DEGGENDORF INSTITUTE OF TECHNOLOGY

Module Handbook

Programme

Mechatronics
(Bachelor)

Faculty

Faculty of Mechanical Engineering
and Mechatronics

Contents

Module	M-01
Module name	Basic Principles of Mathematics
Module components	M1101 Basic Analytical Principles of the Study of Engineering
Curriculum classification:	Mechatronics (Bachelor)
Study focus	General
Credit points (ECTS)	5
Form of assesssment	Examination of completed Module Written 90 mins or oral 30 mins.
Module supervisor	Prof. Dr. rer. nat. Stefan Schulte
Entry conditions and recommendations	---
Learning objectives	○ Acquiring basic mathematical knowledge (i.e. definitions and problem-solving methods) as needed for the first semester. ○ First steps towards devising mathematical methods independently for engineering applications (esp. from textbooks).

Course	M1101
Course name	Basic Analytical Principles of the Study of Engineering
Course instructor	Prof. Dr. rer. nat. Stefan Schulte
Module classification	M-01 Basic Principles of Mathematics
No. of Semesters	1
Hrs. per wk. per semester	4
Credit points (ECTS)	5
Attendance /assignments	150hrs: attendance 60hrs, assignments 60hrs, exam preparation 30hrs
Examination	See Module
Final grading	Examination of completed Module
Language	German
Form of tuition	Lectures with integrated exercises, assignments
Tuition media	Writing on board combined with script
Literaturee	To be announced in lectures
Module supervisor	Prof. Dr. rer. nat. Stefan Schulte
Course content	○ Basic Principles (eg.values of real and complementary numbers, diagrammatic terms) ○ Linear equation systems, matrixes, determinants ○ Sequences and series (of real numbers) ○ Functions of a real variable ○ (planar) curves and their mathematical descriptions ○ Functions of several variables ○ Observations on functions in n-dim. space

Module	M-02
Module Name	Advanced Mathematics
Module Parts	M2101 Mathermatics for Engineers M3101 Mathermatics for Engineers 2
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	10
Examination	Examination of complete Module Written. 90 mins or oral 30 mins.
Head of Module	Prof. Dr. rer. nat. Stefan Schulte
Recommended Prerequisites	---
Learning Objectives	○ Understanding of mathematical approach to finding engineering solutions to technical problems which can be described and solved by means of (normal) differential equations. In particular the mathematical treatment of differential equations in the context of technical applications will be studied, from model - building to (analytical) solution and finally the interpretation of results. ○ Ability to work in a team with members of other disciplines (ie. to create conditions for subject-specific dialogue with colleagues from other specialist areas) eg. sciences, neighbouring fields of engineering, economics, …) ○ The student learns the nature and the significance of mathematical models as an essential part of the increasingly important simulation-program. Key topic areas here are fields of application such as measurement and control technology, thermal transfer and fluid mechanics

Name of Course	M2101

Name	Mathematics for Engineers1
Instructor	Prof. Dr. rer. nat. Stefan Schulte
Module	M-01 Higher Mathematics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	2
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150hrs:attendance 60hrs, assignments 60hrs, examination preparation 30hrs
Examination Requirement	See Module
Final Grade	Examination of completed Module
Language	German
Instruction Method	Lectures with integrated exercises, assignments
Media	Writing on board in combination with script
Literature	To be announced in lectures
Head of Module	Prof. Dr. rer. nat. Stefan Schulte
Content	o Differential calculus (for the functions of one variable) o Integral calculus o Power series o Basic terms of differential geometry of planar curves o Surface calculation of planar fields limited by (any type of) curves, o Differential calculus for the functions of several variables o Optimisation, method of the smallest squares o Multiple integers o Fourier-series

Name of Course	M3101
Name	Mathematics for Engineers 2
Instructor	Prof. Dr. rer. nat. Stefan Schulte
Module	M-02 Higher Mathematics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	3
Hours per week/Semester	4
Credit Points (ECTS)	5
Time required	150hrs: attendance 60hrs, assignments 60hrs, exam preparation 30hrs
Examination Requirement	See Module
Final Grade	Examination of completed Module
Language	German
Instruction Method	Lectures with integrated exercises, assignments,
Media	Writing on board in combination with script
Literature	To be announced in lectures
Head of Module	Prof. Dr. rer. nat. Stefan Schulte
Content	o (normal) differential equations o examples of numerical processes for the solving of normal differential equations o examples of applications from science and technology

Module	M-03
Module Name	Basic Principles of Engineering Design
Module Parts	M-1104 Design 1 M-2104 Design 2
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit Points (ECTS)	8
Examination	The final grade of the Module results from the part-grades weighted with the ECTS-Points
Head of Module	Prof. Dr.-Ing Rudolf Strohmayr
Requirements and Recommended Prerequisites	---
Learning Objectives	○ Ability to sketch the component parts of a mechatronic system spatially and represent these in a technical drawing ○ Ability to produce components having regard for functional and technical-commercial considerations ○ Ability to develop a component assembly (list of requirements, design, calculation, configuration, execution) ○ Ability to apply a 2D-CAD system for the representation of a component assembly and separate component parts

Name of Course	M1104
Name	Design 1
Instructor	Prof. Dr.-Ing. Rudolf Strohmayr
Module	M-03 Principles of Design Engineering
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	1
Hours per week/Semester	4
Credit points (ECTS)	4
Time required (Workload)	120hrs: 60rsh lectures, 40hrs assignments, 20hrs exam preparation
Examination Requirement	written 90mins or oral 30mins
Final Grade	Written exam100% or oral exam 100%
Language	German
Instruction Method	Seminar instruction with integrated design tasks, assignments
Media	Writing on board / OHP transparencies /: visualisation with data projector
Literature	Conrad, K. J. (1998), *Grundlagen der Konstruktionslehre*, Hanser, München Hoischen, H. (1998), *Technisches Zeichnen*, Cornelsen, Berlin. Klein, P. (2001) *Einführung in die DIN-Normen*, Beuth, Berlin, Wien, Zürich.
Head of Module	Prof. Dr.-Ing. Rudolf Strohmayr
Content	○ Basic geometric designs ○ Orthographic projection (third angle projection) ○ Axonometric projection / free-hand drawing ○ Standard dimensioning ○ Execution of production documents ○ Screw connections ○ Measurement tolerances and fits ○ Tolerances in shape and position ○ Surface properties ○ Preferred numbers and series ○ Systematic arrangement of drawings

Name of Course	M2104
Name	Design 2
Instructor	Prof. Dr.-Ing. Karl Hain
Module	M-03 Basic Principles of Design Engineering
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	2
Hours per week/Semester	4 (2V+2P)
Credit points (ECTS)	4
Time required (Workload)	120hrs: attendance 60hrs; dissertation/assignments 60hrs
Examination Requirement	Dissertation + record of achievement
Final Grade	Final grade from dissertation produced during course
Language	German
Instruction Method	Seminar instruction with integrated PC-design exercises, assignments
Media	Calculations : writing on board / transparencies CAD-exercises visualisation with data projector
Literature	Roloff H., Matek W., Muhs D. (2007) *Maschinen-elemente*, 18. Auflage, Vieweg, Braunschweig Autodesk: AutoCAD LT 2008; Benutzerhandbuch Firmenkataloge: Normteile / Lager usw.
Head of Module	Prof. Dr.-Ing. Rudolf Strohmayr
Content	○ General design process ○ Presentation of design documentation suitable for production ○ Application of specific methods of calculation ○ Design of mechatronic products suitable for production ○ Design with due attention to stresses and strains ○ Design with due attention to tolerances ○ Design suitable for welding ○ Use of standard parts and catalogues ○ Basic 2D-CAD for mechatronics

Module	M-04
Module Name	Basic Principles of Physics
Module Parts	M1107 Applied Physics 1 M2106 Applied Physics 2
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	9
Examination	The final grade results from the part-grades of the Module components weighted with the ECTS-Points
Head of Module	Dr. Thomas Stirner
Recommended Prerequisites	---
Learning Objectives	Understanding of the basic physical principles of mechanics, oscillations, waves, thermodynamics electricity, magnetism, light, and modern physics, especially linear motion and rotary motion. Application of conservation theories of energy, linear impulse und rotary impulse. Understanding of physical properties of fluids in state of inertia and in motion. Understanding of harmonic oscillations and wave propagation. Application of wave equation. Understanding the concepts of temperature, heat and the main theorems of thermodynamics. Understanding the concepts of electric potential, electric and magnetic fields. The concepts of interference, bending and breaking. Understanding of the concepts of modern physics, such wave-particle-dualism and energy-quantisation. The student should be able to analyse natural systems and processes according to basic physical concepts, to describe them using the corresponding laws of physics and carry out calculations for given system parameters. Ability to carry out, evaluate and write up accounts of simple physical experiments.

Name of Course	M1107
Name	Applied Physics 1
Instructor	A.R. Frau Klippert-Daiminger
Module	M-04 Basic Principles of Physics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	1
Hours per week/Semester	4 (3V+1P)
Credit points (ECTS)	5
Time required	150hrs: lectures 45hrs, Laboratory15hrs, Lab preparation and follow-up 15hrs, exercises 22,5hrs, assignments 22,5hrs, exam preparation 30 hrs
Examination Requirement	Laboratory work and written exam 90 mins or orqal 30mins
Final Grade	Written examination 100% or oral 100%
Language	German
Instruction Method	Seminar instruction, exercises, practical
Media	Board and OHP
Literature	Tipler P.A., Mosca G. (2006), *Physik für Wissenschaftler und Ingenieure*, 2. Auflage, Elsevier, München. Mills D. et al. (2005), *Arbeitsbuch zu Tipler/Mosca*, 2. Auflage, Elsevier, München.
Head of Module	Dr. Thomas Stirner
Content	○ Systems of units ○ Mechanics of one-dimensional movement Movement in two and three dimensions ○ Newton's Axioms, application of Newton's Axioms of work, energy and energy conservation ○ Particle systems and the conservation of linear impulse, rotary movements ○ Conservation of rotary impulse, gravitation, Fluids ○ Oscillations and wave oscillations, ○ Wave propagation, superposition of standing waves

Name of Course	M2106
Name	Applied Physics 2
Instructor	Dr. Thomas Stirner
Module	M-04 Basic Principles of Physics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	2
Hours per week/Semester	5 (4V+1P)
Credit points (ECTS)	5
Time required	150hrs: lectures 60hrs, exercises 30hrs, practical 15hrs, preparation and follow-up of practical 15hrs assignments 30hrs, exam preparation 30hrs
Examination Requirement	Written examination 90 mins or oral 30mins
Final Grade	Written exam100% or oral 100%
Language	German
Instruction Method	Seminar instruction , exercises, practical
Media	Board and OHP
Literature	Tipler P.A., Mosca G. (2006), *Physik für Wissenschaftler und Ingenieure*, 2. Auflage, Elsevier, München. Mills D. et al. (2005), *Arbeitsbuch zu Tipler/Mosca*, 2. Auflage, Elsevier, München.
Head of Module	Dr. Thomas Stirner
Content	○ Thermodynamics: temperature und kinetic gas theory, heat, first and second main theorem of thermodynamics ○ Electricity and magnetism : electric fields, electrical potential, the magnetic field, magnetic induction, Maxwell´s equations ○ Light : properties of light, optical imaging, interference and diffraction ○ Modern Physics: wave-particle dualism, Schrödinger-equation, theory of relativity

Module	M-05
Module Name	Basic Principles of Mechanics
Module Parts	M1103 Technical Mechanics 1 (Statics) M2103 Technical Mechanics 2 (Mechanics of Materials)
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	10
Examination	Examination of complete Module Written 90mins or oral 30mins.
Head of Module	Prof. Dr.-Ing. Franz Bergbauer
Recommended Prerequisites	---
Learning Objectives	Students are able to : o interpret substituted mechanical systems o apply the method of sections o establish the conditions of equilibrium and solve the resulting systems of equations o calculate the inner loads (internal force variables) of mechanical systems o determine centres of gravity o give due consideration to the influence of friction o to determine stresses and deformations of substituted mechanical systems for the three main load types (tension/pressure, bending, torsion) o solve simple problems relating to conditions of multi-dimensional stress and deformation o apply the concept of work in the solution of simple problems in statics and elastostatics o calculate elementary buckling equations (Euler)

Name of Course	M1103
Name	Technical Mechanics 1 (Statics)
Instructor	Prof. Dr.-Ing. F. Bergbauer / NN_Mechanics 2
Module	M-05 Basic Principles of Mechanics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	1
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150 hrs : lectures 60 hrs, exercises 60 hrs (30 hrs offered as supervised study (WZF), examination preparation 30 hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction, exercises
Media	Writing on board, exercises and supplementary documentation via PC-Network
Literature	Gross D., Hauger W., Schröder, Wall (2009), *Technische Mechanik 1*, 10. Auflage, Springer, Berlin
Head of Module	Prof. Dr.-Ing. F. Bergbauer
Content	o Basic terminology and definitions o Forces with common point of application o General systems of force and the equilibrium of a fixed body o Centre of gravity o Bearing reactions o Frameworks o Internal force variables of beams, frames and arches Work o Adhesion and friction

Name of Course	M2103
Name	Technical Mechanics 2 (Mechanics of Materials)
Instructor	Prof. Dr.-Ing. F. Bergbauer / NN_Mechanik2
Module	M-05 Basic Principles of Mechanics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	2
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150 hrs: lectures 60 hrs, exercises 60 hrs (30 hrs are offered as supervised study (WZF) examination preparation 30 hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction , exercises
Media	Writing on board, exercises and supplementary documentation via PC-Network
Literature	Gross D., Hauger W., Schröder, Wall (2009), *Technische Mechanik 2*, 10. Auflage, Springer, Berlin
Head of Module	Prof. Dr.-Ing. F. Bergbauer
Content	o Tension and pressure in bars o State of stress, state of strain, law of elasticity o Bending of beams o Torsion o Concept of work in elastostatics o Buckling

Module	M-06
Module Name	Basic Principles of Information Technology
Module Parts	M1105 Information Technology 1 M1106 Information Technology 1 Practical M2105 Information Technology 2
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	8
Examination	Examination of complete Module : written. 90mins or oral. 30mins.
Head of Module	Prof. Dr.-Ing. Fröhlich
Requirements and Recommended Prerequisites	---
Learning Objectives	○ Basic understanding of computer hardware and peripherals ○ Ability to calculate with Boole's algebra elementary computer operations with binary numbers, calculation from and into the hexadecimal numbers system ○ Understand the working of an operating system (based on window and command line) ○ Understanding of the tools Editor, Assembler, Compiler, Linker. ○ Ability to convert simple algorithms into a MATLAB-Program ○ Knowledge of basic software engineering methods, ability to implement programming guidelines ○ Master the handling of a C-development environment, understand the tasks of a precompiler ○ The student should be able to algorithmise problems of basic to moderate complexity and to code successfully using C language ○ Ability to incorporate C-Code into a MATLAB-function

Name of Course	M1105
Name	Information Technology I
Instructor	Prof. Dr.-Ing. Fröhlich
Module	M-05 Basic Principles of Information Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	1
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs : lectures 30hrs, preparation and follow-up of lectures 15h, examination preparation 15hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction , exercises
Media	Board / Script
Literature	Rechenberg P. (2000) *Was ist Informatik?*, 3. Auflage, Hanser, München Skript
Head of Module	Prof. Dr.-Ing. Fröhlich
Content	○ Construction of computer and peripherals ○ Number systems, coding, Boole's algebra ○ Operating systems, dealing with operating systems and file systems ○ Software engineering tools: Editor, Compiler, Linker.

Name of Course	M1106
Name	Information Technology 1 Practical
Instructor	Prof. Dr.-Ing. Fröhlich
Module	M-06 Basic Principles of Information Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	1
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs: practical 30hrs, practical preparation and follow-up 15hrs, exam preparation 15hrs
Examination Requirement	See Module
Final Grade	See Module
Language	See Module German
Instruction Method	Practical
Media	Board/script / practice on computer
Literature	Script Stein, U. (2007), *Einstieg in das Programmieren mit MATLAB*, Hanser, München
Head of Module	Prof. Dr.-Ing. Fröhlich
Content	○ Programming in a higher programming language : MATLAB ○ Functions ○ In- and output ○ Fields ○ Application flow structures ○ Bifurcations ○ Loops ○ String processing ○ File access

Name of Course	M2105
Name	Information Technology 2
Instructor	Dr. Thomas Stirner
Module	M-06 Basic Principles of Information Technolgy
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	2
Hours per week/Semester	3 (1,5V+1,5P)
Credit points (ECTS)	4
Time required	120hrs: attendance lectures 22.5hrs practical 22.5hrs, preparation and follow-up of lectures and computer-practical (partly as homework) 40hrs, exam preparation 35hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction, exercises , practical
Media	Writing on board, exercise tasks Script, print-outs of OHP transparencies PC/Laptop, data projector PC-Practical
Literature	Rechenberg P. (2000) *Was ist Informatik?*, 3. Auflage, Hanser, München Klima R., Selberherr S. (2007) *Programmieren in C*, 2. Auflage, Springer, Berlin
Head of Module	Prof. Dr.-Ing. Fröhlich
Content	o Software Engineering: procedure models, Organisation of software projects o Instructions for programming o Theoretical information technology : Minimal computer models, calculability o Development environments for C-programming: gcc, Dev-Cpp o Precompiler: include, define, macros o Data types, data structures: Point numbers and integers, characters and character strings, abstract data types o Arithmetical operators,comparisons, logical operators o Control structures: bifurcations, loops, functions, recursions o Pointers: character strings, vector, fields, concatenated lists o Dynamic memory o Incorpoation of C-Routines into MATLAB(MEX-File) programming

Module	M-07
Module Name	Basic Principles of Electrical Engineering
Module Parts	M1102 Basic Principles of Electrical Engineering 1 M2102 Basic Principles of Electrical Engineering 2
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	10
Examination	The final grade results from the part-grades of the component Modules weighted with the ECTS-Points
Head of Module	Prof. Dr.-Ing. Fröhlich
Requirements and Recommended Prerequisites	---
Learning Objectives	o Understanding of the basic physical principles of electrical engineering o Ability to apply general procedures in the analysis of networks o Ability to determine the parameters of periodic signals o The student is able to calculate networks with, sinusoidal excitation by the use of complex alternative current calculations and vector diagrams. o Ability to observe systems with transmission functions o The student will be able to dimension simple electrical filters o He/she will be able to calculate oscillations with initial conditions using the La Place transformation o The student is able to ascertain the spectrum of non-sinusoidal periodic signals o He/she knows how to apply the SPICE simulation tool for the simulation of simple stationary and non-stationary problems o Practical knowledge of the most important electrical components for eg. resistance, capacity, and inductivity o Construction of simple electrical circuits in the lab on printed circuit board, carrying out basic measurements o Work with multimeters, signal generators and oscilloscope

Name of Course	M1102
Name	Basic Principles of Electrical Engineering 1
Instructor	Prof. Dr.-Ing. Fröhlich
Module	M-07 Basic Principles of Electrical Engineering
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	1
Hours per week/Semester	4 (3,5V+0.5P)
Credit points (ECTS)	5
Time required	150hrs: lectures 52.5hrs,practical (5x1.5hrs) =7. 5hrs, practical preparation and follow-up 10hrs, preparation and follow-up of lectures 40hrs, exam preparation 4hrs
Examination Requirement	Written examination 90mins or oral 30mins
Final Grade	Written exam 100% or oral 100%
Language	German
Instruction Method	Seminar instruction, exercises, practical
Media	Board, OHP transparencies
Literature	Führer A., Heidemann K., Nerreter W. (2006) *Grundgebiete der Elektrotechnik*, Band 1, 8. Auflage (auch Aufgabenbuch), Hanser, München Hagmann G. (2009) *Grundlagen der Elektrotechnik* 14. Auflage, Aula-Verlag (auch Aufgabenbuch) Moeller F. (2008) *Grundlagen der Elektrotechnik*, 21. Auflage, Vieweg, Wiesbaden
Head of Module	Prof. Dr.-Ing. Fröhlich
Content	○ Basic principles of physics: physical sizes, Ohms Law, work, output, sources ○ Network theory: Kirchhoff's laws, general network analysis, network theorems ○ Non-linear elements ○ Periodic signals: Parameters, output, development of Fourier series ○ Alternating current circuits : Alternating current components, parameters, complex alternating current calculation ○ Frequency responses, standardisation, decibel values ○ Practical: introduction to Pspice, simulation of direct and alternating current circuits

Name of Course	M2102
Name	Basic Principles of Electrical Engineering 2
Instructor	Prof. Dr.-Ing. Fröhlich
Module	M-07 Basic Principles of Electrical Engineering
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	2
Hours per week/Semester	4 (3,5V+0.5P)
Credit points (ECTS)	5
Time required	150rs: lectures 52.5hrs, practical (5x1.5hrs)=7.5hrs, Practical preparation and follow-up 10hrs, preparation and follow-up of lectures 40h, exam preparation 40hrs
Examination Requirement	Written examination 90mins or oral. 30mins
Final Grade	Written exam 100% or oral 100%
Language	German
Instruction Method	Seminar instruction, exercises , practical
Media	Board, OHP
Literature	Führer A., Heidemann K., Nerreter W. (2006) *Grundgebiete der Elektrotechnik*, Band 1 und 2, 8. Auflage (auch Aufgabenbuch), Hanser, München Hagmann G. (2009) *Grundlagen der Elektrotechnik* 14. Auflage, Aula-Verlag (auch Aufgabenbuch) Moeller F. (2008) *Grundlagen der Elektrotechnik*, 21. Auflage, Vieweg, Wiesbaden
Head of Module	Prof. Dr.-Ing. Fröhlich
Content	○ Frequency response functions, Bode-diagrams, transient effects locus ○ Electrical filters: curves, filter types, realisations Multi-phase systems ○ Periodic non-sinusoidal signals : Fourier series, Fourier-spectrum ○ Transient effects : Laplace transformation, Calculation of transient effects with initial conditions using Laplace transformation ○ Transformers and transducers

Module	M-08
Module Name	English for Engineers
Module Parts	M1108 English for Engineers
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	2
Examination	Examination of complete Module Written 90 mins or oral 30 mins.
Head of Module	Maria Schönauer M.A.
Recommended Prerequisites	B1: General Certificate; B2: Advanced Level
Learning Objectives	o Listening texts with technical or business-based contexts to be analysed for general or detailed information o Reading and listening texts to be summarised orally in discussion and to express a point of view o Give short presentations o Read technical texts quickly, distinguishing between detailed knowledge and a general understanding o Be able to use and expand vocabulary relating to general technical and commercial subjects o Improve written expression

Name of Course	M1108
Name	English for Engineers
Instructor	M. Schönauer / NN
Module	M-08 English for Engineers
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	1
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs : lectures with exercises 30hrs, assignments 15hrs, exam preparation 15hrs
Examination Requirement	Written examination 90mins or oral 30mins
Final Grade	Examination100% or oral 100%
Language	English
Instruction Method	Language course with group activities and pair-work
Media	OHP, CD, board
Literature	„Englisch für technische Berufe“
Head of Module	Frau Maria Schönauer M.A.
Content	Eg. materials and their properties, energy, job applications, alternators, bridges, HDTV; Grammar: passive, further topics as nec. Material partly taken from textbooks, partly current texts from press and internet

Module	M-09
Module Name	Digital Technology
Module Parts	M2107 Digital Technology 1 M3107 Digital Technology
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	6
Examination	The final grade for the Module results from part grades for the Module components weighted with ECTS-points
Head of Module	Prof. Dr.-Ing. A. Grzemba
Recommended Prerequisites	M-07 Basic knowledge of electrical engineering, M1105 Information Technology 1
Learning Objectives	o Basic knowledge of digital circuits; o Ability to synthesise and analyse digital systems o Knowledge of advantages and disadvantages of various digital circuit families o Construction and implementation of digital circuits in laboratory experiments o Knowledge of typical measurements of digital circuits

Name of Course	M2107
Name	Digital Technology 1
Instructor	Prof. Dr.-Ing. A. Grzemba
Module	M-09 Digital Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	2
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs lectures 30hrs ; assignmemts 15hrs; examination preparation 15hrs
Examination Requirement	Written examination 90mins or oral 30mins
Final Grade	100% exam or 100% oral
Language	German
Instruction Method	Seminar instruction , exercises
Media	Script / OHP /data projector
Literature	Scarbata G. (2001), *Synthese und Analyse Digitaler Schaltungen*, Oldenbourg, München Pernards P. (2001) *Digitaltechnik*, Hüthig, Heidelberg Hoffmann D. W. (2007) *Grundlagen der Technischen Informatik*, Hanser, München
Head of Module	Prof. Dr.-Ing. A. Grzemba
Content	o Theorems and laws of circuit algebra o Circuit functions - Normal forms of circuit functions (SF) - Minimalisation of circuit functions o Combinatorial circuits, - General design guidelines - Transcribers - Comparators - Multiplexers and demultiplexers - Adders - Dynamic behavioiur of combinatorial circuits o Flip-Flop (FF), bistable triggers - Basic RS-Flip-Flop - D-Flip-Flop - JK-Flip-Flop - Conversion from Flip-Flop o Counters - design of parallel counters - register circuits - latches

Name of Course	M3107
Name	Digital Technology 2
Instructor	Prof. Dr.-Ing. A. Grzemba
Module	M-09 Digital Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	3
Hours per week/Semester	4 (2V+2P)
Credit points (ECTS)	4
Time required	120hrs ; lectures 30hrs; assignments 15hrs; practical 30hrs, preparation and follow-up to practical 30hrs, exam preparation 15hrs
Examination Requirement	Written examination 90mins or oral 30mins
Final Grade	100% written exam or 100% oral
Language	German
Instruction Method	Seminar instruction, exercises, practical
Media	Script / OHP / data projector
Literature	Scarbata G. (2001), *Synthese und Analyse Digitaler Schaltungen*, Oldenbourg, München Pernards P. (2001), *Digitaltechnik*, Hüthig, Heidelberg Hoffmann D. W. (2007), *Grundlagen der Technischen Informatik*, Hanser, München
Head of Module	Prof. Dr.-Ing. A. Grzemba
Content	o Sequential circuits, digital machines - Description and design of switching arrangements - Circuit mechanism of a coin changing machine - Operating systems of machine types - Integrity and consistency - Equivalence of Moore- und Mealy-machines - Reduced state equalization - Coding of machines - Design of complex circuits on the basis of Moore- und Mealy- machines o Elektronic realisiation of logical functions - CMOS-logic families - TTL-logic families o Programmable logic circuits - Principles of construction

Module	M-10
Module Name	Applied Mechanics
Module Parts	M3102 Machine Parts M3103 Technical Mechanics 3
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	10
Examination	The final grade results from the part grades of the Module components weighted with the ECTS-points
Head of Module	Prof. Dr.-Ing. Franz Bergbauer
Empfohlene Voraussetzungen	Knowledge of Modules M-01, M-02 (Mathematics for Engineers) IM-05 Basic Principles of Mechanics, M-03 Basic Principles of Design Engineering
Learning Objectives	○ Recognise the most famous design and machine components for mechatronic assemblies, their uses and their design (from examples); ○ Ability to assess these components and deploy them in small designs. ○ Active use of technical drawings and knowledge ○ Acquire basic knowledge geometric-spatial and temporal movement sequences in mechanical systems ○ Interaction between movement, force and momentum in on simple mechanical structures.

Name of Course	M3102
Name	Maschine Parts
Instructor	Prof. Dr.-Ing. Karl Hain
Module	M-10 Applied Mechanics
Curriculum	Mechatronics (Bachelor)
general	Allgemein
Semester	3
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150hrs: 60hrs attendance + 30hrs preparation and follow-up of lectures, 30hrs assignments + 30hrs exam preparation
Examination Requirement	Written exam 90mins or oral 30mins
Final Grade	Written: 100% or oral100%
Language	Deutsch
Instruction Method	Seminaristischer Unterricht, Übung
Media	Board, OHP, data projector
Literature	Roloff H., Matek W., Muhs D. (2007) *Maschinen-elemente*, 18. Auflage, Vieweg, Braunschweig Köhler/Rögnitz (2007), *Maschinenteile 1 und 2*, 10. Auflage, Vieweg, Wiesbaden Decker K.-H. (2009), *Maschinenelemente*, 17. Auflage, Hanser, Mümchen Steinhilper W., Sauer B. (2008) *Konstruktionselemente des Maschinenbaus*, Band 1 und 2, 7. Auflage, Springer, Berlin
Head of Module	Prof. Dr.-Ing. Franz Bergbauer
Vorkenntnisse	Module M-05 Basic Principles of Mechanics
Content	○ Positive locking and frictionally engaged traction drives and gear transmissions: forms of construction, application, calculation ○ Shiftable couplings ○ Strength calculation of shafts and axles and welding connections, proof of fatigue resistance ○ Calculation of typical application examples from drive technology ○ Strength calculation of shafts and axles, welding connections, proof of fatigue resistance, traction drives and couplings etc .

Name of Course	M3103
Name	Technical Mechanics 3 (Kinematics)
Instructor	Prof. Dr.-Ing. Stefan Götze
Module	M-10 Applied Mechanics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	3
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150hrs: 60hrs attendance + 30h preparation and follow-up of lectures , 30hrs assignments + 30hrs exam prep.
Examination Requirement	Written examination 90mins or oral 30mins
Final Grade	Written: 100% or oral 100%
Language	German
Instruction Method	Seminar instruction, exercises
Media	board,OHP, data projector
Literature	Holzmann G., Meyer H., Schumpich G. (2006) *Technische Mechanik , Kinetik und Kinetik*, 9. Auflage, Teubner, Wiesbaden Knappstein G. (2004), *Kinematik und Kinetik*, 2. Auflage, Harry Deutsch, Frankfurt am Main Hibbeler R. C. (2006), *Technische Mechanik 3*, 10. Auflage, Pearson, München
Head of Module	Prof. Dr.-Ing. Franz Bergbauer
Vorkenntnisse	Module M-05 Basic Principles of Mechanics
Content	○ Kinematics of a point –Kinematics of a disc ○ Kinetics of point mass, pure translatory motion, work, energy, output ○ Impulse, Impulse theory, Iimpulse conservation theory for mass points ○ Movement of a body in a medium ○ Rotation of a body around a fixed axle ○ Work, energy, output in rotary movement ○ Linear momentum, linear momentum theory, linear momentum conservation theory in rotary movement ○ General planar movement of a fixed body

Module	M-11
Module Name	Applied Information Technology
Module Parts	M3104 Information Technology 3 M4107 Microcomputer Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	9
Examination	Examination of complete Module Written 90 mins or oral 30 mins.
Head of Module	Prof. Dr.-Ing. Fröhlich
Empfohlene Voraussetzungen	Module M-01 Basic Principles of Mathematics M-06 Basic Principles of Information Technology
Learning Objectives	○ Students should understand the object –oriented mechanisms in C++ and be able to apply these in prescribed problems ○ They will acquire the ability to design and structure algorithms from various areas of technology and convert them into C++, selecting the appropriate data type for the purpose. . ○ Use various software tools fort he support of programming and error-finding. ○ and functions of microprocessors and microcontrollers ○ They understand the construction and the possible uses of the most important memory and peripheral components ○ They learn basic skills in the programming of microcomputer systems / microcontrollers in C language

Name of Course	M3104
Name	Information Technology 3
Instructor	Prof. Dr.-Ing. A. Penningsfeld
Module	M-11 Applied Information Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	3
Hours per week/Semester	3 (2V+1P)
Credit points (ECTS)	9
Time required	120hrs: lectures30hrs, I T lab 15hrs, assignments 25hrs Lab prep. 30hrs, exam prep. 20 hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Lectures with integrated exercises, programming practical in C++
Media	OHP, data projector,
Literature	Script
Head of Module	Prof. Dr.-Ing. P. Fröhlich
Content	o Basic principles of Windows programming, o Unification and use of classes in C++, derived classes, classes/inheritance, o Programming in C++: fundamental data types and structures control structures, o Pointers, functions, concept of class, inheritance, polymorphy, operator overload dealing with exceptions, masks, overview of TL. o Abstract data types: Keller, Schlange, Listen, Binary tree, graphs, complex numbers. o Algorithms: searching, sorting, hashing, recursion principle, simple graph algorithms. o Introduction to GUI programming.

Name of Course	M4107
Name	Microcomputer Technology
Instructor	Prof. Dr.-Ing. P. Fröhlich
Module	M-11 Applied Information Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	4 (2V+2P)
Credit points (ECTS)	5
Time required	150hrs: lecture 30hrs, micro-controller lab 30hrs, lab prep. and follow-up 35hrs, assignments 25hrs, exam prep. 30hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction,exercises, practical,
Media	Board /data projector / micro-controller practical
Literature	Script
Head of Module	Prof. Dr.-Ing. P. Fröhlich
Content	o Construction and function of a simple microcontroller following the example of the Renesas M16C familiy o Programming of microcontrollers, (assemblers, compilers, interpreters, IDE, typical program examples) o Typical sources of error in microcontroller-programs, debugging of programs o Observation of examples of peripheral functions von microcontrollers o Structures and capabilities of larger microcontrollers o Insight into DSP structures o Criteria for evaluation and selection of microcontrollers

Module	M-12
Module Name	Applied Physics
Module Parts	M-3105 Technical Optics M-3106 Semiconductor Technology
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	8
Examination	The final grade results from the part-grades of the Module components weighted with the ECTS-points
Head of Module	Prof. Dr. rer. nat. Franz Daiminger
Recommended Prerequisites	Module M-01 Basic Mathematical Principles, and M-04 Basic Principles of Physics
Learning Objectives	○ Students should be able to understand and apply the basic theoretical principles of optics ○ They should have knowledge of the most important optical processes and apparatus ○ They know the limits of real optical configurations and can evaluate these. ○ Students understand the fundamental functional groups in optical equipment ○ They are able to calculate simple optical systems in Raytracing programs and to interpret the various presentations of results ○ Students understand the theoretical basis of semiconductor physics. ○ They know the basic functions of the most important components of a semiconductor ○ They acquire the ability to use appropriate Literaturee in order to work independently on problems relating specifically to semiconductor physics or semiconductor components.

Name of Course	M3105
Name	Technical Optics
Instructor	Prof. Dr. rer. nat. Franz Daiminger
Module	M-12 Applied Physics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	3
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150hrs: 60hrs attendance, assignments 60 hrs, 30 hrs exam prep.
Examination Requirement	Written . 90mins oder oral 30mins
Final Grade	100% Written exam or 100% oral
Language	German
Instruction Method	Lectures with integrated exercises, and assignments
Media	board, OHP, data projector, PC, presentations
Literature	Schröder G., Treiber H. (2007), *Technische Optik*, 10. Auflage, Vogel, Würzburg Litfin G. (2004), *Technische Optik in der Praxis*, 3. Auflage, Springer, Berlin Kühlke D. (2004), *Optik: Grundlagen u. Anwendungen*, 2. Auflage, Harry Deutsch, Frankfurt am Main, Hecht E. (2005), *Optik*, 4. Auflage, Oldenburg, München
Head of Module	Prof. Dr. rer. nat. Franz Daiminger
Content	○ Light propagation and optical imaging ○ (Light, wave optics, particle optics ,optical imaging, comparison of images) ○ Image forming components (materials, lenses, plane surfaces, prisms, image defects,) ○ Fieldstops, aperture stops, pupils ○ Fibre optics ○ Optical instruments (telescope, microscope, magnifying glass, projectors, camera lenses, enlargement) ○ Determining data from optical systems ○ Exercises on PC with Raytracing Program

Name of Course	M3106
Name	Semiconductor Technology
Instructor	Prof. Dr. rer. nat. Franz Daiminger
Module	M-12 Applied Physics
Curriculum	Mechatronics(Bachelor)
Subject Major	General
Semester	3
Hours per week/Semester	3
Credit points (ECTS)	3
Time required	90hrs: 45hrs lectures, 25hrs preparation and assignments, 20hrs exam preparation
Examination Requirement	Written examination 90mins or oral 30mins
Final Grade	100 % written exam or 100% oral
Language	German
Instruction Method	Lectures with integrated exercises and assignments
Media	Board, OHP, data projector
Literature	Thuselt F. (2005) *Physik der Halbleiterbauelemente*, Springer, Berlin
Head of Module	Prof. Dr. rer. nat. Franz Daiminger
Content	○ Fields and and potentials (electrical field, electrical potential, current density) ○ Movement of charge carriers, densities of movable charge carriers ○ Semiconductors in thermodynamic equilibrium ○ Semiconductors in state of non-equilibrium ○ The pn-junction in the installation of direct voltage supply ○ Alternating current effects and real diodes ○ Metal semiconductor junctions (junctions in metal-metal, Schottky-diodes, Ohms contacts ○ Behaviour of bipolar transistors- direct and alternating currents (transistor function, charge control model, Ebers-Moll model, small signal-alternating current models, real bipolar transistors) ○ The barrier layer-field-effect transistor, ○ MOS-Transistors (description, small-signal and switching behaviour, non-ideal behaviour)

Module	M-13
Module Name	Industrial Process and Control
Module Parts	M4101 Feedback Control Technology 1 M4102 Practical Feedback Control Technology M4103 Control Technology
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	6
Examination	Examination of complete Module : Written 90 mins or oral 30 mins
Head of Module	Prof. Dr.-Ing. Christoph Rappl
Recommended Prerequisites	Knowledge of Module M-01 Basic Principles of Mathematics, M-02 Higher Mathematics, M-07 Basic Principles of Electrical Engineering M-05 Basic Principles of Mechanics
Learning Objectives	○ Familiarity with modelling of simple mechatronic systems in state space, ○ Knowledge of most important characteristics of simple transfer functions ○ Full understanding of application of algebraic stability criteria on control paths, and closed control circuits ○ Skills needed for Nyquist stability test ○ Recognising advantages and disadvantages of design methods using “characteristic frequency curves“ and “root locus “ ○ Students should also be able to set up simple simulation models using MATLAB and SIMULINK and to complete prescribed planning tasks. ○ The students can also distinguish feedback control systems from control systems, and apply Boole’s algebra to simple analysis and synthesis tasks in binary control technology. ○ Using a KV-diagram he/she can simplify Boole’s expressions as far as possible. ○ He/she knows examples of applications of various FlipFlops and counter types and can integrate these into control tasks. Similarly with timer components ○ The student knows the basic functionality of an SPS and can define the function plan of a sequencer when solving a problem

Name of Course	M4101
Name	Feedback Control Technology 1
Instructor	Prof. Dr.-Ing. Christoph Rappl
Module	M-13 Feedback Control and Control Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	general
Semester	4
Hours per week/Semester	3
Credit points (ECTS)	3
Time required	90hrs: lectures 45hrs, assigmnents22.5hrs, exam preparation 22.5hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Lectures with integrated exercises, assignments, exercises
Media	Writing on board, demonstrations with MATLAB and SIMULINK on data projector
Literature	Unbehauen H. (2007), *Regelungstechnik 1*, 14.Auflage, Vieweg, Wiesbaden Dorf R., Bishop R. (2005), *Moderne Regelungssysteme*, Pearson-Deutschland, München
Head of Module	Prof. Dr.-Ing. Christoph Rappl
Content	o Basic definitions, measuring principles, measuring chains o Model-building of mechatronic systems o Revision of Laplace transformation o Linearisation, rest position, transfer function o Compositoin and calculation of block diagrams o Characterisitics of selected transfer functions of 1^{st} and 2^{nd} order in areas of time and frequency o Influence of zero points on systems dynamics o BIBO-Stability, proof according to Hurwitz / Routh o Bode diagram and Nyquist plots o Closed control circuit and its characteristics, remaining deviations from the norm o General and specific Nyquist criterion in locus and Bode diagram, root loci according to Evans, Basis of design using WOK on dominant poles o Parametering of PID – controllers in frequency response- and design of root locus o Multi-loop control circuits

Name of Course	M4102
Name	Practical Feedback Control Technology
Instructor	Prof. Dr.-Ing. Christoph Rappl
Module	M-13 Feedback Control and Control Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	1
Credit points (ECTS)	1
Time required	30hrs: Practical 15hrs, preparation and follow-up 15hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Laboratory practical
Media	Writing on board, working with MATLAB and SIMULINK, Experimental configurations for classic feedback control
Literature	Lab script Feedback Control Technology
Head of Module	Prof. Dr.-Ing. Christoph Rappl
Content	o Determining the frequency response of an unknown control path establishing the step response o Experiments with rotation speed and position control o Experiments with ball-rocker o Experiments with ball on rim o Experiments with temperature control

Name of Course	M4103
Name	Control Technology
Instructor	Prof. Dr.-Ing. Christoph Rappl
Module	M-13 Feedback Control Technology and Control Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs: 15hrs attendance (lectures), 15hrs attendance (SPS-laboratory) 15hrs assignments, 15hrs exam preparation
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction, exercises, lab. practical
Media	Writing on board, laptop-data –projector
Literature	Wellenreuther G., Zastrow D. (1998), *Steuerungstechnik mit SPS*, 5. Auflage, Vieweg, Wiesbaden
Head of Module	Prof. Dr.-Ing. Christoph Rappl
Content	o Introduction to Control Technology o Revision: binary and digital numbers, Bool's algebra, rules for simplification o KV -diagram o Memory functions o Counters o Construction and workings of an SPS o Program examples in FUP (Function plan) o Realisation of process control using sequencers.

Module	M-14
Module Name	Sensor Systems and Statistics
Module Parts	M4105 Sensor Systems M4104 Statistics
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	5
Examination	Examination of complete Module: Written. 90 mins or oral 30 mins
Head of Module	Prof. Dr. Stefan Schulte
Recommended Prerequisites	Knowledge of Module M-01 Basic Principles of Mathematics, M-02 Higher Mathematic, M-07 Basic Principles of Electrical Engineering
Learning Objectives	○ Dealing confidently with terminology of measuring techniques and physical units. ○ Knowledge of the basic principles of measuring ○ Students have knowledge relating to procedures for measuring non-electrical values ○ Knowledge of basic structure of various types of sensor which are relevant to mechatronic applications ○ Students are able to select the appropriate sensors for a technical measuring problem ○ The student is able to deal independently with the solution of simple statistical tasks from engineering practice ○ Students understand the methods for calculation of error especially in the case of propagation of coincidental error Students can rank influences of Stochastic nature on measuring chains and calculate their approximate effect

Name of Course	D4105
Name	Sensor Systems
Instructor	Prof. Dr. Roswitha Giedl-Wagner
Module	M-14 Sensor Systems and Statistics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs: 30hrs attendance, 15hrs assignments, 15hrs exam preparation
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Lectures and exercises
Media	Presentation with data projector Writing on board,
Literature	Parthier, R. (2008), *Messtechnik*, 4. Aufl., Vieweg, Wiesbaden Kleger, R. (2008) Sensorik für Praktiker, 2. Auflage, VDE-Verlag, Düsseldorf
Head of Module	Prof. Dr. Stefan Schulte
Content	○ Measuring: measuring values, unit systems ○ Measuring signals:classification and transformation ○ Measuring methods: amplitude, difference methods, compensation ○ Measuring equipment: basic structure, static and dynamic parameters ○ Evaluation of measuring results: deviances, error propagation in systematic and coincidental deviances, error types ○ Measurement of electrical values: current, voltage, power, resistance, condensors, coils, time, frequency ○ Measurement of non-electrical values: measuring chain, sensor for measurement of geometry, force, oscillation, temperature, flow, ○ Techniques for measuring co-ordinates ○ Automated measuring systems

Name of Course	M4104
Name	Statistics
Instructor	Prof. Dr. rer. nat. Stefan Schulte
Module	M-14 Sensor Systems and Stsatistics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	2
Credit points (ECTS)	3
Time required	90hrs: 30rs attendance, 30hrs assignments, tutorial 30hrs exam preparation
Examination Requirement	See moduile
Final Grade	See Module
Language	German
Instruction Method	Lectures with integrated exercises, assignments
Media	Writing on board in combination with script
Literature	To be announced in lectures
Head of Module	Prof. Dr. rer. nat. Stefan Schulte
Content	o Introductory overview o Descriptive statistics o Basic concepts of probability calculation o Concluding statistics o Examples of appliocation fropm engineering paractice (eg. Quality control, experiental planning) o Application of statistical methods in sensor sytems

Module	M-15
Module Name	Electronics
Module Parts	M4106 Circuit Technology (Analogue Technology) M5103 Opto-elecronics and Laser Technology 1
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	10
Examination	The final grade results from the part-grades of the Module components weighted with the ECTS points
Head of Module	Prof. Dr.-Ing. Werner Bogner
Recommended Prerequisites	M-07 Grundlagen der Elektrotechnik, M3106 Halbleitertechnik
Learning Objectives	o Ability to analyse and use analogue semiconductors. o Ability to design and dimension simple analogue semiconductor circuits. o Knowledge of elementary light generation processes and the interaction between light and materials o Theoretical understanding of the working of a laser. With this the student should able to ascribe the individual components of a laser to their underlying functions. o Knowledge about the basic characteristics and features of laser radiation. The student is able understand the information about laser radiation supplied in the data sheets and to create these in accordance with the requirements of industrial application o Knowledge of the design and construction of the technical assemblies of laser components o Knowledge of the different operating modes of lasers and the radiation emitted by each. o Knowledge of the most important types of lasers and their characteristic features. The student is able to name the possible laser types for the various classes of application.

Name of Course	M4106
Name	Circuit Technology
Instructor	Prof. Dr.-Ing. W. Bogner
Module	M-15 Elektronics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	4 (3V+1P)
Credit points (ECTS)	5
Time required	150hrs: lectures 45hrs; lab 15hrs, preparation and follow-up of lab work 15hrs, assignments 30hrs; preparation and follow-up of lectures incl. exam prep 45hrs
Examination Requirement	Written exam 90 mins or oral 30mins
Final Grade	100% writtten exam or 100% oral
Language	German
Instruction Method	Seminar instruction, exercises
Media	Script / OHP /data projector
Literature	Köstner R., Möschwitzer A. (1993), *Elektronische Schaltungen*, Hanser, München Tietze U., Schenk Ch. (2002), *Halbleiter-Schaltungstechnik*, 12. Auflage, Springer, Berlin Goerth J. (1999), *Bauelemente und Grundschaltungen*, Teubner, Wiesbaden Wupper H., Niemeyer J. (1996), *Elektronische Schaltungen I+II*, Springer-Verlag, Berlin
Head of Module	Prof. Dr.-Ing. W. Bogner
Content	○ Introduction: tasks, applications of analogue circuits, networks, network elements, notation, formulae ○ Basic principles of analogue circuits: linear two-ports, non-linear circuits ○ Diode circuits: definition and characteristics equivalent circuit diagrams, simple diode circuits

	○ Basic transistor circuits: bipolar transistors, Definition and characteristics, Equivalent circuit diagrams, operation at high frequencies (upper frequency limit), biasing, simple transistor stages (basic circuits), special circuits ○ Multi-stage amplification circuits, coupling of transistor stages, amplifiers – OPV ○ Output stages (power stages), power loss, thermal resistance, cooling problems, quasi-linear power stages

Name of Course	M5103
Name	Optical Electronics and Laser Technology1
Instructor	Prof. Dr.rer. nat. Franz Daiminger
Module	M-15 Electronics
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	5
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150hrs: 60hrs attendance, 60hrs assignments, 30hrs exam preparation
Examination Requirement	Written examination 90mins or oral 30mins
Final Grade	Written exam 100% or oral 100%
Language	German
Instruction Method	Lecture with integrated exercises, assignments,
Media	Board, OHP, data projector, presentations, items for demonstration
Literature	Eichler J., Eichler H. J. (2006), *Laser*, 6. Auflage, Springer, Berlin Meschede D. (2006), *Optics, Light and Lasers*, 2. Auflage, Wiley VCH, Weinheim Hecht E. (2005), *Optik*, 5. Auflage, Oldenbourg, München
Head of Module	Prof. Dr. rer. nat. Franz Daiminger
Content	o Light, atoms, molecules and solid bodies and full radiators o Absorption, spontaneous emission, stimulated emission, spectral line width o Standard construction and functioning of a laser, balance equations o Light propagation, the Gauss ray and its transformation, the product of ray parameters o Optical resonators, longitudinal, transversal modes and coherence o Pulsed operating modes of lasers, relaxations, oscillations, Q-Switch, cavity-dumping, mode-locking, compression of pulses o Most important types of lasers, overview of laser applications

Module	M-16
Module Name	Project Module
Module Parts	M4108 Project 1 M5104 Project 2
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	7
Examination	The final grade results from the part-grades of the Module components weighted with the ECTS points
Head of Module	Prof. Dr.-Ing. Christoph Rappl
Recommended Prerequisites	M-03 Basic Principles of Design Engineering, M-07 Basic Electrical Engineering , M-06 Basic Principles of Information Technology, M3105 Technical Optics
Learning Objectives	o Analysis of tasks, drawing up a project schedule, examination of various solution strategies o Understanding the interaction of mechanical, electronic and software technical aspects of the mechatronic end product. o Training in powers of communication, Presentation of results within group, o Acquisition of practical skills in the fields of mechanical designs and manufacture, configuration of electronic component assemblies, micro controller programming. o Dimensioning and selection of sensors and actuators. o The “Mechatronics“ project should ideally result in a synthesis of those areas of knowledge gained through the course so far.

Name of Course	M4108
Name	Project 1
Instructor	All professors in the faculties MB+MC and ET+MT
Module	M-16 Project Module
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	2
Credit points (ECTS)	3
Time required	90hrs : 70hrs project work per student, 20hrs documentation
Examination Requirement	Project presentation + project report
Final Grade	The final grade results 50% from evaluation of the candidate's share of the project, and 50% from the evaluation of the project report
Language	German
Instruction Method	Project activity under guidance of various instructors
Media	-
Literature	Depending on project topic
Head of Module	Prof. Dr.-Ing. C. Rappl
Content	Definition, design and simulation of a mechatronic system in a team of 3 – 5 students, according to complexity of task. Each student works on a particular aspect of the project, but shares active responsibility with the project team to ensure that an entire functioning system is achieved. Each participant compiles a share of the project report which is then Individually assessed.

Name of Course	M5104
Name	Project 2
Instructor	All professors in the faculties MB+MC and ET+MT
Module	M-16 Project Module
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	5
Hours per week/Semester	2
Credit points (ECTS)	4
Time required	120hrs: 100hrs project work per student, 20hrs documentation
Examination Requirement	Project presentation + project report
Final Grade	The final grade results 50% from evaluation of the candidate's share of the project, and 50% from the evaluation of the project report
Language	German
Instruction Method	Project activity under guidance of various instructors
Media	-
Literature	Depending on project topic
Head of Module	Prof. Dr.-Ing. C. Rappl
Content	Realisation and testing of a mechatronic system in a team of 3 – 5 students, according to complexity of task. Each student works on a particular aspect of the project, but shares active responsibility with the project team to ensure that an entire functioning system is achieved. Each participant compiles a share of the project report, which is then individually assessed.

Module	M-17
Module Name	Materials and Manufacturing Processes
Module Parts	M4109 Materials M4110 Non-cutting Manufacturing Processes
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	6
Examination	Examination of complete Module: Written 90 mins or oral 30 mins.
Head of Module	Prof. Dr.-Ing. Thomas Petersmeier
Requirements and Recommended Prerequisites	---
Learning Objectives	○ Ability to assess the behaviour of materials and achieve targeted modification of their properties by means of alloying elements and/or micro-structural adjustment. ○ Understanding of the basic property correlation between structure/composition. ○ Ability to select suitable materials and combinations, whilst giving due consideration to their property profiles, component geometry and component loading. ○ Basic knowledge of manufacturing methods used today and the processes they involve. ○ With the knowledge from this Module, the mechatronics engineer should be equipped to design a production lay-out appropriate to the given task and apply technical skills in optimal dimensioning of the processes, as required ○ Specific focus is given to standard processes as employed in the manufacture of mechatronic components.

Name of Course	M4109
Name	Materials
Instructor	Prof. Dr.-Ing. Thomas Petersmeier, N.N.
Module	M-17 Materials and Manufacturing Processes
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: 60hrs attendance + practical (3*2h) 24hrs assignments + 30hrs exam prep.
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction, practical
Media	Board, OHP, data projector
Literature	Bergmann W. (2008), *Werkstofftechnik Teil 1 und Teil 2*, 6. Auflage, Hanser, München Bargel H. J., Schulze G. (2005), *Werkstoffkunde*, 9. Auflage, Springer, Berlin Berns H. (1993), *Stahlkunde für Ingenieure*, 2. Auflage, Springer, Berlin
Head of Module	Prof. Dr.-Ing. Thomas Petersmeier
Content	○ Categorisation of materials, ○ Crystalline state , ○ Elastic and plastic behaviour of metals, ○ Thermally activated processes, ○ Phase changes, alloying, ○ Equilibrium diagrams the iron carbon system, thermal treatment of steels, ○ Precipitation hardening, ○ Mechanically destructive testing procedures, ○ Short-terms for iron-steel materials

Name of Course	M4110
Name	Non-cutting Manufacturing Processes
Instructor	Prof. Dr.-Ing. Helmut Hansmaier
Module	M-17 Materials and Manufacturing Processes
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	4
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs: 30 hrs. attendance, 30 hrs. Preparation and follow-up of lectures incl. Exam preparation
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction, exercises
Media	Lectures with visualisation
Literature	Various sources –Literaturee listed in script
Head of Module	Prof. Dr.-Ing. Thomas Petersmeier
Content	o The basic principles of non-cutting manufacturing techniques will be dealt with, as needed for the production of mechatronic components and their separate mechanical parts. o These include among other things the basic processes of turning, drilling, milling and grinding, as well as methods for calculating forces occurring and required performance. o Special attention will be paid to the various possible implementations and their limits in terms of accuracy and technological potential. o Tools and their materials will be discussed. o Calculation tasks will be worked through using examples from practice.

Module	M-18
Module Name	Electrical Drive Mechanisms
Module Parts	M5101 Electrical Drive Merchanisms
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	4
Examination	Examination of complete Module: Written 90 mins or oral 30 mins
Head of Module	Prof. Dr.-Ing. Peter Firsching
Recommended Prerequisites	Knowledge of Modules M-01 Basic Mathematical Principles, M-07 Basic Principles of Electrical Engineering, M-05 Basic Principles of Mechanics
Learning Objectives	o Knowledge relating to generation of movement on the basis of a magnetic field o Features of electrical drive mechanisms o Dynamic behaviour of electrical drives o Students are able to construct a modern electric single- or multi-axle system, also mechanically in essential parameters.

Name of Course	M5101
Name	Electrical Drive Mechanisms
Instructor	Prof. Dr.-Ing. P. Firsching
Module	M-18 Electrical Drives
Curriculum	Mechatronic (Bachelor)
Subject Major	General
Semester	5
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: lectures 52,5 hrs, preparation and follow-up of lectures 30hrs, lab 7.5hrs, preparation and follow-up 10hrs, exam prep 20hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction, exercises, practical work in lab
Media	Script, writing on board, prepared transparencies, demo software
Literature	Fischer R. (1999), *Elektrische Maschinen*, Hanser, München Kremser, A. (2004), *Elektrische Maschinen und Antriebe*, Teubner, Wiesbaden Merz H. (2001), *Elektrische Maschinen und Antriebe*, VDE-Verlag, Düsseldorf Hering E., Vogt A., Bressler K. (1999), *Handbuch der elektrischen Anlagen und Maschinen*, Springer, Berlin Riefenstahl U. (2000), *Elektrische Antriebstechnik*, Teubner, Wiesbaden
Head of Module	Prof. Dr.-Ing. Peter Firsching
Content	o Basic principles of electrical machines and drives o Direct current motors o Basic principles of induction machines o Electrionically commutated motor o Asynchronic motor o Synchronic generator o Controlled drives

Module	M-19
Module Name	Micro-system Technology
Module Parts	M5102 Micro-system Technology
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	4
Examination	Examination of complete Module : Writing 90 mins. or oral 30 mins.
Head of Module	Prof. Dr.-Ing. Benstetter
Recommended Prerequisites	M-07 Basic Principles of Electrical Engineering, M3106 Semiconductor Technology M4106 Circuit Technology
Learning Objectives	o The students will gain basic knowledge of areas of application and manufacturing processes of micro-systems, o He/she will learn methods for the design and layout of integrated circuits and systems o He/she will gain a functional understanding of micro-systems and the capability to implement integrated circuits and systems as required in practice.

Name of Course	M5102
Name	Micro-system Technology
Instructor	Prof. Dr.-Ing. G. Benstetter
Module	M-19 Micro-system Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	5
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: lectures 60hrs, preparation and follow-up of lectures 30hrs, exam prep. 30 hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction,ecercises
Media	Lectures with visualisation
Literature	Widmann D., Mader H., Friedrich H. (1996), *Technologie hochintegrierter Schaltungen*, 2. Auflage, Springer, Berlin Hoppe B. (1997), *Mikroelektronik 1 und 2*, Vogel, Würzburg Gerlach G., Dötzel W. (1997), *Grundlagen der Mikrosystemtechnik*, Hanser Verlag, München Brück R., Rizivi N., Schmidt A. (2001), *Angewandte Mikrotechnik*, Hanser, München Chang C. Y., Sze S. M. (1996), *ULSI Technology,* McGraw-Hill, Singapore
Head of Module	Prof. Dr.-Ing. G. Benstetter
Content	○ Introduction and motivation, development of IC-market, overview: electronic circuits and IC technologies, development trends with exam0ples from DRAMs ○ Semiconductor technology and micro fabrication, manufacture of mono-crystalline silicon wafers, doping of semiconductor material ○ Metal semiconductor contacts, ideal Schottky contacts, boundary surface states and degradation of Schottky barriers, transport of current through a Schottky contact ○ Coating technology, SiO_2 coatings, epitaxial coatings

	○ Non-epitaxial CVD surface coatings, metallic coatings ○ Lithography, etching and cleaning techniques, complete process ○ Casing techniques, miniaturisation of structures, development trends in e und CMOS technology, ○ Microsystems technology, sensors, actuators, integrated systems, examples ○ Design and layout of integrated circuits: layout, active device modeling, analogue CMOS sub circuits, switched capacitor (SC) circuits

Module	M-20
Module Name	Practical Module
Module Parts	M6101 Practical Seminar for all study focuses M6102 Selected Topics from Practice 1 M6103 Selected Topics from Practice 2
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	6
Examination	All Module components must be assessed as "Pass level"
Head of Module	Prof. Dr. Martin Aust
Course Entry Requirements	Entry to the practical semester is dependent on prior achievement of a minimum of 90 ECTS credit points.
Learning Objectives	o Familiarity with the basic principles of pneumatics and hydraulics (practical training at BMW Dingolfing) o Familiarity in practice with handling of an SPS control, development of the control software for a straightforward system (Model-lift) o Improvement of powers of co-operation and communication and understanding of the significance of teamwork. o Presentation of tasks and results aimed at during industrial placement, in a form suitable for target groups

Name of Course	M6101
Name	Practical Seminar for all study focuses
Instructor	Prof. Dr.-Ing. Helmut Hansmaier
Module	M-20 Practical Module
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	6
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	In total: 60 hrs, seminar attendance 20 hrs, preparation : 40 hrs
Examination Requirement	Presentation (20 mins) The successful completion of the practical seminar is a precondition for passing the “Industrial Placement“ Module and thus to achieving recognition of the ECTS points for the practical
Final Grade	Successful participation is assessed as “Pass“.
Language	German
Instruction Method	Presentation
Media	o Writing on board o Projection by data projector or OHP o Demonstrations
Literature	Various, including internet research
Head of Module	Prof. Dr. Martin Aust
Vorkenntnisse	None
Content	Compiling a presentation and a report on the activities and tasks carried out by the student during the industrial placement. In this way all students gain information about new developments, processes and skills that are current in the various business organisations. Through their presentations, students should inform each other about companies in the area. They will gain insight into various local businesses and their key competences, as well as information about the production process of products in the field of mechatronics.

Name of Course	M6102
Name	Selected Topics from Practice 1
Instructor	Prof. Dr.-Ing. Helmut Hansmaier
Module	M-20 Practical Module I
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	6
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs: o 11hrs lectiures incl. simulation on PC o 9 hrs practical training with equipment o 40hrs preparation of lectures and practical in individual study
Examination Requirement	Successful completion of oral examination at pass level
Final Grade	Assessed at pass level after successful participation .
Language	German
Instruction Method	Lectures with integrated calculation exercises as well as circuit simulations on PC
Media	o Writing on board o Projection (data projector, OHP) o Demonstrations with simulation software Fluidsim o Exercises with Fluidsim o Practice with training equipment
Literature	Top be announced in lectures
Head of Module	Prof. Dr. Martin Aust
Content	o Differences as well as advantages and disadvantages of pneumatics and hydraulics o Pressure and build-up of pressure, generation of pressure, treatment in pneumatics. o Pneumatic drives, construction, production, areas of application and assembly of cylinders, control components, directional valves, flow-control valves, stop-valves, pressure valves, holding valves, two-way valves. o Completion of functional diagrams o Construction of hydraulic aggregates and pumps and construction forms o Hydraulic working and controlling components. Dimensioning of pneumatic and hydraulic components and equipment plus reservoir.

Name of Course	M6103
Name	Selected Topics from Practice 2
Instructor	Prof. Dr.-Ing. Christoph Rappl
Module	M-20 Practical Module
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	6
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs: attendance at lectures, presentations, excursions 15hrs, SPS Practical 15hrs, preparation and follow-up of course 30hrs
Examination Requirement	Oral examination completed successfully at “pass“ level
Final Grade	Assessed at pass level after successful participation
Language	German
Instruction Method	Lectures with SPS practical in lab. Presentations and excursions to companies
Media	o Writing on board o Projection (data projector, OHP) o Demonstrations
Literature	Wellenreuther G., Zastrow D. (1998), *Steuerungstechnik mit SPS*, 5. Auflage, Vieweg, Wiesbaden
Head of Module	Prof. Dr. Martin Aust
Vorkenntnisse	M4103 Control Technology
Content	Teil I) o Technology and characteristics of various typical SPS-bus-systems o Programming of Profibus DP with use of straightforward examples o eil II) External speakers from industry give talks on topics from general engineering, electrical engineering, and Mechatronics. Topics include : Assembly equipment, sintering processes and their uses, tool manufacture, digital distance measuring, selection of various measuring techniques, use of control and automation technology, examples of robot gripping technology, its configuration and calculation, clamping technology, design of special equipment and special engineering, from customers’ requirements through to the execution and construction of the equipment. The talks are carefully chosen and followed by a discussion

Module	M-21
Module Name	Industrial Internship
Module Parts	M6104 Internship
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	24
Examination	See LV M6104
Head of Module	Prof. Dr. Martin Aust
Course Entry Requirements	Entry to the Internship Semester is dependent on prior achievement of a minimum of 90 ECTS credit points.
Learning Objectives	o The general aim is to give all students an early opportunity of putting into practice the knowledge they have gained, whilst familiarising themselves with business processes within a company o Practical application of knowledge acquired in other Modules. o Application, reinforcement, and expansion of knowledge gained so far with a view to solving problems in engineering practice. o Improvement of communication and co-operation skills and recognition of the significance of teamwork. o Presentation for the group of tasks and results during the industrial internship.

Name of Course	M6104
Name	Internship
Instructor	Prof. Dr. Martin Aust
Module	M-21 Industrial Internship
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	6
Hours per week/Semester	Industrial Internship lasting18 weeks
Credit points (ECTS)	Industrial Internship: 24 ECTS
Time required	Industrial Internship: 720hrs incl. documentation
Examination Requirement	Industrial Internship: o Report on work carried out during internship (written account 18 pages DIN A4 in digital form) o Certification from the company in the form of a testimonial
Final Grade	Successful participation will be evaluated as “pass“
Language	German
Head of Module	Prof. Dr. Martin Aust
Content	Practical activity in an industrial firm or with alternative suitable training establishment for a period of 18 weeks. The students will be involved in the company’s current projects. Individual topics from the following areas: o Development, project planning, design, (mechanical or electrical engineering) o Production (manufacture and assembly), o Preparation and control of manufacturing, o Assembly, operation, and maintenance of mechatronic machinery and equipment o Testing and final inspection in manufacturing o Information technology in the industrial processing of mechatronic products

Module	M-22
Module Name	Mechatronic Systems
Module Parts	M5105 Feedback Control 2 M5106 Mechatronics
Curriculum:	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Credit points (ECTS)	8
Examination	The final grade for the Module results from the part-grades of the Module components, weighted with the ECTS-points
Head of Module	Prof. Dr.-Ing. Christoph. Rappl
Recommended Prerequisites	M-07 GET, M-02 Higher Mathematics M-05 Basic Principles of Mechanics, M-13 Industrial Process and Control
Learning Objectives	○ Learning the methods and processes in automation technology with the help of selected examples ○ Mode of operation for essential components of mechatronic systems ○ Computer-aided development of mechatronic systems such as drive mechanisms ○ Selection of appropriate sensors ○ Integration of individual components to form a fully integrated system ○ Transfer of methods of analogue RT to time-discreet systems, knowledge of connections, how the s-plane can be represented on the z-plane. ○ How can the terminals of the closed circuit be positioned in an integrated circuit, in order to achieve the required dynamics and insulation? ○ Starting with the parameters of the control path, the student can make proposals for the choice of scanning time. ○ Starting with a control synthesis in accordance with the root locus process, the student is able to determine the parameters of an additive PID-structure from the representation of the pole-zero-point of the time-discreet control unit ○ After completion of this Module, the student is able to carry out simple tasks of analysis and synthesis of time-discreet control circuits with the MATLAB/ SIMULINK tools. ○ Design of control mechanisms with sequencers and state diagrams ○ Programming of control units on a micro-controller / PC ○ Practical programming exercises

Name of Course	M5105
Name	Feedback Control 2
Instructor	Prof. Dr.-Ing. C. Rappl
Module	M-22 Mechatronic Systems
Curriculum	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems
Semester	5
Hours per week/Semester	4 (3V+1P)
Credit points (ECTS)	4
Time required	120hrs: lectures incl. MATLAB/SIMULINK exercises - 45hrs, practical work in lab 15hrs, preparation and follow-up of lectures and lab work 30hrs, exam prep. 30hrs
Examination Requirement	Written exam 90 mins od oral exam 30 mins
Final Grade	Written 100% or oral 100%
Language	German
Instruction Method	Seminar instruction, exercises, MATLAB-SIMULINK-practical, laboratory practical
Media	Writing on board, lap-top-data-projector
Literature	Unbehauen H. (2007), *Regelungstechnik 2*, 14.Auflage, Vieweg, Wiesbaden Dorf R., Bishop R. (2005), *Moderne Regelungssysteme*, Pearson-Deutschland, München
Head of Module	Prof. Dr.-Ing. C. Rappl
Content	○ Introduction to time-discreet systems, Z-Transformation, Reverse-transformation, solving differential equations ○ Discretisation of continuous systems with equidistant scanner and zero-order holding element ○ Jury's stability criterion as applied to time-discreet control paths and circuits ○ Design of a digital control path on a dominant terminal-pair, choice of scanning time ○ Correction of response by means of pre-filters, parametering of discreet PID-controllers, quasi-continuous controllers. ○ Programming of digital controllers on SPS / Micro-controller ○ Practical experiments in digital feedback control

Name of Course	M5106
Name	Mechatronics
Instructor	Prof. Dr.-Ing. H. Hansmaier
Module	M-22 Mechatronic Systems
Curriculum	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Semester	5
Hours per week/Semester	4 (2V+2P)
Credit points (ECTS)	4
Time required	120hrs: lectures 30hrs, simulation lab 30hrs, assignments 30hrs, exam prep 30hrs
Examination Requirement	Written exam 90mins or oral 30mins
Final Grade	100% written or 100% oral exam
Language	German
Instruction Method	Lecture with integrated MATLAB/SIMULINK- practical
Media	OHP, data-projector
Literature	Script
Head of Module	Prof. Dr.-Ing. C. Rappl
Content	o Components of mechatronic systems: actuators, sensors, control, mechanical components o Information processing in the development of mechatronic systems (simulation technology) o Aspects of feedback control in mechatronics o Matlab/Simulink-programming of mechatronic systems

Module	M-23
Module Name	Automation Technology and Robotics
Module Parts	M7105 Automation Technology M7106 Robotics
Curriculum:	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Credit points (ECTS)	8
Examination	The final grade results from the part-grades of the Module components weighted with the ECTS-points.
Head of Module	Prof. Dr.-Ing. H. Hansmaier
Requirements and Recommended Prerequisites	M-07 Basic Principles of Electrical Engineering, M-13 Industrial Process and Control , M-05 Basic Principles of Mechanics, M3103 Technical Mechanics 3
Learning Objectives	○ Understanding the operation of continuous path control and digital drive control of standard poly-axial robots ○ Knowledge of kinematic construction and technological functionality in of an industrial robot. ○ Knowledge of control engineering function and programming. Use of simulation technology for Offline programming ○ Basic knowledge of the structures of automation systems ○ Basic knowledge of all aspects of sensor operations in automation systems

Name of Course	M7105
Name	Automation Technology
Instructor	Prof. Dr. rer. nat. Martin Jogwich
Module	M-23 Automation Technology and Robotics
Curriculum	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Semester	7
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: attendance: 60 hrs, individual study / follow-up /exam preparation: 60 hrs
Examination Requirement	Written examination 90 mins or oral 30mins
Final Grade	Written 100 % or oral100%
Language	German
Instruction Method	Lectures, workshop, practice exercises, practical work
Media	Transparencies, board, Powerpoint script, data projector, lab constructions
Literature	Bergmann J. (1999), *Automatisierungs- und Prozessleittechnik*, Fachbuchverlag Leipzig bei Hanser, München Früh K. F. (2008), *Handbuch der Prozessautomatisierung*, 4. Auflage, Oldenbourg, München Gevatter H. J. (2000), *Automatisierungstechnik*, Springer, Berlin Heinrich B., Berling B., Thrun W., Vogt W. (2005), *Kaspers/Küfner: Messen – Steuern – Regeln*, 8 Auflage, Vieweg, Wiesbaden Simic D., Hochheimer G., Reichwein J. (2007), *Messen, Regeln und Steuern – Grundoperationen der Prozessleittechnik*, 2. Auflage, VCH, Weinheim
Head of Module	Prof. Dr.-Ing Helmut Hansmaier
Content	o Use of sensors in automation systems –various aspects o Automation and process control systems, construction and programming o Interaction of sensors, feedback control and actuators in automation systems

Name of Course	M7106:
Name	Robotics
Instructor	Prof. Dr.-Ing. H. Hansmaier
Module	M-23 Automation and Robotics
Curriculum	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Semester	7
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: attendance 60hrs, assignments 30hrs, exam preparation 30 hrs
Examination Requirement	Written exam. 90mins or oral 30mins
Final Grade	100% written or 100% oral
Language	German
Instruction Method	Lectures with integrated exercises
Media	OHP, data projector
Literature	Script
Head of Module	Prof. Dr.-Ing. H. Hansmaier
Content	o Construction types, areas of application of industrial robots (IR) o Kinematics and kinetics of IR o Coordinate transformation (forward transformation, reverse transformation) o Components of IR o Programming of IR o Control methods o Benchmarking values of IR o Simulation of IR o Safety aspects involved in IR

Module	M-24
Module Name	Power Electronics
Module Parts	M5107 Power Electronics
Curriculum:	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Credit points (ECTS)	5
Examination	Examination of complete Module Written 90 mins or oral 30 mins.
Head of Module	Prof. Dr.-Ing. Günther Keller
Recommended Prerequisites	M-07 Basic Principles of Electrical Engineering, M3106 Semiconductor Technology, M4106 Circuit Technology
Learning Objectives	○ Knowledge of the application of electronic circuit breakers ○ Ability to construct thermal power electronic circuits ○ Analysis and dimensioning of line-commutated and self-commutated converters ○ Ability to select appropriate power supply switching in accordance with application

Name of Course	M5107
Name	Power Electronics
Instructor	Prof. Dr.-Ing. Günter Keller
Module	M-24 Power Electronics
Curriculum	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Semester	5
Hours per week/Semester	4
Credit points (ECTS)	5
Time required	150hrs: attendance 60hrs, individual study 60hrs, exam preparation 30hrs
Examination Requirement	See Module
Final Grade	Se Module
Language	German
Instruction Method	Seminar instruction, practice exercises
Media	Writing on board, transparencies, data projector, simulation software, lecture script
Literature	Erickson R. W., Marksimovic D. (2001), *Fundamentals of Power Electronics*, 2. Auflage, Springer, Niederlande Mohan N., Undeland T.M., Robbins W.P. (2002), *Power Electronics*, 3. Auflage, Whiley, N.Y. Rashid M.H. (2001), *Power Electronics Handbook*, Academic Press, San Diego Kassagian J., Schlecht M., Verghese G. (1992), *Principles of Power Electronics*, Prentice Hall, New Jersey
Head of Module	Prof. Dr.-Ing. G. Keller
Content	○ Components of power electronics, cooling ○ Line-commutated converters: operating methods of circuit-breaking, commutation ○ Self-commutated converters: Basic circuits with chopper controller, pulse-controlled inverter circuits, generation of pulse pattern, dimensioning, loads, operating modes ○ Switch-mode power supplies: switching variants, electromagnetic compatibility, auxiliary circuits

Module	M-25
Module Name	Simulation Technology
Module Parts	M7107 Simulation Technology
Curriculum:	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Credit points (ECTS)	5
Examination	Examination of completed Module: Written: 90 mins or oral. 30 mins.
Head of Module	Prof. Dr. rer. nat. Stefan Schulte
Recommended Prerequisites	M-01 Mathematische Grundlagen, M-02 Höhere Mathematik
Learning Objectives	o Construction and solution of (mathematical) model o Students learn to formulate mathematical models for the solution of problems with typical mechatronic applications (esp. multi-body systems) and apply correctly the methodology established for this purpose o Learn the basic principles of numerical calculation o Solution of typical differential equations from engineering practice and ability to evaluate numerical solution methods in order to make a suitable choice. o Be able to make appropriate use of a simulation environment such as SIMULINK for the solution of mechatronic problems

Name of Course	M7107
Name	Simulation Technology
Instructor	Prof. Dr. rer. nat. Stefan Schulte
Module	M-25
Curriculum	Mechatronics (Bachelor)
Subject Major	Mechatronic Systems (MEC)
Semester	7
Hours per week/Semester	4 (3V+1P)
Credit points (ECTS)	5
Time required	150hrs: lectures 45hrs, simulation practical 15hrs, assignments and follow-up of lectures 60hrs, exam preparation 30hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Lectures with integrated exercises
Media	Writing on board in combination with script
Literature	Script
Head of Module	Prof. Dr. rer. nat. Stefan Schulte
Content	o Introduction to simulation, explanation of terms such as model, modelling error, solution error, hierarchic modelling etc. o Construction of model using examples of mechatronic systems, introduction of various modelling techniques o Basic principles and terminology of numerical calculation (eg. machine numbers, machine accuracy, round-off error (-analyses), stability of an algorithm) with examples o Numerical procedures for normal differential equations, examples with MATLAB, SIMULINK o Further procedures in numerics (esp. methods of elimination and iterative processes for linear equation systems, dealing with non-linear equation systems)

Module	M-26
Module Name	Optical Technologies
Module Parts	M5108 Optical Materials M5109 Optical Manufacturing Processes
Curriculum:	Mechatronics (Bachelor)
Subject Major	Optical Technology (OPE)
Credit points (ECTS)	8
Examination	The final Module grade results from the part-grades of the individual components, weighted with the ECTS-points
Head of Module	Prof. Dr.-Ing. Rolf Rascher
Requirements and Recommended Prerequisites	M3105 Technical Optics
Learning Objectives	○ Set out in the form of a lecture on basic principles, which allows the prospective mechatronic engineer to understand and assess the significance of modern manufacturing methods and the optical materials used, as well as the potential difficulties involved in their handling and in the construction of manufacturing facilities. ○ With the technical knowledge and expertise gained from this Module, the mechatronic engineer should be well equipped be able to carry through the optimum design and installation of production facilities required for a specific manufacturing task. ○ Special attention is paid to standard processes and materials as utilised the manufacture of optical components.

Name of Course	M5108

Name	Optical Materials
Instructor	Dipl.-Ing. Otto Maier
Module	M-26 Optical Technologies
Curriculum	Mechatronics (Bachelor)
Subject Major	Optical Technology (OPE)
Semester	5
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: 60 hrs. Attendance, 60 hrs prep/follow-up and exam preparation
Examination Requirement	Written exam 90mins or oral 30mins
Final Grade	Written100 % or oral 100%
Language	German
Instruction Method	Seminar instruction and exercises
Media	Lectures with visualisation
Literature	Various – reading list with script
Head of Module	Prof. Dr.-Ing. Rolf Rascher
Content	○ Selection of suitable optical materials with regard to the functionality of optical components and the pre-eminence of the Modules, which are manufactured from these. ○ The commercial success of an opto-mechatronic system depends ultimately on the choice of suitable materials. ○ The lectures should convey knowledge of materials and their properties in their technology and application. With this knowledge the student will be equipped to make a substantiated selection of materials. The respective qualities of specific materials will be discussed in relation to examples. ○ Particular importance will be placed upon the production of optical materials, their chacteristic behaviour in the processing of optical surfaces as well as selected procedures for material testing.

Name of Course	M5109
Name	Optical Manufacturing Processes
Instructor	Prof. Dr.-Ing. Rolf Rascher
Module	M-26 Optical Technologies
Curriculum	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Semester	5
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: 60 hrs. attendance, 60 hrs. Preparation and follow-up incl. exam prep.
Examination Requirement	Written exam 90mins or oral 30mins
Final Grade	Written100 % or oral 100%
Language	German
Instruction Method	Seminar instruction and exercises
Media	Lectures with visualisation
Literature	Various – reading list with script
Head of Module	Prof. Dr.-Ing. Rolf Rascher
Content	○ The manufacturing process is particularly significant in the production of high precision optical components. The lectures should convey knowledge of the technology and application of modern methods involved in optical manufacturing processes. ○ The basic calculations and the technological processes and properties underlying the manufacture will be discussed with specific reference to examples ○ The knowledge thus acquired and the technical understanding of the manufacturing processes should enable the student to select the manufacturing process according to commercial circumstances and to complete the appropriate production plan. ○ Special attention is given to the processes of grinding and polishing of optical surfaces as well as selected processes alongside shaping techniques and the associated metrology.

Module	M-27
Module Name	Optical System Components
Module Parts	M7108 Opto-electronics and Laser Technology 2 M7109 Optical Sensors and Metrology
Curriculum:	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Credit points (ECTS)	4
Examination	The final grade results from the part-grades of the Module components, weighted with the ECTS-points
Head of Module	Prof. Dr.rer. nat. Peter Sperber
Requirements and Recommended Prerequisites	M-01 Basic Principles of Mathematics M-02 Higher Mathematics, M-07 Basic Principles of Electrical Engineering, M-12 Applied Physics
Learning Objectives	○ Students should have extensive knowledge of the manipulation of light. This knowledge will enable them to understand many existing technical solutions in laser technology ○ After an initial training period, they will have the ability to co-operate themselves on new solutions ○ They should understand the theoretical basis of construction and light generation in opto-electronic semiconductor components and have knowledge of the structure und characteristics of the most important semi-conductor lasers and light diodes. ○ Understanding and application of optical principles in metrology. ○ Ability to evaluate metrological problems involved in optical sensors. ○ Ability to make application-oriented selection of measuring principles for specific tasks and to asses their potential use. ○ Detailed knowledge and understanding of applications for optical sensors and metrology ○ Understanding of opto-electronic systems, laser measurement and optical measurement.

Name of Course	M7108

Name	Opto-electronics and Laser Technology 2
Instructor	Prof. Dr. rer. nat. Franz Daiminger
Module	M-27 Optical System Components
Curriculum	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Semester	7
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: 60hrs attendance , 30hrs assignments, 30hrs exam preparation
Examination Requirement	Written exam 90mins or oral 30mins
Final Grade	Written 100 % or oral 100%
Language	German
Instruction Method	Lectures with integrated exercises and assignments
Media	Board, OHP, data-projector, demonstration items
Literature	Eichler J., Eichler H. J. (2006), *Laser*, 6. Auflage, Springer, Berlin Bludau W. (1995), *Halbleiter-Optoelektronik*, Fachbuchverlag Leipzig Schubert F. (2006), *Light Emitting Diodes*, 2. Auflage, Cambridge University Press
Head of Module	Prof. Dr. rer. nat. Franz Daiminger
Content	o Moduleation and deflection of light o Frequency selection in lasers o Mirrors and coatings o Frequency transformation (generation of sum- and difference-frequencies, generation of higher harmonic and other non-linear effects) o Radiative and non-radiative recombination in semiconductors o Semiconductor hetero-structures o Design of light diodes and semiconductor lasers o Parameters and characteristics of semiconductor lasers and light diodes o Special semiconductor lasers and light diodes o Ageing behaviour in opto-electronic semiconductor components o Micro-optics for diode lasers o Photo-detectors o Characterisation of rays

Name of Course	M7109

Name	Optical Sensors and Metrology
Instructor	Prof. Dr. Peter Sperber / Dr. Schötz
Module	M27 Optical System Components
Curriculum	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Semester	7
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120 hrs: attendance 60hrs; assignments 40hrs; exam prep. 20hrs
Examination Requirement	Written 90 mins or oral 30mins
Final Grade	Written100 % or oral 100%
Language	German
Instruction Method	Seminar instruction, exercises
Media	Writing on board, visualisation with data projector
Literature	Script
Head of Module	Prof. Dr. P. Sperber
Content	o Basic principles of particle and wave optics o Diffraction o Light sources and detectors o Holography o Opto-electronic distance measurement o Spectroscopy o Speckle methods o Polarisation and its uses o Optical fibres in metrology o Time-resolved measurements

Module	M-28

Module Name	Lighting Technology
Module Parts	M5110 Lighting Technology
Curriculum:	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Credit points (ECTS)	4
Examination	Examination of completed Module : Written 90 mins or oral 30 mins
Head of Module	Prof. Dr. rer. nat. Franz Daiminger
Recommended Prerequisites	M-01 Basic Mathematical Principles, M-02 Advanced Mathematics M-04 Basic Principles of Physics, M-07 Basic Principles of Electrical Engineering
Learning Objectives	o Understanding the theoretical principles of photometry and radiology o Knowledge of the most important types of lamp with their characteristics and applications. o Students are able to work independently in the laboratory on various measuring techniques and simulation software and to recognise their scope and their limitations o Students have sufficient basic knowledge to fully understand the datasheets of lamps and lights and to select these appropriately for a variety of specific needs

Name of Course	M5110

Name	Lighting Technology
Instructor	Prof. Dr. rer. nat. Franz Daiminger
Module	M-28 Lighting Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Semester	5
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: 60hrs attendancet, 30hrs assignments, 30 hrs exam preparation
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Lectures with integrated exercises, assignments
Media	Board, OHP, demonstration items
Literature	Hentschel H. J. (2001), *Licht und Beleuchtung*, 5. Auflage, Hüthig, Heidelberg Bergmann L., Schäfer C. (2004), *Optik*, 9. Auflage, Walter de Gruyter, Berlin, New York
Head of Module	Prof. Dr. rer. nat. Franz Daiminger
Content	○ Light and vision (light and radiation, structure of the eye, elementary visual processes) ○ Measurement systems in optical radiation (basic geometric principles, values and units in radiation physics , values and units in lighting technology, levels of effectiveness and efficiency) ○ Concept of visual performance (light density and adaptation, sensitivity to difference and shape, speed in sensitivity to difference and shape, glare) ○ Optical radiometry, measurement of light and colour (measurement of values in lighting technology, basic terminology of colour mixing and measurement, reproduction of colour) ○ Lighting technology (temperature radiation, gas discharge, light diodes, electrical supply)

Module	M-29

Module Name	Digital Image Processing
Module Parts	M7110 Digital Image Processing
Curriculum:	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Credit points (ECTS)	4
Examination	Examination of completed Module: Written 90 mins or oral 30 mins
Head of Module	Prof. Dr. rer. nat. Martin Jogwich
Requirements and Recommended Prerequisites	M-01 Basic Principles of Mathematics M-02 Higher Mathematics M3105 Technical Optics
Learning Objectives	o Basic knowledge of analogue image recording o Knowledge of digital image recording o Skills in image enhancing using technical equipment or software o Ability to use an image processing system o The student can estimate the effects of lighting on image quality

Name of Course	M7110

Name	Digital Image Processing
Instructor	Prof. Dr. rer. nat. Martin Jogwich
Module	M-29 Digital Image Processing
Curriculum	Mechatronics (Bachelor)
Subject Major	Optical Technologies (OPE)
Semester	7
Hours per week/Semester	4
Credit points (ECTS)	4
Time required	120hrs: attendance, lectures 45 hrs, practical 15hrs, individual study / follow-up / exam prep. 60 hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Lectures, workshop/practice exercises/ practical work
Media	Transparencies, board, Powerpoint script, data projector, image processing programmes, cameras, frame grabber cards, various lighting systems
Literature	Bässmann H., Kreyss J. (2004), *Bildverarbeitung Ad Oculos*, 14. Auflage, Springer, Berlin Demant C., Streicher-Abel B., Waszkewitz P. (1998), *Industrielle Bildverarbeitung*, Springer, Berlin Hermes T. (2005), *Digitale Bildverarbeitung*, Hanser, München Jähne B. (2005), *Digitale Bildverarbeitung*, 6. Auflage, Springer, Berlin Jähne B. et al. (1996), *Technische Bildverarbeitung - Maschinelles Sehen*, 10. Auflage, Springer, Berlin
Head of Module	Prof. Dr. rer. nat. Martin Jogwich
Content	○ Basic principles of image recording ○ Modern lighting technology ○ Optical images, light sensors, ○ Types of camera images ○ Data transfer and data compression ○ Basic principles of image processing

Module	M-30

Module Name	Business Studies
Module Parts	M7103 Business Studies
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	2
Examination	Examination of completed Module: Written. 90 mins or oral 30 mins.
Head of Module	Dr. Jutta Hübscher
Requirements and Recommended Prerequisites	---
Learning Objectives	o The Module should provide a comprehensive factual overview leading to a basic understanding of business topics and problems. o The student will thus build up a basic knowledge of the individual business disciplines that he can further develop during his course of study or as needed later on in his profession. o Alongside the technical content, this Module should therefore contribute to the acquisition of additional qualifications which will enable the student to undertake business-based tasks in projects, or leadership activities in middle management, thus assuming an “interface” function between the technical and the business side of a company.

Name of Course	M7103

Name	Business Studies
Instructor	Frau Dr. Jutta Hübscher
Module	M-30 Business Studies
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	7
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60 hrs: attendance 30 hrs, individual study incl. exam preparation: 30 hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Seminar instruction and exercises
Media	Script, writing on board, presentations
Literature	Wöhe G. (2005), *Einführung in die allgemeine Betriebswirtschaftslehre*, Vahlen, München Steven M. (2006), *BWL für Ingenieure*, Oldenbourg Verlag, München Schneider D. (2000), *Unternehmensführung und strategisches Controlling*, Hanser, München Thommen, J. P., Achleitner A. K. (2007), *Allgemeine Betriebswirtschaftslehre Arbeitsbuch*, 5. Auflage, Gabler, Wiesbaden Busse von Colbe W. (2007), *Betriebswirtschaft für Führungskräfte*, 3. Auflage, Schäffer-Poeschel, Stuttgart
Head of Module	Prof. Dr. Christian Lendner
Content	o The business process with participants o Basic principles of accounting o Cost calculation with exercises o Introduction to balancing of accounts and balance sheet analysis o Business finance options o Overview of legal forms and structures o Basic tax law o Basic principles of materials management and logistics o Introduction to market research and marketing o Basic definitions relating to human resource management and organisation o The most important principles of decision-making

Module	M-31
Module Name	Laser Processing Technology
Module Parts	M7104 Laser Processing Technology
Curriculum:	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	2
Examination	Examination of completed Module: Written 90 mins or oral 30 mins
Head of Module	Prof. Dr. Rosi Giedl-Wagner
Requirements and Recommended Prerequisites	M-12 Applied Physics, M-17 Materials and Manufacturing Processes
Learning Objectives	○ Basic knowledge of the characteristics of laser radiation, its spread and focusing. Understanding of the effect of laser radiation on materials and its utilisation for material processing ○ Basic knowledge of industrial lasers, their applications and laser manufacturing processes– latest technology

Name of Course	M7104
Name	Laser Processing Technology
Instructor	Prof. Dr. R. Giedl-Wagner
Module	M-31 Laser Processing Technology
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	7
Hours per week/Semester	2
Credit points (ECTS)	2
Time required	60hrs: Attendance: 30 hrs, individual study incl. exam preparation: 30 hrs
Examination Requirement	See Module
Final Grade	See Module
Language	German
Instruction Method	Lectures with exercises
Media	Data projector, board, exercises, demonstrations, simulations-SW
Literature	Eichler J., Eichler H. J. (2006), *Laser*, 6. Auflage, Springer, Berlin Poprawe R. (2005), *Lasertechnik für die Fertigung*, 17. Auflage, Springer, Berlin Beyer E. (1995), *Schweißen mit Laser*: Grundlagen, Springer, Berlin Beyer E. (1998), *Oberflächenbehandlung mit Laserstrahlung*, Springer, Berlin
Head of Module	Prof. Dr. R. Giedl-Wagner
Content	○ Construction and mode of operation of industrial lasers for manufacturing processes, as well as current innovations ○ Characteristics of the Gaussian beam: beam propagation, focusing, beam widening ○ Interactions – laser/material: absorption, transmission, reflection; heat conduction; laser-induced plasma; ○ Laser processing methods: cutting, welding, drilling, removing, inscribing, surface treatment in macro- and micro applications

Module	M-32
Module Name	Bachelor Module
Modulebausteine	M7101 Bachelor Thesis M7102 Bachelor Colloquium
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Credit points (ECTS)	2
Examination	The final grade of the Module results from the part-grades of the Module components, weighted with the ECTS-points
Head of Module	Prof. Dr.-Ing. Helmut Hansmaier
Zugangs- und empfohlene Voraussetzungen	
Learning Objectives	o Insight into topics, methods and ways of thinking of various subject areas in general science o Acquisition of key skills such as ability to work in a team, foreign languages, etc. o Ability to evaluate interdisciplinary or cross-curricular topics and their applications o Acquisition of intercultural and social skills o Ability to present and to defend a scientific paper

Name of Course	M7101
Name	Bachelor Thesis
Instructor	Professor in charge
Module	M-32 Bachelor Module
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	7
Hours per week/Semester	Supervision: ca. 0.2 hrs per week
Credit points (ECTS)	12
Time required	360hrs
Examination Requirement	Written thesis, no oral examination
Final Grade	See Module
Language	German, but the paper may be written in English by special arrangement with the supervisor.
Instruction Method	Independent study
Media	----
Literature	Depending on subject area
Head of Module	Prof. Dr.-Ing. Helmut Hansmaier
Content	Theoretical and /or experimental work towards the solution of practice-related problems

Name of Course	M7102
Name	Bachelor Colloquium
Instructor	----
Module	M-32 Bachelor Module
Curriculum	Mechatronics (Bachelor)
Subject Major	General
Semester	7
Hours per week/Semester	1
Credit points (ECTS)	2
Time required	30hrs
Examination Requirement	Oral presentation 20mins Written, poster
Final Grade	Presentation of thesis 50% Poster 50%
Language	German
Instruction Method	Seminar
Media	Lectures, presentation with data projector
Literature	Eco. U. (2007), *Wie man eine wissenschaftliche Abschlussarbeit schreibt*, 12. Auflage, UTB, Heidelberg Von Werder, L. (1995), *Grundkurs des wissenschaftlichen Schreibens*, Schibri-Verlag, Milow (Uckerland)
Head of Module	Prof. Dr.-Ing. Helmut Hansmaier
Vorkenntnisse	---
Content	o Preparation for writing Bachelor Thesis o Structure and written form of a scientific paper o Presentation, discussion and evaluation of progress o Final presentation and production of a poster