DEGGENDORF INSTITUTE OF TECHNOLOGY

Module Handbook

Programme

Applied computer science and infotronic
(Bachelor)

Faculty

Faculty of Electrical Engineering,
Media Technology and Computer Science

Examination Regulations

AI-B-Okt-11

Module: Mathematics

Module number	O-01
Module responsible	Prof. Dr. Gerald Kupris
Course specialization	
Course number and course name	
	O1101 Mathematics 1
	O2101 Mathematics 2
Lecturer	Prof. Dr. Gerald Kupris
Semester	1, 2
Length of the Module	2 Semesters
Module frequency	
Course type	Mandatory
SWS	13.0
ECTS	13.0
Workload	Total: 0.0 hours
Teaching-/Course language	German

Module's objectives

The students should be able to apply during the studies mathematical concepts and methods for technical tasks and for working purposes.

The students will gain the following competencies: Dominate symbolic fractions (extend, shorten, exclude,...).

Solve, by means of vectors, basic geometrical tasks such as the following: distance from point-line, point-plane, straight-straight and angle of intersection of a straight-line with another straight line.

Manage to calculate complex numbers; especially by dominating calculations in different representations (Cartesian, polar, exponential). This way you will be able to apply the complex AC circuit analysis.

You should know about elementary function definitions, domain, range, special function values, important calculation rules and differentials. Particularly you should be able to draw graphics. You know about derivatives and its physical, geometrical and analytical meanings. You know about Deferential rules and know how to use it in expressions that are built from elementary functions.

You know about basic integrals and are able to apply the integration by substitution and partial integrate to simple cases.

You are able to apply integral calculations on geometrical or physical questions.

You can research linear systems of equation with the help of the Gaussian elimination method.

You are able to apply matrix calculus.

You can apply the differential and integral calculations to spatial curves, surfaces and areas. Particularly you are able to determine tangents and tangents' plane. You know the definition of Gradient, Divergence and rotation and their geometrical and physical meaning.

The students should be able to apply mathematical methods and concepts to technical tasks, during their studies and work.

In order to achieve this, the students will acquire the following skills:

Analysis and synthesis of periodic functions by Fourier series.

Solution of differential equations in first and second order.

Application of the Laplace Transformation on technical tasks.

Application of the Fourier-Transformation.

Basic understanding of the possibilities and the use of MATLAB.

O1101 Mathematics 1

Objectives

The students should be able to apply mathematical methods and concepts to technical tasks, during their studies and work.

In order to achieve this, the students will acquire the following skills:

Dominate symbolic fractions (extend, shorten, exclude...).

Solve, by means of vectors, basic geometrical tasks such as the following: distance from point-line, point-plane, straight-straight and angle of intersection of a straight-line with another straight line.

Manage to calculate complex numbers; especially by dominating calculations in different representations (Cartesian, polar, exponential). Through this you will be able to apply the complex AC circuit analysis.

You know about elementary function definitions, domain, range, special function values, important calculation rules and differentials. Particularly you should be able to draw graphics. You know about derivatives and its physical, geometrical and analytical meanings. You know about Deferential rules and know how to use it in expressions that are built from elementary functions.

You know about basic integrals and are able to apply the integration by substitution and partial integrate to simple cases. You are able to apply integral calculations on geometrical or physical questions. You can research linear systems of equation with the help of the Gaussian elimination method. You are able to apply matrix calculus. You can apply the Differential and integral calculations to spatial curves, surfaces and areas. Particularly you are able to determine tangents and tangents' plane. You know the definition of Gradient, Divergence and rotation and their geometrical and physical meaning.

Content

Chapter 1. Numbers and Vectors

- Quantities and Illustrations
- The real numbers
- Planes
- Vectors
- Products
- Lines and Planes
- Complex numbers

Chapter 2. Functions, Limits. Steadiness

- Functions (Main Concepts)
- Polynomials and rational functions
- The circular functions
- Cipher and limits
- Calculation rules for Limits and convergence criteria
- Function limits, Steadiness

Chapter 3. Differentiation

- The derivations of a differential function
- Application of differentials
- Inverses
- The exponential and logarithmic functions

Chapter 4. Integration

- The certain integral
- Integration rules
- The integration of rational functions
- Improper Integrals

Chapter 5. Linear Algebra

- Linear Systems of equations and matrices
- The matrix multiplication
- Determinants

Types of tests

oral exam, written exam 90 minutes

Methods

Seminars

Literature

Jürgen Koch, Martin Stämpfle: Mathematik für das Ingenieurstudium, Hanser Verlag, München, 2010

Lothar Papula: Mathematik für Ingenieure und Naturwissenschaftler, Vieweg+Teubner Verlag, 2009

Thomas Rießinger: Mathematik für Ingenieure, Springer Verlag, Berlin 2009

Kurt Meyberg, Peter Vachenauer: Höhere Mathematik 1, Springer Verlag 2003

O2101 Mathematics 2

Objectives

The students should be able to apply mathematical methods and concepts to technical tasks, during their studies and work.

In order to achieve this, the students will acquire the following skills:

Analysis and synthesis of periodic functions by Fourier series

Solution of differential equations in first and second order

Application of the Laplace Transformation on technical tasks

Application of the Fourier-Transformation
Basic understanding of the possibilities and the use of MATLAB

Content

Periodic Functions and Fourier series
Differential equations
Laplace-Transformation
Fourier-Transformation
Introduction in MATLAB

Test types

Written exam, 90 Min.

Methods

Seminars

Literature

Jürgen Koch, Martin Stämpfle: Mathematik für das Ingenieurstudium, Hanser Verlag, München, 2010

Lothar Papula: Mathematik für Ingenieure und Naturwissenschaftler, Vieweg+Teubner Verlag, 2009

Thomas Rießinger: Mathematik für Ingenieure, Springer Verlag, Berlin 2009

Kurt Meyberg, Peter Vachenauer: Höhere Mathematik 1, Springer Verlag 2003

Module: Physics

Module number O-02
Module responsible Prof. Dr. Gerald Kupris
Course specialization
Course number and course name
O1102 Physics
Semester 1
Length of the Module 1 Semester
Module frequency
Course type Mandatory
Level
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching-/Course language German

Modules' objective

Develop understanding of physical relationships: mathematical modelling of physical phenomena; learn about basic physical concepts and laws and how to apply them; Solve physical problems; Conduct and evaluate experiments.

Access or recommended requirements

Basic knowledge of differential, integral and vector calculus

Content

Introduction of physical methods
Mechanics (kinematics and dynamics of particles)
Vibration and Waves
Electrical
Solid state physics

Teaching and learning

Classes
Seminars
Tutorials

Literature

Paul A. Tipler, Gene Mosca: Physik für Wissenschaftler und Ingenieure, Spektrum Akademischer Verlag, August 2009

O1102 Physics

Objectives

The students should be able to apply physical methods and concepts to technical tasks, during their studies and work.

In order to achieve this, the students will acquire the following skills:

Knowledge about physical quantities and their measurement

Basic knowledge in mechanics, Vibration theory and electrodynamics.

Content

Measurement and Units

dimensional motion

Movement in two and three dimensions

The Newtonian axioms

Work and und kinetic energy

Energy conservation

Momentum

Circular motion

Angular momentum

Vibration and Waves

Superposition and standing waves

The electric field

The electric potential

Capacity

Electricity

Magnetism and electricity

Effect and sources of the magnetic field

Magnetic river

Magnetic induction

Electromagnetic waves, Mobiles

Atoms, molecules and solids

Electric line: conductor, dielectric, semiconductors

Test Types

Written exam, 90 Min.

Methods

Seminars

Literature

Paul A. Tipler, Gene Mosca: Physik für Wissenschaftler und Ingenieure, Spektrum Akademischer Verlag, August 2009

Module: Fundamentals of electrical engineering

Module number	O-03
Module responsible	Prof. Dr. Robert Bösnecker
Course specialization	
Course number and course name	
	O1103 Basics of electrical engineering
Semester	1
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
Level	
SWS	6.0
ECTS	7.0
Workload	Attending time: 90.0 hours
	Independent study: 120.0 hours
	Total: 210.0 hours
Teaching-/Course language	German

Content

DC Teaching

Electric charge and current density
Electric potential and voltage
Ohm's Law
Specifically Resistivity and conductivity
Temperature dependence from electrical
Resistance types
Electrical work/energy
Electrical power and efficiency
relationally & Arrow systems
Kirchhoff's laws
Ideal and linear electrical sources
Series Connection
Parallel connection
Delta-Start transformation
Network calculation
Superposition theorem
Equivalent voltage source
Alternating electricity theory
Periodic conditions
Sinusoidal sizes
Cursors
Complex calculations
Performance and energy

passive equivalent circuits
Series connection of R,L,C
Parallel-circuit von R,L,C
Branched circuits
Networks and transformations
Simple RC-filter
Transfer functions

O1103 Fundamentals of electrical engineering

Test type

Written exam, 90 Min.

Module: Fundamentals of Computer science

Module number O-04
Module responsible Prof. Dr. Peter Jüttner
Course specialization

Course number and course name O1104 Fundamentals of Computer science
O1105 Introduction to Programing
Semester 1
Length of the Module 1 Semester
Module frequency
Course type Mandatory
SWS 8.0
ECTS 10.0
Workload Total: 0.0 hours
Teaching-/Course language German

Modules' objective

- Knowledge and understanding of computer science, its concepts and methods
- The ability to understand these basic principles and to apply them on examples

O1104 Fundamentals of computer science

Objectives

- Knowledge and understanding of computer science, its concepts and methods
- The ability to understand these basic principles and to apply them on examples

Content

- IT Definition
- IT working fields
- Information and messages
- Number systems
- Encodings
- Computer architectures
- Operating systems
- Propositional logic
- Predicate logic
- Machines' state
- Modularization of programs

Access- recommended requirements

- none

Test type

Written exam, 90 Min.

Methods

Seminars and practical exercises, partly group work

Literature

- Andrew S. Tanenbaum and James Goodman:

Computerarchitektur. Strukturen, Konzepte, Grundlagen. Pearson, 2001

- Helmut Herold, Bruno Lurz, Jürgen Wohlrab: Grundlagen der Informatik - Praktisch - Technisch - Theoretisch. Pearson, 2007

- Rolf Socher: Theoretische Grundlagen der Informatik. Fachbuchverlag Leipzig, 2005

O1105 Introduction to programing

Objectives

- Knowledge and understanding of IT basics, its concepts and methods
- The ability to understand this basic principles and to apply them on examples

Content

- "Program" und "Programing" concepts
- Definition and characteristics of Programing language and compilers
- History of the Programing language C
- Main structure and elements of C Programs
  - main
  - Variable
  - Constant
  - Data types
  - Input and Outputs
  - Operators
  - Control Structure
  - Vectors
  - Pointer
  - Functions and procedures

Access- recommended requirements

none

Test Types

Written exam, 90 Min

Methods

Seminars and practical exercises, partly group work

Literature

- Helmut Erlenkötter: C Programmieren von Anfang an. rororo Verlag, 2009
- Brian Kernighan, Dennis Ritchie: The C Progrmming Language. Prentice Hall, 2011
- Brian Kernighan, Dennis Ritchie: Programmieren in C. Hanser Verlag, 1990

Module: Fundamentals of Sensor Systems

Module number O-05
Module responsible Prof. Dr. Martin Jogwich
Course specialization
Course number and course name
O2102 Fundamentals of Sensor Systems
Semester 2
Length of the Module 1 Semester
Module Frequency
Course type Mandatory
Level To be clarified by the studies director
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching-/Course language German

O2102 Fundamentals of Sensor Systems

Objectives

Understanding physical and technical basics about the general functions and principles of different sensors.

Content

Sensor principles of mechanics

Sensor principles of thermodynamics

Sensor principles of electrostatics and dynamics

Sensor principles of propagation of electromagnetic waves and optics

Test Types

Written exam of 90 Min.

Methods

Seminars

Module: Object-Oriented Programming

Module number O-06
Module responsible Prof. Dr. Peter Jüttner
Course specialization
Course number and course name
O2103 Object-Oriented Programming
Semester 2
Length of the Module 1 Semester
Module frequency
Course type Mandatory
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching-/Course language German

Objectives

- Knowledge and understanding about object-oriented programming and its concepts and methods
- Comprehensive knowledge of programming C++
- The ability to apply independently this knowledge when creating smaller Programs C++

O2103 Object-Oriented Programming

Objectives

- Knowledge and understanding about object-oriented programming and its concepts and methods
- Comprehensive knowledge of programming C++
- The ability to apply independently this knowledge when creating smaller Programs C++

Content

- Introduction: History, Differences to the "traditional" programming, applications
- Basics
  - Data encapsulation
  - Abstract data types
  - Motivation object
  - Motivation class
- Object orientation C++
  - Classes and objects

- Constructors and destructors
- Heredity
- Data encapsulation
- Polymorphism and Dynamic Binding
- Peculiarities from C++
  - Input and output (console, file)
  - Overloaded operators
  - Static member and Static Methods
  - Copy constructors

Access or recommended requirements

- Lecture "Introduction to Programming"
- Lecture "Foundations of computer science"

(or equivalent)

Types of exam

Written exam fro 90 Min.

Methods

Seminars and practical exercises, partly group work

Literature

- Bernhard Lahres, Gregor Raýman: Praxisbuch Objektorientierung. Galileo Computing, ISBN 3-89842-624-6 (Frei verfügbar auf der Verlags-Webseite)
- Heide Balzert: Objektorientierte Systemanalyse. Spektrum Akademischer Verlag, Heidelberg 1996, ISBN 3-8274-0111-9
- Grady Booch: Object-Oriented Analysis and Design with Applications. Addison-Wesley, ISBN 0-8053-5340-2.
Peter Eeles, Oliver Sims: Building Business Objects. John Wiley & Sons, ISBN 0-471-19176-0
- Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides: Design Patterns: Elements of Reusable Object Oriented Software. Addison-Wesley, ISBN 0-201-63361-2
- Paul Harmon, William Morrissey: The Object Technology Casebook. Lessons from Award-Winning
Business Applications. John Wiley & Sons, ISBN 0-471-14717-6
- Ivar Jacobson: Object-Oriented Software Engineering: A Use-Case-Driven Approach. Addison-Wesley, ISBN 0-201-54435-0
- Bertrand Meyer: Object-Oriented Software Construction. Prentice Hall, ISBN 0-13-629155-4
- Bernd Oestereich: Objektorientierte Programmierung mit der Unified Modeling Language. Oldenbourg, ISBN 3-486-24319-5
- James Rumbaugh, Michael Blaha, William Premerlani, Frederick Eddy, William Lorensen:
Object Oriented Modeling and Design. Prentice Hall, ISBN 0-13-629841-9

Module: Algorithms and Data Structures

Module number	O-07
Module responsible	Prof. Dr. Peter Jüttner
Course specialization	
Course number and course name	zero O2104 Algorithms and Data Structures
Semester	2
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Total: 0.0 hours
Teaching-/Course language	German

Objectives

- Knowledge and understanding of the concept „Algorithms“ and properties of algorithms.
- Knowledge and understanding of the term "recursion“.
- Knowledge and understanding of important algorithms for searching and sorting out data.
- Knowledge and understanding of important dynamic data structures.
- The ability to understand these principles and apply them independently on examples.

O2104 Algorithms and Data Structures

Objectives

- Knowledge and understanding of the concept „Algorithms“ and properties of algorithms.
- Knowledge and understanding of the term "recursion“.
- Knowledge and understanding of important algorithms for searching and sorting out data.
- Knowledge and understanding of important dynamic data structures.
- The ability to understand these principles and apply them independently on examples.

Contents

Seminars and practical exercises, partly group work

Access or recommended requirements

Lectures:

- Introduction to Programing
- Foundations of computer science

Test type

Written exam, 90 Min.

Literature

- Algorithmen und Datenstrukturen, Skript zur Vorlesung, Dieter Hofbauer und Friedrich Otto, FB Elektrotechnik / Informatik und FB Mathematik / Informatik, Universität Kassel

- Algorithmen und Datenstrukturen, Vorlesungsskript, Gunter Saake, Kai-Uwe Sattler Universität Magdeburg, Juli 2000

- Uwe Schöning: Algorithmik, oder Algorithmen - kurz gefasst, Spektrum, ST 134 S365

- Uwe Schöning: Theoretische Informatik - kurz gefaßt, Spektrum, ST 130 S365

- R. Sedgewick: Algorithmen in Java, Pearson, oder Algorithms in Java, Addison-Wesley, ST 250 J35

- M. Goodrich, R. Tamassia: Data Structures and Algorithms in Java, Wiley, ST 265 G655

- V. Heun, Grundlegende Algorithmen, Vieweg, ST 134 H593

- H. Gumm, M. Sommer: Einführung in die Informatik, Oldenbourg, ST 110 G974

- W. Küchlin, A. Weber: Einführung in die Informatik, Springer-Verlag, ST 110 K95

- T.H. Cormen, C.E. Leiseron, R.R. Rivest, C. Stein: Introduction to Algorithms, 2nd ed., The MIT Press / McGraw-Hill, ST 134 C811 (2)

- J. Kleinberg, E. Tardos: Algorithm Design, Addison-Wesley, ST 134 K64

Module: Soft skills

Module number	O-08
Module responsible	Prof. Peter Schmieder
Course specialization	
Course number and course name	
zero	O2106 Rhetoric & Communication
	O2107 English for engineers
	O2105 Business Administration
Semester	1, 2
Length of the Module	2 Semester
Module frequency	
Course type	Mandatory
SWS	8.0
ECTS	8.0
Workload	Total: 0.0 hours
Teaching-/Course language	German and English

Course Objectives

The students will learn about the basics, purposes and content of Soft Skills. Through this, the students will deepen their knowledge on impairment and benefits for direct professional practices.

The students use presented scientific models or tools directly in order to analyse its practical benefits and reflect their own implementation skills.
Here should be recognized the direct links between professional success and the application of the presented skills.

The students will evaluate and examine the analysis of the contents. This way they will generate a deeper implementation and relevant self-understanding about their own behaviour, through self-reflections.
Ultimately this course will cover the „employability", which is also required in the undergraduate level.

Side facts and Concepts (e.g. about Communication, NLP, Presentation and rhetoric) are mainly about process-oriented knowledge (e.g. Briefings, Self presentations and negotiations).
Through the analysis of strengths and weaknesses will each personality's development and social understanding promoted.

It is all about a clear social and emotional horizon expansion, particularly on how to support the future professional success.

O2106 Rhetoric & Communication

objectives

The students will learn about the basics, purposes and content of Soft Skills. Through this, the students will deepen their knowledge on impairment and benefits for direct professional practices.

The students use presented scientific models or tools directly in order to analyse its practical benefits and reflect their own implementation skills.
Here should be recognized the direct links between professional success and the application of the presented skills.

The students will evaluate and examine the analysis of the contents. This way they will generate a deeper implementation and relevant self-understanding about their own behaviour, through self reflections.
Ultimately this course will cover the „employability", which is also required in the undergraduate level.

Side facts and Concepts (e.g. about Communication, NLP, Presentation and rhetoric) are mainly about process-oriented knowledge (e.g. Briefings, Self presentations and negotiations).
Through the analysis of strengths and weaknesses will each personality's development and social understanding promoted.

It is all about a clear social and emotional horizon expansion, particularly on how to support the future professional success.

Content

1. What are Soft Skills?

1.1 History and meaning
1.2 Definition and Boundaries
1.2.1 Expertise
1.2.2 Social skills
1.2.3 methodological skills
1.2.4 Personal Competencies
1.3 Use and applicability

1. Selected key skills

2.1 Communication
2.1.1 Watzlawick
2.1.2 Schulz von Thun
2.1.3 Gordon
2.1.4 NLP
2.1.5 TA

2.1.6 Applications exercises, particularly in negotiations and engineering requirements

2.2 Self-reflection

2.2.1 Self- confidence

2.2.2 Self- knowledge

2.2.3 Possibilities and limitations of personality tests

2.2.4 Application in interviews and Assessments

2.2.5 Implications for personal and social behaviour

2.3 Presentation techniques and rhetoric

2.3.1 Strength and effect of the language

2.3.2 Rules and boundaries of a good presentation

2.3.3 Non-verbal communication

2.3.4 Media Technical Communications

2.3.5 EXKURS 1: Aristoteles and Hollywood

2.3.6 EXKURS 2: Modern brain research, constructivism and behaviourisms

1. Concrete application of Soft Skills

3.1 Presentations

3.2 Skill-analysis of media products

3.3 Feedback practices

Access or recommended requirements

none

Types of Test

Written exam, of 90 Min.

Methods

Seminars and lectures with in and outdoor activities, group work, individual projects and evaluated presentations

Literature

1. Deutscher Managerverband e.V.: Handbuch Soft Skills. Band 1-3, VDF Hochschulverlag, Zürich 2003, Band 2 und 3: Zürich 2004.
2. Vigenschow, Schneider: Soft Skills für Software-Entwickler. Fragetechniken, Konfliktmanagement, Kommunikationstypen und –modelle, Dpunkt Verlag, 1. Auflage, Heidelberg 2007.
3. Moritz, Rimbach: Soft Skills für Joung Professionals. Alles, was Sie für Ihre Karriere brauchen, Gabal Verlag, 2. Auflage, Offenbach 2008.
4. Jung, von Matt: Momentum – Die Kraft, die gute Werbung heute braucht, Lardon Verlag, 5. Auflage, Berlin 2007.
5. Gapski. Medienkompetenz messen? Verfahren und Reflexion zur Erfassung von Schlüsselkompetenzen, Kopaed Verlag, Marl 2006.

6. Schulz von Thun: Miteinander reden (Band 1-3), Rowohlt, 46. Auflage, Reinbek 2008.
7. Watzlawick: Wie wirklich ist die Wirklichkeit? – Wahn, Täuschung, Verstehen, Piper, 7. Auflage, München 2007.
8. Reynolds: ZEN oder die Kunst des Präsentierens, Addison-Wesley, München 2008.
9. Häusel: Think Limbic! Die Macht des Unbewussten verstehen und nutzen für Motivation, Marketing, Management, Haufe, 4. Auflage (Nachdruck), München 2005.

Aristoteles: Rhetorik, Reklam, bibliographisch ergänzte Ausgabe, Stuttgart 2007.

O2107 English for Engineers

Content

- Magnetism and electricity
- Batteries
- General technical vocabulary
- Types of energy
- Mathematical operations
- Materials and their properties
- Tools
- Shapes
- Short presentations
- Review of particular grammar topics (e.g. adverbs & adjectives, superlatives & comparatives, passive forms, if-clauses, etc.)

Access or recommended requirements

none

Test Type

Written exam of 90 Min.

Methods

Seminar instruction and practice, independent study

Literature

Bauer, Hans-Jürgen. English for Technical Purposes.
Copyright © 2000. Cornelson. Berlin.

Büchel, Wolfram and Rosamarie Mattes. u.a. Englisch
Grundkurs für technische Berufe. Copyright © 2001.
Klett. Stuttgart.

engine: Englisch für Ingenieure (www.engine-magazin.de)
(various issues). Hoppenstedt. Darmstadt.

Hollett, Vicki and John Sydes. Tech Talk Intermediate. Copyright © 2009. Oxford. Oxford.

Morgan, David and Nicholas Regan. Take-Off: Technical English for Engineering. Course book and workbook. Copyright © 2008. Gernet. Reading.

Praglowski-Leary, K.-D. Englisch für technische Berufe. Copyright © 2004. Klett. Stuttgart.

O2105 Business Administration

Test Type

Written Exam, 90 Min.

Module: General Science, mandatory elective

Module number	O-09
Module responsible	Prof. Dr. Andreas Grzemba
Course specialization	
Course number and course name	
	O3101 General Science, mandatory elective 2
	O2108 General Science, mandatory elective 1
Semester	2, 3
Length of the Module	2 Semester
Module frequency	
Course type	elective
SWS	4.0
ECTS	4.0
Workload	Total: 0.0 hours

Teaching-/Course language **German**

Module Objective
Deepen your knowledge in the field of General Sciences

O3101 General Sciences, mandatory elective 1

Objective
Deepen your knowledge in the field of General Sciences

Content
Module description of the selected course

Type of Test
Written Exam of 90 Min.

O2108 General Sciences, mandatory elective 2

Objective
Deepen your knowledge in the field of General Sciences

Content
Module description of the chosen course

Exam Type
Written Exam of 90 Min.

Module: Software Engineering

Module number O-10
Module responsible Prof. Dr. Peter Jüttner
Course specialization
Course number and course name
O3102 Software Engineering
Semester 3
Length of the Module 1 Semester
Module frequency
Course type Mandatory
SWS 6.0
ECTS 8.0
Workload Total: 0.0 Hours
Teaching-/Course language **German**

O3102 Software Engineering

Content

- Motivation und Definition
- Elements of Software Engineering
- Methodology
  - Requirements Engineering
  - Software design (general)
  - Software design (object oriented analysis and design)
  - Implementation
  - Code Metrics
  - Software Test
  - Software quality assurance

Access or recommended requirements

Classes
- Foundations of computer science
- Introduction to Programming
- Object-oriented Programming

Test Type

Written exam of 90 Minutes

Methods

- Seminars and practical exercises, partly group work
- Internship along the semester in group work

Literature

- H. Balzer, Lehrbuch der Software-Technik, Spektruk Akademischer Verlag
- I. Sommerville, Software Engineering, Addison Wesley Verlag
- B. Kahlbrandt, Software-Engineering mit der UML, Springer Verlag

- C. Rupp et. al. UML 2 - Glasklar, Hanser Verlag

- A. Spillner, T. Linz, Basiswissen Softwaretest, dpunkt Verlag - B. Beizer, Black-Box Testing: Techniques for Functional Testing of Software and Systems, Wiley Verlag - P. Liggesmeyer, Software-Qualität: Testen, Analysieren und Verifizieren von Software, Spektrum Verlag - H. Sneed, M. Winter, Testen objektorientierter Software, Hanser Verlag

Module: Mandatory elective - Project

Module Number O-11
Module responsible Prof. Dr. Gerald Kupris
Course Specialization
Course number and course name
O4101 Mandatory elective - Project
Semester 4
Length of the Module 1 Semester
Frequency of the Module
Course type Mandatory
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching-/Course language German

Objective

- Be able to perform independently a small development project (SW and/or HW) within the framework of a group.

O4101 Mandatory elective-Project

- - Be able to perform independently a small development project (SW and/or HW) within the framework of a group.

Content

- Analysing a task
- Plan a project
- Conduct a project
- Present the project outcomes

Access or recommended requirements

- To have attended the class of the prior semester

Test Types

Written exam, 90 Min

Methods

- Study on your own
- Coaching by the persons handing out the tasks

Module: Database

Module number	O-12
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	
Course number and course name	
	O4102 Database
Lecturer	Prof. Dr. Wolfgang Dorner
Semester	4
Length of the Module	1 Semester
Module frequency	yearly
Course type	Mandatory
Level	Undergraduate
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Self study: 90.0 hours
	Total: 150.0 hours
Teaching-/Course language	German

Objective

The Module has the following objectives:
Be able to describe the developing process for database.

Know about the Elements from an Entity-Relationship-Model
Be able to create an an Entity-Relationship-Model for database
Be able to recognize anomalies and to correct them in a table
Be able to manage databases through database management systems

Be able to implement Database inquiries through SQL
Know about the DBMS function

O4102 Database

Objective

The Module has the following objectives:
Be able to describe the developing process for database.

Know about the Elements from an Entity-Relationship-Model
Be able to create an an Entity-Relationship-Model for database
Be able to recognize anomalies and to correct them in a table
Be able to manage databases through database management systems

Be able to implement Database inquiries through SQL
Know about the DBMS function

Content

1 Initiation
1.1 Introduction
1.2 Why Databases?

1.3 Examples
2 Terms, definitions and relationships
2.1 Basic terms
2.2 Relational Data Model
2.3 Databases
2.4 DBMS
2.5 How to use Databases
2.6 Keys in relational databases
2.7 Relational Integrity
3 SQL
3.1 Initiation
3.2 SQL and the BNF
3.3 DDL
3.4 DML
3.5 Tools (phpMyAdmin, sqlExplorer, Squirrel, etc.)
4 Analysis and Design
4.1 Steps for Database development
4.2 Questioning techniques / information gathering
4.3 Applications
4.4 Tools
5 ERM
5.1 UML
5.2 Entities
5.3 Relationships
5.4 Attributes
5.5 Multiplicity of relationships
5.6 Tools
6 Normalization
6.1 Initiation
6.2 Anomalies
6.3 First Normal form
6.4 Functional Dependence and the 2NF
6.5 Third NF
7 From Design to Implementation
7.1 Introduction
7.2 ER-Modelling
7.3 Depict the ER model to tables
7.4 Normalize tables
7.5 Double check business rules
7.6 Check with users
7.7 Application Development
8 Further aspects

Access or recommended requirements

None

Computer science basic courses

Test Type

Presentation that accumulate for the final grade an a written exam of 90 Min.

Methods

Classes with Exercises

Literature

Thomas M. Conolly, Carolyn E. Begg: Database Solutions, A step-by-step guide to building databases, Pearson Education Limited, Harlow, Essex, 2nd Edition 2004.
Thomas M. Conolly, Carolyn E. Begg: Database systems, A practical approach to design, implementation, and managment.Addison-Wesley, an imprint of Pearson Education, 4th edition 2005.

Module: Project Management

Module number	O-13
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	
Course number and course name	
	O4103 Project management
Semester	4
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Self study: 90.0 hours
	Total: 150.0 hours
Teaching-/Course language	German

Objective

The students will learn in the class the most important content of (IT-) Project Management:

- Create a project contract
- Create requirement and functional specifications
- Develop a project plan and calculate expenses for a project
- Employ appropriate software tools for support

O4103 Project management

Objectives

The students will learn in the class the most important content of (IT-) Project Management:

- Create a project contract
- Create requirement and functional specifications
- Develop a project plan and calculate expenses for a project
- Employ appropriate software tools for support

Content

1. The Project Definition
2. Project Phases

2.1 Project Order

2.2 Project Planning and Delivery

2.3 Project controlling

2.4 Project completion and documentation
3. Allocation of projects
3.1 Client and contractor perspective
3.2 Engineering requirements
3.3 Loads and specifications
3.4 Interface to agile methods
4. Tools
4.1 Visio
4.2 MS Project
4.3 MS Team Foundation Server and Interface
4.4 Excel in Project management
5. On-going project work

Test type

Written exam, 90 Min

Methods

Seminars with on-going exercises

Literature

Module: Research Methods

Module number	O-14
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	
Course number and course name	
	O7101 Research methods
Semester	7
Length of the Module	1 Semester
Course type	Mandatory
Level	Undergraduate
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Self Study: 50.0 hours
	Virtual share: 40.0 hours
	Total: 150.0 hours
Teaching-/Course language	German

O7101 Research methods

Objectives

The students should understand how to apply methods and procedures in a scientific context.

After finishing this module:

- The students know the process of a scientific project,
- The students know how to formulate a research question and a hypothesis
- The students know about the most important national databases as well as of literature research methods
- The students know how to formulate a method proposal in order to analyse deeper a scientific problem
- The students know how to create a rudimentary theory paper and a simple literature review

Content

1. Introduction to scientific working
2. Sequence and structure of scientific papers
3. Literature research and literature study
4. Writing scientific papers

4.1 With Word

4.2 With LATEX

5. Deep statistic

5.1 Repetition of Basic knowledge

5.2 Descriptive statistics
5.3 Explorative Statistic
6. Visualization of scientific data

Test Type

Accumulative grades of presentations

Methods

Classes and Seminars, virtual course

Literature

Module: Bachelor thesis and colloquium

Module number	O-15
Module responsible	Prof. Dr. Andreas Grzemba
Course specialization	
Course number and course name	
	O7103 Bachelor colloquium
	O7102 Bachelor thesis
Semester	7
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
SWS	4.0
ECTS	15.0
Workload	Total: 0.0 hours
Teaching-/Course language	German

Objectives

The Bachelor thesis and the project results shall be presented in a final presentation to targeted groups .

The knowledge and abilities obtained through the studies shall be applied in a project in the field of applied computer science methods.

A problem should be structured within a given deadline, processed systematically, using scientific methods, and finally documented in a transparent way.

O7103 Bachelor colloquium

Objectives

The Bachelor thesis and the project results shall be presented in a final presentation to targeted groups

.

Access or recommended requirements

Bachelorthesis completed

Test type

Written exam, 90 Min.

O7102 Bachelor thesis

Objectives

The abilities and knowledge learned during the studies shall be applied in a Project in the field of applied computer science.

A problem should be structured within a given deadline, processed systematically, using scientific methods, and finally documented in a transparent way.

Content

Individual topic

Access or recommended requirements

Formal: at least 160 ECTs

Content: Knowledge and Ability to apply the studies content

Test Type

Written exam, 90 Minutes

Module: Digital technology

Module number	O-30
Module responsible	Prof. Dr. Robert Bösnecker
Course specialization	embedded Systems
Course number and course name	O3111 Digital technology
Semester	3
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
Level	
SWS	4.0
ECTS	5.0
Workload	Total: 0:00 hours
Teaching-/Course language	German

Content

Basic concepts of digital technology
Number systems: Denominational number system, BCD-number representation, Calculate with Dual numbers, Hexadecimal and BCD numbers
Codes: Codes for lengths- and angle measurements, coding alphanumeric signs, characteristics from Codes
Boolean algebra: basic operations, composite operators (NAND, NOR, EXOR), calculation rules
Functions: Normal forms, simplification (KV-Diagram, Quine/McCluskey), NAND- and NOR-Representation
Switching Networks: exemplary treatment of common function modules (Code converter, multiplexer / demultiplexer,Comparators, arithmetic circuits)

Memory elements:

Basic-Flip-flops, RS-, D- und JK-FFs,
clock control
(Level, slope control),
Master-Slave-Principle
Circuits with Flip-flops:
Counter (asynchronous, synchronous),
Frequency divider,
Parallel-Register,
Shift registers,

Synchronous control works,

Finite state machines

O3111 Digital technology

Specialisation

Embedded Systems

Test Type

Written exam, 90 Min

Module: Deepening in Electro technology

Module number	O-31
Module responsible	Prof. Dr. Robert Bösnecker
Course specialization	Embedded systems
Course number and course name	deepening in electro technology
Semester	3
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
Level	
SWS	4.0
ECTS	5.0
Workload	Total: 0.0 hours
Teaching-/Course language	German

Content

- Deeper analysis of Transfer Functions
- NY Quist plot, Bode-plots
- dB calculation
- Filter (passive Filter)

Low pass, high pass, band pass, band stop, all pass
Various filter systems
Apply NY Quist plots and Bode plots on filters
Filter design method (Tscheby, Bessel, Butterworth, etc.)

- Fourier Transformation

(continuous waveforms)

- Laplace Transformation

If there is time left:
active filter with OpAmps.

O3112 Deepening in Electro technology

Specialization

Embedded systems

Test type

Written Exam of 90 minutes

Module: Measurement technology

Module number O-32
Module responsible Prof. Dr. Martin Jogwich
Course specialization embedded systems
Course number and course name O3113 Measurement technology
Semester 3
Length of the Module 1 Semester
Module frequency
Course type Mandatory
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching-/Course language German

Objectives

Acquire knowledge to understand measurements from predefined metrics, knowledge from measurement techniques and structures and their components. Especially amplifier circuits.

O3113 Measurement technology

Specialization

Embedded systems

Objective

Acquire knowledge to understand measurements from predefined metrics, knowledge from measurement techniques and structures and their components. Especially amplifier circuits.

Content

Basics (metrological structures, accuracy criteria, system response)

Measurement of electrical sizes (Current, voltage, power, active and reactive resistors)

Components (Sensors, oscilloscopes, amplifiers)

Measurement from non-electrical sizes (geometric quantities, pressures / forces / torques, temperatures, volume and mass flows)

Access or recommended requirements

Formal: none

Content-wise: If possible have attended the course „Basics of Sensor Systems" (1. Semester) or a similar course. It is best if a good grade was obtained in the exam.

Test Type

Written exam of 90 minutes

Methods

Seminars

Literature

W.-J. Becker, K. W. Bonfig, K. Höing: Handbuch Elektrische Messtechnik (Hüthig-Verlag)

K. Bergmann: Elektrische Messtechnik (Vieweg+Teubner Verlag)

G. Heyne: Elektronische Messtechnik (Oldenbourg Verlag)

R. Lerch: Elektrische Messtechnik (Springer Verlag)

Th. Mühl: Einführung in die elektrische Messtechnik (Vieweg + Teubner)

J. Niebuhr, G. Lindner: Physikalische Messtechnik mit Sensoren (Oldenbourg Verlag)

R. Parthier: Messtechnik (Vieweg+Teubner Verlag)

W. Pfeiffer: Elektrische Messtechnik (VDE Verlag)

E. Schrüfer: Elektrische Messtechnik (Hanser Verlag)

N. Weichert, M. Wülker: Messtechnik und Messdatenerfassung (Oldenbourg-Verlag)

Module: Microcomputer technology

Module number	O-33
Module responsible	Prof. Dr. Gerald Kupris
Course specialization	Embedded systems
Course number and course name	O3114 Microcomputer technology
Semester	3
Length of the Module	1 Semester
Module frequency	
Course type	mandatory
SWS	4.0
ECTS	5.0
Workload	Total: 0.0 hours
Teaching-/Course language	German

Objective

Knowledge about general construction of microcomputers, in particular microcontrollers

Knowledge of the use of various classes of microcontrollers,

Knowledge of the general structure of programs for microcontrollers,

Development of simple programs for microcontrollers using the example of Cortex,

Interfaces and features of microcontrollers.

O3114 Microcomputer technology

Specialization

Embedded Systems

Objectives

Knowledge about general construction of microcomputers, in particular microcontrollers

Knowledge of the use of various classes of microcontrollers,

Knowledge of the general structure of programs for microcontrollers,

Development of simple programs for microcontrollers using the example of Cortex, Interfaces and features of microcontrollers.

Content

Construction of microcomputers and microcontrollers

Programming and debugging interfaces

Reading and writing registers

I/O-Pins, Describing and reading single bits
Clock generation, and CPU processing power Interrupts
Memory
Timer and PWM, Watchdog-Timer
A/D-Wandler
Synchronous interfaces: SPI und IIC
Asynchronous interfaces: UART und CAN
Microcontroller in the hardware environment
Power consumption, and low power modes

Test Type

Written Exam of 90 minutes

Methods

Seminars
lab Project/internship

Literature

Schaaf: Mikrocomputertechnik, 5. Auflage 2010 Hanser Verlag, München,
Beierlein: Taschenbuch Mikroprozessortechnik, 4. Auflage, 2011, Hanser Verlag, München,
Joseph Yiu: The Definitive Guide to the ARM Cortex-M3, Elsevier 2007
Bähring: Mikrorechner-Technik 1&2, Springer-Verlag, 2002

Module: Electronic Components and Circuits

Module number O-34
Module responsible Prof. Dr. Gerald Kupris
Course specialization Embedded systems
Course number and course name O4111 Electronic Components and Circuits
Semester 4
Length of the Module 1 Semester
Module frequency
Course type mandatory
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching-/Course language German

Objective

Knowledge of the structure and the function of electronic components
Structure and function of the most important semiconductor devices
Use of components in electronic circuits
Basic circuits of electronic
Reading and understanding schematics
Design of electronic assemblies

O4111 Electronic Components and Circuits

Specialization

Embedded systems

Objectives

Knowledge of the structure and the function of electronic components
Structure and function of the most important semiconductor devices
Use of components in electronic circuits
Basic circuits of electronic
Reading and understanding schematics
Design of electronic assemblies

Content

Passive components
Fundamentals of Semiconductor Devices
PN-Transition

Semiconductor diode: Structure, characteristic, operations
Diode circuits, diode types
LEDs and photovoltaic cells, optocouplers
Bipolar Transistors
Basic circuit of the bipolar transistor
Differential amplifier
NE555
MOSFET-Transistors
CMOS-Logic
Thermistors, TRIACs, power components
Voltage Regulators
Design and manufacture of electronic assemblies

Test Type

Written exam of 90 minutes

Methods

Seminars

lab Project/internship

Literature

Tietze / Schenk: Halbleiter-Schaltungstechnik, Springer Verlag, Berlin 2009

Wilfried Plaßmann, Detlef Schulz: Handbuch Elektrotechnik, Grundlagen und Anwendungen für Elektrotechniker

Paul A. Tipler, Gene Mosca: Physik für Wissenschaftler und Ingenieure, Spektrum Akademischer Verlag, August 2009

Module: Computer Networks

Module number	O-35
Module responsible	Prof. Dr. Peter Jüttner
Course specialization	Embedded Systems
Course number and course name	O4112 Computer Networks
Semester	4
Length of the Module	1 Semester
Module frequency	
Course type	mandatory
SWS	4.0
ECTS	5.0
Workload	Total: 00:00 hours
Teaching-/Course language	German

Objectives

- Knowledge and understanding of the structure and operation of computer networks
- Ability to apply these skills in the coupling of computers

O4112 Computer Networks

Specialization

Embedded systems

Objectives

- Knowledge and understanding of the structure and operation of computer networks
- Ability to apply these skills in the coupling of computers

Content

- Definition / Motivation from Computer Networks
- History
- Examples
- Communication models
- Classification
- ISO-Layers (Definition and tasks)
  - Physical Layer
  - Data Link Layer
  - Network Layer
  - Transport layer

- Ethernet, TCP / IP

Access / Needed requirements

Classes
- Basics of computer science
- E-technological

Test Type

Written exam of 90 Minutes

Methods

Seminars with practical exercises, partly Group work

Literature

- Axel Sikora: Technische Grundlagen der Rechnerkommunikation, Carl Hanser Verlag, ISBN 3-446-22455-6

- Andrew S. Tanenbaum: Computernetzwerke, 4. Auflage; Pearson Studium, ISBN: 978-3-8273-7046-4

- Gerald Kupris, Axel Sikora: ZIGBEE, Datenfunk mit IEEE 802.15.4 und Zigbee, Franzis Verlag, ISBN 978-3-7723-4159-5

Module: Real-Time Systems

Module Number: O-36
Module responsible Prof. Dr. Peter Jüttner
Specialization Embedded Systems
Course number and course name
O4113 Real-time Systems
Semester 4
Length of the Module 1 Semester
Frequency of the Module
Course Type Mandatory
SWS 4.0
ECTS 5.0
Workload Total: 0:00 hours
Course Language: German

Objectives

- Knowledge and understanding from the main Definitions and Principles for Programing real-time
- The ability to apply these definitions and principles on examples

O4113 Real-time Systems

Specialization

Embedded Systems

Goals

- Knowledge and understanding from the main Definitions and Principles for Programing real-time
- The ability to apply these definitions and principles on examples

Content

- Introduction (History, Definitions, Examples)
- Classification form Real-Time Systems (hard / soft real-time)
- Operating System Concepts
- Architecture
- Scheduling
- Programming
- Safety-Critical Applications
- Real-time algorithms
- Petri nets
- Multiprocessor systems
- Design of operating systems

Access/ Needed requirements

Classes:

- Introduction to Programming
- Basics of computer science
- Algorithms and data structure

Test Type

Written exam of 90 minutes

Methods

Seminars with practical tasks, probably also group works

Literature

- Andrew S. Tanenbaum, Moderne Betriebssysteme, Pearson Studium, ISBN: 978-3-8273-7342-7
- William Stallings, Operating Systems, Prentice Hall , 2001, ISBN 0-13-032986-6
- Quing Li, Caroline Yao, Real-Time Concepts for Embedderd Systems, CMP Books, ISBN 1-57820-124-1
- Alan Burns and Andy Wellings, Real-Time Systems and Programming Languages, 3rd ed., Addison Wesley, 2001, ISBN 0-201-72988-1
- Phillip A. Laplante, Real-time Systems Design and Analysis, Wiley, ISBN 0-471-22855-9
- Jürgen Quade, Harte und weiche Echtzeitsysteme - (Material zur Vorlesung Echtzeitsysteme - I+II im Studienfach Technische Informatik an der Hochschule Niederrhein),http://w3-o.cs.hm.edu/~mfischer/WS2004_05/ezs_buch.pdf

Module: Internship

Module number: O-37
Module responsible: Prof. Dr. Gerald Kupris
Course specialization Embedded Systems
Course number and course name
O5111 Internship ES
O5113 Internship complements ES
O5112 practice Seminar ES
Semester 5
Length of the Module 1 Semester
Frequency of the Module
Course Type PLV, Mandatory
SWS 4.0
ECTS 30.0
Workload Total: 0.0 hours
Course language: German

Objectives

-Expand and deepened on the aspects learned through the practical experience
-Learn about the meaning of group work;
-Present the tasks performed during the internship as well as the results of such tasks.

O5111 Internship ES

Specialization

Embedded Systems

Objectives

-Expand and deepened on the aspects learned through the practical experience
-Learn about the meaning of group work;
-Present the tasks performed during the internship as well as the results of such tasks.

Content

Individual topic choice

Access/ Needed requirements

Formal: At least 70 ECTS;
Content-wise: Knowledge and ability to apply the content of the studies from the Bachelor studies

Completing successfully the Internship seminar is a requirement in order to pass this module and to obtain the necessary credits for the internship.

Test Type
Written exam of 90 minutes

Methods
Internship

O5113 Internship complements ES

Course Specialization
Embedded Systems

Test Type
Written exam of 90 minutes

O5112 Practice Seminar ES

Course Specialization
Embedded systems

Test Type
Written exam of 90 minutes

Module: Hardware-Modelling

Module number:	O-38
Module responsible	Prof. Dr. Robert Bösnecker
Course Specialization	Embedded Systems
Course number and course name	
	O6111 Hardware-Modelling
Semester	6
Length of the Module	1 Semester
Frequency of the Module	
Course type:	Mandatory
Level	
SWS	4.0
ECTS	5.0
Workload	Total: 0.0 hours
Course language	German

Access/ Needed requirements

Digital technology 1 and 2

Content

- Introduction to hardware architecture
- Modelling of circuits in VHDL
- Basic design of microcontroller systems
- Interfaces and peripheral control
- Applied use of VHDL in a EPLD or FPGA
- Practical application of architectures

O6111 Hardware-Modelling

Course Specialization

Embedded Systems

Test Type

Written exam of 90 minutes

Module: Numerical methods

Module number	O-39
Module responsible	Prof. Dr. Peter Jüttner
Course specialization	Embedded Systems
Course number and course name	
	O6112 Numerical Methods
Semester	6
Length of the Module	1 Semester
Frequency of the Module	
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Total: 0.0 hours
Course language	German

Objectives

- Knowledge and understanding from the representation and processing of floating point numbers in computers and the resulting problems
- Knowledge and understanding of some fundamental methods of numerical analysis to solve mathematical problems
- The ability to apply this knowledge when programming and analysing floating-point calculations in the C programming

Objectives

- Knowledge and understanding from the representation and processing of floating point numbers in computers and the resulting problems
- Knowledge and understanding of some fundamental methods of numerical analysis to solve mathematical problems
- The ability to apply this knowledge when programming and analysing floating-point calculations in the C programming

Content

- Definition
- Error types on calculations with floating point numbers (through examples)
- Error analysis based on the representation of floating-point numbers as machine numbers
- Basic arithmetic
- Conditioning and numerical stability
- Error propagation
- Examples of numerical algorithms
  - Gauss Algorithms (including. Matrix- und vectors)
  - Differential Equations

- Obtaining roots

Access/ Needed requirements

Class:
- Math I/II
- Basics of computer science
- Introduction to Programing

Test Types

Written exam of 90 minutes

Methods

Seminars with practical exercises, partly group work

Literature

- Roland Freund, Ronald Hoppe: Stoer/Bulirsch: Numerische Mathematik 1 und 2, Springer Verlag, ISBN 978-3-540-21395-6

- Hermann Schichl: Numerik 1, Skriptum zur Vorlesung WS 2000/01, Universität Wien,http://www.mat.univie.ac.at/~herman/skripten

- Serge Kräutle: Numerische Mathematik I, Wintersemester 2007/08, Universität Erlangen,
http://www1.am.uni-erlangen.de/~kraeutle/skripte.html

Module: System Programming

Module number O-40
Module responsible Prof. Dr. Andreas Grzemba
Course specialization Embedded systems
Course number and course name
O6113 System programming
Semester 6
Length of the Module 1 Semester
Frequency of the module yearly
Course type Mandatory
Level Bachelor
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Course language German

Objective

The students will learn concrete approaches for the design and implementation of modular operating systems. They will acquire detailed knowledge about the structure of individual Operating system components and the impact of increased modularity of the operating system.

For this the students should know the advantages (greater protection, increased stability, improved adaptability, etc.) and also the problems of modularization (increased communication overhead, less flexible interfaces, poor performance, etc.)

The students will know the current technical state of modular operating systems and will gain insight on how their solutions can be implemented in practical systems.

During an internship, the student shall be able to work and implement a Design of the most important sub-components of an operating system, according to the common principles

Access/Needed requirements

Successfully completed the course real-time systems

Content

Core interfaces

File Systems

Tasks/Scheduling

Driving devices

Internship in an embedded operating system

Teaching methods

Seminars/ Internship

Literature

Jonathan Corbet, Alessandro Rubini, and Greg Kroah-Hartman; Linux Device Drivers, Third Edition; O'Reilly Media; 2005; ISBN: 0-596-00590-3

Alan Burns and Andy Wellings: Real-Time Systems and Programming Languages, 3rd ed., Addison Wesley, 2001, ISBN 0-201-72988-1

William Stallings: Operating Systems, Prentice Hall , 2001, ISBN 0-13-032986-6

Phillip A Laplante: Real-Time Systems Design and Analysis, 3rd ed., IEEE press, 2004, ISBN 0-471-22855-9

O6113 System Programming

Course Specialization

Embedded Systems

Test Type

Written exam of 90 minutes

Module: Digital Signal Processing

Module number	O-41
Module responsible	Prof. Dr. Nikolaus Müller
Course specialization	Embedded Systems
Course number and course name	
	O6114 Digital signal processing
Semester	6
Length of the module	1 Semester
Frequency of the module	
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Total: 0.0 hours
Teaching language	German

Objectives

The ability to solve tasks from signal processing with the help of digital systems.

The ability to apply this knowledge on PC- Simulations and on systems with embedded digital signal processing.

O6114 Digital Signal processing

Course Specialization

Embedded Systems

Objectives

The ability to solve tasks from signal processing with the help of digital systems.

The ability to apply this knowledge on PC- Simulations and on systems with embedded digital signal processing.

Content

1. Description form analogy signals in the time and frequency domain
2. Description of time-discrete signals with the aid of the z-transform
3. Application environments Matlab and DSP
4. The discrete Fourier transformation (DFT)
5. Functions generator
6. Digital filter (FIR, IIR)

Test Type

Written exam of 90 minutes

Methods

Seminars, Class notes, PC-Simulations

Literature

A. Braun: Grundlagen der Regelungstechnik. Fachbuchverlag Leipzig, 2005,

O. Föllinger: Regelungstechnik. 10.Auflage, Hüthig Verlag, 2008;

M. Horn, N. Dourdoumas: Regelungstechnik. Pearson, 2004;

J. Lunze: Regelungstechnik 1. Springer Verlag, 4. Aufl., 2004;

H. Lutz / W. Wendt: Taschenbuch der Regelungstechnik. Verlag Harri Deutsch, 7. Aufl., 2007;

H. Mann, H. Schiffelgen, R. Froriep: Einführung in die Regelungstechnik. Hanser Verlag, 11. Aufl., 2009;

M. Reuter, S. Zacher: Regelungstechnik für Ingenieure. Verlag Vieweg, 12. Aufl., 2008;

H. Unbehauen: Regelungstechnik I. Verlag Vieweg, 15. Aufl., 2008

Module: Controlling technology

Module number O-42
Module responsible Prof. Dr. Nikolaus Müller
Course specialization Embedded Systems
Course number and course name
O6115 controlling technology
Semester 6
Length of the Module 1 Semester
Frequency of the module
Course type Mandatory
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Course language German

Objective

Basic understanding of the system dynamics;
Solve simple tasks from Control technology

O6115 Controlling technology

Course Specialization

Embedded System

Objectives

Basic understanding of the system dynamics;
Solve simple tasks from Control technology

Content

- Introduction
- Description of dynamic systems in the block diagram
- Characteristics from Controlling (Analysis)
- Control Design (synthesis)
- Structural (cascade control a.m.)

Access/ Needed requirements

Formal: none;
Content-wise: Mathematics: Complex Numbers, Laplace transformation, Physics

Test Type

Written exam of 90 minutes

Methods

Seminars, Class notes, PC-Simulation

Literature

A. Braun: Grundlagen der Regelungstechnik. Fachbuchverlag Leipzig, 2005,

O. Föllinger: Regelungstechnik. 10.Auflage, Hüthig Verlag, 2008;

M. Horn, N. Dourdoumas: Regelungstechnik. Pearson, 2004;

J. Lunze: Regelungstechnik 1. Springer Verlag, 4. Aufl., 2004;

H. Lutz / W. Wendt: Taschenbuch der Regelungstechnik. Verlag Harri Deutsch, 7. Aufl., 2007;

H. Mann, H. Schiffelgen, R. Froriep: Einführung in die Regelungstechnik. Hanser Verlag, 11. Aufl., 2009;

M. Reuter, S. Zacher: Regelungstechnik für Ingenieure. Verlag Vieweg, 12. Aufl., 2008;

H. Unbehauen: Regelungstechnik I. Verlag Vieweg, 15. Aufl., 2008

Module: Mandatory elective 1

Module number O-43
Module responsible Prof. Dr. Gerald Kupris
Course Specialization Embedded Systems
Course number and course name
O6116 Mandatory elective 1 ES
Semester 6
Length of the Module 1 Semester
Frequency of the Module
Course Type Mandatory elective
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching language German

Objective

View more detailed the studies content in the field of the elective chosen

O6116 Mandatory elective 1 ES

Course Specialization

Embedded Systems

Objectives

View more detailed the studies content in the field of the elective chosen

Content

The course description of the elective chosen

Test Type

Written exam of 90 minutes

Module: Modelling & simulation

Module number O-44
Module responsible Prof. Dr. Peter Jüttner
Course specialization Embedded Systems
Course number and course name
null O7111 Modelling and simulation
Semester 7
Length of the module 1 Semester
Frequency of the module
Course type Mandatory
SWS 4.0
ECTS 5.0
Workload Total: 0.0 hours
Teaching language German

Objectives

-Knowledge and understanding from different methods from modelling and simulation from SW-Systems, components and algorithms

-The ability to apply this knowledge on examples

O7111 Modelling and Simulation

Course Specialization

Embedded systems

Objectives

-Knowledge and understanding from different methods from modelling and simulation from SW-Systems, components and algorithms

-The ability to apply this knowledge on examples

Content

- Pattern
  - Definition
  - Pattern in computer science
    - Pattern for SW-architecture
    - Patter for SW-Design
    - Pattern for SW-Coding (Idiom)
    - Anti-pattern
- Modelling and simulation from System components and algorithms within MATLAB
  - MATLAB Overview
  - MATLAB Programming
  - MATLAB Simulink
  - MATALB State flow

Access/ Needed entry requirements

Classes:
- Basics of computer science
- Introduction to computer science
- Goal oriented programming
- Algorithms and data structure
- Numerical methods

Test Type

Written exam, 90 minutes

Methods

Seminars with practical aspects, partly group work

Literature

- A. Angermann et al., MATLAB-Simulink-Stateflow, Gruindlagen, Toolboxen, Beispiele,
  Oldenbourg-Verlag, ISBN 978-3-486-58985-6
- F. Buschmann et. al., A System of Patterns, Wiley Verlag, 1996, ISBN 0-471-96869-7
- E. Gamma, R. Helm, R. Johnson, J. Vlissides, Entwurfsmuster, Addison Wesley, 2001
- William J. Brown, Raphael C. Malveau, Hays McCormick, Anti Patterns, MITP-Verlag, 2004

Module: Mandatory Elective 2

Module number	Prof. Dr. Gerald Kupris
Course Specialization	Embedded Systems
Course number and course name	O7112 Mandatory elective 2 ES
Semester	7
Length of the Module	1 Semester
Frequency of the Module	
Course type	Mandatory elective
SWS	4.0
ECTS	5.0
Workload	Total: 0.0 hours
Teaching language	German

Objective

View in more detail the studies content in the field of the chosen elective

O7112 Mandatory elective 2 ES

Course specialization

Embedded Systems

Objectives

View in more detail the studies content in the field of the chosen elective

Content

Course description of the subject chosen as elective

Test Type

Written exam of 90 minutes

Module: Spatial reference systems and positioning

Module number	O-60
Module responsible	Prof. Dr. Wolfgang Dorner
Course Specialization	Mobile und spatial system
Course number and course name	O3121 Spatial reference systems and positioning
Lecturer	Patrick Reidelstürz
Semester	3
Length of the Module	1 Semester
Frequency of the Module	annually
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Independent study: 30.0 hours
	Total: 90.0 hours
Teaching language	German

Objectives

The students will learn about different spatial reference systems and will be able to differentiate among them

The students will learn about the functioning of global positioning, especially about GPS.

At the end of the course the student will be able to apply the learned spatial systems as well as the positioning options according appropriate to a certain context.

O3121 Spatial reference systems and positioning

Course Specialization

Mobile und spatial systems

Objectives

The students will learn about different spatial reference systems and will be able to differentiate among them

The students will learn about the functioning of global positioning, especially about GPS .

At the end of the course the student will be able to apply the learned spatial systems as well as the positioning options according appropriate to a certain context.

Content

(A)Spatial reference systems

1. The basics of spatial reference systems
1.1 Introduction to spatial reference systems
1.2 Geoid
1.3 Distance and height

2 Projections
3 Coordinate Systems
4 Visualization

(B) Positioning
1 Introduction and History of positioning systems
2 positioning systems
3 Error influences of positioning
4 Current formats and data storage of positioning data
5 Application examples

Test Type

Written exam of 90 minutes

Methods

Seminars and class practices

Module: Introduction of GIS

	O-60
	Prof. Dr. Wolfgang Dorner
	Mobile und spatial system
	O3121 Spatial reference systems and positioning
Lecturer	Patrick Reidelstürz
Semester	3
	1 Semester
Frequency of the Module	annually
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Independent study: 30.0 hours
	Total: 90.0 hours

Module number	O-61
Module responsible	Prof. Dr. Wolfgang Dorner
Course Specialization	Mobile und spatial Systems
Course number and course name	O3122 Introducion to Geo information systems (GIS) in Geographic Information Systems (GIS)
Lecturer	Roland Zink
Semester	3
Length of the Module	1 Semester
Frequency of the Module des Moduls	
Couse type	mandatory
SWS	4.0
ECTS	5.0
Workload	
	Attendance: 30.0 hours
	Independent sutyd: 90.0 hours
	Virtual share: 30.0 hours
	Total: 150.0 hours
Teaching language	German

Objectives

The students will be able to define Geographical information at the end of the course. Furthermore thy will understand its function and will manage to work on basic spatial issues through ArcGIS, gvSIG and QuantumGIS.

The students can capture Geographical data on their own in order to collect it, store it, edit it, analyze it and presen it.

O3122 Introduction to Geographical information systems (GIS)

Objectives

The students will be able to define Geographical information at the end of the course. Furthermore thy will understand its function and will manage to work on basic spatial issues through ArcGIS, gvSIG and QuantumGIS.

The students will learn different Geographical formats and can apply them accordingly.

The students can capture Geographical data on their own in order to collect it, store it, edit it, analyse it and present it.

Content

1Introduction of GIS

1.1 Definition of GIS

1.2 Current Applications

2. Operation of GIS

2.1 Illustration of the real world

2.2 Georeferencing

2.3 Layer principle

2.4 Geoobjects

3. Geodata formats

3.1 Geometry and topology data

3.2 Vectors

3.3 Grids

3.4 Graphic data

3.5 factual data

4. Working with Spatial Data

4.1 Electronic capture of spatial data

4.2 Quality of spatial data

4.3 Standardization of spatial data and OGC

4.4 ATKIS and ALKIS

4.5 INSPIRE

5. Database systems and data management

5.1 Data management in GIS

5.2 Database and database systems

5.3 Spatial database systems

5.4 SQL

6. GIS-Software

6.1 Status and development of software

6.2 Autodesk Map 3D and Civil 3D

6.2 ESRI ArcGIS

6.3 Open Source-Products

6.4 Web-GIS
7. Space acquisition and mapping in GIS
7.1 Spatial relationships
7.2 Coordinates
7.3 Reference Systems
7.4 Grid designs
7.5 Coordinate transformations
7.5 Primary detection methods
7.6 Secondary detection methods
8. Spatial queries
8.1 Topological queries
8.2 Attribute-based queries
8.3 Geometric analysis
9. Conversions
9.1 Transformation of coordinate systems
9.2 Vector to grid
9.3 Table to grid
9.4 Grid to vector
10. Presentation
10.1 Graphical representation forms
10.2 Interactive forms of presentation
10.3 Web presentations
10.4 Data Exchange
11. Development of GI systems
12. Outlook, connector and repetition

Test Type

Written exam of 90 minutes

Literature

Bill, R. (2010): Grundlagen der Geo-Informationssysteme. Berlin.

Ehlers, M. & Schiewe, J. (2012): Geoinformatik. Darmnstadt.

GI Geoinformatik GmbH (Hrsg.) (2011): ArcGIS 10, das deutschsprachige Handbuch für ArcView und ArcEditor. Berlin.

Module: Fundamentals of Spatial Sciences

Module number	O-62
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile und spatial systems
Course number and course name	
	O3123 Fundamentals of space sciences
Lecturer	Roland Zink
Semester	3
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Independent study: 90.0 hours
	Total: 150.0 hours
Teaching-/Course language	German

Objectives

The students will be able to define terms of spatial science.

The students know the interfaces between computer science and spatial science.

The students will be able to employ various qualitative and quantitative methods of spatial science, thus being able to detect further areas to explore.

The students can illustrate and classify spatial phenomena mathematically and cartographically in order to apply them in spatial planning.

The student will have at the end of the courses a sound knowledge about spaces and should be able to analyze, question and process complex spatial and interdisciplinary issues.

The students will know the basics of design, modeling and perception of spaces and have knowledge of spatial planning.

O3123 Fundamentals of Spatial Sciences

Objectives

The students will be able to define terms of spatial science.

The students know the interfaces between computer science and spatial science.

The students will be able to employ various qualitative and quantitative methods of spatial science, thus being able to detect further areas to explore.

The students can illustrate and classify spatial phenomena mathematically and cartographically in order to apply them in spatial planning.

The student will have at the end of the courses a sound knowledge about spaces and should be able to analyze, question and process complex spatial and interdisciplinary issues.

The students will know the basics of design, modeling and perception of spaces and have knowledge of spatial planning.

Content

I Introduction to the fundamentals of spatial sciences

1. Importance of place and space and their respective introduction
1.1 Geographical approaches
1.2 Computer science approaches
1.3 Regionalization, globalization and cyberspace
2. Interpretation of place and space
2.1 Mathematical, physical and Euclidean space
2.2 Geographical, social and architectural space
2.3 Further spaces
3. Detection and mapping of areas
3.1 Cartesian systems
3.2 Coordinates, position and location
3.3 Geographic coordinate systems
3.4 Vectors and grids
4. Capturing geographical spaces
4.1 Measurement methods: Distance, area, and angle measurement
4.2 Measurement accuracy
4.3 Georeferences and referencing methods
5. Practice: Recognition from Geo-spaces and creation of maps
6. Cartographic illustrations geographical spaces
6.1 Types of cards
6.2 Cards layout: Colors, symbols and topology
6.3 3D-Presentations
7. Practice: Cards interpretation
8. Space analysis
8.1 Spatial descriptions
8.2. Absolute and relative positions
8.3 Interaction and diffusion
8.4 Availability

II Designing spaces

1. Spatial planning
1.1 Spatial structures
1.2 The sense behind a sustainable space planning
1.3 Principles of spatial planning
2. Methods of spatial planning
2.1 Situations analysis

2.2 Potential analysis
2.3 Risk analysis
3. Practices: Spatial planning in examples of the HUD

III Space modeling

1. Environmental modeling
1.1 Geodata: Format, context and use
1.2 Modeling geodata
1.3 Computer-supported simulation of environmental processes
2. CAD in the spatial planning
2.1 Constructions and drawing work
2.2 Objects and space
2.3 Software solutions
3. Visualization in 2D and 3D
3.2 2D-Plans
3.3 Nuts from 3D-visualization
3.4 Dynamic 3D- Landscape modeling
4. Geoinformation and Geoinformatics
4.1 Incorporation of space and information
4.2 Layer principles
4.3 Software solutions
5. Spatial systems on the Web
5.1 Web maps
5.2 Virtual Globes
5.3 Router planned
5.4 Geodata-Services
6. Practice: Environmental Modeling and Simulation Environment

IV Perception of space

1. Evaluation of spatial perception
1.1 Factors influencing the perception of space
1.2 Cognitive maps and mental maps
2. Empirical Social Research: Quantitative vs. qualitative methods

V Computer Science and space

1. Geoinformation and Geoinformatics
1.1 What is Geoinformation – an introduction
1.2 Development of the geoinformatics
2. Future areas of Geoinformatics
2.1 Career options
2.2 Applications

VI Outlook, connector and repetition

Test Type

Written exam of 90 minutes

Methods

Seminars and exercises

In the exercises: individual-, partner- and group work

Practical teaching sessions on measurement procedures

Computer assisted instruction sequences in the exercises

Literature

Ehlers, M. & Schiewe, J. (2012): Geoinformatik. Darmstadt.

Fürst, D. (2010): Raumplanung, Herausforderungen des deutschen Institutionensystems. Detmold.

Knox, P. & Marston, S. (2008): Humangeographie. Heidlberg.

Langhagen-Rohrbach, Ch. (2019): Raumordnung und Raumplanung. Darmstadt.

Module: Mobile Operating Systems

Module number	O-63
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile und spatial systems
Course number and course name	
	O3124 Mobile Operating Systems
Lecturer	Prof. Dr. Wolfgang Dorner
Semester	3
Length of the Module	1 Semester
Module frequency	yearly
Course type	Mandatory
Level	Undergraduate
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Independent study: 90.0 hours
	virtual share: 150.0 hours
	Total: 300.0 hours
Teaching-/Course language	German

O3124 Mobile Operating systems

Objectives

The students will learn how to deal with programming based mobile operating systems such as Androids or Windows Phones. After finishing they will dominate the basics from other relevant Program languages (specially C# or Java), will know the basics for construction of an operating system in general, and a mobile operating system and related hardware basics. They will be able to develop independently, smaller application and access on hardware's.

Content

1. Basic Operating Systems
1.1 Development of operating systems
1.2 Tasks of an OS
1.3 Applications and Types
1.4 Structure
2. Introduction to mobile and embedded operating systems
2.1 Types and Applications
2.2 Current/ up-to-date examples
2.3 Introduction to Androids

2.4 Introduction to WP7/WP8
3. Hardware Specifications
3.1 OS hardware requirements
3.2 Interfaces in Android
4. Introduction to a programming language
3.1 Java Fundamentals for Android
3.2 Java and Web technologies
3.3 Access to OS components
5. Fundamentals of Mobile Application Development
5.1 Types of applications
5.2 Web-based apps
5.3 Native Apps
5.4 Hybrid approaches
6. Implementation of simple access to hardware interfaces
6.1 Retrieval of GPS data
6.2 Access on acceleration and direction information
6.3. Camera

Access or recommended requirements

- Basic knowledge about programming and goal oriented programing

Test Types

Written exam of 90 minutes

Methods

Seminars and programming exercises in the computer lab.

As part of the seminar-classes, essential theoretical knowledge will be taught, such as operating systems, hardware architectures and basic elements of the language. Using concrete examples, the students will be introduced to programming exercises in the practical application of the knowledge acquired. Here, the method of problem-based learning is in the foreground and is meant to promote among students the ability for independent acquisition of knowledge and problem-solving skills.

Module: Geoinformation – Application and use

Module number	O-64
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile und spatial systems
Course number and course name	
	O4121 Geoinformation – Application and use
Semester	4
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
SWS	6.0
ECTS	5.0
Workload	Attendance: 90.0 hours
	Independent study: 60.0 hours
	Total: 150.0 hours
Teaching-/Course language	German

Course Objectives

The course is built on previous knowledge of the "Introduction GIS" and is accompanied by an extensive practical training in integrated geographic information systems.

Suring the practices the learned outcomes of application-oriented content will be tested/proven from examples.

The student will have an extensive knowledge of the application and use of GIS.

The students will be able to create spatial, statistical and mathematical models for specific tasks and purposefully apply them.

The student is able to transfer the content learned about modelling spatial structures on new issues and adjust it accordingly.

The student has a basic knowledge of VBA programming.

O4121 Geoinformation – Application and use

Objectives

The course is built on previous knowledge of the "Introduction GIS" and is accompanied by an extensive practical training in integrated geographic information systems.

Suring the practices the learned outcomes of application-oriented content will be tested/proven from examples.

The student will have an extensive knowledge of the application and use of GIS.

The students will be able to create spatial, statistical and mathematical models for specific tasks and purposefully apply them.

The student is able to transfer the content learned about modelling spatial structures on new issues and adjust it accordingly.

The student has a basic knowledge of VBA programming.

Content

1. Spatial modelling and simulation - an introduction
2. Introduction to the use of software
2. Data models
2.1 Hierarchical Data Models
2.2 Relational/Comparative Data Model
2.3 Object-Oriented Data Model
3. geometric analysis
3.1 Geometric Fundamentals
3.2 Clipping
3.3 Buffering
3.4 Surface intersections
3.5 Point-in-polygon test
3.6 Adjacency Graph
4. Topological analysis methods
4.1 Graph Theoretical Foundations
4.2 Networks analysis
5. Statistical analysis methods
5.1 Introduction to Statistic
5.2 Univariate procedure
5.3 Bivariate method
5.4 Multivariate methods
5.5 interpolation methods
5.6 Cluster Analysis
5.7 Geostatistics
6. Volume methods
6.1 Boolean Algebra
6.2 Fuzzy-Mathematics
6.3 Relational/Comparative Operators
6.4 Research method
6.5 Reclassification
6.6 Aggregation
7. Simulations
8. Special algorithms
9. 3D-Analysis methods
9.1 Grid and surface analysis
9.2 Visibility analyses
9. VBA Programming in GIS
9.1 Customizing user Interfaces
9.2 Creating Controls
9.3 language syntax and controlling alternatives

9.4 Visual Basic Editor in ArcGIS

9.5 Object-oriented programming and introduction Arc Objects

10. Summary and Outlook

Access and/or recommended requirements

The course is built or prior knowledge of „Introduction to GIS" and will be accompanied with a practical training in common GIS systems. The learning outcomes will be tested on adequate examples.

Test Type

Written exam of 90 minutes

Methods

Seminars and Practices

Individual-, Partner- and Teamwork

Workshops in GIS-lab.

Literature

Bill, R. (2010): Grundlagen der Geo-Informationssysteme. Berlin.

De Lange, N. (2005): Geoinformatik in Theorie und Praxis. Heidelberg.

Ehlers, M. & Schiewe, J. (2012): Geoinformatik. Darmnstadt.

GI Geoinformatik GmbH (Hrsg.) (2011): ArcGIS 10, das deutschsprachige Handbuch für ArcView und ArcEditor. Berlin.

Module: Storage and processing of spatial data

Module number	O-65
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile und spatial systems
Course number and course name	
	O4122 Storage and processing of spatial data
Semester	4
Length of the Module	1 Semester
Module frequency	yearly
Course type	Mandatory
Level	Undergraduate
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Independent study: 90.0 hours
	Virtual share: 150.0 hours
	Total: 300.0 hours
Teaching-/Course language	German

O4122 Storage and processing of spatial data

Course Specialization

Mobile and spatial systems

Course Objectives

Students learn relevant data structures, basic algorithms and analytical methods to store spatial data and process it.

These should relate specifically to vector and raster data structures.

After completing this module, the students will be able to choose different applications data structures, algorithms and fundamental analysis and to implement it in a target language.

They will also understand the possibilities of storing and processing data in the DBMS and will be able to formulate corresponding insertion and query operations for (object-relational) DBMS.

Content

1. Discrete versus continuous phenomena

1.1 Choosing data structures

1.2 Fields

1.3 Data and file formats

2. Vector data

2.1 Construction of vector data
2.2 Mathematical models for the description
2.3 Data structures
3. Graph Theory
3.1 Structure of graphs
3.2 Mathematical Foundations
3.3 Storing and processing of graphics
4. Grid data
4.1 Structure of grid formats
4.2 Mathematical Foundations
4.3 Data structures
4.4 Data and File Formats
5. Special data formats
5.1 TIN
5.2 Voxel
6. Basic algorithms for vector data
7. Basic algorithms for grid data
8. Geodatabases
8.1 Object-Oriented Databases
8.2 Simple features concept
8.3Geoobjects
8.4 Definition of access on objects in SQL

Types of Test

Written exam, 90 minutes

Methods

Seminars and programing exercises in the computer lab.

As part of the seminar-classes, essential theoretical knowledge will be taught. Using concrete examples, the students will be introduced to programming exercises in the practical application of the knowledge acquired. Here, the method of problem-based learning is in the foreground and is meant to promote among students the ability for independent acquisition of knowledge and problem-solving skills.

Module: Internship

Module number O-66
Module responsible Prof. Dr. Wolfgang Dorner
Course specialization Mobile and spatial systems
O5123 Additional, reinforcement practice MRS
O5122 Practical seminars MRS
O5121 Internships MRS
Semester 5
Length of the Module 1 Semester
Module frequency
Course type PLV, Mandatory
Level Undergraduate
SWS 4.0
ECTS 30.0
Workload
Attendance: 420.0 hours
Independent study: 30.0 hours
Total: 450.0 hours
Course number and course name German

O5123 Additional, reinforcement practice MRS

Main focus
Mobile and spatial systems

Objectives
Learning content directly related to the practical activity

Content
diverse

Types of test
none

Methods
Seminars, Practices, excursion

O5122 Practical seminar MRS

Focus
Mobile and spatial systems

Objectives
Preparation for the internship

Content
diverse

Test Type
LN written

Methods
Seminars, Exercises, excursion

O5121 Internship MRS

Focus
Mobile and spatial systems

Objectives
Anchoring and expanding what has already been learned from the experience.

Understand the importance of teamwork.
Presentations about the tasks performed during the internship and the results obtained at work.

Content
Individual and studies related topics

Access or recommended requirements
Formal: at least 70 ECTs (credits)

Content: Knowledge and application of the topics and content of the Bachelor program;

The successful completion of the internship is a requirement for passing this module and thus for the recognition of ECTS points.

Test type
No exam

Methods
internship

Module: Special algorithms

Module number	O-67
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile and spatial systems
Course number and course name	O6121 Special algorithms
Semester	6
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
Level	Undergraduate
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours Independent study: 90.0 hours Virtual share: 150.0 hours total: 300.0 hours
Teaching-/Course language	German

O6121 Special algorithms

Course Focus

Mobile and spatial systems

Objectives

The students will learn algorithms that are essential for working on spatial data. After finishing the course the students will be able to implement diverse algorithms for the remote sensing, photogrammetry, routing and spatial analysis.

Content

1. Routing and operations in graphs
2. Remote Sensing and index method
3. Photogrammetric processing
4. Analysis algorithms for vector data
5. Grid analysis

Test types

Written exam of 90 minutes

Methods

Seminars and exercises in the computer

Literature

Module: Programming mobile systems

Module number	O-68
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile and spatial systems
Course number and course name	O6122 programming mobile systems
Semester	6
Length of the Module	1 Semester
Module frequency	yearly
Course type	mandatory
Level	Undergraduate
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours Independent study: 90.0 hours Virtual share : 150.0 hours Total: 300.0 hours
Teaching-/Course language	German

O6122 Programming mobile systems

Course Focus

Mobile and spatial systems

Objectives

The students will develop the ability and knowledge for further implementation in mobile devices. After finishing the course the students will be able to develop comprehensive applications for a specified platform and to apply different techniques (web based applications, native applications and hybrid applications). They can access it on (selected) hardware interfaces and develop context-based applications

Content

1. Software concepts
1.1 Native applications
1.2 Web based applications
1.3 Hybrid approaches
2. Basic structures of larger applications
3. Web technologies
3.1 HTML 5
3.2 XML
3.3 JavaScript

3.4 JSON
4. Structure and concepts design
5. Deeper view of Java
6. Access to hardware interfaces
7. Libraries and frameworks
8. Usability
9. Context based applications

Access/recommended requirements

- Fundamentals of mobile and embedded operating systems
- Storage and processing of spatial data

Spatial reference systems and positioning

Test type

Written exam of 90 minutes

Methods

Seminars and programming exercises in the computer lab.

During the lectures relevant theoretical basic-knowledge will be taught. Through specific examples the students will be able to apply this knowledge on programming exercises. Here, the method of problem-based learning is in the foreground and is meant to promote among students the ability for independent acquisition of knowledge and problem-solving skills.

Literature

Module: Sensors and hardware-specific programming

Module number	O-69
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile and spatial systems
Course number and course name	O6123 Sensors and hardware-specific programming
Semester	6
Length of the Module	1 Semester
Module frequency	
Course type	mandatory
Level	Undergraduate
SWS	4.0
ECTS	5.0
Workload	
	Attendance: 60.0 hours
	Independent study: 90.0 hours
	Virtual share: 150.0 hours
	Total: 300.0 hours
Teaching-/Course language	German

O6123 Sensors and hardware-specific programming

Course Focus

Mobile and spatial systems

Objectives

The students will learn about different sensor types in the fields of Remote sensing, positioning and traditional mobile devices. Upon completion of the subject, students may work on selected sensors and sensor data processing.

Content

1. Repetitions of the basics of sensors
2. Sensors Remote Sensing
3. Sensors of spatial measurement techniques
4. Integrated sensors mobile devices
5. Access to hardware interfaces
6. Hardware dependent programming
7. Processing of sensor data

Types of Test

Written exam of 90 minutes

Module: Architectures for Networked Software Systems

Module number O-70
Module responsible Prof. Dr. Wolfgang Dorner
Course specialization Mobile and spatial systems
Course number and course name
O6124 Architectures for Networked Software Systems
Semester 6
Length of the Module 1 Semester
Module frequency
Course type Mandatory
SWS 4.0
ECTS 5.0
Workload Attendance: 60.0 hours
Independent study: 90.0 hours
Virtual share: 150.0 hours
Total: 300.0 hours
Teaching-/Course language German

Course Focus

During the lectures the students will learn about the most relevant (particularly the internet based-) technologies and standards in order to be able to build OGC solutions for Geodata infrastructure. After this course, the students know the main OGC standards (Simple Feature, WFS, WMS) and systems and technologies that are based on this.

They will be able to program interfaces and to access to interfaces of programing. Parallel to this, the students will learn about the proprietary standards and how to integrate it into their own systems.

O6124 Architectures for Networked Software Systems

Course focus

Mobile and spatial systems

Objectives

During the lectures the students will learn about the most relevant (particularly the internet based-) technologies and standards in order to be able to build OGC solutions for Geodata infrastructure. After this course, the students know the main OGC standards (Simple Feature, WFS, WMS) and systems and technologies that are based on this.

They will be able to program interfaces and to access to interfaces of programing. Parallel to this, the students will learn about the proprietary standards and how to integrate it into their own systems.

Content

1. Internet technologies
2. Web services

3. Geodata infrastructure
4. OGC Standards
4.1 Simple Features
4.2 WFS
4.3 WMS
5. Proprietary Standards
5.1 Google Maps API
5.2 Bing API
6. Access to Web services
7. Develop their own applications using interfaces

Test type

Written exam of 90 minutes

Methods

Seminars accompanied by exercises

Literature

Module: Digital Imaging and Augmented Reality

Module number	O-71
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile and spatial systems
Course number and course name	
	O6125 Digital Imaging and Augmented Reality
Lecturer	Patrick Reidelstürz
	Roland Zink
Semester	6
Length of the Module	1 Semester
Module frequency	
Course type	Mandatory
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours
	Independent Study: 90.0 hours
	Virtual share: 150.0 hours
	Total: 300.0 hours
Teaching-/Course language	German

Objectives

The students will learn about processes and options for digital image processing, especially in context with civilian remote sensing.

Remote sensing applications are geared with the voluntary elective "Civilian use of drones and remote sensing."

The students understand the content and meaning of derived remote sensing information and are able to apply and analyse it.

They can interpret continuous process pictorial information and remote sensing.

The student knows the possibilities, the value but also the limitations of augmented reality.

The student knows the function of augmented reality and knows the necessary hardware and software components.

The student will be able to create independently small augmented reality applications.

O6125 Digital Imaging and Augmented Reality

Main Focus

Mobile and spatial systems

Objectives

The students will learn about processes and options for digital image processing, specially in context with civilian remote sensing.

Remote sensing applications are geared with the voluntary elective "Civilian use of drones and remote sensing."

The students understand the content and meaning of derived remote sensing information and are able to apply and analyse it.

They can interpret continuous process pictorial information and remote sensing.

The student knows the possibilities, the value but also the limitations of augmented reality.

The student knows the function of augmented reality and knows the necessary hardware and software components.

The student will be able to create independently small augmented reality applications.

Content

1 Introduction of Digital Image Processing in Remote Sensing

2 Sensor support and sensors in remote sensing
2.1 Satellite Remote Sensing and Sensors
2.2 Aircraft and UAV-based remote sensing and sensors

3 Post-processing and analysis of remote sensing data
3.1 Basics of image processing
3.2 Multispectral analysis, vegetation indices and classification methods
3.3 Decision tree classification
3.4 Simple georeferencing of remotely sensed data
3.5 Photogrammetric orientation and georeferencing

Augmented Reality

1. Augmented Reality (AR) – an introduction
1.1 Can reality be upgraded?
1.2 Definition of AR
1.3 Delimitation to virtual reality
1.4 Application of Augmented Reality
2. Functions of Augmented Reality
2.1 Perceived reality
2.2 Computer generated reality
2.3 Upgraded reality
3. Augmented Reality Systems (ARS)
3.1 Architecture of ARS
3.2 Imaging
3.3 Positioning, sight and tracking procedures
3.4 Forms of representation
3.5 Software solutions
3.6 AR-Applications

3.7 Software development
4. Technical components for augmented reality
4.1 Automated image recognition
4.2 Forms of representation
4.3 Stationary Systems
4.4 Mobile Devices
5. Augmented Reality-examples
5.1 QR-Code based AR
5.2 GIS and AR
6. Augmented Reality in the practice
6.1 Current/ up-to-date fields of application
6.2 Potential of augmented Reality
6.3 Boundaries of augmented Reality
7. Future applications of Augmented Reality
8. Outlook connector and repetition

Test type

Written exam of 90 minutes

Methods

Seminars with exercises

Literature

Furht, B. (Hrsg.) (2011): Handbook of Augmented Reality. Heidelberg, New York.

Mehler-Bicher, A., Reiß, M. & Steiger, L. (2011): Augmented Reality, Theorie und Praxis. München.

Module: Mandatory elective 1

Module number	O-72
Module responsible	Prof. Dr. Wolfgang Dorner
Course specialization	Mobile and spatial systems
Course number and course name	O6126 Mandatory elective 1 MRS
Semester	6
Length of the Module	1 Semester
Module frequency	
Course Type	elective
SWS	4.0
ECTS	5.0
Workload	Attendance: 60.0 hours Independent study: 90.0 hours Virtual share: 150.0 hours Total: 300.0 hours
Teaching-/Course language	German

Objectives

Complement the content of the studies in the field of the courses offered as electives

O6126 Mandatory elective 1 MRS

Course focus

Mobile and spatial systems

Objectives

Complement the content of the studies in the field of the courses offered as electives

Content

Description of the chosen elective

Test Type

Written exam of 90 minutes

Module: Mandatory elective 2

Module number O-73
Module responsible Prof. Dr. Wolfgang Dorner
Course specialization Mobile and spatial systems
Course number and course name
O7121 Mandatory elective 2 MRS
Semester 7
Length of the Module 1 Semester
Module frequency
Course type elective
SWS 4.0
ECTS 5.0
Workload
Attendance: 60.0 hours
Independent study: 90.0 hours
Virtual share: 150.0 hours
Total: 300.0 hours
Teaching-/Course language German

Objectives

Complement the content of the studies in the field of the courses offered as electives

O7121 Mandatory elective 2 MRS

Course focus

Mobile and spatial systems

Objectives

Complement the content of the studies in the field of the courses offered as elective

Content

To be found in the description of the chosen elective

Test Type

Written exam of 90 minutes

Module: Mandatory elective 3

Module number: O-74
Module responsible Prof. Dr. Wolfgang Dorner
Course specialization Mobile and spatial systems
Course number and course name
O7122 Mandatory elective 3 MRS
Semester 7
Length of the Module 1 Semester
Module frequency
Course type elective
SWS 4.0
ECTS 5.0
Workload Attendance: 60.0 hours
Independent study: 90.0 hours
Virtual share: 150.0 hours
Total: 300.0 hours
Teaching-/Course language German

Objectives

Complement the content of the studies in the field of the courses offered as electives

O7122 Mandatory elective 3 MRS

Course focus

Mobile and spatial systems

Objectives

Complement the content of the studies in the field of the courses offered as elective

Content

To be found in the description of the chosen elective

Test Type

Written exam of 90 minutes