fhwedel
UNIVERSITY OF APPLIED SCIENCES

Staatlich anerkannte Fachhochschule
PTL Wedel, Prof. Dr. D. Harms, Prof. Dr. H. Harms
Gemeinnützige Schulgesellschaft mbH

Modulhandbuch

Master-Studiengang
IT Engineering

M_ITE15.0

Wedel, den 30. Juni 2016

Inhaltsverzeichnis

1 Module Handbook

2 Explanations of the module descriptions

In the following, each module is described in tabular form. The order follows the alphabetical codes.
Preceding the module descriptions there are two directories which support direct access to single descriptions. One directory sorts the descriptions by code, the other by name alphabetically.
The following explanations should make it easier to interpret the entries to the individual fields showing the context in which these entries were made.

Entries for a module

`Module code:`	Wedel specific code being unique with a study programme
`Module:`	Name of the module
`Course(s):`	Courses contained in the module with their code and name
`Examination in semester:`	Semester in which the module should be taken assuming a regular course of study
`Module leader:`	The strategic tasks od the module leader comprise of • synergetic use of the module also in other study programmes • initiating advancements of the module and its parts • quality management (e. g. relevance to the programme, work load) The operative tasks of the module leader comprise in particular of • coordination of dates for courses and exams. • initiating and updating the module and course descriptions. • merging different parts of the exams, collecting the results in tight cooperation with all teachers of the module. • being the contact person for the students in all questions related to the module .
`Assignement to curriculum:`	List of all study programmes containing this module
`Querweise:`	Links to other modules
`Lessons per week:`	Sum of the lessons of all courses contained in this module.
`Credits of the module:`	Sum of credits that can be earned in the courses of this module
`Student workload:`	The total workload is the number of credits multiplied with 30 hours. The contact time is computed from the lessons per week using the formula 1 lesson = 37.5 minutes. The individual study time is the difference between total workload and contact time.
`Prerequesites:`	Modules, courses and skills that are required at the beginning of the module. If a course is required, the corresponding module is mentioned.

`Duration:`	Number of semesters needed to complete this module
`Frequency of occurrence:`	indicates how often the module is offered per year (every semester or every year)
`Assessment:`	List of all types of assessments which are used in some course of the module
`Prozentualer Anteil an der Gesamtnote:`	Percentage of final score
`Language:`	In IT Engineering all courses are offered in English unconditionally. This applies to courses also used in German study programmes, too. In the other study programmes the courses are offered in German by default. However, some courses are eligible to be taught in English if at least one student of an international partner university is enrolled. Such courses are also listed on a special website in order to allow students of the partner universities to choose a course at home already.
`Learning targets of the module:`	High level targets referring to the competences to be acquired summarising the individual targets of the course(s)

Entries for a course:

`Course:`	Name of this course
`Lecturer(s):`	Name(s) of the teachers involved in this course
`Recommended semester:`	Number of semester in which this course should be attended according to the regular course of studies
`Course type:`	Compulsory or elected, possibly referring to the study programme
`Teaching methods / lessons per week:`	List of all teaching methods applied, each marked with the individual lessons per week. If not clearly separated, the total sum of the lessons per week for this course is given.
`Credits:`	Credits to be earned by attendence of this course
`Teaching style:`	List of all teaching styles applied in this course
`Learning targets of this course:`	Keywords of the central learning targets of this course
`Topics:`	Structured list of the essential topics covered in this course
`References:`	List of the basic references recommended to the students for reviewing and deepening the essential topics. The list of references actually used may be broader.

MSc IT-Engineering (in English)

Start in summer

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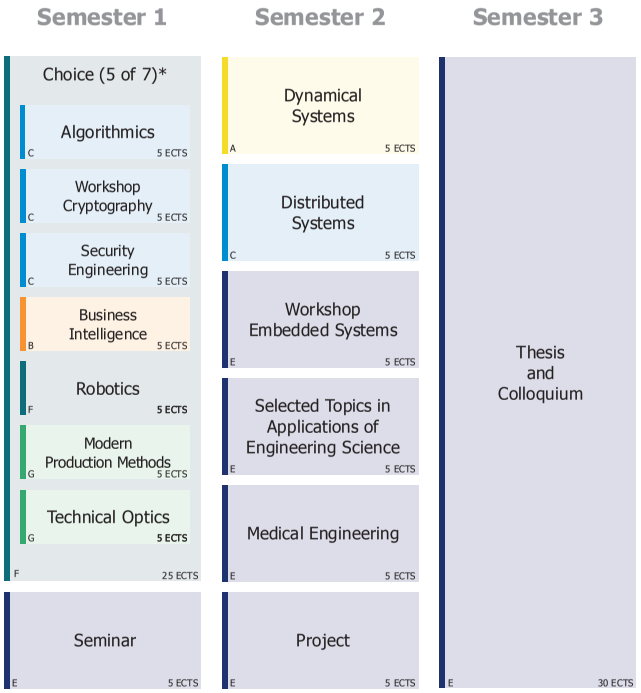

*It is not yet finally decided by the academic senate, if any combination of 5 courses will be feasible.

A MATHEMATICS
B B. A. AND LAW
C COMPUTER SCIENCE
E CORE SUBJECT
F SPECIALISATION / CHOICE
G NATURAL SCIENCES AND TECHNICS

All information subject to change
22.02.2016

MSc IT-Engineering (in English)

Start in winter

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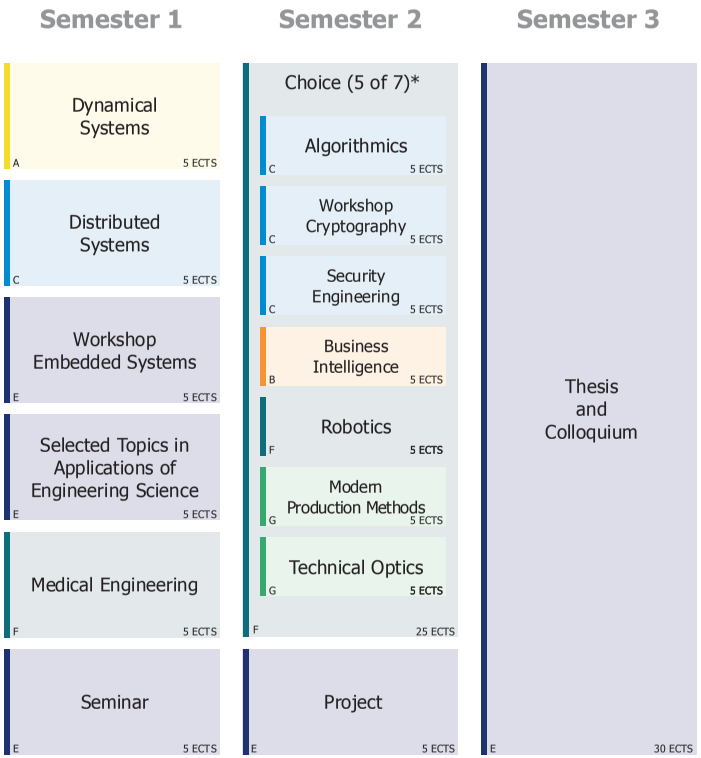

* It is not yet finally decided by the academic senate, if any combination of 5 courses will be feasible.

A MATHEMATICS
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G NATURAL SCIENCES AND TECHNICS

All information subject to change
22.02.2016

4 Module descriptions

4.1 Algorithmics

M003 Algorithmics	
Study programme	Master-Studiengang IT Engineering
Module code	M003
Module	Algorithmics
Course(s)	`M003a` Algorithmics
Module leader	Prof. Dr. Sebastian Iwanowski
Assignment to curriculum	Informatik (Master) IT Engineering (Master) IT-Sicherheit (Master)
Links to other modules	The module is a starting module. It sets the theoretical fundamentals for a scientific IT oriented study. It covers the knowledge about fundamental algorithms that are necessary for the solution of various application problems.
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	Understanding basic mathematical concepts such as definitions, theorems and proofs. ability of logically sound formulation The students must be able to follow proofs from the beginning of this course. Required is excellent knowledge of the basics of discrete mathematics, specially in number theory and graph theory. The students must have good programming knowledge and experience in implementing basic algorithms.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written or oral examination
Percentage of final score	6,25
Language	english

Learning targets of the module

The students know how to evaluate the efficiency of algorithms with theoretically sound methods. For selected application domains, they know how to describe algorithms in detail, show examples and implement them. They are able to solve basic proofs for efficiency and

correctness on their own. They can understand even complicated proofs and explain them to other people.

4.1.1 Algorithmics

Course	Algorithmics
Course leader(s)	Sebastian Iwanowski
Attendence in semester	2
Course type	Pflicht (M_Inf14.0, M_ITS14.0) Wahl (M_ITE15.0)
Teaching methods / lessons per week	lecture with tutorial, workshop, assignment
Credits	5.0
Teaching style	-

Learning target of the course

The students ...

- know the fundamental problems of algorithmics and the classical solving methods.
- are able to analyse the correctness and efficiency of algorithms.
- have detailed knowledge of advanced algorithms for miscellaneous problems in selected application domains.
- know how to implement theoretical results in practical applications.

Content

- Introduction into formal algorithmics
  - Comparing basic sorting techniques
  - Complexity measures for the analysis of algorithms
  - Lower bound for algorithms using comparisons only
- Advanced searching and sorting
  - Order statistics
  - Searching in sorted arrays
  - Sorting in finite domains
- Solutions for the dictionary problem
  - Hashing and other methods for optimising the average case behaviour
  - (2,3)-trees as example for an optimal worst case behaviour tree
  - Other optimal worst case methods for search trees
  - Optimal binary search trees (Bellman)
- Graph algorithms
  - Minimum spanning trees as motivation for basic algorithms
  - Shortest paths (Dijkstra, Floyd-Warshall, Strassen)
  - Computation of maximum flows in s/t-networks (Ford-Fulkerson, Edmonds-Karp, Dinic)
  - Computation of graph matchings (bipartite, Edmonds)
- String matching

- Fundamentals of algorithmic geometry
  - Basic problems and the use of Voronoi diagrams for solving them
  - Sweep techniques (including computation of Voronoi diagrams)

References

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  MIT Press 2001 (2nd ed.)
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  Introduction to the Design and Analysis of Algorithms.
  Addison-Wesley 2006, ISBN 0-321-36413-9
- Mehlhorn, K. / Sanders, P.:
  Algorithms and Data Structures The Basic Toolbox.
  Springer 2008, ISBN 978-3-540-77977-3
- Papadimitriou, C. / Steiglitz, K.:
  Combinatorial Optimization Algorithms and Complexity.
  Dover 1998, ISBN 0-486-40258-4

4.2 Business Intelligence

M101 Business Intelligence

Study programme	Master-Studiengang IT Engineering
Module code	M101
Module	Business Intelligence
Course(s)	`M101a` Business Intelligence
Module leader	Prof. Dr. Martin Schultz
Assignment to curriculum	Betriebswirtschaftslehre (Master) E-Commerce (Master) IT Engineering (Master)
Links to other modules	The module „Business Intelligence“ builds on the knowledge and competencies the students gained during their bachelor studies in the areas of business processes and IT support in companies. These competencies are deepened towards an integrated view of transactional and analytical application systems for management support in current business environments. Accordingly, this module can be systematically combined with the module „Enterprise Resource Planning“ with primarily deals with the management perspective on transactional systems.
Lesson load per week of the module	6
Credits of the module	5
Student workload	attendance study: 56 hours self study: 94 hours
Prerequisites	The students need a thorough understanding of business transactions and business processes as well as an understanding of the nature and extent of information systems support in current business.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written or oral examination (+ bonus points)
Percentage of final score	6,25
Language	english

Learning targets of the module

Under todays competitive market conditions, the targeted use of analytical application systems is a key factor for many companies in attracting and maintaining competitive advantage. On completion of this module the students are able to explain, apply and evaluate the basic concepts, methods and techniques from the field of business intelligence. They are able to describe the structure and functionality of common analytical application systems and use selected business intelligence software solutions. Furthermore, they can highlight specific differences between systems. For various business application scenarios they can select and critically compare suitable data analysis methods.

4.2.1 Business Intelligence

Course	Business Intelligence
Course leader(s)	Martin Schultz
Attendence in semester	2
Course type	Pflicht (M_BWL16.1, M_BWL16.2, M_ECom16.0) Wahl (M_ITE15.0)
Teaching methods / lessons per week	lecture with tutorial, workshop, assignment
Credits	5.0
Teaching style	Blackboard, projector presentation, tutorials, software presentation

Learning target of the course

The students are able to ...

- present the basic terms in the field of business intelligence and relate them to each other
- explain, apply and evaluate basic methods and techniques from the area of business intelligence
- describe and compare the design and functions of typical analytical application systems
- apply and critically compare selected business intelligence software solutions
- highlight specific differences between business intelligence systems for various practical fields of application
- select and evaluate appropriate data analysis methods for diverse business application scenarios.

Content

The course aims at providing students with a comprehensive understanding of the use of analytical application systems in current corporate practice. Besides an introduction of a sound theoretical basis on the concepts, methods and techniques from the field of business intelligence, the design and functions of typical analytical application systems is illustrated. This theoretical knowledge is applied and deepened with the help of practical case studies. The case studies included the usage of various business intelligence software solutions. Thereby, the focus is set on the selection and application of appropriate software solutions for various business application scenarios.

Outline

- IT support for management tasks - Fundamentals and vocabulary
- Data Warehouse architectures and techniques Multidimensional data modeling and analysis (OLAP)
- Requirements, design and characteristics of management support systems and data warehouses
- Methods and techniques of data mining
- Business Application Scenarios for Business Intelligence
- Current developments in the area of Business Intelligence

References

- Inmon, William H: *Building the data warehouse*. 4th ed. Aufl. Indianapolis, Ind. : Wiley, 2005
- Kimball, Ralph ; Ross, Margy ; Thornthwaite, Warren ; Mundy, Joy ; Becker, Bob: *The Data Warehouse Lifecycle Toolkit*. 2. Aufl. Indianapolis, IN : Wiley, 2008.
- Turban, Efraim ; Sharda, Ramesh ; Delen, Dursun ; King, David: *Business intelligence: a managerial approach*. 2. Aufl. Boston, Mass. : Pearson, Prentice Hall, 2011.
- Inmon, W.H.; Linstedt, D.: *Data architecture a primer for the data scientist: big data, data warehouse and data vault*. 2014.

4.3 Workshop Cryptography

M009 Workshop Cryptography

Study programme	Master-Studiengang IT Engineering
Module code	M009
Module	Workshop Cryptography
Course(s)	`M009a` Workshop Cryptography
Module leader	Prof. Dr. Gerd Beuster
Assignment to curriculum	Informatik (Master) IT Engineering (Master) IT-Sicherheit (Master)
Links to other modules	For this module, basic knowledge of discrete mathematics is required. The students acquire advanced knowledge about the mathematical basis of cryptography and its practical application. This knowledge can be utilized in all fields where cryptography methods are used.
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	Students need the knowledge about discrete mathematics typically acquired in an undergraduate study programme in computer science or a similar field. Students must be familiar with the common Internet protocols. Students must have some basic knowledge in programming.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	acceptance test
Percentage of final score	0
Language	english

Learning targets of the module

In the cryptography workshop, students gain knowledge about the mathematical base of cryptography and its practical application. After completing the course, students are able to use cryptographic methods in the context of secure IT systems, and to evaluate the use of cryptographic methods in existing systems.
This covers both software- and hardware-based cryptography. A focus is put on cryptography used on the Internet and for E-Commerce. The students know how to ensure the confidentiality and integrity of personal data and business data by cryptographic means. Based on real world cryptographic systems, students learned that many side conditions have to be taken into account when implementing and using cryptographic methods.

4.3.1 Workshop Cryptography

Course	Workshop Cryptography
Course leader(s)	Gerd Beuster
Attendence in semester	2
Course type	Pflicht (M_ITS14.0, M_ITS16.0) Wahl (M_Inf14.0, M_ITE15.0)
Teaching methods / lessons per week	workshop
Credits	5.0
Teaching style	Blackboard, projector presentation, overhead slide presentation, handout, software presentation, student computer exercises, E-Learning

Learning target of the course

After completing the module, students are able to ...

- use security tools as an essential building block of modern information and communication systems.
- apply their knowledge of all relevant aspects of data, network and web security.
- asses the application of cryptographic methods, especially for authentication, encryption and integrity preservation.
- assess they algorithmic strengths and weaknesses of cryptographic methods.
- assess and implement cryptographic protocols, especially for authentication in e-commerce.
- consider all side conditions relevant for implementation and application of cryptographic methods.
- assess the quality of random number generators.
- assess the suitability of software and hardware cryptography for a given task.

Content

- Theory of Cryptography
  - Semantic Security
  - Unbreakable Encryption and One Time Pad
  - Diffusion and Confusion
- Classic Cryptography
  - Substitution and Transposition
  - Affine Encryption
  - Rotor Machines
- Modern Cryptography
  - Stream and Block Ciphers
  - DES and GOST
  - AES

- Block Cipher Modes of Operation
  - ECB, CBC, CTR, AES-GCM
- Random number generators
  - TRNG and PRNG
  - Requirements for CSPRNG
  - PRNG based on mathematical problems
    - Blum-Blum-Shub
- Hashing
  - Hashing Algorithms
    - SHA 2
    - Keccak
  - Message authentication
    - CMAC and HMAC
- Asymmetric Cryptography
  - Diffie-Hellman
  - RSA
  - Elliptic Curves
  - Asymmetric Encryption and Digital Signatures
- Practical Cryptography: PGP and SSL
- Hardware Cryptography
  - Trusted Computing
  - Smartcards
  - Differential Power Analysis

References

- Stallings, William: Cryptography and Network Security : Principles and Practice. 6. Edition. Harlow, UK: Pearson, 2013.
- Ferguson, Niels; Schneier, Bruce; Kohno, Tadayoshi: Cryptography Engineering : Design Principles and Practical Applications. Indianapolis (IN), USA: Wiley Publishing, 2010.
- Menezes, Alfred J.;van Oorschot, Paul C.; Vanstone, Scott A.: Handbook of Applied Cryptography. Boca Raton (FL), USA: CRC Press, 1996.
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- Lawrence C. Washington: Elliptic Curves : Number Theory and Cryptography. 2. Edition. Boca Raton (FL), USA: CRC Press, 2008.
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- Katz, Jonathan; Lindell, Yehuda: Introduction to Modern Cryptography. Boca Raton (FL), USA: CRC Press, 2007.
- Swenson, Christopher: Modern Cryptanalysis : Techniques for Advanced Code Breaking. Indianapolis (IN), USA: Wiley Publishing, 2008.
- Mao, Wenbo: Modern Cryptography: Theory and Practice, Upper Saddle River (NJ), USA: Prentice Hall, 2003.

4.4 Security Engineering

M019 Security Engineering

Study programme	Master-Studiengang IT Engineering
Module code	M019
Module	Security Engineering
Course(s)	`M019a` Security Engineering
Module leader	Prof. Dr. Gerd Beuster
Assignment to curriculum	IT Engineering (Master) IT-Sicherheit (Master)
Links to other modules	The module requires basic knowledge in the fields of computer architecture, operating systems, computer networks, and programming. The skills acquired in this module are applicable to all tasks involving software and security engineering.
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	Students must be able to think analytically and to build formal methods. These abilities are typically acquired in an undergraduate study programme in computer science or a similar field. In addition, students must know the general principals of modern computers and operating systems, network technology, and programming.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written or oral examination
Percentage of final score	6,25
Language	english

Learning targets of the module

After completing the module, the students are able to evaluate the security of existing IT systems and to design and implement new, secure IT systems. This module focuses on the engineering aspects of IT security. When the module is completed, the students know the state of the art in secure software, secure hardware, network security and physical security. The students are able to design systems providing adequate security both for personal and business data.

4.4.1 Security Engineering

Course	Security Engineering
Course leader(s)	Gerd Beuster
Attendence in semester	2
Course type	Pflicht (M_ITS14.0, M_ITS16.0) Wahl (M_ITE15.0)
Teaching methods / lessons per week	lecture with tutorial, workshop, assignment
Credits	5.0
Teaching style	Blackboard, projector presentation, overhead slide presentation, handout, software presentation, student computer exercises, guest speakers, E-Learning

Learning target of the course

After completing the module, students are able to ...

- apply the basic concepts of IT Security.
- define and check security requirements for software.
- develop and evaluate secure software.
- assess and evaluate the security of hardware components
- evaluate the security of computer networks
- design secure computer networks.

Content

- Basic Concepts of IT Security
- Threat Modeling
- Threats in Practice
- Security Modeling
- Security Administration and Physical Security
- Operating System Security and Access Rights
- Security Protocols
- Methods for Developing Secure Software
- Typical Attacks on Software Systems
- Distributed Systems / Network Security
- Secure Hardware

References

- Allen, Julia H.; Barnum, Sean; Ellison, Robert J.; McGraw, Gary; Mead, Nancy R.: Software Security Engineering : A Guide for Project Managers. Bosten (MA), USA: Addison Wesley, 2008.
- Anderson, Ross J.: Security Engineering : A Guide to Building Dependable Distributed

Systems. 2. Edition. Hoboken (NJ), USA: Wiley & Sons, 2008.
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- Wilhelm, Thomas: Professional Penetration Testing : Creating and Operating a Formal Hacking Lab. 2. Edition. Amsterdam, NL: Elsevier, 2013.

4.5 Robotics

M018 Robotics

Study programme	Master-Studiengang IT Engineering
Module code	M018
Module	Robotics
Course(s)	`M018a` Robotics
Module leader	Prof. Dr. Ulrich Hoffmann
Assignment to curriculum	Informatik (Master) IT Engineering (Master)
Links to other modules	The module is reasonably combined with the basic modules „Einführung in die Robotik“ and „Bildbearbeitung und -analyse“ as well as the module „Learning & Softcomputing“. It can be used in all technical degree programs.
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	Prerequisites are the comprehensive understanding of information technology and software engineering concepts. These are best achieved by a previous studies of computer science or IT engineering with focus on media technology or computer architecture. These studies should have established a bachelor of science in computer science degree. It is assumed that students will be able to work independently in a scientific environment.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	assessment
Percentage of final score	6,25
Language	english

Learning targets of the module

Students earn fundamental competence in selected robot concepts and technlogies.
One focus is to perculate the properties of mobile and autonomous systems. Starting with the basic foundation of robotics topics students wir gain experience in motion and action modelling concepts as well as intelligent learning sensors as basis of autonomous robot behavior.
A showcase implementation within a slef organized group oriented project of one of the theoretically presented concepts enhances the understanding of the concepts at hand.
Students especially achieve a thorough understanding and can categorize and rate practical problems that arise in robot actions guided by visual image processing.
In addition the project leads to an improved presentation style and presentation technique as well as enhanced abilities to freely discuss complex scienticic situations in a team.

4.5.1 Robotics

Course	Robotics
Course leader(s)	Ulrich Hoffmann
Attendence in semester	2
Course type	Wahl
Teaching methods / lessons per week	different types of lectures
Credits	5.0
Teaching style	Handout

Learning target of the course

Students ...

- have basic knowledge of selected concepts and technologies of robotics.
- thoroughly understand mainly properties of mobile autonomous systems.
- have a deep understanding of the technical foundation of robotics and especially of the concepts of movement and action modeling as well as intelligent learning sensors as basis of autonomous robot behavior.
- are able to realize show case implementations of presented theoretical concepts in a self organized and group oriented project.
- have the competence to understand practical problems that occur when robot actions are guided by visual images.
- are able to convey comprehensibly their scientific results in an appropriate presentation with suitable presentation techniques.
- have the capability to communicate complex scientific facts in a technical discussion in a competent way.

Content

- Structure and composition of robots
  - Kinematics
  - Motion and movers
  - Effectors
  - Programming systems
- Motion modeling
  - Point to point control
  - Interpolation of trajectories
- Action modeling
- Intelligent sensors
  - Tactile sensors
  - Optical sensors
- Learning robots

- Practical project in groups in order to self-dependently implement and study a given complex topic area.
- Regular discussion of project results and presentations in groups.

References

4.6 Seminar IT Engineering

M041 Seminar IT Engineering

Study programme	Master-Studiengang IT Engineering
Module code	M041
Module	Seminar IT Engineering
Course(s)	`M041a` Seminar IT Engineering (Master)
Module leader	Prof. Dr. Sebastian Iwanowski
Assignment to curriculum	IT Engineering (Master)
Links to other modules	The module can be used to deepen the knowledge in an individual field / topic and extend this in the project and even in the masters thesis.
Lesson load per week of the module	2
Credits of the module	5
Student workload	attendance study: 20 hours self study: 130 hours
Prerequisites	Survey knowledge in the research area from which the topic is selected.
Duration	1 semester
Frequency of occurrence	every semester
Admissible assessment types	written documentation (if necessary presentation)
Percentage of final score	6,25
Language	english

Learning targets of the module

The students are able to work self-responsible on technically advanced topics. They can prepare documentation according to standards accepted in the research community. The students are able to present and discuss results.

4.6.1 Seminar IT Engineering (Master)

Course	Seminar IT Engineering (Master)
Course leader(s)	jeweiliger Dozent
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	seminar
Credits	5.0
Teaching style	Blackboard, projector presentation, handout

Learning target of the course

The students are able to work self-responsible on technically advanced topics. They can prepare documentation according to standards accepted in the research community. The students are able to present and discuss results.

Content

The students work on varying topics, mainly from the areas of computer science and general engineering. They prepare a report and present their results to the group, including Q & A.

References

Depending on the selected topic.

4.7 Selected Topics in Applications of Engineering Science

M039 Selected Topics in Applications of Engineering Science

Study programme	Master-Studiengang IT Engineering
Module code	M039
Module	Selected Topics in Applications of Engineering Science
Course(s)	`M039a` Selected Topics in Applications of Engineering Science
Module leader	Prof. Dr. Sebastian Iwanowski
Assignment to curriculum	IT Engineering (Master)
Links to other modules	This module opens the opportunity to get to know how theoretical foundations of other modules are put into practice. Furthermore, it is good for generating topics for the project and the master thesis.
Lesson load per week of the module	2
Credits of the module	5
Student workload	attendance study: 20 hours self study: 130 hours
Prerequisites	No specific prerequesites.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written documentation (if necessary presentation)
Percentage of final score	0
Language	english

Learning targets of the module

The students get to know current problems from engineering applications. They know selected companies and their local representatives. They know how to structure and write a scientific thesis.

4.7.1 Selected Topics in Applications of Engineering Science

Course	Selected Topics in Applications of Engineering Science
Course leader(s)	Sebastian Iwanowski
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	workshop
Credits	5.0
Teaching style	-

Learning target of the course

The students ...

- know IT applications of engineering conducted in companies.
- are acquainted with local representatives of companies they could work after their study.
- know how to structure and write scientific papers.

Content

varies: depends on guest lecturer

References

depends on topic and speaker

4.8 Medical Engineering

M059 Medical Engineering

Study programme	Master-Studiengang IT Engineering
Module code	M059
Module	Medical Engineering
Course(s)	`M059a` Medical Engineering
Module leader	PD Dr. Dennis Säring
Assignment to curriculum	IT Engineering (Master)
Links to other modules	The module „Medical Engineering“ can be combined with modules „Algorithmics“ and „Robotics“.
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	Students shall know at least one programming language and notation formalism for specifying algorithmic complexity (big O notation).
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written or oral examination
Percentage of final score	6,25
Language	english

Learning targets of the module

Students understand the importance of the fields of engineering and computer science for medicine and understand main regulatory issues to be regarded when designing medical applications.
They know the different physical working principles used for different medical imaging devices and the corresponding main algorithms used for computing images from these devices.
Students know techniques used for artifical implants and computer assisted surgery. They have further basic knowledge about main methods used in bioinformatics for sequence analysis and protein structure prediction.

4.8.1 Medical Engineering

Course	Medical Engineering
Course leader(s)	Dennis Säring
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	lecture
Credits	5.0
Teaching style	Blackboard, projector presentation, handout, E-Learning

Learning target of the course

Students ...

- shall understand the importance of the fields of engineering and computer science for medicine.
- shall understand that designing and approving medical devices is different from designing non-medical devices (regulatory issues).
- will learn to understand the different physical working principles and main algorithms used for different medical imaging devices such as Ultrasonography, Electroencephalography, X-ray Computed Tomography and Magnetic Resonance Imaging.
- will get to know techniques used for implants such as cochlear and retina implant and artificial limb control.
- will learn techniques for computer-assisted surgery and automatic robotic surgery.
- will also get a short introduction into bioinformatics (sequence analysis, protein structure prediction) and some of the main algorithms used here and the linkage between bioinformatics and medical informatics.

Content

- Introduction
  - Where Can Computer Science Help In Medicine?
  - A Short History of Medical Engineering
  - Designing Medical Devices and Corresponding Regulatory Issues
- Medical Imaging
  - Working Principle And Algorithms For Ultrasonography
  - Working Principle And Algorithms For Electroencephalography (EEG)
  - Working Principle And Algorithms For X-ray Computed Tomography (CT)
  - Working Principle And Algorithms For Magnetic Resonance Imaging (MRI)
- Implants
  - Artifical Limbs and Their Control
  - Cochlear Implant (CI)
  - Visual Prosthesis
  - Tissue Engineering (TE)

- Computer-Assisted Surgery (CAS)
  - Surgical Navigation
  - Robotic Surgery
- Bioinformatics for Medical Applications
  - DNA Sequence Analysis
  - Protein Structure Prediction

References

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- van Bemmel, J.; Musen, M.A.:
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- Smith, N.B.; Webb, Andrew:
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  Cambridge Texts in Biomedical Engineering, 2010, ISBN 978-0521190657
- Preim, B.; Bartz, D.:
  Visual Computing for Medicine.
  Morgan Kaufmann Series in Computer Graphics, 2013, ISBN 978-0124158733
- Lesk, A.:
  Introduction to Bioinformatics.
  Oxford University Press, 4th Edition, 2013, ISBN 978-0199651566

4.9 Distributed Systems

M035 Distributed Systems

Study programme	Master-Studiengang IT Engineering
Module code	M035
Module	Distributed Systems
Course(s)	`M035a` Distributed Systems `M035b` Tutorial: Distributed Systems
Module leader	Prof. Dr. Ulrich Hoffmann
Assignment to curriculum	Informatik (Master) IT Engineering (Master) IT-Sicherheit (Master)
Links to other modules	The module can well be combined with modules „Funktionale Programmierung“ and „Aktuelle Entwicklungen in der Informatik“ as well as with the „Seminar Master“.
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	The practical exercises assume advanced programming abilities. In addition the module assume solid knowledge of internet arhitecture and structure as well as basic knowledge of enterprise workflow processe organization.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written or oral examination (Teil M035a), acceptance test (Teil M035b)
Percentage of final score	6,25
Language	english

Learning targets of the module

Students gain extended knowledge of technical aspects of distributed systems as well as their area of applications in commercial contexts. They experience and discuss technological inherent problems of distributed systems and thus have the ability to address the challenges of distributet system and to copy with them. They know the architecture and major algorithms in distributetd systems as well as processes in development and administration that lead to successful distributed products. They are able to program distributed systems in different programm paradigms.

4.9.1 Distributed Systems

Course	Distributed Systems
Course leader(s)	Ulrich Hoffmann
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	lecture
Credits	3.0
Teaching style	Handout

Learning target of the course

The students gain ...

- thorough understanding of principles of distributed applications.
- knowledge in mastering base technologies and current software tools for distributes systems.
- knowledge of state of the are in different application areas such as service mediation and e-commerce.
- knowledge of basic algorithms in distributed systems.
- precise knowledge of current web service architectures.
- practical skills to realize a project.
- distributed programming skills in different paradigms.

Content

- practical examples
- general requirements of distributed systems
- the client server relation and resulting questions
- communications in distributed systems
- naming services
- techniques for concurrency
- remote calls
- alternative paradigms (actor concept, ...)
- synchronisation of data and processes
- coordination methods
- replication techniques
- WEB services with SOAP and REST
- fault tolerance concepts
- security in distributed systems

- programming with threads
- communication via sockets, structure of clients and servers
- remote procedure call / remote method invocation
- using naming services
- programming WEB services (SOAP, server / client, WSDL, data binding)
- distributed programming with alternate concepts
- programming synchronisation algorithms
- programming distributed election algorithms
- programming of REST based services and clients
- fault tolerant programming in distributed systems

References

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  Pragmatic Programmers, 2007
- ODERSKY, Martin; SPOON, Lex; VENNERS, Bill:
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  Artima Press, Mountain View, 2008
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  Addison-Wesley, 2011, ISBN 0-1321-4301-1
- TANENBAUM, Andrew; VAN STEEN, Marten:
  Distributed Systems, Priciples and Paradigms.
  Prentice Hall, 2006, ISBN 0-1323-9227-5

4.9.2 Tutorial: Distributed Systems

Course	Tutorial: Distributed Systems
Course leader(s)	Ulrich Hoffmann
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	tutorial/lab/business game
Credits	2.0
Teaching style	-

Learning target of the course

The students ...

- have the ability to operate typical software systems (middleware) in the area of distributed systems and use them to solve problems.
- are accustomed to problems that occur in reality and are able to overcome these.
- have deep knowledge of the specific properties of distributed systems by practical experience. They can categorize and evaluate these properties.

Content

Lecture accompanying practical exercises in programming distributed systems and their algorithms in different programming paradigms.

References

- c., f. lecture
- numerous online ressources

4.10 Dynamical Systems

M037 Dynamical Systems

Study programme	Master-Studiengang IT Engineering
Module code	M037
Module	Dynamical Systems
Course(s)	`M037a` Digital Feedback Control `M037a` Dynamical Systems
Module leader	Prof. Dr.-Ing. Carsten Burmeister
Assignment to curriculum	IT Engineering (Master)
Links to other modules	The module is combined with other modules from IT Engineering
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	Basic knowledge on systems and modelling of systems.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written or oral examination
Percentage of final score	6,25
Language	english

Learning targets of the module

Students have a good overview on digital feedback systems. They are able to digitize continuous systems and know the effects that sampling and quantization has on the accuracy of the model. They can analyze discrete time systems and have experiences in using computer simulation tools for this purpose. The studentes can design digital control systmes using various methods and have experiences in using computer tools for this purpose.

4.10.1 Digital Feedback Control

Course	Digital Feedback Control
Course leader(s)	Carsten Burmeister
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	lecture
Credits	2.5
Teaching style	Handout

Learning target of the course

The Students can ...

- digitize continuous systems and know the effects that sampling and quantization has on the accuracy of the model.
- apply the z-transform to analyze discrete time systems.
- know the basic concepts of discrete time control systems.
- design control systems using root locus method, frequency response method, and various empirical design methods.

Content

- Review of Continuous Control
- Introduction to Digital Control
- Discrete Time Systems analysis
- Root Locus Design Method
- Frequency Response Design Method
- Empirical Design Methods

References

- Franklin, Powell, Workman: Digital Control of Dynmiac Systems, 3rd Edition, Ellis-Kagle Press, 1998.
- Fadali, Visioli: Digital Control Engineering, 2nd Edition, Academic Press, 2012.
- Lavretsky, Wise: Robust and Adaptive Control, 1st Edition, Springer, 2013.

4.10.2 Dynamical Systems

Course	Dynamical Systems
Course leader(s)	Ioana Serban
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	lecture with tutorial, workshop, assignment
Credits	2.5
Teaching style	-

Learning target of the course

The aim of this course is to provide a broad introduction to nonlinear dynamics, for students with no prior exposure to the subject.
After successful participation the students ...

- know how to model basic physical, technical, sociological and economical systems with linear and nonlinear equations.
- know the fundamental problems of nonlinear systems and the classical solving methods.
- are able to analyse the correctness and efficiency of the used mathematical model.
- have detailed knowledge of certain specific dynamical systems, like the nonlinear damped and driven pendulum, the logistic equation or the Lorenz system.
- know how to implement theoretical results in practical applications.

Content

- One-Dimensional Flows
  - Flows on the Line
  - Bifurcations
  - Flows on the circle
- Two-Dimensional Flows
  - Linear Systems
  - Phase Space
  - Limit Cycles
  - Bifurcations revisited
- Chaos
  - Lorenz Equations
  - One-Dimensional Maps
  - Fractals
  - Strange Attractors

References

- Strogatz, S. H., :
  Nonlinear Dynamics and Chaos - With Applications to Physics, Biology, Chemistry and Engineering,
  Westview Press (2., Edition) 2015
- Argyris, J.;, Faust,G.;, Haase, M.;, Friedrich, R.:
  Die Erforschung des Chaos - Eine Einführung in die Theorie nichtlinearer Systeme,
  Springer Verlag (2., Auflage) 2010

4.11 Embedded Systems Workshop

M038 Embedded Systems Workshop

Study programme	Master-Studiengang IT Engineering
Module code	M038
Module	Embedded Systems Workshop
Course(s)	`M038a` Embedded Systems Workshop
Module leader	Dipl.-Ing. (FH) Timm Bostelmann
Assignment to curriculum	IT Engineering (Master)
Links to other modules	This module fits in with other modules covering hardware and software engineering.
Lesson load per week of the module	6
Credits of the module	5
Student workload	attendance study: 56 hours self study: 94 hours
Prerequisites	Knowledge of electronics engineering and low-level programming
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	acceptance test
Percentage of final score	6,25
Language	english

Learning targets of the module

The students know how to engineer a prototype of an embedded system based on a functional specification. Furthermore they are able to perform methodical tests and create a technical documentation.
The students are able to utilize data-sheets to read up on complex components like microcontrollers and embedded sensors. They can engineer embedded hardware and handle the specific demands of embedded software development.

4.11.1 Embedded Systems Workshop

Course	Embedded Systems Workshop
Course leader(s)	Timm Bostelmann
Attendence in semester	1
Course type	Pflicht
Teaching methods / lessons per week	workshop
Credits	5.0
Teaching style	Blackboard, projector presentation, software presentation, student computer exercises

Learning target of the course

The students are able to ...

- engineer a prototype of an embedded system based on a functional specification.
- understand and utilize data-sheets.
- read up on complex components like micro-controllers and embedded sensors.
- engineer analogue and digital interface hardware for an embedded system (depending on the workshop topic).
- engineer embedded software.
- create a technical documentation.

Content

- Introduction to embedded systems.
  - Embedded system engineering
  - Embedded hardware engineering
  - Embedded software engineering
- Introduction to the laboratory equipment.
- Guided engineering of a simple embedded system.
- Engineering, testing and documentation of an embedded system prototype.

References

various data-sheets depending on the workshop topic

4.12 Project IT Engineering

M040 Project IT Engineering

Study programme	Master-Studiengang IT Engineering
Module code	M040
Module	Project IT Engineering
Course(s)	`M040a` Project IT Engineering
Module leader	Prof. Dr.-Ing. Carsten Burmeister
Assignment to curriculum	IT Engineering (Master)
Links to other modules	Within this module the students can use their gained theoretical knowledge and skills in a practical project. Hence, it is combined with other modules from IT Engineering.
Lesson load per week of the module	2
Credits of the module	5
Student workload	attendance study: 20 hours self study: 130 hours
Prerequisites	Depending on the selected topic.
Duration	1 semester
Frequency of occurrence	every semester
Admissible assessment types	written documentation (if necessary presentation)
Percentage of final score	6,25
Language	english

Learning targets of the module

The students have gained a deeper understanding of a selected technical topic. They have gained experiences on how to work on a project in a team, how to organize the team, how to approach and solve a typical technical problem and how to test and document the solution.

4.12.1 Project IT Engineering

Course	Project IT Engineering
Course leader(s)	verschiedene Dozenten
Attendence in semester	2
Course type	Pflicht
Teaching methods / lessons per week	project
Credits	5.0
Teaching style	-

Learning target of the course

The students have gained ...

- a deeper understanding of a selected technical topic.
- experiences on how to work on a project in a team, how to organize the team, how to approach and solve a typical technical problem and how to test and document the solution.

Content

A topic is selected by a team of students or given by the tutor of the project. Typically a technical problem would be solved. Software and hardware tools may be required to be used. The tools may or may not be already known to the students from proceeding courses in this Master or a previous Bachelor program. The team of students need to organize themselves, which results in a detailed project plan. The developed solution needs to be tested and documented and the result is to be presented.

References

Depending on the selected topic.

4.13 Modern Production Methods

M014 Modern Production Methods

Study programme	Master-Studiengang IT Engineering
Module code	M014
Module	Modern Production Methods
Course(s)	`M014a` Fiber reinforced plastics and hybrids (FRP) `M014b` Laser Engineering
Module leader	Dr. Ioana Serban
Assignment to curriculum	IT Engineering (Master) Wirtschaftsingenieurwesen (Master)
Links to other modules	Keine Abhängigkeiten.
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	Grundlegende Kenntnisse der Chemie, Werkstoffkunde und der Physik, insbesondere elektromagnetische Wellen und Atomphysik.
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	written or oral examination
Percentage of final score	3,13
Language	english

Learning targets of the module

Im ersten teil des Moduls lernen die Studierenden moderne Produktionsverfahren zur Verarbeitung von Kunststoffen, Elastomeren kennen. Die Studierenden sollen an einem konkreten Produkt die angewandten Fertigungsverfahren erkennen und benenn können. Fertigungsprozesse werden sowohl in technologischer als auch in wirtschaftlicher Hinsicht beurteilt. Die Studierenden werden die Anforderungen eines Produktes an ein geeignetes Fertigungsverfahren analysieren, entsprechende Fertigungsverfahren auswählen sowie neue Prozessketten entwickeln können.
Im zweiten teil lernen die Studierenden die physikalischen Grundprinzipien eines Lasersystems kennen. Sie können diese Prinzipien danach benennen und erklären. Die Eignung des Lasers als Werkzeug in der Fertigung wird heraus gestellt und gegenüber anderen Fertigungsverfahren abgegrenzt.
Die Studierenden können unterschiedliche Fertigungsanforderungen zu den behandelten Lasersystemen zuordnen und sind in der Lage die Entscheidung über die Auswahl eines Lasersystems für ein konkretes Fertigungsvorhaben zu treffen.

4.13.1 Fiber reinforced plastics and hybrids (FRP)

Course	Fiber reinforced plastics and hybrids (FRP)
Course leader(s)	Hauke Lengsfeld
Attendence in semester	2
Course type	Pflicht (M_WIng14.0) Wahl (M_ITE15.0)
Teaching methods / lessons per week	lecture
Credits	2.5
Teaching style	-

Learning target of the course

The students gain ...

- knowledge of FRPs and lightweight materials properties.
- knowledge of manufacturing and assembling technologies.
- basic knowledge of manufacturing engineering and design principles of FRP parts.
- basic skills to assess manufacturing processes from a technical and economical position.

Content

- basic knowledge of
  - properties of typical fibers and reinforcments
  - semi-finished products: textiles, prepregs
  - manufacturing of fibers and textiles
  - requirements and properties of matrix materials
- engineering with FRPs
  - properties of FRPs, differences to metals
  - engineering design principles with FRPs
  - manufacturing friendly part design
- processing and part manufacturing with FRPs
  - processing and manufacturing technologies
  - processing of semi-finished products (textiles, matrix, prepregs)
  - postprocessing (milling, drilling) of FRP parts
  - assembling technologies of FRP parts
  - recycling
- applications of FRP parts
  - space & aeropsace
  - automotive
  - wind energy & industry

References

- Lengsfeld, Hauke; Wolff-Fabris, Felipe; Krämer, Johannes; Lacalle, Javier; Altstädt,

Volker: Composite Technology, Carl Hanser Verlag, Munich 2016, ISBN: 978-1-56990-599-9, E-Book ISBN: 978-1-56990-600-2
- Astrom Tomas B.: Manufacturing of Polymer Composites, Printed in Great Britain by St. Edmundsbury Press, ISBN 0-142-81960-0
- Dodiuk, Hanna; Goodman, Sydney: Handbook of Thermoset Plastics, William Andrew Publishing; 3rd Edition 2013, ISBN-10: 1455731072, ISBN-13: 978-1455731077
- Rosato, Donald V.; Rosato, Dominick V.: Reinforced Plastics Handbook, Elsevier Science & Technology; 3rd Edition 2005, ISBN-10: 1856174506, ISBN-13: 978-1856174503
- Olabisi, Olagoke; Adewale, Kolapo: Handbook of Thermoplastics, Crc Pr Inc; 2nd Edition 2015, ISBN-10: 1466577223, ISBN-13: 978-1466577220
- Ehrenstein, Gottfried Wilhelm: Thermal Analysis of Plastics: Theory and Practice, Hanser Gardner Publications 2004, ISBN-10: 156990362X, ISBN-13: 978-1569903629
- Ehrenstein, Gottfried Wilhelm: Polymeric Materials - Structure, Properties, Applications; Hanser Publishers 2001, ISBN-10: 3446214615, ISBN-13: 978-3446214613

German Books

- Lengsfeld, Hauke; Wolff-Fabris, Felipe; Krämer, Johannes; Lacalle, Javier; Altstädt, Volker: Faserverbundwerkstoffe Prepregs und ihre Verarbeitung, Carl Hanser Verlag, München 2016, Print-ISBN: 978-3-446-43300-7, E-Book-ISBN: 978-3-446-44080-7
- Flemming, M.; Ziegmann, G.; Roth, S.: Faserverbundbauweisen Halbzeuge und Bauweisen, Berlin Heidelberg, Springer, 1996
- Flemming, M.; Ziegmann, G.; Roth, S.: Faserverbundbauweisen Fertigungsverfahren mit duroplastischer Matrix, Berlin Heidelberg, Springer, 1999
- Flemming, M.; Ziegmann, G.; Roth, S.: Faserverbundbauweisen Faser und Matices, Berlin Heidelberg, Springer, 1995
- Neitzel, Manfred; Mitschang, Peter: Handbuch Verbundwerkstoffe: Werkstoff, Verarbeitung, Anwendung; München, Hanser, 2004
- Ehrenstein, Gottfried Wilhelm: Faserverbund-Kunststoffe, München, Hanser, 2. Auflage 2006
- Schwarz, Otto; Ebeling, Friedrich-Wolfhard; Furth, Brigitte: Kunststoffverarbeitung, Würzburg, Vogel, 10. Auflage 2005
- Michaeli, Walter: Einführung in die Kunststoffverarbeitung, München, Hanser, 5. Auflage 2006

4.13.2 Laser Engineering

Course	Laser Engineering
Course leader(s)	Ioana Serban
Attendence in semester	2
Course type	Pflicht (M_WIng14.0) Wahl (M_ITE15.0)
Teaching methods / lessons per week	lecture
Credits	2.5
Teaching style	Handout

Learning target of the course

After successful completion of this module, students are able to ...

- name and explain the modern production methods for plastics, elastomers and composite materials

- recognize the employed production methods of finished products
- evaluate production methods according to technological and economical aspects
- analyze the demands a product poses for a production method, select corresponding production methods and develop new process chains
- name and explain the physical principles of the laser
- expose the advantages of lasers as production tools and show differences to other methods
- assign different production demands to different laser systems.

Content

- physical principles
  - electromagnetic radiation
  - elements of atomic physics
  - interaction of light and matter
- laser physics
  - light amplification, population inversion
  - first laser condition
  - dynamics
- laser resonators
  - mirror resonators
  - stability
  - second laser condition
  - resonator modes (longitudinal, transversal)
- laser pulses
  - q-switching
  - mode coupling
- laser systems
  - distinction of different active media
  - properties of special laser systems
- technological applications

References

- Lasers - Anthony Siegmann, ISBN-0-935702-11-5
- Handbook of Lasers and Optics - Frank Träger (Ed.), Springer Verlag, ISBN-10: 0-387-95579-8, ISBN-13: 978-0-387-95579-7
- Principles of Lasers - Orazio Svelto, Springer Verlag, ISBN 978-1-4419-1301-2

4.14 Technical Optics

M115 Technical Optics

Study programme	Master-Studiengang IT Engineering
Module code	M115
Module	Technical Optics
Course(s)	`M115a` Technical Optics
Module leader	Dr. Ioana Serban
Assignment to curriculum	IT Engineering (Master)
Links to other modules	
Lesson load per week of the module	4
Credits of the module	5
Student workload	attendance study: 38 hours self study: 112 hours
Prerequisites	
Duration	1 semester
Frequency of occurrence	every year
Admissible assessment types	different types of examinations
Percentage of final score	6,25
Language	english

Learning targets of the module

After successful completion of this module, students are able to:

- explain the presented physical concepts and set them in relation to each other
- independently solve problems using the acquired physical concepts and mathematical methods
- critically asses the results and derive conclusions
- design simple lens systems and calculate their optical parameters and aberrations
- explain semiconductor-based light sources and detectors and their role in electronic circuitry
- name different fiber types and their applications in fiber optic communication

4.14.1 Technical Optics

Course	Technical Optics
Course leader(s)	Ioana Serban
Attendence in semester	2
Course type	Wahl
Teaching methods / lessons per week	lecture
Credits	5.0
Teaching style	Blackboard, projector presentation

Learning target of the course

After successful completion of this module, students are able to ...

- explain the presented physical concepts and set them in relation to each other
- independently solve problems using the acquired physical concepts and mathematical methods
- critically asses the results and derive conclusions
- design simple lens systems and calculate their optical parameters and aberrations
- explain semiconductor-based light sources and detectors and their role in electronic circuitry
- name different fiber types and their applications in fiber optic communication

Content

- background:
  - ray optics
  - wave optics
    - interference
    - diffraction
    - resolution limits of optical system
  - beam optics
  - Fourier optics, optical filtering, polarization
- optical imaging
  - optical aberrations
  - the five Seidel aberrations
  - methods for aberration correction
  - development of optical systems
  - specifications of optical systems, dependence of aberrations on optical parameters
  - design-programs, tolerancing
- optoelectronics
  - semiconductor photon sources
  - semiconductor photon detectors

  - application: integration into electronic circuits

- fiber optics
  - fiber types
  - attenuation and dispersion
  - fiber optic communications

- optional advanced topics:
  - modulation, switching, and scanning of light: electrically, acoustically, or optically controlled devices
  - wave interactions in nonlinear materials: frequency conversion
  - holography

References

- B.E.A. Saleh, M.C.Teich: “Fundamentals of Photonics”

- G. Litfin: “Technische Optik”

4.15 Master Thesis

M060 Master Thesis

Study programme	Master-Studiengang IT Engineering
Module code	M060
Module	Master Thesis
Course(s)	`M060a` Master Thesis
Module leader	Prof. Dr. Sebastian Iwanowski
Assignment to curriculum	IT Engineering (Master)
Links to other modules	none
Lesson load per week of the module	0
Credits of the module	28
Student workload	attendance study: 2 hours self study: 838 hours
Prerequisites	Required is a good knowledge of the topics taught in the preceding courses, specially of the courses being related to the topic of the thesis.
Duration	1 semester
Frequency of occurrence	every semester
Admissible assessment types	written documentation (if necessary presentation)
Percentage of final score	35
Language	english

Learning targets of the module

The master thesis shall prove that the student is able to elaborate a complex task with scientific methods autonomously. The student knows the scientific context and can present his knowledge in an evidentiary way.
The student has strengthened his ability in organising himself and completed his communication skills.

4.15.1 Master Thesis

Course	Master Thesis
Course leader(s)	jeweiliger Dozent
Attendence in semester	3
Course type	Pflicht
Teaching methods / lessons per week	thesis
Credits	28.0
Teaching style	-

Learning target of the course

The students ...

- cope with all methods of scientific work.
- are able to elaborate a problem autonomously.
- are able to structure the individual goals of a problem.
- are able to present methods and results of their work in a thesis clearly.

Content

Dependent on the topic of the thesis.

References

Dependent on the topic of the thesis

4.16 Master Colloquium

M061 Master Colloquium

Study programme	Master-Studiengang IT Engineering
Module code	M061
Module	Master Colloquium
Course(s)	`M061a` Colloquium
Module leader	Prof. Dr. Sebastian Iwanowski
Assignment to curriculum	IT Engineering (Master)
Links to other modules	none
Lesson load per week of the module	0
Credits of the module	2
Student workload	attendance study: 2 hours self study: 58 hours
Prerequisites	The prerequesite for admission is an accepted master thesis. Furthermore, all module examinations must have been passed.
Duration	1 semester
Frequency of occurrence	every semester
Admissible assessment types	colloquium
Percentage of final score	2,5
Language	english

Learning targets of the module

The colloquium is an interdisciplinary oral examination. It is based on the topics of the master thesis. This is the final examination forthe entire study programme.
In this examination, the graduates start with a scientific presentation about the topics elaborated in their master thesis and then defend this in a discussion. This strengthens their ability to summarise an intensively studied topic in a short time and to discuss this in a professional manner.

4.16.1 Colloquium

Course	Colloquium
Course leader(s)	jeweiliger Dozent
Attendence in semester	3
Course type	Pflicht
Teaching methods / lessons per week	colloquium
Credits	2.0
Teaching style	Blackboard, projector presentation

Learning target of the course

The students ...

- are able to summarise the essentials of a scientific topic elaborated before.
- strengthen their competence to argue about a problem solution and its quality.
- possess distinctive communication and presentation skills.

Content

- Scientific presentation about the topics of the master thesis, the results and the chosen methods
- Discussion about the quality of the results and chosen methods
- Questions of the audience about the topic of the master thesis and related topics.

References

Dependent on the topic of the thesis