Modulhandbuch: Mechatronics & Robotics 90 CP MA

Nr.	Sem.	Ver.	Modulbezeichnung	Lehrende(r)	Fakultät
Pflichtmodule 1. Semester (20 ECTS)					
1	1	1	Drives for Automation Systems MERO	Schrödel	MB
2	1	0	Vibration Engineering MERO	Kolev	MB
3	1	0	Development of Mechatronic Systems MERO	Roth	MB
Wahlpflichtmodule 1. Semester: 2 aus 5 (10 ETCS)					
4	1	1	German Language I MERO	Petschauer	ZfF
5	1	0	Digital Signal Processing for Engineering Applications MERO	Roppel	ET
6	1	1	Rapid Control Prototyping MERO	Schrödel	MB
7	1	1	Mechanical Problems in Mechatronics MERO	Behn	MB
8		1	Workshop Mechatronics I MERO	Bachmann	ET
Pflichtmodule 2. Semester (20 ETCS)					
9	2	0	System Theory MERO	Bachmann	ET
10	2	1	Design of Robot Workplaces MERO	Huxholl	MB
11	2	0	Communication Systems MERO	Roppel	ET
12	2	0	Robotic Vision MERO	Schweigel	ET
Wahlpflichtmodule 2. Semester: 2 aus 4 (10 ETCS)					
13	2	1	German Language II MERO	Petschauer	ZfF
14	2	0	Optics and LASERs MERO	Behn	MB
15	2	0	Simulation Methods for Mechanical Systems MERO	Weidner	MB
16		1	Workshop Mechatronics II MERO	Roth	MB
Pflichtmodule 3. Semester (30 ECTS)					
17	3	0	Master Thesis MA MERO	Studienorganisation	MB
18	3	0	Colloquium Master Thesis MA MERO	Studienorganisation	MB

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**Drives for Automation Systems MERO**	217
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Frank Schrödel	
Qualifikationsziele	Students shall understand the fundamentals as well as current trends of automation technology in the context of modern robotic applications. A special focus of the lecture is on drive systems and control engineering of automated mechatronic systems. 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	• 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 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 (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme	Bachelor Study in Mechan. Eng. or similar; Knowledge/experience in Mechanics, Mechan. Design, Electrical Eng., Gear systems, Automation	
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 exam 120min	

Modulname	**Drives for Automation Systems MERO**	217
Semester	1 Fachsemester	
Häufigkeit des Angebots	winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Pflichtmodule 1. Semester (20 ECTS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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	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, Fachbergriffe 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	Pflichtmodule 1. Semester (20 ECTS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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	Pflichtmodule 1. Semester (20 ECTS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**German Language I MERO**	250
Modulverantwortlicher/ Modulverantwortliche	Ramona Alina Petschauer	
Qualifikationsziele	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	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	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	

Modulname	**German Language I MERO**	250
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	Wahlpflichtmodule 1. Semester: 2 aus 5 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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	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	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	keiner	
Verwendbarkeit	Mechatronics & Robotics 90 CP M.Eng.	
Arbeitsaufwand/Gesamtworkload	Präsenzzeit 60 h + Vorbereitung 90 h = 150 Stunden = 5.0 Credit Punkte	

Modulname	**Digital Signal Processing for Engineering Applications MERO**	204
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	Wahlpflichtmodule 1. Semester: 2 aus 5 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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 devises, controller and drives) for given problems.	
Modulinhalte	• 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	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	

Modulname	**Rapid Control Prototyping MERO**	235
Semester	1 Fachsemester	
Häufigkeit des Angebots	anually in winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Wahlpflichtmodule 1. Semester: 2 aus 5 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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	• 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	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 Ap-plications, 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

Modulname	**Mechanical Problems in Mechatronics MERO**	236
Leistungsnachweis	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	1 Fachsemester	
Häufigkeit des Angebots	anually in winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Wahlpflichtmodule 1. Semester: 2 aus 5 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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	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	Fachsemester	
Häufigkeit des Angebots	summer semester (Once per academic year)	
Dauer	1 Semester	
Art der Lehrveranstaltung	Wahlpflichtmodule 1. Semester: 2 aus 5 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**System Theory MERO**	205
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Silvio Bachmann	
Qualifikationsziele	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	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	Pflichtmodule 2. Semester (20 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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	Pflichtmodule 2. Semester (20 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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	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	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	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	Pflichtmodule 2. Semester (20 ETCS)	
Besonderes		

Modulname	**Robotic Vision MERO**	219 MERO
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr.-Ing. Maria Schweigel	
Qualifikationsziele	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 Module of Matlab. Students will apply theoretical knowledge by solving exercises. The lecture conveys: professional competence 45% method competence 30% system competence 20% social competence 5%	
Modulinhalte	Module content 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)	

Modulname	**Robotic Vision MERO**	219 MERO
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	Pflichtmodule 2. Semester (20 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**German Language II MERO**	251
Modulverantwortlicher/ Modulverantwortliche	Ramona Alina Petschauer	
Qualifikationsziele	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	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	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	

Modulname	**German Language II MERO**	251
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	Wahlpflichtmodule 2. Semester: 2 aus 4 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**Optics and LASERs MERO**	212
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr. Udo Behn	
Qualifikationsziele	On completion of this course, the students should have some background knowledge on the wave properties of light. They should know the basic principles of optical imaging and they should be able to design and to calculate simple optical systems. Furthermore, the students should know the most important parameters to characterize a laser and to pick the right laser for the right application.	
Modulinhalte	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)	
Lehrformen	Vorlesung (3 SWS) Praktikum (1 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge of wave physics and geometrical optics	
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 exam 120 min	
Semester	2 Fachsemester	
Häufigkeit des Angebots	winter semester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Wahlpflichtmodule 2. Semester: 2 aus 4 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**Simulation Methods for Mechanical Systems MERO**	213
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr. Georg Weidner	
Qualifikationsziele	On completion of this course, the students should be able to model the kinematic and dynamic behaviour of machines and vehicles as well as their subsystems. They should understand how Multi-Body-Systems work, apply them to typical problems in the field of Mechanical Engineering and they should be able to evaluate the results of numerical simulation.	
Modulinhalte	Fundamentals of modelling. Numerical solution of equation of motion. Bodies (mass and inertia tensor). Kinematic constraints (joints). Dynamic constraints (springs and dampers). Kinematic drives. Dynamic drives. Examples of modelling linear and particular non-linear systems. Discussion of the results obtained by simulation with a Multi-Body-System.	
Lehrformen	Vorlesung (2 SWS) Übung (2 SWS)	
Voraussetzungen für die Teilnahme	Basic knowledge in technical mechanics in particular kinematics and dynamics of rigid bodies.	
Literatur/multimediale Lehr- und Lernprogramme	Textbooks on kinematics and dynamics of machines	
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 in computer lab.	
Semester	2 Fachsemester	
Häufigkeit des Angebots	Sommersemester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Wahlpflichtmodule 2. Semester: 2 aus 4 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**Workshop Mechatronics II MERO**	238
Modulverantwortlicher/ Modulverantwortliche	Prof. Dr. Stefan Roth	
Qualifikationsziele	Design and realisation of mechatronic systems	
Modulinhalte	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	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	Fachsemester	
Häufigkeit des Angebots	Sommersemester	
Dauer	1 Semester	
Art der Lehrveranstaltung	Wahlpflichtmodule 2. Semester: 2 aus 4 (10 ETCS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

Modulname	**Master Thesis MA MERO**	1920 MERO
Modulverantwortlicher/ Modulverantwortliche	Fakultät Maschinenbau Studienorganisation	
Qualifikationsziele	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	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	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		

Modulname	**Master Thesis MA MERO**	1920 MERO
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	Pflichtmodule 3. Semester (30 ECTS)	
Besonderes		

HOCHSCHULE SCHMALKALDEN
UNIVERSITY OF APPLIED SCIENCES

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 Problemerörterung 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	Selbsstudium 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	

Modulname	**Colloquium Master Thesis MA MERO**	1921 MERO
Art der Lehrveranstaltung	Pflichtmodule 3. Semester (30 ECTS)	
Besonderes		