



## Module Catalogue for PO 2017

## Study Guide for International Mechatronics

Master of Science

academic year 22

Faculty of Mechanical Engineering Faculty of Electrical Engineering and Computer Science Fakultät für Maschinenbau Fakultät für Elektrotechnik und Informatik



# **Study Guide**

for

International Mechatronics

With the degree

Master of Science

## Summer Term 2022

This Study Guide is also available at: http://www.mechatronik.uni-hannover.de/

#### Impressum

#### Herausgeber

#### Gottfried Wilhelm Leibniz Universität Hannover

Prof. Dr.-Ing. B. Ponick für die Fakultät für Elektrotechnik und Informatik Prof. Dr. M. Becker für die Fakultät für Maschinenbau

Sachbearbeitung:	DiplIng. Claudia Wonnemann / Lena Renken, M. Sc.
Studiensekretariat:	Frau Gabriele Schnaidt

Adresse: An der Universität 1, 30823 Garbsen Telefon: +49 (0)511 762-19656 E-Mail: mailbox@mec.uni-hannover.de

Redaktionelle Mitarbeit / Layout

Jördis Samland

#### Introduction

### Dear Student,

You are holding the course and module catalogue for the M.Sc. International Mechatronics pro-gramme. This degree programme crosses borders. Mechatronics itself is an interdisciplinary field which unites knowledge and skills from the disciplines of mechanical, electrical and information engineering. It allows these technologies to be combined and integrated, providing benefit in daily life.

Each student writes a project report, building upon their scientific and research work. This provides them with the skills necessary for the completion of their final master's degree thesis. The defence of the thesis, like the rest of the course, takes place in English.

The Teaching Office (*Studiendekanat*) is pleased to offer advice regarding the planning and organisation of your studies. Leibniz Universität Hannover also provides help with a wide range of student issues. Do not hesitate to take advantage of this assistance. Additionally, support can be found with experienced student representatives (at the *Fachschaftsrat*) and with the research associates of the various University Institutes.

We wish you every success.

Prof. Dr.-Ing. B. Ponick, Faculty for Electrical and Information Engineering, Leibniz Universität Hannover

Prof. Dr. M. Becker, Faculty for Mechanical Engineering, Leibniz Universität Hannover

### **General information**

This course and module catalogue details all courses and modules within the International Mechatronics programme. It has been carefully prepared by the teaching offices of the participating establishments, assisted by the University Institutes and module leaders. Each module consists of several courses, and it is the responsibility of each student to ensure that their course selection meets the requirements of their chosen modules.

The Leibniz Universität Hannover Mechatronics programme website http://www.mechatronik.uni-hannover.de/ provides detailed information regarding mechatronics programmes and the 2012 Examination Regulations. It also offers a variety of insights into the activities of the Faculties. Important information and news can be found on the website of the Mechatronics Student Council (http://www.fmec.uni-hannover.de/).

The Master of Science (M.Sc.) degree provides students with a higher professional qualification. Entry to a master's degree programme requires either a Bachelor of Science degree in an engineering subject, a Bachelor of Engineering degree, or a comparable degree. Further information can be found in the Admission Regulations. A master's degree programme normally lasts for 4 semesters.

#### Examinations

The examinations associated with the individual courses are held during the lecture-free period of each semester. Students should normally take a course and sit the corresponding examination in the same semester. Most examinations can be repeated, if necessary, in each semester. ECTS credit points are awarded for the successful completion of all courses, laboratory exercises, internships and design projects. The overall grade awarded for a module depends on the credit points and grades achieved for the component courses. On completion of the degree, both the overall grade awarded and the grades for specialist fields are derived from the module grades.

#### **Credit points**

When a student passes an examination, ECTS credit points will be awarded in addition to a grade. It is intended that 1 credit point corresponds to 30 hours of study. To successfully complete the master's degree programme, 120 credit points are required.

#### Structure and content of the programme

The two key aspects of the programme's content are a theoretical education, which is provided by lectures and exercises, and practical training offered by experimental work, independent projects and internships.

If a student has already covered the content of individual obligatory courses as part of their bachelor's degree, it may be possible to substitute optional courses for these obligatory courses. Decisions regarding such substitutions will be taken on a case-by-case basis by the Examination Board in consultation with the relevant lecturers. Before a student is allowed to begin work on their six-month master's degree project and thesis, all remaining academic work must be completed and the student must have passed the preliminary examination (*Vorprüfung*).

#### Grading

Credit points are available for all successfully completed courses, laboratory exercises, design projects and internships. If a module consists of several graded components, the overall grade awarded will be a weighted average of the individual grades, with the weighting proportional to the number of credit points available for each component. The overall grade for the degree programme will be a weighted average of the module grades, with the weighting representing the available credit points in the same way.

#### **Registration for course examinations**

Registration for all examinations within the bachelor's and master's degree programmes takes place online. Registration periods will be announced in good time by the Examination Office, both online and on a notice board. The Examination Office publishes a list of candidates and passes this list on to the Institutes. Students must check the list to ensure that their examination registrations have been successful. Each student is free to decide which and how many examinations they wish to take in a given semester.

#### Withdrawal from an examination

Withdrawal from an examination for which a student has registered is possible until directly before the start of the examination. A student wishing to withdraw should speak to the relevant examiner directly.

If a student does not begin to take a particular examination, they will be automatically withdrawn by the Examination Office. Such students are not necessarily required to take the examination at a later date. However, once a student has taken an examination, they must pass this examination before completing their studies.

#### **Examination failure**

Within the programme, module examinations are assigned to various specialist fields. A module is considered to have been passed when all required credit points have been gained.

On average, a student must achieve 30 credit points per semester. At a minimum, 15 credit points much be achieved. If a student achieves fewer than 15 credit points in a semester, they are deemed to have failed the general examination. This can lead to expulsion from the University. On application, an academic hearing with representatives of the Examination Board may be granted. Further details can be obtained from the leaflet concerning the academic hearing process (Anhörungsverfahren), or from the Teaching Office.

#### Continuous assessment

During the semester, certain assignments (*Teilprüfungen*) may be completed for credit. These can include homework, written tests and oral examinations. Participation is optional and the number of credit points available will be announced by the examiner at the start of the semester. In this case, the examination will consist of these assignments together with a final examination.

#### Student advice

A representative offering specialist student advice in mechatronics can be reached using the e-mail address mailbox@mec.uni-hannover.de.

### **Master of Science**

### International Mechatronics

Image: Software Development Technology     Scientific Discourse (3 CP)     Compulsory elective courses, in total 15 CP       3     (6 CP)       4     Pass-fail test       5     Fistory and Methodology of Science (3 CP)     Knowledge and Knowledge (4 CP) Writter Examination Course work     - Other And Nano Systeme (5CP) - Pass-fail test (5CP) - Pass-fail test (5CP) - Pass-fail test (5CP) Writter Knowledge (5CP) Writter Knowledg		1. Semester / St. Petersburg (WiSe)	2. Semester / St. Petersburg (SuSe)	3. Semester / Hannover (WiSe)	4. Semester / Hannover (SuSe)
2     Software Development Technology (S CP)     Scientific Discourse (3 CP)     courses, in total 15 CP -Production of opp-dectorole (3 CP)       3     Foreign Language in Professional Activity (4 CP)     Knowledge Engineering (3 CP)     courses, in total 15 CP -Production of opp-dectorole (4 CP)       4     Pass-fail Test     Management (4 CP)     -Data: and Learning-Based Management (4 CP)       7     Foreign Language in Professional Activity (4 CP)     Cognitive Multiagent Systems (4 CP)     -Context CP)       11     Written Examination Course work     Cognitive Multiagent (4 CP)     -Fundamentals and Course work       13     Neuroinformatics and Vertices and Modeling of Digital Devices (5 CP)     -Pass-fail test       13     Neuroinformatics (4 CP)     Pass-fail test       14     Methods of Optimisation and Decision Making (5 CP)     Software Development Technology (5 CP)       17     Methods of Optimisation and Decision Making (5 CP)     Introduction Practice (6 CP)       22     Intelligent Systems (5 CP)     Project Management (4 CP)       23     Intelligent Systems (5 CP)     Project Management (4 CP)       24     Research Methods (5 CP)     Project Management (6 CP)       23     Intelligent Systems (5 CP)     Project Management (4 CP)       24     Research Methods (5 CP)     Project Management (5 CP)       25     Research Methods (5 CP)       26     Pro	1	(1100)	(0000)	Compulsory elective	
2     Software Development Technology (6 CP)     (3 CP) Grading Test     - Production of opti-electronic Systems (3CP)       4     History and Methodology of Science (3 CP)     Knowledge mand Knowledge Management (4 CP)     - Optical Measurement Technology (5 CP)       6     History and Methodology of Science (3 CP)     Vritten Examination Cognitive Multiagent Systems (4 CP)     - Production of upti-electronic Systems (6 CP)       7     Prosisional Activity (4 CP)     Cognitive Multiagent Systems (4 CP)     - Findamentas and Configuration of Laser Beam Succes (5CP)       12     Neuroinformatics and Modeling of Digital Devices (4 CP)     Devices (6 CP)       13     Neuroinformatics and (4 CP)     Written Examination Course work       14     Neuroinformatics and (4 CP)     Written Examination Course work       15     Written Examination Course work     Software Development Technology (5 CP)       16     Project Insistion (5 CP)     Aspects of Process Design in Forming (5 CP)       17     Methods of Optimisation and Decision Making 19     Introduction Practice (6 CP)       26     Intelligent Systems (6 CP)     Project Management (4 CP)       28     Research Methods (4 CP)     Project Management (4 CP)       28     Research Methods (4 CP)     Project Management (4 CP)       29     Report     Project Management (4 CP)       29     Report       20     Software Development (4 C	-		Scientific Discourse	courses, in total 15 CP	
3     Technology     Grading lest     Systems (CP)     -       4     Pass-fail test     Knowledge Engineering Management (4 CP)     - Otta - and Learning-Based       6     History and Methodology of Science (3 CP)     Written Examination     - Otta - and Nearvernet Trades sequence analysis       7     Foreign Language in Professional Activity (4 CP)     Written Examination     Systems (4 CP)       11     Protessional Activity (4 CP)     Written Examination     Grading of Digital Professional Activity (4 CP)       12     Neuroinformatics and (4 CP)     High-level Synthesis and Modeling of Digital Devices     - New Feberonics (6CP)       13     Neuroinformatics and (4 CP)     Software Development Course work     - New Feberonics (6CP)       14     Neuroinformatics and (4 CP)     Software Development Course project     - New Feberonics (6CP)       14     Neuroinformatics and (4 CP)     Software Development Course work     Aspects of Process Design in Forming Technology (6 CP)       17     Methods of Optimisation Course work     Introduction Practice (6 CP)     Aspects of Process Design in Forming Technology       20     Pass-fail Test     Project Management (4 CP)     Project Management (4 CP)       21     Intelligent Systems (4 CP)     Project Thesis based on scientific and research work (5 CP)       23     Intelligent Systems (4 CP)     Project Thesis based on scientific and research work (5 CP)	2	Software Development	(3 CP)	- Production of opto-electronic	
-     (5 CP) Pass-fail test     - <td< td=""><td>3</td><td>Technology</td><td>Grading Test</td><td>Systems (5CP)</td><td></td></td<>	3	Technology	Grading Test	Systems (5CP)	
4     Pass-fail test     Knowledge Engineering and Knowledge     Correl (6C9) - Optical Masurement (4 CP)     - Optical Masurement Technology (5 CP) - Engineering Dynamics and (4 CP)       7     Methodology of Science (3 CP) Pass-fail Test     Written Examination       9     Poreign Language in Professional Activity (4 CP)     Written Examination Course work     More- and Nuo Systems (5 CP) - Fundamentals and Course work     More- and Nuo Systems (5 CP) - Fundamentals and Course work     Master's Thesis (30 CP)       11     Written Examination Course work     High-level Synthesis and Modeling of Digital Devices (4 CP)     Sources (5 CP) Prass-fail test Course project     - Master's Thesis (30 CP)       13     Neurotechnologies (6 CP)     Software Development Technology (6 CP)     Aspects of Process (5 CP)     Master's Thesis (30 CP)       14     Methods of Optimisation and Decision Making Theory (6 CP)     Software Development Technology (6 CP)     Aspects of Process (5 CP)       17     Methods of Optimisation and Decision Making Theory (6 CP)     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Project Thesis based on scientific and research work (5 CP)       28     Research Methods (4 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       29     Report     Project Thesis based on scientific and research work (5 CP)     Softwara scientific and research work (5 CP) </td <td>-</td> <td>(5 CP)</td> <td></td> <td>- Data- and Learning-Based</td> <td></td>	-	(5 CP)		- Data- and Learning-Based	
S     and Knowledge Management (4 CP)     -Optical Messurement Technology (5 CP)       B     History and Methodology of Science (3 CP)     -Optical Messurement Technology (5 CP)       B     Poreign Language in Professional Activity (4 CP)     Written Examination Course work     -Optical Messurement Technology (5 CP)       10     Professional Activity (4 CP)     -Optical Messurement Systems (4 CP)     -Optical Messurement Technologies (4 CP)       11     Neuroinformatics and Neurotechnologies (4 CP)     -Optical Messurement Systems (4 CP)     -Optical Messurement Technology       13     Neuroinformation Course work     Software Development Technology (5 CP)     -Optical Messurement Software Development Technology (5 CP)       14     Methods of Optimisation Course work     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       17     Methods of Optimisation (6 CP)     Introduction Practice (6 CP)     Aspects of Process Design in Forming Technology Written/Oral Examination     Master's Thesis (30 CP)       22     Intelligent Systems (6 CP)     Introduction Practice (6 CP)     Project Thesis based on scientific and research work (5 CP)       23     Intelligent Systems (6 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       24     30     30	4	Pass-fail test	Knowledge Engineering	Control (5CP)	
Image ment (3 CP)     Manage ment (4 CP)     Technology (5 CP) - Engineering Dynamics and Virten Examination       9     Poresign Language in Poresign Language in (4 CP)     Cognitive Multiagent (4 CP)     - Huge sequence analysis (6 CP)       11     Poresign Language in (4 CP)     Cognitive Multiagent (4 CP)     - Huge sequence analysis (6 CP)       11     Poresign Language in (4 CP)     Mitten Examination Course work     - Huge hereins and Configuration of Laser Beam Sources (5CP)       13     Neuroinformatics and Neurotechnologies (4 CP)     High-level Synthesis and (4 CP)     - How effectionics (5CP)       15     Written Examination Course work     - New reflectionics (5CP)     - How effectionics (5CP)       16     Course work     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       17     Methods of Optimisation and Decision Making     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Project Management (4 CP)       21     Intelligent Systems (6 CP)     Project Management (4 CP)     Project Management (4 CP)       23     Intelligent Systems (6 CP)     Project Management (4 CP)     Project Management (4 CP)       23     Intelligent Systems (6 CP)     Project Management (4 CP)     Project Management (5 CP)       23     Corporate Information 33<	5		and Knowledge	<ul> <li>Optical Measurement</li> </ul>	
6 7 Methodology of Science (3 CP)     (4 CP) Pass-fail Test     - Engening Dynamics and Vibrations (3CP)     - Engening Dynamics and Vibrations (3CP)       9 Foreign Language in 10 Professional Activity (4CP)     - Cognitive Multiagent Systems (4CP)     - Engening Dynamics and Vibrations (3CP)     - Engening Dynamics and Vibrations (3CP)       11 Vitten Examination     - Cognitive Multiagent Systems (4CP)     - Cognitive Multiagent Systems     - Engening Dynamics and Vibrations (3CP)     - Marce and Nano Systems (5CP)       11 Vitten Examination     - Course Work     - Course Work     - Engeneration of Laser Beam Sources (5CP)     - Physics of ultrasound and its applications (5CP)       13 Neuroinformatics and (4CP)     - Engeneration of Course Project     - Physics of Urtasound and its applications (5CP)       17 17 18 Methods of Optimisation and Decision Making 19 18 20 22 21 22 23 10telligent Systems (6 CP)     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       23 24 25 26 26 27 28 28 29 30 30 31 32 33 33 33 33 33 33 34 34 34 34 34 34 34			Management	Technology (5 CP)	
Pass-fail Test     Written Examination     Vibrations (SCP)       9     Foreign Language in Professional Activity (4CP)     Cognitive Multiagent (4 CP)     - mage sequence analysis (5CP)       11     Professional Activity (4CP)     Written Examination Course work     - Foreign Language (4CP)     - Foreign Language (4CP)       11     Neuroinformatics and Neurotechnologies (4CP)     High-level Synthesis and (4 CP)     - Fow effectionics (SCP)       13     Neurotechnologies (4CP)     Posices (4 CP)     - Fow effectionics (SCP)       14     Neurotechnologies (4CP)     Posices (4 CP)     - Fow effectionics (SCP)       15     Written Examination Course work     - Fow effectionics (SCP)       16     Course work     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)       21     Intelligent Systems (1 CP)     Project Management (4 CP)     Foreign Examination       22     Intelligent Systems (1 CP)     Project Management (4 CP)     Foreign Examination       23     Intelligent Systems (1 CP)     Project Thesis based on scientific and research work (5 CP)       33     Corporate Information Systems (4 CP)     Project Thesis based on scientific       33	6	History and	(4 CP)	- Engineering Dynamics and	
Image sequence analysis       I	7	Methodology of Science	Written Examination	Vibrations (5CP)	
a     Pass-fail lest     Cognitive Multiagent Systems     (CCP)       9     Foreign Language in Professional Activity (4CP)     Written Examination Course work     (CCP)       11     Written Examination (4CP)     Fundamentals and Configuration of Laser Beam Sources (SCP)     - Fundamentals and Configuration of Laser Beam Sources (SCP)       12     Neuroinformatics and Neurotechnologies (4 CP)     Boyless fail test     - Power Bectronics (SCP)       13     Neurotechnologies (4 CP)     Pass-fail test     - Power Bectronics (SCP)       14     Written Examination Course work     Software Development Course project     Aspects of Process Design in Forming Technology (5 CP)       17     Methods of Optimisation and Decision Making 19     Software Development Course work     Aspects of Process Design in Forming Technology (5 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Drives (5 CP)       21     Intelligent Systems (5 CP)     Introduction Practice (6 CP)     Project Management (6 CP)       22     Intelligent Systems (4 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       23     Research Methods (4 CP)     Project Information Systems (4 CP)*     Project Information Systems (4 CP)*       31     2     30     34     30     30		(3 CP)		<ul> <li>Image sequence analysis</li> </ul>	
9     Foreign Language in Professional Activity (4 CP)     Systems (4 CP)     - Ware- and Nano Systems (5C)       11     Written Examination (4 CP)     - Ware- and Nano Systems (5C)     - Fundamentals and Configuration of Laser Beam Sources (5CP)       13     Neuroinformatics and Meurotechnologies (4 CP)     High-level Synthesis and Modeling of Digital Devices (4 CP)     - Pwer Bectronics (5CP)       14     Neurotechnologies (4 CP)     High-level Synthesis and Modeling of Digital Devices (4CP)     - Pwer Bectronics (5CP)       15     Written Examination Course work     Course project     - Pwer Bectronics (5CP)       17     Methods of Optimisation and Decision Making Theory (5 CP)     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (6 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)       23     Intelligent Systems (5 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       28     Project Management (4 CP)     Project Thesis based on scientific       29     Report     Project Management (4 CP)     Project Thesis based on scientific       31     Corporate Information Systems (4 CP)'     Project Thesis based on scientific       33     Corporate Information Systems (4 CP)'     Software CP)'       34     30     30	8	Pass-fail Test	Cognitive Multiagent	(5CP)	
Foreign Language in Professional Activity (4CP)(4 CP) Written Examination Course work(5 CP) - Fundamentals and Configuration of Laser Beam Sources (5CP)11Written Examination Provises of utrasound and its applications (5 CP)- Prover Bectronics (5 CP) - Prysises of utrasound and its applications (5 CP)13Neuroinformatics and (4 CP) Written Examination Course work- Prover Bectronics (5 CP) - Prysises of utrasound and its applications (5 CP)14Neuroinformatics and (4 CP) (4 CP)Software Development Course project- Prover Bectronics (5 CP) - Prysises of utrasound and its applications (5 CP)17Written Examination Course workSoftware Development Technology (5 CP)Aspects of Process Design in Forming Technology (5 CP)18Methods of Optimisation and Decision Making 19Introduction Practice (6 CP) ReportSoftware Development Course workAspects of Process Design in Forming Technology (5 CP)22Intelligent Systems (6 CP) Written Examination Course workIntroduction Practice (6 CP) ReportProject Management (4 CP) ReportProject Management (5 CP)28Research Methods (4 CP) ReportProject Management (4 CP) ReportProject Management (5 CP)31Corporate Information Systems (4 CP)* Pass-fail testCorporate Information Systems (4 CP)* Pass-fail test3320343030	9		Systems	<ul> <li>Micro- and Nano Systems</li> </ul>	
10       Professional Activity (4CP)       Written Examination Course work       -Fundamentals and Course work         11       Written Examination       -Goriguration of Laser Beam Sources (5CP)       -Power Bectronics (5CP)         13       Neurotechnologies (4 CP)       Pass-fail test       Project Bectronics (5CP)         15       Written Examination Course work       Software Development Technology (5 CP)       Press-fail test         19       Theory (5 CP)       Software Development Technology (5 CP)       Aspects of Process Design in Forming Technology (5 CP)       Master's Thesis (30 CP)         20       Pass-fail Test       Introduction Practice (6 CP) Report       Electrical Machines and Drives (5 CP)       Master's Thesis (30 CP)         21       Intelligent Systems (5 CP)       Introduction Practice (6 CP) Report       Project Thesis based on scientific and research work (5 CP)         23       Intelligent Systems (4 CP)       Project Management (4 CP)       Project Thesis based on scientific and research work (5 CP)         31       Corporate Information Systems (4 CP) + Pass-fail test       Project Thesis based on scientific and research work (5 CP)         33       Corporate Information Systems (4 CP) + Pass-fail test       Sol         34       30       30		Foreign Language in	(4 CP)	(5CP)	
11     Written Examination     Course work     Configuration of Laser Beam Sources (5CP)       13     Neuroinformatics and Modeling of Digital Devices (4CP)     Power Electronics (5CP)       14     Neuroinechnologies (4CP)     Pass-fail test Course project     Written course work       15     Written Examination Course work     Software Development Technology (5 CP)     Master's Thesis (30 CP)       17     Methods of Optimisation and Decision Making (5 CP)     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)       21     Intelligent Systems (5 CP)     Introduction Practice (6 CP)     Froject Thesis based on scientific and research work (5 CP)       23     Intelligent Systems (5 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       24     Vritten Examination     Corporate Information Systems (4 CP) * Pass-fail test     Project Thesis based on scientific and research work (5 CP)       33     Corporate Information Systems (4 CP) * Pass-fail test     Software complete	10	Professional Activity	Written Examination	<ul> <li>Fundamentals and</li> </ul>	
12     Written Examination     High-level Synthesis and Modeling of Digital Devices (4 CP)     -Pow er Bectronics (5CP)       13     Neuroinformatics and Neurotechnologies (4 CP)     -Pow er Bectronics (5CP)       15     Written Examination Course work     Pass-fail test Course project     -Pow er Bectronics (5CP)       16     Course project     Examination     Master's Thesis (30 CP)       17     Methods of Optimisation and Decision Making     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)       20     Pass-fail Test     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP)       21     Intelligent Systems (5 CP)     Introduction Practice (6 CP)     Froject Thesis based on scientific and research work (5 CP)       23     Research Methods (4 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       24     Corporate Information Systems (4 CP) * Pass-fail test     Corporate Information Systems (4 CP) * Pass-fail test       33     Corporate Information Systems (4 CP) * Pass-fail test     30	11	(4CP)	Course work	Configuration of Laser Beam	
12       High-level Synthesis and Modeling of Digtal       -Pow er Bectronics (SCP)         13       Neurotechnologies (4CP)       -Pow are Bectronics (SCP)         14       Neurotechnologies (4CP)       Written Examination Course work       -Pow are Bectronics (SCP)         16       Written Examination Course work       Pass-fail test Course work       Written or Oral Examination       Master's Thesis (30 CP)         17       Methods of Optimisation and Decision Making Theory (5 CP)       Software Development Technology (5 CP)       Aspects of Process Design in Forming Technology (5 CP)       Master's Thesis (30 CP)         20       Pass-fail Test       Introduction Practice (6 CP)       Electrical Machines and Drives (5 CP)         24       Written Examination (5 CP)       Introduction Practice (6 CP)       Froject Thesis based on scientific and research work (5 CP)         25       Research Methods (4 CP)       Project Management (4 CP)       Project Thesis based on scientific and research work (5 CP)         28       Research Methods (4 CP) * Pass-fail test       Corporate Information Systems (4 CP) * Pass-fail test       Software Development Technology         31       32       30       34       30       30		Written Examination		Sources (5CP)	
13     Neuroinformatics and Neurotechnologies (4CP)     Modeling of Digital Devices (4CP)     -Physics of ultrasound and its applications (5 CP)       15     Written Examination Course work     Pass-fail test Course project     -Physics of ultrasound and its applications (5 CP)       16     Written Examination Course work     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       19     Theory (5 CP)     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)       20     Pass-fail Test     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP)       21     Intelligent Systems (5 CP)     Introduction Practice (6 CP)     Project Thesis based on scientific and research work (5 CP)       23     Research Methods (4 CP)     Project Management (4 CP)     Project Management (4 CP)       23     Research Methods (4 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       31     32     Corporate Information Systems (4 CP)*     Project Thesis based on scientific and research work (5 CP)       33     Corporate Information Systems (4 CP)*     30     30	12		High-level Synthesis and	- Pow er Electronics (5CP)	
Neuroinformatics and Neurotechnologies (4 CP)     Devices applications (5 CP)     maplications (5 CP)       15     Written Examination Course work     Course project     Written or Oral Examination       16     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       19     Theory (5 CP)     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       20     Pass-fail Test     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP)     Mitten Coral Examination       22     Intelligent Systems (5 CP)     Introduction Practice (6 CP)     Project Thesis based on scientific and research work (5 CP)       24     Research Methods (4 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       29     Report     Corporate Information Systems (4 CP) * Pass-fail test     Software Development Corporate Information Systems (4 CP) * Pass-fail test       31     32     30     34     30     30	13		Modeling of Digital	- Physics of ultrasound and its	
14     Neurotechnologies (4CP)     (4CP)     Pass-fail test Course project     Written or Oral Examination     Master's Thesis (30 CP)       16     Written Examination Course work     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       17     Methods of Optimisation and Decision Making     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     Design in Forming Technology (5 CP)     Master's Thesis (30 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)     Project Management (6 CP)       21     Intelligent Systems (5 CP)     Project Management (4 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       28     Research Methods (4 CP)     Project Information Systems (4 CP) * Pass-fail test     Project Information Systems (4 CP) * Pass-fail test       31     32     33     34     30     30		Neuroinformatics and	Devices (4 CP)	applications (5 CP)	
Image: Course work     Project Management (4 CP)     Project Management (5 CP)     Master's Thesis (30 CP)     Master's Thesis (30 CP)       17 17 18 18 19 19 19 19 19 19 19 19 20 20 20 20 21 22 21 22 21 22 23 24 22 23 24 22 24 22 24 22 24 22 24 25 26 26 26 26 27 28 28 24 27 28 28 29 29 29 29 29 20 29 20 20 20 20 20 20 20 20 20 20 20 20 20	14	Neurotechnologies	(4 CP) Pass-fail test	Written or Oral	
Image: Course work     Examination     Examination       16     Course work     Software Development Technology (5 CP)     Aspects of Process Design in Forming Technology (5 CP)     (30 CP)       19     Theory (5 CP)     Written Examination Course work     Aspects of Process Design in Forming Technology (5 CP)     (30 CP)       20     Pass-fail Test     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)     Introduction Practice (5 CP)       21     Intelligent Systems (5 CP)     Introduction Practice (6 CP)     Electrical Machines and Drives (5 CP)       24     Vritten Examination     Project Thesis based on scientific and research work (5 CP)       27     Research Methods (4 CP)     Project Management (4 CP)       29     Report     Project Information Systems (4 CP)*       30     34     30     30       31     32     34     30     30       33     34     30     30     30	15	(4CP)	Course project		
16       Course work       Software Development Technology (5 CP)       Aspects of Process Design in Forming Technology (5 CP)       Aspects of Process Design in Forming Technology (5 CP)         20       Pass-fail Test       Introduction Practice (6 CP)       Belectrical Machines and Drives (5 CP)         21       Intelligent Systems (5 CP)       Introduction Practice (6 CP)       Electrical Machines and Drives (5 CP)         24       Written Examination       Project Thesis based on scientific and research work (5 CP)         26       Project Thesis based on scientific and research work (5 CP)         27       Research Methods (4 CP)       Project Management (4 CP)         29       Report       Corporate Information Systems (4 CP) * Pass-fail test         31       32       34       30       30         31       32       34       30       30	10	Course work		Examination	Master's Thesis
17     Methods of Optimisation and Decision Making 19     Software Development Technology (5 CP) Pass-fail Test     Aspects of Process Design in Forming Technology (5 CP) Written/Oral Examination       20     Pass-fail Test     Introduction Practice (6 CP) Written Examination     Electrical Machines and Drives (5 CP) Written/Oral Examination       21     Intelligent Systems (5 CP) Written Examination     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP)       24     Written Examination     Project Management (4 CP) Report     Project Thesis based on scientific and research work (5 CP)       28     Research Methods (4 CP) Report     Project Information Systems (4 CP) * Pass-fail test       31     32       33     34     30       34     30     30	16	Course work			(30 CP)
Image: Second	17		Software Development	Aspects of Process	
Interfluence     Methods of optimisation and Decision Making Theory (5 CP)     (5 CP) Written Examination Course work     Technology (5 CP)       20     Pass-fail Test     Introduction Practice (6 CP) Written/Cral Examination     Electrical Machines and Drives (5 CP)       21     Intelligent Systems (5 CP)     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP)       24     Vritten/Examination     Project Thesis based on scientific and research work (5 CP)       27     Research Methods (4 CP)     Project Management (4 CP)       29     Report     Project Information Systems (4 CP) * Pass-fail test       31     32     33       33     34     30		Marth a da a Constitucionation	Technology	Design in Forming	
19     Theory (5 CP) Pass-fail Test     Written Examination Course work     (5 CP) Written/Oral Examination       21     Intelligent Systems (5 CP) Written Examination     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP) Written/Oral Examination       23     Intelligent Systems (5 CP) Written Examination     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP)       24     Written Examination     Project Thesis based on scientific and research work (5 CP)       27     Research Methods (4 CP) Report     Project Thesis based on scientific and research work (5 CP)       30     Corporate Information Systems (4 CP)* Pass-fail test     Solution 30       31     Corporate Information Systems (4 CP)* Pass-fail test     30       33     34     30     30	18	and Decision Making	(5 CP)	Technology	
13     Intervention       20     Pass-fail Test       21     Intelligent Systems (5 CP) Written Examination     Introduction Practice (6 CP) Report       24     Written Examination       25     Project Management (4 CP) Report       28     Research Methods (4 CP) Report       29     Report       30     34       31     32       33     34	10	Theory	Written Examination	(5 CP)	
20       Pass-fail Test         21       Intelligent Systems (5 CP) Written Examination       Introduction Practice (6 CP) Report       Electrical Machines and Drives (5 CP) Written/Oral Examination         24       Written Examination       Project Management (4 CP) Report       Project Thesis based on scientific and research work (5 CP)         29       Research Methods (4 CP) Report       Project Management (4 CP) Report       Project Thesis based on scientific and research work (5 CP)         31       31       Corporate Information Systems (4 CP)* Pass-fail test       Solution (4 CP)         132       33       34       30       30         14       30       34       30       30	13	(5 CP)	Course work	Written/Oral Examination	
21     Intelligent Systems (5 CP) Written Examination     Introduction Practice (6 CP) Report     Electrical Machines and Drives (5 CP) Written/Oral Examination       25     Project Management (4 CP) Report     Project Management (4 CP) Report     Project Thesis based on scientific and research work (5 CP)       30     31       31     Corporate Information Systems (4 CP)* Pass-fail test       12     30       34     30       35     34       36     30	20	Pass-fail Test			
22       Intelligent Systems (5 CP)       Introduction Practice (6 CP)       Electrical Machines and Drives (5 CP)         24       Written Examination       Project Management (4 CP)       Project Thesis based on scientific and research work (5 CP)         28       Research Methods (4 CP)       Project Information Systems (4 CP)       Project Thesis based on scientific and research work (5 CP)         30       31       Corporate Information Systems (4 CP) *       Pass-fail test         33       34       30       30	21				
22       Intelligent Systems (5 CP)       Introduction Practice (6 CP)       Electrical Machines and Drives (5 CP)         24       Written Examination       Project Management (4 CP)       Project Thesis based on scientific and research work (5 CP)         28       Research Methods (4 CP)       Project Management (4 CP)       Project Project Management (5 CP)         30       31       Corporate Information Systems (4 CP) *       Project Project Management (5 CP)         31       32       Corporate Information Systems (4 CP) *       Project Project Management (4 CP) *         33       34       Additional Project Management (5 CP)       Additional Project Proj	21				
23     Intelligent Systems (5 CP) Written Examination     Introduction Practice (6 CP) Report     Drives (5 CP) Written/Oral Examination       25     Project Management (4 CP) Report     Project Thesis based on scientific and research work (5 CP)       29     Research Methods (4 CP) Report     Project Management (4 CP) Report       31     Corporate Information Systems (4 CP)* Pass-fail test       33     34     30       34     30     30	22			Electrical Machines and	
23     Intelligent Systems (5 CP)     Intelligent S	23	Intellinent Oresterne	Introduction Practice	Drives	
24     Written (3 CF)     Report     Written/Oral Examination       25     Project Management (4 CP)     Project Management (4 CP)     Project Thesis based on scientific and research work (5 CP)       30     31       31     Corporate Information Systems (4 CP)*       33     (4 CP)*       34     30       35     34       4     30       34     30       35     34       36     30	20	Intelligent Systems	(6 CP)	(5 CP)	
25     26       27     Research Methods       28     (4 CP)       29     Report       30     (4 CP)       31     Corporate Information Systems (4 CP) * Pass-fail test       33     34       12     30       34     30       30     34       30     34       30     34       31     124	24	Written Examination	Report	Written/Oral Examination	
26     Project Thesis based on scientific and research work (4 CP)       29     Report       30     Report       31     Corporate Information Systems (4 CP) * Pass-fail test       33     Quarter Complete       34     30	25				
26     Project Thesis based on scientific and research work       27     Research Methods (4 CP) Report       29     Report       30     Corporate Information Systems (4 CP)* Pass-fail test       33     (4 CP)* Pass-fail test					
27     Research Methods     Project Management (4 CP)     Project Management (4 CP)     and research work (5 CP)       30     31       31     32       33     4       34     Corporate Information Systems (4 CP)*       29     Report       31     Systems (4 CP)*       29     Project Management (5 CP)       31     Corporate Information Systems (4 CP)*       33     34       34     30       35     30       36     30	26			Drainet Theois hear day	
28     Research Methods (4 CP) Report     Project Management (4 CP) Report     and research work (5 CP)       31     Corporate Information Systems (4 CP)* Pass-fail test       33       34	27			roject inesis based on scientific	
28     Report     Project management (4 CP)     Amount (4 CP)       30     31       31     32       33     Corporate Information Systems (4 CP) * Pass-fail test       LP     30       34     30       30     34       30     34       30     30       34     30       35     30       36     30		Research Methods		and research work	
29         Report         Report           30         31         Corporate Information Systems (4 CP) * Pass-fail test           33         4         30           34         30         30           LP         30         34         30           Master complete         124	28		(4 CP)	(5 CP)	
30         Corporate Information Systems (4 CP)*           33         2           34         2           LP         30         34           Master complete         124	29	(4 CP)	Report		
30         Corporate Information Systems (4 CP)* Pass-fail test           34         30         30           LP         30         34         30         30           Master complete         124	H	кероп	. inport		
31         Corporate Information           32         Systems           33         (4 CP) *           Pass-fail test         Pass-fail test	30				
32     Corporate Information Systems (4 CP)* Pass-fail test       34     30       LP     30       34     30       Master complete     124	31				
32         Systems (4 CP)*           33         34           LP         30         34         30         30           Master complete         124	$\vdash$		Corporate Information		
33         (4 CP) *           Pass-fail test         Pass-fail test           LP         30         34         30         30           Master complete         124	32		Systems		
Pass-fail test           34         30         30           LP         30         34         30         30           Master complete         124         124	33		(4 CP) *		
34         30         30           LP         30         34         30         30           Master complete         124	$\vdash$		Pass-fail test		
LP         30         34         30         30           Master complete         124	34				
LP         30         34         30         30           Master complete         124	·1			l l	
Master complete 124	LP	30	34	30	30
	<u> </u>		<u>.</u>	Master complete	124

4 CP Scientific and research work will still be assigned to the 5 courses of the 3rd semester.

\* Additional, elective

course (not obligatory)

### **Modules and Courses**

N.N. in the course lists indicates that the course will take place but that the lecturer is not yet known; the abbreviation means "nomen nominandum" ("the name is to be announced"). Courses with an asterisk (\*) will always take place.

#### Stand: 23.03.2022

Modulname	Aspects of Process Design in Forming Technology						
Modulname EN	Aspect	s of Process Desig	n in Fo	orming Techn	olo	ду	
Verantw. Dozent/-	Behrens	, Krimm			Se	mester	WiSe
Institut	Institut fi	ür Umformtechnik und	l Umfor	mmaschinen	EC	CTS	5
Art	✓ Pfli	cht 🗌 Wahlpflich	W	ahl 🗌 Stud	ium	genera	ale / Tutor
Vertiefungsrichtun	g	Prüfungsfo			m schriftlich		ich
Präsenzstudienzei	40	Selbststudienzeit	110	Kursumfang	V	'2/Ü1	
Modulbeschreibun	g						
This module provide Understanding of the used for the analysis • Ability to apply dig Content: After an inf forming processes, addressed. Experim forming process tak Subsequently, proce	s an insig e basic pi s of forminital design roduction the comp entally de es place l ess-integr	th into the process of inciples for material of ing processes in tools to solve proble into the fundamental uter aided design pro etermined parameters by use of various form ated quality assurance	f metal haracte ms rela s of forr cess an build th hing ma e metho	forming. C rrisation and nu uted to forming ming technolog ind the finite ele he input for the chines and per ods will be pres	bjeo ume tech gy, tl mer se a ripho sent	ctives: - rical sin nnology he deve analyses eral dev ed.	nulation lopment of sis will be s. The ices.

#### Vorkenntnisse

keine

#### Literatur

Handbook of Metal Forming, Lange, K.; McGraw-Hill, New York, 1985. R.H. Wagoner, J.L. Chenot: Fundamentals of Metal Forming, John Wiley and Sons, Inc. 1997 T. Altan, G. Ngaile, and G. Shen: Cold and Hot Forging, Fundamentals and Applications, ASM International, 2005 Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter <u>www.springer.com</u> eine Gratis Online-Version.

#### Besonderheit

Vorlesungssprache: Englisch / Language of lectures: English

Modulname	Bilds	equenzanalyse	9				
Modulname EN	Image	Image sequence analysis					
Verantw. Dozent/-	Mehltret	Mehltretter Semester WiSe					
Institut	Institut fi	ür Photogrammetrie u	ind Geo	information	EC	TS	5
Art	Pfli	cht 🗹 Wahlpflich	W	ahl 🗌 Stud	ium	genera	le / Tutor
Vertiefungsrichtun	g			Prüfungsfor	m	mündli	ch
Präsenzstudienzei	t 56	Selbststudienzeit	94	Kursumfang	V2	2/Ü2	
Modulbeschreibun	q						

#### Aim of the course

The module teaches the extraction of information from image sequences with a focus on semantic aspects. A major topic is object detection and tracking, incl. motion models. As a basis for further Master's studies, the students should develop their analytical and transfer skills through exercises, also from current research projects.

#### **Qualification goals**

At the end of the course, students have a good insight into the goals, tasks and methods of image sequence analysis. They are able to evaluate monoscopic and stereoscopic image sequences with regard to 3D geometry and content and know the limits of the automatic methods used for this purpose. At the end of the course, students have exemplary detailed knowledge in individual areas, e.g. in the area of tracking-by-detection and data association.

#### Content

foreground/background separation, optical flow and scene flow object detection and tracking motion models

#### Vorkenntnisse

Photogrammetric Computer Vision (from Institute of Photogrammetry and GeoInformation, IPI) or Computer Vision (from TNT)must have been successfully finished before this course can be taken.

#### Literatur

David A. Forsyth and Jean Ponce (2003). Computer Vision, A Modern Approach. Prentice Hall. Richard Hartley and Andrew Zisserman (2003). Multiple View Geometry in Computer Vision. Cambridge University Press. http://homepages.inf.ed.ac.uk/rbf/CVonline/motion.htm

#### Besonderheit

The course is taught in English

Electrical Machines and Drives						
Electrical Maschines and Drives						
Ebrahimi Semester WiSe						
nstitut fü	ir Antriebssysteme u	nd Leist	ungselektroni	E	CTS	5
✔ Pflic	cht 🗌 Wahlpflich	W	ahl 🗌 Stud	ium	genera	ale / Tutor
Vertiefungsrichtung Prüfungsform schriftlich					ich	
t 60 Selbststudienzeit 90 Kursumfang V2/Ü1/L1						
	Electric brahim stitut fü Pflic	Electrical Maschines and brahimi istitut für Antriebssysteme u Pflicht Wahlpflich 60 Selbststudienzeit	Electrical Maschines and Drives brahimi estitut für Antriebssysteme und Leist Pflicht Wahlpflich Wa 60 Selbststudienzeit 90	Electrical Maschines and Drives brahimi estitut für Antriebssysteme und Leistungselektroni Pflicht Wahlpflich Wahl Stud Prüfungsforn 60 Selbststudienzeit 90 Kursumfang	Electrical Maschines and Drives         brahimi       Se         stitut für Antriebssysteme und Leistungselektroni       Ed         Pflicht       Wahlpflich       Wahl       Studium         Prüfungsform       60       Selbststudienzeit       90       Kursumfang       V	Electrical Maschines and Drives brahimi Semester astitut für Antriebssysteme und Leistungselektroni ECTS ✓ Pflicht Wahlpflich Wahl Studium genera Prüfungsform schriftl 60 Selbststudienzeit 90 Kursumfang V2/Ü1/L1

#### Modulbeschreibung

Fundamental of electromagnetics, Maxwell equations, Biot-Savart Formulation, Faraday law of induction, Lorentz Force. Fundamental of electromechanical energy conversion. Magnetic equivalent circuit for flux calculation in magnetic structures, magnetomotive force

law, permanent magnet Materials, Ferromagnetic materials, non-linear BH-curves, Hysteresis and eddy current losses.

Permanent magnet DC motor, separately excited DC motor, series DC motors, Universal motors, equivalent circuits and load calculation, lap and wave winding, armature reaction. Fundamentals of rotating field theory, three phase synchronous motor, permanent magnet synchronous motor, BLDC motors.

Basics of control of electrical machines, basics of power electronic devices, pulse width modulation, basics of gearing and mechanical components in mechatronic systems, basic of sensory systems.

Design of a mechatronic device, Biomechanical calculation, electromechanical drive calculation, selection of motor, gearing, battery, power electronics and sensory systems.

#### Vorkenntnisse

Basic knowledge of electrical engineering and electrical machines would be helpful.

#### Literatur

Stölting, Kallenbach, Amrhein: Handbook of Fractional-Horsepower Drives, Springer Verlag. Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter <u>www.springer.com</u> eine Gratis Online-Version.

#### Besonderheit

Lecture will be teached in english. A course credit must be completed in the form of a lab.

Stand: 23.03.2022			Inte	rnational Mech	atronics MS	PO2017		
Modulname	Intro	duction to Mec	hanic	al Vibratio	ons			
Modulname EN	Introdu	uction to Mechanica	Vibra	tions				
Verantw. Dozent/-	Wanger	nheim			Semester	WiSe		
Institut	Institut f	ür Dynamik und Schw	ingunge	en	ECTS	5		
Art	Pfli	icht 🗹 Wahlpflich	W	ahl 🗌 Stud	ium genera	ale / Tutor		
Vertiefungsrichtung	I			Prüfungsfor	m schriftl	ich		
Präsenzstudienzeit	56	Selbststudienzeit	94	Kursumfang	V2/Ü2			
Modulbeschreibung	I							
Learning Objectives In this module, we gi successful participati • set up linearized ed • characterize the pro- • determine system r • propose appropriate • understand the pro- vibrations Content: • Free and forced vib • SDOF systems with • System response fu • Periodic and transite • Systems with two d • Vibration absorbers • Introduction to syst • Vibrations of strings	Modulbeschreibung         Learning Objectives         In this module, we give an introduction into the linear vibrations of mechqanical systems. After successful participation, our students will be able to         • set up linearized equations of motion for single-degree-of-freedom (SDOF) systems         • characterize the properties of free vibrations by means of eigenvalues         • determine system responses for harmonic, periodic and transient excitation         • propose appropriate measures to improve the system's dynamical performance         • understand the properties of solutions of partial differential equations describing continuum vibrations         Content:         • Free and forced vibrations of single-degree-of-freedom (SDOF) systems         • SDOF systems with damping         • System response functions in frequency and time domain         • Periodic and transient excitation of SDOF systems         • Systems with two degrees of freedom         • Vibration absorbers and tuned mass dampers         • Introduction to systems with multiple degrees of freedom (MDOF)							
Vorkenntnisse	1.21							
Statics, Elastostatics	, Kinema	atics, Kinetics (Techni	sche M	echanik 1 - 3)				
Literatur				·				
Gross et al.: Enginee Prentice Hall Meirovi Mechanical Vibration	ring Mee ch: Fun , Literary	chanics 3. Dynamics. damentals of Vibratior y Licensing, LL	Springe ns. McC	er Inman: Engir Graw-Hill Tong:	neering Vibr Theory of	ration.		
Besonderheit								
Integrated course co "Technische Mechan	ntaining ik 4 / Te	lecture (2h) and tutori chnische Schwingung	als (2h) slehre"	. Contents equ taught in sum	ial to Germa mer term.	an course		

#### Stand: 23.03.2022

Modulname	Masterarbeit						
Modulname EN	Master	Thesis					
Verantw. Dozent/-	Professo	prinnen und Professo	ren der	Fakultät für M	Se	mester	Wi-/SoS
Institut	Diverse				E	CTS	30
Art	✓ Pflie	cht 🗌 Wahlpflich	W	ahl 🗌 Stud	ium	genera	ale / Tutor
Vertiefungsrichtun	g			Prüfungsfor	m	schrift.	/münd.
Präsenzstudienzeit		Selbststudienzeit		Kursumfang	9	00h	
Modulbeschreibun	g						
Nach dem erfolgreichen Absolvieren des Moduls sind Studierende in der Lage an einer wissenschaftlichen Problemstellung aus den Themenfeldern des Master-Studiums mitzuarbeiten, Teilprobleme in bestehende Theorien einzuordnen und im Studium erlernte Methoden geeignete Methoden zu identifizieren. Sie können erreichte Ergebnisse wissenschaftlich formulieren und dabei übliche Zitierregeln und Recherchemethoden anwenden. Durch die Teilnahme am Modul Masterarbeit üben Studierende gänginge Tätigkeiten von Ingenieurinnen und Ingenieuren aus, die in der Forschung, der Industrie oder dem Entrepreneurwesen tätig sind.							
Vorkenntnisse							
keine							
Literatur							
Diverse							
Besonderheit		eiche Drässetieren d	en Alec-				
∠um Modul gehort d	as ertolgi	reiche Prasentieren d	er Absc	niussarbeit (1	LP)		

Modulname	Micro	- and Nanosys	tems					
Modulname EN	Micro-	Micro- and Nanosystems						
Verantw. Dozent/-	Wurz				Semester	WiSe		
Institut	Institut fi	ür Mikroproduktionste	chnik		ECTS	5		
Art	✓ Pfli	cht 🗌 Wahlpflich	W	ahl 🗌 Stud	ium genera	ale / Tutor		
Vertiefungsrichtun	g			Prüfungsfor	m schrift	ich		
Präsenzstudienzei	t 32	Selbststudienzeit	118	Kursumfang	V2/Ü1			
Modulbeschreibun	g							
Students gain knowledge about the most important application areas of micro- and nano technology. A microtechnical system has the following components: micro sensor technology, micro actuating elements, microelectronics. Furthermore, the active principle and construction of micro components as well as requirements of system integration will be explained.								

Nanosystems usually use quantum mechanical effects. An example will be the display of the employment of nanotechnology in various areas

#### Vorkenntnisse

Mikro- und Nanotechnolgie

#### Literatur

Vorlesungsskript; Hauptmann: Sensoren, Prinzipien und Anwendungen, Carl Hanser Verlag, München 1990; Tuller: Microactuators, Kluwer Academic Publishers, Norwell 1998.

#### Besonderheit

This lecture is given in English. In addition to a separate exam (4 credits), an online test will be conducted (1 credits). Both must be performed to pass the module. The grade is composed proportionate.

Modulname	Optische Messtechnik								
Modulname EN	Optical	Optical Measurement Technology							
Verantw. Dozent/-	Reithme	ier			Semester	WiSe			
Institut	Hannove	ersches Zentrum für C	Optische	Technologie	ECTS	5			
Art	Pflie	cht 🗹 Wahlpflich	W	ahl 🗌 Stud	ium genera	ale / Tutor			
Vertiefungsrichtun	g			Prüfungsfor	m schrift.	/münd.			
Präsenzstudienzei	t 58	Selbststudienzeit	92	Kursumfang	V2/Ü2				
Modulbeschreibun	g								
The lecture gives ar beginning, fundame which are essential metrology in researc measurement of top include concepts su semi-optical method addressed and com an in-depth understa setups are explained	Modulbeschreibung The lecture gives an overview on theory, methods and devices in optical metrology. At the beginning, fundamentals of optics and photonics such as ray and wave optics are revised, which are essential for the understanding of concepts in optical metrology. Focusing on metrology in research and industrial applications, the lecture covers optical methods for measurement of topography, distance, and deformation as well as fiber optical sensors, which include concepts such as interferometry, holography and confocal microscopy. In addition, semi-optical methods such as atomic force microscopy and near field microscopy are addressed and compared to non-optical methods, e.g., scanning electron microscopy. To gain an in-depth understanding of the concepts involved in optical metrology, all devices and optical								

#### Vorkenntnisse

Messtechnik I / Measurement Technology I

#### Literatur

Born, Wolf. Principles of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light; Demtröder: Experimentalphysik; Saleh, Teich: Grundlagen der Photonik; Lauterborn, Kurz: Coherent Optics; Goodman: Introduction to Fourier Optics; Hugenschmidt: Lasermesstechnik; Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter www.springer.com eine Gratis Online-Version.

#### Besonderheit

Prüfung je nach Teilnehmerzahl: Einzelprüfung mündlich 20 Min. oder schriftlich 90 Min.

Modulname	Physics of ultrasound and its applications						
Modulname EN	Physic	Physics of ultrasound and its applications					
Verantw. Dozent/-	Twiefel,	Twiefel, Long Semester WiSe					
Institut	Institut fü	Institut für Dynamik und Schwingungen ECTS 5					
Art	Pfli	cht 🖌 Wahlpflich	W	ahl 🗌 Stud	ium gener	ale / Tutor	
Vertiefungsrichtur	g			Prüfungsfor	<b>m</b> münd	ich	
Präsenzstudienzei	t 32	Selbststudienzeit	118	Kursumfang	V2/Ü1		
Modulbeschreibur	g						
This lecture is complementary to the lecture "Ultraschalltechnik für industrielle Produktion, Medizin- und Automobiltechnik" in the summer semester, both lectures can be attended independently of each other and therefore in any order. This lecture focuses on the effects that							

independently of each other and therefore in any order. This lecture focuses on the effects that can be achieved by ultrasound and their various applications, while the summer lecture deals with the basics and methods of the generation of ultrasound.

Learning Objectives: Students will be capable of

- Naming and describing the different effects of ultrasound
- Judging where the application of ultrasound is helpful
- · Estimating the impact of ultrasound utilizing the methods used in class

 Describing the necessary system design for the different applications and the ability to identify the operation principle of an unknown ultrasonic system Contents

The lecture is structured in three main parts

Effects of ultrasound on: contact mechanics (vibro-impacts); friction reduction; acoustoplastic
effect; dynamic recrystallization and atomic diffusion; cavitation in fluids; levitation

 Applications of power ultrasonics: Ultrasonic cleaning (atomization, defoaming); Sonochemistry (mixing, agglomeration, etc.); Metal joining and welding (incl. additive manufacturing); Plastic joining and forming; Ultrasonic metal forming and machining; Ultrasonic motors and transformers (incl. filters); Sensing with ultrasound

Hands-on-Experience in Ultasound and i

#### Vorkenntnisse

none

#### Literatur

Gallego-Juárez, J.A. and Graff, K.F.: Power ultrasonics: applications of high-intensity ultrasound. Elsevier. Heywang, W., Lubitz, K. and Wersing, W.: Piezoelectricity: evolution and future of a technology. Springer Science & Business Media.

#### Besonderheit

Weekly lecture: 90min and bi-weekly hands-on-lecture: 90min, Lecture will be given in English. Students should prepare protocols for the experiments, which will be included in the grading.

Modulname	Powe	er Electronics				
Modulname EN	Power	Electronics				
Verantw. Dozent/-	Friebe				Semester	WiSe
Institut	Institut f	ür Antriebssysteme un	nd Leist	ungselektroni	ECTS	5
Art	Pfli	cht 🗹 Wahlpflich	W	ahl 🗌 Stud	lium genera	ale / Tutor
Vertiefungsrichtun	g			Prüfungsfor	<b>m</b> mündli	ich
Präsenzstudienzei	t 72	Selbststudienzeit	78	Kursumfang	V2/Ü2/L1	1
Modulbeschreibung						
The lecture gives ar strong focus on the participation the stur semiconductors, de simulate converter s interaction between	introduc operation dents will sign pass tages. Th one or m	tion into the general to principle of power ele- be able to explain the ive components for ty ney will also be able to ultiple converters and	opics of ectronic basic pical ap o unders the grid	modern powe circuits and the characteristics oplications and stand and char d.	r electronica neir compon of power I calculate a racterize the	s with a ents. After ind
Vorkenntnisse						
Power Electronics for commutated convert	or high ef ter, dc/dc	ficient energy convers -Converter, dc/ac-Co	ion, Ap nverter	plications, Cor	nponents, L	.ine-
Literatur						
-Mohan, Undeland, Schlangenotto, Sch Valchev: Inductors a	Robbins: euermani and Trans	Power Electronics: C n, De Donker: Semico formers for Power Ele	onverte ndutor ectronic	rs, Application Power Devices s	s, and Desig s -Van den I	gn -Lutz, Bossche,

### Besonderheit

Covered within "Energy Technologies" and "International Mechatronics.

Modulname	Production of Optoelectronic Systems						
Modulname EN	Produc	Production of Optoelectronic Systems					
Verantw. Dozent/-	Overme	Overmeyer Semester WiSe					
Institut	Institut fü	ir Transport- und Aute	omatisie	erungstechnik	ECTS	5	
Art	Pfli	cht 🗹 Wahlpflich	W	ahl 🗌 Stud	ium genera	ale / Tutor	
Vertiefungsrichtung Prüfungsform schriftlich					ich		
Präsenzstudienzei	t 40	Selbststudienzeit	110	Kursumfang	L2/E2		

#### Modulbeschreibung

Outcomes: This module gives basic knowledge about processes and devices that are used in production of semiconductor packages and microsystems. The main focus is on the back-end-process that means the process thins wafer dicing. After successful examination in this module the students are able to

• correctly use the terms optoelectronic system, wafer production, front end and back end and to give an overview of production processes of semiconductor packages

• explain the production processes beginning from crude material sand and to have an idea about process relevant parameters

visualize different packaging techniques and explain the corresponding basics of physics

• choose and classify different package types for an application Contents:

- Wafer production
- Mechanical Wafer treatment
- Mechanical connection methods (micro bonding, soldering, eutectic bonding)
- Electrical connection methods (wire bonding, flip chip bonding, TAB)
- · Package types for semiconductors
- Testing and marking of packages
- Design and production of printed circuit boards
- · Printed circuit board assembly and soldering techniques

#### Vorkenntnisse

#### Literatur

Lau, John H.: Low cost flip chip technologies : for DCA, WLCSP, and PBGA assemblies. McGraw-Hill, New York 2000. Pecht, Michael: Integrated circuit, hybrid, and multichip module package design guidelines : a focus on reliability. Wiley, New York 1994. Bei vielen Titeln des Springer-Verlages gibt es im W-Lan der LUH unter <u>www.springer.com</u> eine Gratis Online-Version.

#### Besonderheit

Modulname	Scientific Research Work: Mechatronics Lessons					
Modulname EN	Scientific Research Work: Mechatronics Lessons					
Verantw. Dozent/-	N.N.				Semester	Wi-/SoS
Institut	Institut für Mechatronische Systeme				ECTS	5
Art	Pflicht Wahlpflich Wahl Studium generale / Tutor					
Vertiefungsrichtun	j F		Prüfungsfor	m schrift./münd.		
Präsenzstudienzei	t 16	Selbststudienzeit	104	Kursumfang	Ü	
Modulbeschreibung						
The scientific and research work enables each student to practise research techniques, literature review, academic discussion, scientific writing and the practical application of specialist knowledge. After completion of the course, each student becomes familiar with a current research theme and assumes responsibility for a small project. The project is completed under guidance, with the student documenting the results in written form, giving a presentation and finally leading an academic discussion on the subject.						
Vorkenntnisse						
keine						
Literatur						
"Holman, J. P.: Experimental Methods for Engineers, Mcgraw-Hill Publ.Comp. Ackerson, L.G.: Literature Search Strategies for Interdisciplinary Research: A Sourcebook For Scientists and Engineers. Scarecrow Press."						
Besonderheit						

Keine