtnote	27.00 27/90	1
Leistungsnachweis		
Semester	3 Fachsemester	
Häufigkeit des Angebots	Winter- und Sommersemester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Compulsory module 3. Semester	
Besonderes		

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Modulname	Colloquium Master Thesis MA MERO	1921 MERO
Modulverantwortlicher/ Modulverantwortliche	Fakultät Maschinenbau Studienorganisation	
Qualifikationsziele	Die Studierenden sollen begleitend zur Bearbeitung der Master-Arbeit und aufbauend auf den erworbenen Methoden- und Sozialkompetenzen des Masterstudiums mit den Prinzipien wissenschaftlichen Arbeitens und der Ergebnispräsentation vertraut gemacht werden. Die Gestaltungsgrundlagen von wissenschaftlichen Arbeiten sollen konkret, eindeutig und transparent umgesetzt werden. Kenntnisse und Erfahrungen zur Evaluierung von Konzepten, Projektergebnissen, Konstruktionsleistungen, Planungsvarianten und anderen wissenschaftlich-technischen Arbeiten werden erworben. Fähigkeiten und Erfahrungen zur Präsentation praxisgebundenen Arbeitsergebnisse werden schrittweise aufgebaut.	
Modulinhalte	Einordnung einer Aufgabenstellung in ein betriebliches Umfeld und Zuordnung zu ingenieurwissenschaftlichen Teildisziplinen. Inhaltlich und quantitativ optimale Abgrenzung eines vorgegebenen Problems. Möglichkeiten der Gewinnung und praxisgerechten Darstellung von notwendigen Daten und Datensammlungen. Auswahl und transparente Nutzung von Bewertungsmethoden sowie Varianten der Präsentation von Arbeitsergebnissen mit der Auswahl der individuell optimalen Methode. Training der Problemerkörterung und Gesprächsführung, des Sprechstils und Konfliktverhaltens. Persönliches Zeitmanagement und Optimierung der persönlichen Präsentation.	
Lehrformen	Kolloquium	
Voraussetzungen für die Teilnahme	87 Credit Punkte aus Modulen (Master-Studiengang)	
Literatur/multimediale Lehr- und Lernprogramme	entsprechend des zu bearbeitenden Themas	
Lehrbriefautor	individuelle Kolloquiumsvorbereitung; Konsultationen	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Selbststudium 90 h = 90 Stunden = 3.0 Credit Punkte	
ECTS und Gewichtung der Note in der Gesamtnote	3.00 3/90	1
Leistungsnachweis	Mündliche Prüfung (min. 30 Minuten, max. 60 Minuten), gegliedert nach Vortrag und Diskussion, (benotet)	
Semester	3 Fachsemester	
Häufigkeit des Angebots	bedarfsweise, sowohl im Winter- als auch im Sommersemester	
Dauer	1 Semester	

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Art der Lehrveranstaltung	Compulsory module 3. Semester
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