M.Sc. Electrical Engineering and Information Technology (PO 2014)

Micro and Precision Engineering
Date: 01.03.2019

TECHNISCHE UNIVERSITÄT DARMSTADT

Department of Electrical Engineering and Information Technology

Module manual: M.Sc. Electrical Engineering and Information Technology (PO 2014)
Micro and Precision Engineering
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Department of Electrical Engineering and Information Technology
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Contents

1 Fundamentals

Module name Sensor Technique					
Module Nr. 18-kn-2120	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 75 h	**Duration** 1	**Cycle offered** WiSe
Language German			**Module owner** Prof. Dr. Mario Kupnik		

1	**Content** The module provides basic principles of different sensors and the necessary skills for proper application of sensors. In terms of measuring chain, the focus of the event is located in the forming of any generally non-electric variable in an electrically evaluable signal. Resistive, capacitive, inductive, piezoelectric, optical and magnetic measuring principles are treated in the lectures, in order to convey measuring of important values such as force, torque, pressure, acceleration, velocity, and flow. In addition to the phenomenological description of the principles and resulting technical description, it should be traced an understood the main elements of the primary and secondary electronic for each principle. In addition to the measuring principles, the errors description will be treated. Thereby in addition to static and dynamic errors also error in the signal processing and error analysis of the entire measuring chain will be discussed.
2	**Learning objectives / Learning Outcomes** The Students acquire knowledge of the different measuring methods and their advantages and disadvantages. They can understand error in data sheets and descriptions interpret in relation to the application and are thus able to select a suitable sensor for applications in electronics and information, as well process technology and to apply them correctly.
3	**Recommended prerequisite for participation** Measuring Technique
4	**Form of examination** Module final exam: • Module exam (Technical examination, Written Examination, duration: 90 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Technical examination, Written Examination, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc WI-ETiT, MSc MEC
7	**References** • Slide set of lecture • Script of lecture • Textbook Tränkler „Sensortechnik“, Springer • Exercise script
Courses	

	Course Nr. 18-kn-2120-vl	**Course name** Sensor Technique		
	Instructor Prof. Dr. Mario Kupnik		**Type** Lecture	**SWS** 2
	Course Nr. 18-kn-2120-ue	**Course name** Sensor Technique		
	Instructor Prof. Dr. Mario Kupnik		**Type** Practice	**SWS** 1

Module name					
Technology of Microsystems Technology					
Module Nr.	**Credit Points**	**Workload**	**Self study**	**Duration**	**Cycle offered**
18-sl-2010	4 CP	120 h	75 h	1	Every 2. Sem.
Language			**Module owner**		
German			Prof. Dr.-Ing. Helmut Schlaak		

1	**Content** Provide insights into the various production and processing methods in micro- and precision engineering and the influence of these methods on the development of devices and components.
2	**Learning objectives / Learning Outcomes** To describe coating processes like powder coating, electrochemical and vacuum deposition and CVD. To explain manufacturing of glass conponents: glass production, optical components, glass fibres, glass ceramics. To describe microfabrication technologies: photolithography, etching, diffusion, silicon micromachining, LIGA. To report manufacturing of electronic assemblies/modules and surface mount technologies (SMT).
3	**Recommended prerequisite for participation** Technology of Micro and Precision Engineering (recommended)
4	**Form of examination** Module final exam: • Module exam (Technical examination, Optional, duration: 30 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Technical examination, Optional, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc MEC, MSc Wi-ETiT
7	**References** Script for lecture: Technology of Microsystem Technology

Courses

	Course Nr. 18-sl-2010-vl	**Course name** Technology of Microsystems Technology		
	Instructor Prof. Dr.-Ing. Helmut Schlaak		**Type** Lecture	**SWS** 2
	Course Nr. 18-sl-2010-ue	**Course name** Technology of Microsystems Technology		
	Instructor Prof. Dr.-Ing. Helmut Schlaak		**Type** Practice	**SWS** 1

Module name Electromechanical Systems Lab					
Module Nr. 18-kn-2090	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 75 h	**Duration** 1	**Cycle offered** SoSe
Language German			**Module owner** Prof. Dr. Mario Kupnik		

1	**Content** Electromechanical sensors, drives and actuators, electronic signal processing mechanisms, systems from actuators, sensors and electronic signal processing mechanism.
2	**Learning objectives / Learning Outcomes** Elaborating concrete examples of electromechanical systems, which are explained within the lecture EMS I+II. The Analyzing of these examples is needed to explain the mode of operation and to gather characteristic values. On this students are able to explain the derivative of proposals for the solution. The aim of the 6 laboratory experiments is to get to know the mode of operation of the electro- mechanical systems. The experimental analysis of the characteristic values leads to the derivation of proposed solutions.
3	**Recommended prerequisite for participation** Bachelor ETiT
4	**Form of examination** Module final exam: • Module exam (Study archievments, Oral Examination, duration: 30 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Study archievments, Oral Examination, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc WI-ETiT, MSc MEC
7	**References** Laboratory script in Electromechanical Systems

Courses

Course Nr. 18-kn-2090-pr	**Course name** Electomechanical Systems Lab		
Instructor Prof. Dr. Mario Kupnik		**Type** Internship	**SWS** 3
Course Nr. 18-kn-2090-ev	**Course name** Electomechanical Systems Lab - Introduction		
Instructor Prof. Dr. Mario Kupnik		**Type** Introductory Course	**SWS** 0

Module name Microsystem Technology					
Module Nr. 18-sl-2040	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 75 h	**Duration** 1	**Cycle offered** WiSe
Language German			**Module owner** Prof. Dr.-Ing. Helmut Schlaak		

1	**Content** Introduction and definitions to micro system technology; definitions, basic aspects of materials in micro system technology, basic principles of micro fabrication technologies, functional elements of microsystems, micro actuators, micro fluidic systems, micro sensors, integrated sensor-actuator systems, trends, economic aspects.
2	**Learning objectives / Learning Outcomes** To explain the structure, function and fabrication processes of microsystems, including micro sensors, micro actuators, micro fluidic and micro-optic components, to explain fundamentals of material properties, to calculate simple microsystems.
3	**Recommended prerequisite for participation** BSc
4	**Form of examination** Module final exam: • Module exam (Technical examination, Written Examination, duration: 90 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Technical examination, Written Examination, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc MEC, MSc WI-ETiT
7	**References** Script for lecture: Mikrosystemtechnik

Courses

	Course Nr. 18-sl-2040-vl	**Course name** Microsystem Technology		
	Instructor Prof. Dr.-Ing. Helmut Schlaak		**Type** Lecture	**SWS** 2
	Course Nr. 18-sl-2040-ue	**Course name** Microsystem Technology		
	Instructor Prof. Dr.-Ing. Helmut Schlaak		**Type** Practice	**SWS** 1

Module name					
Product Development Methodology III					
Module Nr.	**Credit Points**	**Workload**	**Self study**	**Duration**	**Cycle offered**
18-bu-2125	4 CP	120 h	75 h	1	WiSe
Language			**Module owner**		
German			Prof. Ph.D. Thomas Peter Burg		

1	**Content** Practical experiences by using methodical procedures in the development of technical products. In addition teamwork, verbal and written representation of results and the organisation of development. Work in a project team and organize the development process independendly.
2	**Learning objectives / Learning Outcomes** Applying the development methodology to a specific development project in a team. To do this, students can create a schedule, can analyze the state of the art, can compose a list of requirements, can abstract the task, can work out the sub-problems, can seek solutions with different methods, can work out optimal solutions using valuation methods, can set up a final concept, can derive the parameters needed by computation and modeling, can create the production documentation with all necessary documents such as bills of materials, technical drawings and circuit diagrams, can build up and investigate a laboratory prototype and can reflect their development in retrospect.
3	**Recommended prerequisite for participation** Product Development Methodology I
4	**Form of examination** Module final exam: • Module exam (Study archievments, Optional, standard grading system)
5	**Grading** Module final exam: • Module exam (Study archievments, Optional, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc MEC, MSc WI-ETiT
7	**References** Script: Development Methodology (PEM)

Courses

Course Nr.	Course name		
18-bu-2125-pj	Product Development Methodology III		
Instructor		**Type**	**SWS**
Prof. Ph.D. Thomas Peter Burg		Project Seminar	3

2 Optional Modules

2.1 MFT: Open catalogue

Module name Selected Chapters from Measuring and Sensor Technique					
Module Nr. 18-kn-2140	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 90 h	**Duration** 1	**Cycle offered** WiSe
Language German			**Module owner** Prof. Dr. Mario Kupnik		

1	**Content** The module promotes the interlinking with current research contents and transferring from theoretical knowledge that already gained into practical applications of measuring and sensor technique. The module treats modeling methods and tools such as statistic design of experiments, analysis methods for error propagation and applications of sensors and sensor systems in current research questions in the form of a few similar to lecture introduction events and as an independent work of the students. In comparison to final works (thesis) only single aspects of a subject are looked deeply within the scope of the module.
2	**Learning objectives / Learning Outcomes** The students learn to apply existing knowledge from the measuring and sensor technique for the modelling or Simultation of a system, to work up the structured results and to present.
3	**Recommended prerequisite for participation** Measuring Technique, Sensor Technique, Sensor Signal Processing
4	**Form of examination** Module final exam: • Module exam (Study archievments, Optional, standard grading system)
5	**Grading** Module final exam: • Module exam (Study archievments, Optional, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc Wi-ETiT, MSc MEC
7	**References** Slide set of lecture

Courses

	Course Nr. 18-kn-2140-ps	**Course name** Selected Chapters from Measuring and Sensor Technique		
	Instructor Prof. Dr. Mario Kupnik		**Type** Introductory Seminar Course	**SWS** 2

Module name Finite Element Methods in Structural Mechanics					
Module Nr. 16-19-5030	**Credit Points** 6 CP	**Workload** 180 h	**Self study** 120 h	**Duration** 1	**Cycle offered** Every 2. Sem.
Language German			**Module owner** Dr. rer. pol. Markus Lazanowski		

1 Content

Continuum mechanical modelling of solids, work and energy principles, discretisation of field variables, isoparametric elements, shape functions, element matrices, assembly of stiffness matrices, h- and p-adaptivity, error estimators, mesh refinement algoritms, plate, shell, and membrane element formulations, structural dynamics, nonlinear problems.

2 Learning objectives / Learning Outcomes

On successful completion of this module, students should be able to:

- Explain the basics of continuum mechanical modelling of solids.
- Apply work and energy principles to problems of modelling of solids.
- Discretise field variables.
- Explain concepts of isoparametric elements, shape functions, and element matrices.
- Assemble stiffness matrices.
- Describe h- and p-adaptivity, error estimators, and mesh refinement algorithims.
- Recognise plate, shell, and membrane element formulations.
- Explain the basics of structural dynamics finite-element computations.
- State sources of nonlinearities and how to deal with them.

3 Recommended prerequisite for participation

Numerical Mathematics and Numerical Methods recommended

4 Form of examination

Module final exam:

- Module exam (Technical examination, Technical Examination, standard grading system)

5 Grading

Module final exam:

- Module exam (Technical examination, Technical Examination, weighting: 100 %)

6 Usability of this module

WPB Master MPE III (Wahlfächer aus Natur- und Ingenieurwissenschaft)
WPB Master PST III (Fächer aus Natur- und Ingenieurwissenschaft für Papiertechnik)
Master ETiT MFT

7 References

manuscript (available in FNB secretary); Exercises in WWW; Schäfer, Numerik im Maschinenbau, Springer, 1999; Schäfer, Numerical Methods in Engineering, Springer, 2006

Courses

Course Nr. 16-19-5030-vl	**Course name** Finite Element Methods in Structural Mechanics		
Instructor		**Type** Lecture	**SWS** 3

Course Nr. 16-19-5030-ue	**Course name** Finite Element Methods in Structural Mechanics		
Instructor		**Type** Practice	**SWS** 1

Module name					
Lighting Technology I					
Module Nr.	**Credit Points**	**Workload**	**Self study**	**Duration**	**Cycle offered**
18-kh-2010	5 CP	150 h	90 h	1	WiSe
Language			**Module owner**		
German			Prof. Dr.-Ing. Khanh Quoc Tran		

1	**Content** Structure and functionality of the human eye, terms and unit in lighting technology, photometry, radiometric and photometric properties of materials, filters, physiology of vision, colour theory, lighting, light sources. Measurement of luminous flux, luminous intensity, illuminance, luminance, determination of the spectral responsivity function of the human eye, colorimetry colour rendering, colour as traffic signals, measuring of optical material characteristics, LED properties
2	**Learning objectives / Learning Outcomes** To list and connect terms, units and radiometric and photometric properties of materials in lighting technology, to describe and understand structure and functionality of the human eye and the physiology of vision, to illustrate basics of lighting, measuring methods and application. Being able to measure base items in lighting technology, applying knowlegde of lighting and enhance them with experiments. Developing a better understanding for light and color.
3	**Recommended prerequisite for participation** MSc ETiT, MSc Wi-ETiT, MSc MEC
4	**Form of examination** Module final exam: • Module exam (Technical examination, Oral Examination, duration: 30 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Technical examination, Oral Examination, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc Wi-ETiT, MSc MEC
7	**References** Script for lecture: Lighting Technology I Excersisebook: laboratory: lighting technology I

Courses

Course Nr.	Course name		
18-kh-2010-vl	Lighting Technology I		
Instructor		**Type**	**SWS**
Prof. Dr.-Ing. Khanh Quoc Tran		Lecture	2
Course Nr.	**Course name**		
18-kh-2010-pr	Lighting Technology I		
Instructor		**Type**	**SWS**
PD Dr.-Ing. Peter Zsolt Bodrogi		Internship	2

Module name					
Lighting Technology II					
Module Nr.	**Credit Points**	**Workload**	**Self study**	**Duration**	**Cycle offered**
18-kh-2020	5 CP	150 h	90 h	1	SoSe
Language			**Module owner**		
German			Prof. Dr.-Ing. Khanh Quoc Tran		

1 Content

Chosen topics in lighting technology – current developments and applications: Street lighting, Physiology: Detektion / Glare / Lighing and Health, LED – Generation of white Light / State of the Art, Modern Methods of Light Measurement, Interiour Lighting, Display Technologies, Non-visual Light Impacts,UV-Applications, Automotive Lighting, Solar Modules.

2 Learning objectives / Learning Outcomes

To know current developments and applications, list and connect terms, to illustrate special topics of lighting, measuring methods and application.
Beeing able to measure base items in lighting technology, applying knowlegde of lighting and dedicated applications and further to enhance them with experiments. Developing a better understanding for light, color, perception and lighting situations.

3 Recommended prerequisite for participation

Lighting Technology I

4 Form of examination

Module final exam:

- Module exam (Technical examination, Oral Examination, duration: 30 min, standard grading system)

5 Grading

Module final exam:

- Module exam (Technical examination, Oral Examination, weighting: 100 %)

6 Usability of this module

MSc ETiT, MSc Wi-ETiT, MSc MEC

7 References

Excercisebook: laboratory: lighting technology II

Courses

Course Nr.	Course name		
18-kh-2020-vl	Lighting Technology II		
Instructor		**Type**	**SWS**
Prof. Dr.-Ing. Khanh Quoc Tran		Lecture	2
Course Nr.	**Course name**		
18-kh-2020-pr	Lighting Technology II		
Instructor		**Type**	**SWS**
Prof. Dr.-Ing. Khanh Quoc Tran		Internship	2

Module name Micro Actuators and Small Motors					
Module Nr. 18-sl-2020	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 75 h	**Duration** 1	**Cycle offered** WiSe
Language German			**Module owner** Prof. Dr.-Ing. Helmut Schlaak		

1	**Content** Linear and rotating movements, action of force, actuators with mechanical and electronic commutation as well as alternating stator field, switched reluctance, stepping motors, micro actuators, piezoelectric motors and special actuators, gears. Measurement and control in actuation systems, choosing electrical actuators.
2	**Learning objectives / Learning Outcomes** The educational objective of the course is to teach the students to independently design an actuation system in precision engineering. The students will be able to describe several actuator concepts and basic physical principles and optimally choose an actuator for a specific task.
3	**Recommended prerequisite for participation** BSc ETiT
4	**Form of examination** Module final exam: • Module exam (Technical examination, Oral Examination, duration: 30 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Technical examination, Oral Examination, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc MEC, MSc WI-ETiT
7	**References** Script for lecture: Small electromechanical actuators and motors

Courses

Course Nr. 18-sl-2020-vl	**Course name** Micro Actuators and Small Motors		
Instructor Prof. Dr.-Ing. Helmut Schlaak		**Type** Lecture	**SWS** 2
Course Nr. 18-sl-2020-ue	**Course name** Micro Actuators and Small Motors		
Instructor Prof. Dr.-Ing. Helmut Schlaak		**Type** Practice	**SWS** 1

Module name Numerical Methods					
Module Nr. 16-19-5010	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 75 h	**Duration** 1	**Cycle offered** Every 2. Sem.
Language German			**Module owner** Prof. Dr. rer. nat. Michael Schäfer		

1 Content

Basics of continuum mechanical modelling, simple field problems, finite-volume method, approximation of surface and volume integrals, discretisation of convective and diffusive fluxes, Galerkin method, finite-element method, simple elements and simple functions, time discretisation, explicit and implicit methods, properties of numerical solution methods, stability, consistency, convergence, boundedness, conservativity, numerical errors, error control.

2 Learning objectives / Learning Outcomes

On successful completion of this module, students should be able to:

- Explain the basics of continuum mechnical modelling of simple field problems
- Explain the theoretical background of finite volume methods.
- Describe the theory of finite-element methods and derive simple elements.
- Describe simple time discretization methods and differentiate between explicit and implicit methods.
- Explain/describe important properties of numerical solution techniques, such as stability, consistency, convergence, and conservativity, and their relevance for the computation.
- Carry out an error estimation of numerical results.

3 Recommended prerequisite for participation

'Numerical Mathematics' recommended

4 Form of examination

Module final exam:

- Module exam (Technical examination, Technical Examination, standard grading system)

5 Grading

Module final exam:

- Module exam (Technical examination, Technical Examination, weighting: 100 %)

6 Usability of this module

Bachelor MPE Pflicht
Master ETiT MFT, Master Mechatronik

7 References

Lecture and exercsie script (available in fnb office)
Schäfer: Numerik im Maschinenbau, Springer Verlag, 1999.
Schäfer, Numerical Methods in Engineering, Springer Verlag, 2006.

Courses

Course Nr. 16-19-5010-vl	**Course name** Numerical Methods		
Instructor		**Type** Lecture	**SWS** 2

Course Nr. 16-19-5010-ue	**Course name** Numerical Methods		
Instructor		**Type** Practice	**SWS** 1

Module name Optical Technologies in Car Lighting					
Module Nr. 18-kh-2041	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 75 h	**Duration** 1	**Cycle offered** Every 2. Sem.
Language German			**Module owner** Prof. Dr.-Ing. Khanh Quoc Tran		

1	**Content** History and standardisation of car lithing. Description of the oused lighting sources and the function of these(lowbeam, highbeam, bending light, stop lamp, daytime running light...), visuell perception, glare, detection, traffic infrastructure, traffic elements, interior lighting, driver assistance systems(GPS, Radar, Lidar...), methods of psychophysics, lighting application concepts in future automated vehicles. Voluntary trip planed to an automobile manufacturer
2	**Learning objectives / Learning Outcomes** To describe the basics and deepening knowledge of car lighting, understanding of the light distribution of head and rear lamps, to learn the basics of standardisation, enlarge glare and detection skills, know the traffic elements, as well as the driver assistance systems
3	**Recommended prerequisite for participation** Lighting technology 1(desireable)
4	**Form of examination** Module final exam: • Module exam (Technical examination, Oral Examination, duration: 30 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Technical examination, Oral Examination, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc WI-ETiT, MSc iST, MSc MEC, MSc MPE, MSc Physik
7	**References** Lecture slides, Automotive Lighting and Human Vision, Handbuch Fahrassistenzsysteme

Courses

	Course Nr. 18-kh-2041-vl	**Course name** Optical Technologies in Car Lighting		
	Instructor Prof. Dr.-Ing. Khanh Quoc Tran		**Type** Lecture	**SWS** 2
	Course Nr. 18-kh-2041-pr	**Course name**		
	Instructor Prof. Dr.-Ing. Khanh Quoc Tran		**Type** Internship	**SWS** 1

Module name Product Development Methodology IV					
Module Nr. 18-kh-2125	**Credit Points** 5 CP	**Workload** 150 h	**Self study** 105 h	**Duration** 1	**Cycle offered** SoSe
Language German			**Module owner** Prof. Dr.-Ing. Khanh Quoc Tran		

1	**Content** Practical experiences by using methodical procedures in the development of technical products. In addition teamwork, verbal and written representation of results and the organization of development. Work in a project team and organize the development process independently.
2	**Learning objectives / Learning Outcomes** Applying the development methodology to a specific development project in a team. To do this, students can create a schedule, can analyze the state of the art, can compose a list of requirements, can abstract the task, can work out the sub-problems, can seek solutions with different methods, can work out optimal solutions using valuation methods, can set up a final concept, can derive the parameters needed by computation and modeling, can create the production documentation with all necessary documents such as part lists, technical drawings and circuit diagrams, can build up and investigate a laboratory prototype and can reflect their development in retrospect.
3	**Recommended prerequisite for participation** Product Development Methodology I
4	**Form of examination** Module final exam: • Module exam (Study archievments, Optional, standard grading system)
5	**Grading** Module final exam: • Module exam (Study archievments, Optional, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc MEC
7	**References** Script: Development Methodology (PEM)

Courses

Course Nr. 18-kh-2125-pj	**Course name** Product Development Methodology IV		
Instructor Prof. Dr.-Ing. Khanh Quoc Tran		**Type** Project Seminar	**SWS** 3

Module name					
Sensor Signal Processing					
Module Nr.	**Credit Points**	**Workload**	**Self study**	**Duration**	**Cycle offered**
18-kn-2130	3 CP	90 h	60 h	1	Every 2. Sem.
Language			**Module owner**		
German			Prof. Dr. Mario Kupnik		

1	**Content** The module provides knowledge in-depth about the measuring and processing of sensor signals. In the area of primary electronics, some particular characteristics such as errors, noise and intrinsic compensation of bridges and amplifier circuits (carrier frequency amplifiers, chopper amplifiers, Low-drift amplifiers) in terms of error and energy aspects are discussed. Within the scope of the secondary electronic, the classical and optimal filter circuits, modern AD conversion principles and the issues of redundancy and error compensation will be discussed.
2	**Learning objectives / Learning Outcomes** The Students acquire advanced knowledge on the structure of modern sensors and sensor proximity signal processing. They are able to select appropriate basic structure of modern primary and secondary electronics and to consider the error characteristics and other application requirements.
3	**Recommended prerequisite for participation** Measuring Technique, Sensor Technique, Electronic, Digital Signal Processing
4	**Form of examination** Module final exam: • Module exam (Technical examination, Written Examination, duration: 90 min, standard grading system)
5	**Grading** Module final exam: • Module exam (Technical examination, Written Examination, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc Wi-ETiT, MSc MEC
7	**References** • Slide set of lecture • Skript of lecture • Textbook Tränkler „Sensortechnik“, Springer • Textbook Tietze/Schenk „Halbleiterschaltungstechnik“, Springer

Courses

Course Nr.	Course name		
18-kn-2130-vl	Sensor Signal Processing		
Instructor		**Type**	**SWS**
Prof. Dr. Mario Kupnik		Lecture	2

Module name Advanced seminar Microsystem Technology					
Module Nr. 18-sl-2050	**Credit Points** 4 CP	**Workload** 120 h	**Self study** 90 h	**Duration** 1	**Cycle offered** SoSe
Language German			**Module owner** Prof. Dr.-Ing. Helmut Schlaak		

1	**Content** Intensive arguing with current research topics in microsystem technology. The compilation of self gatherd information and a scientific report are evaluated thereby and consulted as test achievement.
2	**Learning objectives / Learning Outcomes** To explain current specialized topics in the area of the micro system technology. To work out a scientific specialized topic independently, and to give a lecture on it. To write a scientific report about this topic. Getting to know the institute's own clean room laboratory for MEMS fabrication. Autonoumous fabrication of micro structures.
3	**Recommended prerequisite for participation** Microsystem Technology
4	**Form of examination** Module final exam: • Module exam (Study archievments, Optional, standard grading system)
5	**Grading** Module final exam: • Module exam (Study archievments, Optional, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc MEC, MSc WI-ETiT
7	**References**

Courses

Course Nr. 18-sl-2050-se	**Course name** Advanced seminar Microsystem Technology	
Instructor Prof. Dr.-Ing. Helmut Schlaak	**Type** Seminar	**SWS** 2

Module name Project seminar Applications of Lighting Engineering					
Module Nr. 18-kh-2051	**Credit Points** 5 CP	**Workload** 150 h	**Self study** 105 h	**Duration** 1	**Cycle offered** WiSe/SoSe
Language German and English			**Module owner** Prof. Dr.-Ing. Khanh Quoc Tran		

1	**Content** The project seminar deals with the following subjects: automotive lighting, interior lighting, exterior lighting; generation, perception and cognition of the visual stimulus (luminaires, displays, projection); LED/OLED technology; physical and psychophysical light measurement; illuminating engineering, color perception.
2	**Learning objectives / Learning Outcomes** The objective of this project seminar is the practice oriented implementation of the material learned during the lectures in form of a project work. Via communication of the interdisciplinary way of thinking of the lighting engineer, students should carry out autonomous project work on their own or in a team.
3	**Recommended prerequisite for participation** Lighting Technology I-II (desireable)
4	**Form of examination** Module final exam: • Module exam (Study archievments, Optional, standard grading system)
5	**Grading** Module final exam: • Module exam (Study archievments, Optional, weighting: 100 %)
6	**Usability of this module** MSc ETiT, MSc iST, MSc WI-ETiT, MSc MEC, MSc MPE, MSc Phys
7	**References** Lecture notes of Lighting Technology I (Khanh); Lecture slides of our Laboratory; Book “LED Lighting: Technology and Perception” (Khanh et al., Wiley); Book „Farbwiedergabe“ (Khanh et al., Pflaum-Verlag); specific literature depending on the topic, publications.

Courses

Course Nr. 18-kh-2051-pj	**Course name** Project seminar Applications of Lighting Engineering		
Instructor Prof. Dr.-Ing. Khanh Quoc Tran		**Type** Project Seminar	**SWS** 3

Module name Ultra-Large Scale Integration Technology					
Module Nr. 18-sw-2010	**Credit Points** 6 CP	**Workload** 180 h	**Self study** 120 h	**Duration** 1	**Cycle offered** WiSe
Language German			**Module owner** Prof. Dr. rer. nat. Udo Eugen Schwalke		

1 Content

0) Introduction
1) Basic material
2) Layer technology
3) Lithography
4) Etching techniques and cleaning
5) Doping processes
6) Metallisation
7) Structual design technology
8) Process control
9) Process integration
10) Simulation

2 Learning objectives / Learning Outcomes

- knowledge about the various process steps to manufacture advanced integrated circuits
- knowledge about the semiconductor process technologies for fabrication of advanced CMOS
- understand semiconductor technology in later career, to apply this technology
- and develop systems within the rapidly changing semiconductor industry

3 Recommended prerequisite for participation

examinations passed: Microelectronic devices - the basics, Electrical Engineering and Information Technology 1, Electrical Engineering and Information Technology 2, Laboratory ETiT 1, Laboratory ETiT 2, Mathematics 1, Mathematics 2, Introductory Physics

4 Form of examination

Module final exam:

- Module exam (Technical examination, Optional, standard grading system)

5 Grading

Module final exam:

- Module exam (Technical examination, Optional, weighting: 100 %)

6 Usability of this module

MSc ETiT

7 References

Lecture slides
Lecture notes in preparation
[1] Widmann, Mader, Friedrich: Technologie hochintegrierter Schaltungen, Springer Verlag
[2] Richard C. Jaeger: Introduction to Microelectronic Fabrication Prentice Hall, 2002 [3] S.M. Sze: VLSI Technology, McGraw-Hill

Courses

Course Nr. 18-sw-2010-vl	**Course name** Ultra-Large Scale Integration Technology		
Instructor Prof. Dr. rer. nat. Udo Eugen Schwalke		**Type** Lecture	**SWS** 3

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	18-sw-2010-ue	Ultra-Large Scale Integration Technology		
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	Prof. Dr. rer. nat. Udo Eugen Schwalke		Practice	1