TECHNISCHE HOCHSCHULE DEGGENDORF

Module Guide
Applied Computer Sciences

Faculty Computer Science
Examination regulations 01.10.2015
Date: Tuesday 16.02.2021 15:15

O-01 Mathematics

Module code	O-01
Module coordination	Prof. Dr. Terezia Toth
Course number and name	O1101 Mathematics I O2101 Mathematics II
Lecturers	Prof. Dr. Wolfgang Dorner Prof. Dr. László Juhász Prof. Dr. Terezia Toth
Semester	1, 2
Duration of the module	2 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	13
ECTS	13
Workload	Time of attendance: 195 hours self-study: 195 hours Total: 390 hours
Language of Instruction	German

Module Objective

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.

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 I

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.

Learning 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

Type of Examination

written ex. 90 min.

O2101 Mathematics II

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

Learning Content

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

Type of Examination

written ex. 90 min.

O-02 Physics

Module code	O-02
Module coordination	Prof. Dr. Richard Hämmerle
Course number and name	O1102 Physics
Lecturer	Prof. Dr. Richard Hämmerle
Semester	1
Duration of the module	1 semester
Module frequency	
Course type	required course
Level	
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weight	
Language of Instruction	German

Module 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.

Entrance Requirements

Basic knowledge of differential, integral and vector calculus

Learning Content

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

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.

Learning 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

Type of Examination

part of module exam

O-03 Fundamentals of Electrical Engineering

Module code	O-03
Module coordination	Prof. Dr. Robert Bösnecker
Course number and name	O1103 Fundamentals of Electrical Engineering
Lecturer	Prof. Dr. Robert Bösnecker
Semester	1
Duration of the module	1 semester
Module frequency	
Course type	required course
Level	
Semester periods per week (SWS)	6
ECTS	7
Workload	Time of attendance: 90 hours self-study: 120 hours Total: 210 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weight	
Language of Instruction	German

Module Objective

Entrance Requirements

Learning 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

Type of Examination

part of module exam

O-04 Fundamentals of Computer Science

Module code	O-04
Module coordination	Prof. Dr. Andreas Berl
Course number and name	O1104 Fundamentals of Computer Science O1105 Introduction to Programming
Lecturers	Prof. Dr. Andreas Berl Nicki Bodenschatz Markus Eider
Semester	1
Duration of the module	1 semester
Module frequency	
Course type	required course
Semester periods per week (SWS)	8
ECTS	10
Workload	Time of attendance: 120 hours self-study: 180 hours Total: 300 hours
Type of Examination	written ex. 120 min.
Duration of Examination	120 min.
Language of Instruction	German

Module Objective

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

Learning 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

Type of Examination

part of module exam

O1105 Introduction to Programming

Objectives

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

Learning 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

Type of Examination

part of module exam

O-05 Fundamentals of Measurement Technology and Sensors

Module code	O-05
Module coordination	Prof. Dr. Stefan Zorn
Course number and name	O2102 Fundamentals of Measurement Technology and Sensors
Lecturer	Prof. Dr. Stefan Zorn
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weight	
Language of Instruction	German

Module Objective

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

Entrance Requirements

Sensor principles of mechanics;
Sensor principles of thermodynamics;

Sensor principles of electrostatics and dynamics;
Sensor principles of propagation of electromagnetic waves and optics

O2102 Fundamentals of Measurement Technology and Sensors

Objectives

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

Learning Content

Sensor principles of mechanics;
Sensor principles of thermodynamics;
Sensor principles of electrostatics and dynamics;
Sensor principles of propagation of electromagnetic waves and optics

Type of Examination

part of module exam

O-06 Object-oriented Programming

Module code	O-06
Module coordination	Prof. Dr. Peter Jüttner
Course number and name	O2103 Object-oriented Programming
Lecturer	Prof. Dr. Peter Jüttner
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	undergraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weight	5/210
Language of Instruction	German

Module Objective

- 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++

Entrance Requirements

- Lecture "Introduction to Programming"

- Lecture "Foundations of computer science"

Learning 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

O2103 Object-oriented Programming

Learning Content

Type of Examination

part of module exam

O-07 Algorithms and Data Structures

Module code	O-07
Module coordination	Prof. Dr. Peter Jüttner
Course number and name	O2104 Algorithms and Data Structures
Lecturer	Prof. Dr. Peter Jüttner
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	undergraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Weight	5/210
Language of Instruction	German

Module Objective

- 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.

Entrance Requirements

Lectures:

- Introduction to Programing

- Foundations of computer science

Teaching Methods

Seminars and practical exercises, partly group work.

O2104 Algorithms and Data Structures

Learning Content

Type of Examination

part of module exam

O-08 Softskills 1

Module code	O-08
Module coordination	Prof. Dr. Roland Zink
Course number and name	O2105 Business Administration O2106 Rhetoric O2110 O2111 English Language for Engineers
Lecturers	Dozenten/innen für AWP und Sprachen, vhb Prof. Dr. Thomas Geiß NN NN PK AI/IAS/CS Marcus Schlegel Javier Valdes Prof. Dr. Roland Zink
Semester	2
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	8
ECTS	8
Workload	Time of attendance: 120 hours self-study: 120 hours Total: 240 hours
Type of Examination	written student research project, written examination
Language of Instruction	English, German

Module Objective

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.

- 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.)

O2105 Business Administration

Type of Examination

written ex. 90 min.

O2106 Rhetoric

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.
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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.

Learning 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

2. 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

3. Concrete application of Soft Skills
3.1 Presentations
3.2 Skill-analysis of media products
3.3 Feedback practices

Type of Examination

written ex. 90 min.

O2110

Type of Examination

written student research project

O2111 English Language for Engineers

Objectives

- 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.)

Learning Content

Type of Examination

written ex. 60 min.

Recommended 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.

O-09 Compulsory elective subject of a general academic nature (AWP)

Module code	O-09
Module coordination	Tanja Mertadana
Course number and name	O2108 Compulsory elective subject of a general academic nature I (AWP I) O3101 Compulsory elective subject of a general academic nature II (AWP II)
Lecturer	Dozenten und Dozentinnen für AWP und Sprachen
Semester	2, 3
Duration of the module	2 semester
Module frequency	each semester
Course type	elective course
Semester periods per week (SWS)	4
ECTS	4
Workload	Time of attendance: 60 hours self-study: 60 hours Total: 120 hours
Type of Examination	written student research project, written ex. 60 min.
Duration of Examination	60 min.
Language of Instruction	German

Module Objective

Deepen the knowledge in the field of General Sciences.
Deepen your knowledge in the field of General Sciences.

O2108 Compulsory elective subject of a general academic nature I (AWP I)

Objectives

Deepen the knowledge in the field of General Sciences.

Learning Content

Module description of the selected course.

Type of Examination

written student research project, written ex. 60 min.

O3101 Compulsory elective subject of a general academic nature II (AWP II)

Objectives

Deepen your knowledge in the field of General Sciences.

Learning Content

Module description of the chosen course.

Type of Examination

written student research project, written ex. 60 min.

O-10 Software-Engineering

Module code	O-10
Module coordination	Prof. Dr. Peter Jüttner
Course number and name	O3102 Software Engineering
Lecturer	Prof. Dr. Peter Jüttner
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	
Semester periods per week (SWS)	6
ECTS	8
Workload	Time of attendance: 90 hours self-study: 150 hours Total: 240 hours
Type of Examination	written student research project, , written ex. 90 min.
Duration of Examination	90 min.
Weight	
Language of Instruction	German

Module Objective

Entrance Requirements

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

Learning 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

O3102 Software Engineering

Learning Content

Type of Examination

part of module exam

O-11 Mandatory Elective - Project

Module code	O-11
Module coordination	Prof. Dr. Marcus Barkowsky
Course number and name	O4101 Mandatory Elective - Project
Lecturers	Prof. Dr. Gökçe Aydos Prof. Dr. Marcus Barkowsky
Semester	4
Duration of the module	1 semester
Module frequency	
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project
Language of Instruction	German

Module Objective

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

O4101 Mandatory Elective - Project

Objectives

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

Learning Content

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

Type of Examination

part of module exam

O-12 Databases

Module code	O-12
Module coordination	Prof. Dr. Wolfgang Dorner
Course number and name	O4102 Databases
Lecturers	Prof. Dr. Wolfgang Dorner Prof. Dr. Udo Garmann
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module 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 Databases

Objectives

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

Learning 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

Type of Examination

part of module exam

O-13 Project Management

Module code	O-13
Module coordination	Prof. Dr. Christina Bauer
Course number and name	O4103 Project Management
Lecturers	Prof. Dr. A Admin Prof. Dr. Christina Bauer
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, assignment, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module 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

Learning 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

Type of Examination

part of module exam

O-15 Bachelor Thesis and Colloquium

Module code	O-15
Module coordination	Prof. Dr. Peter Jüttner
Course number and name	O7102 Bachelor Thesis O7103 Bachelor Colloquium
Lecturers	Prof. Dr. A Admin Prof. Dr. Peter Jüttner
Semester	7
Duration of the module	1 semester
Module frequency	
Course type	required course
Level	
Semester periods per week (SWS)	4
ECTS	15
Workload	Time of attendance: 45 hours self-study: 405 hours Total: 450 hours
Type of Examination	bachelor thesis
Weight	
Language of Instruction	German

Module Objective

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.

Entrance Requirements

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.

Learning Content

Type of Examination

part of module exam

O7103 Bachelor Colloquium

Objectives

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

Learning Content

Type of Examination

oral ex. 30 min.

O-16 Mobile Operating Systems 0-63

Module code	O-16
Module coordination	Prof. Dr. Wolfgang Dorner
	Mobile und Räumliche Systeme
Course number and name	O3103 Operating Systems
Lecturers	Prof. Dr. Wolfgang Dorner Rainer Pöschl
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, , written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

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.

O3103 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.

Learning 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
4.1 Java Fundamentals for Android
4.2 Java and Web technologies
4.3 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

Type of Examination

part of module exam

Methods

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.

O-17

Module code	O-17
Module coordination	Prof. Dr. Andreas Fischer
Course number and name	O4112 Networks and Network Technologies
Lecturer	Prof. Dr. Andreas Fischer
Semester	3
Duration of the module	1 semester
Module frequency	
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, , written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

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

O4112 Networks and Network Technologies

Objectives

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

Learning 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

Type of Examination

part of module exam

O-18 Softskills 2

Module code	O-18
Module coordination	Prof. Dr. Roland Zink
Course number and name	O7104 Research Methods O7105 Presenting in English
Lecturers	Prof. Dr. Christina Bauer Dozenten und Dozentinnen für AWP und Sprachen Dozenten/innen für AWP und Sprachen, vhb Prof. Dr. Roland Zink
Semester	7
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 50 hours virtual learning: 40 hours Total: 150 hours
Language of Instruction	English, German

Module Objective

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

O7104 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

Learning 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

Type of Examination

written student research project

O7105 Presenting in English

Type of Examination

written student research project

O-30 Digital Technology

Module code	O-30
Module coordination	Prof. Dr. Terezia Toth
Studienrichtung	Eingebettete Systeme
Course number and name	O3111 Digital Technology
Lecturer	Prof. Dr. Terezia Toth
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O-33 Micro Computer Technology

Module code	O-33
Module coordination	Prof. Thomas Limbrunner
Studienrichtung	Eingebettete Systeme
Course number and name	O3114 Micro Computer Technology
Lecturers	Prof. Dr. Peter Jüttner Kai Walz
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, , written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module 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 Micro Computer Technology

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.

Learning 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

Type of Examination

part of module exam

O-34 Electric Components and Circuits

Module code	O-34
Module coordination	Prof. Dr. Robert Bösnecker
Studienrichtung	Eingebettete Systeme
Course number and name	O4111 Electric Components and Circuits
Lecturers	Prof. Dr. Robert Bösnecker Andreas Federl Stephan Weber Prof. Dr. Matthias Wuschek
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, , written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module 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 Electric Components and Circuits

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

Learning 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

Type of Examination

part of module exam

O-35 Industrial and Automotive Bus Systems

Module code	O-35
Module coordination	Prof. Dr. Terezia Toth
Studienrichtung	Eingebettete Systeme
Course number and name	O4114
Lecturers	NN Laboringenieure AI NN NN PK AI/IAS/CS Prof. Dr. Terezia Toth
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, , written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O-36 Real Time Systems

Module code	O-36
Module coordination	Prof. Dr. Andreas Fischer
Studienrichtung	Eingebettete Systeme
Course number and name	O4113 Real Time Systems
Lecturer	Prof. Dr. Andreas Fischer
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

- 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

Objectives

- Knowledge and understanding from the main Definitions and Principles for Programing real-time

- The ability to apply these definitions and principles on examples

Learning 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

Type of Examination

part of module exam

O-37 Internship

Module code	O-37
Module coordination	Prof. Dr. Peter Jüttner
Studienrichtung	Eingebettete Systeme
Course number and name	O5111 Internship O5112 Practice Seminar O5113 Additional Reinforment Practice
Lecturer	Prof. Dr. Peter Jüttner
Semester	5
Duration of the module	1 semester
Module frequency	annually
Course type	PLV, required course
Level	
Semester periods per week (SWS)	4
ECTS	30
Workload	Time of attendance: 60 hours self-study: 840 hours Total: 900 hours
Weight	
Language of Instruction	German

Module Objective

-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.

Entrance Requirements

Learning Content

Individual topic choice

O5111 Internship

Type of Examination

O5112 Practice Seminar

Type of Examination

written student research project

O5113 Additional Reinforment Practice

Type of Examination

O-38 Hardware Modelling

Module code	O-38
Module coordination	Prof. Dr. Robert Bösnecker
Studienrichtung	Eingebettete Systeme
Course number and name	O6111 Hardware Modelling
Lecturer	Prof. Dr. Robert Bösnecker
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O6111 Hardware Modelling

Learning 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

Type of Examination

part of module exam

O-39 Numerical Methods

Module code	O-39
Module coordination	Prof. Dr. Peter Jüttner
Studienrichtung	Eingebettete Systeme
Course number and name	O6112 Numerical Methods
Lecturer	Prof. Dr. Peter Jüttner
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Level	undergraduate
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Weight	5/210
Language of Instruction	German

Module Objective

- 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

Entrance Requirements

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

Learning 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

O6112 Numerical Methods

Type of Examination

part of module exam

O-40 Systems Programming

Module code	O-40
Module coordination	Prof. Dr. Martin Schramm
Studienrichtung	Eingebettete Systeme
Course number and name	O6113 System Programming
Lecturers	Prof. Dr. Robert Bösnecker Laurin Dörr NN NN PK AI/IAS/CS
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module 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

O6113 System Programming

Objectives

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

Learning Content

Core interfaces
File Systems
Tasks/Scheduling
Driving devices
Internship in an embedded operating system

Type of Examination

part of module exam

O-41 Digital Signal Processing

Module code	O-41
Module coordination	Prof. Dr. Robert Bösnecker
Studienrichtung	Eingebettete Systeme
Course number and name	O6114 Digital Signal Processing
Lecturer	Prof. Dr. Robert Bösnecker
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

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

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.

Learning 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)

Type of Examination

part of module exam

O-42 Controlling Technology

Module code	O-42
Module coordination	Prof. Dr. László Juhász
Studienrichtung	Eingebettete Systeme
Course number and name	O4115 Controlling Technology
Lecturer	Prof. Dr. László Juhász
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O-43 Mandatory Elective I

Module code	O-43
Module coordination	Prof. Dr. Peter Jüttner
Studienrichtung	Eingebettete Systeme
Course number and name	Introduction to Advanced Driver-Assistance Systems C in Automotive Software Development O6116 Mandatory Elective I O6116 Introduction to Artificial Intelligence O6116 Java Programming O6116 Special Topics in Informatics
Lecturers	Prof. Dr. Marcus Barkowsky Nicki Bodenschatz Prof. Dr. Peter Faber Prof. Dr. Andreas Fischer Prof. Thomas Limbrunner
Semester	6, 7
Duration of the module	2 semester
Module frequency	
Course type	compulsory course, compulsory elective course
Level	
Semester periods per week (SWS)	25
ECTS	5
Workload	Time of attendance: 360 hours self-study: 540 hours Total: 900 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Weight	

Language of Instruction	German

Module Objective

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

Entrance Requirements

Learning Content

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

Introduction to Advanced Driver-Assistance Systems

Type of Examination

written student research project, written ex. 90 min.

C in Automotive Software Development

Type of Examination

written student research project, written ex. 90 min.

O6116 Mandatory Elective I

Type of Examination

part of module exam

O6116 Introduction to Artificial Intelligence

Type of Examination

written student research project, written ex. 90 min.

O6116 Java Programming

Type of Examination

written student research project, written ex. 90 min.

O6116 Special Topics in Informatics

Type of Examination

written student research project, written ex. 90 min.

O-44 Modelling and Simulation

Module code	O-44
Module coordination	Prof. Dr. Peter Jüttner
Studienrichtung	Eingebettete Systeme
Course number and name	O7111 Modelling and Simulation
Lecturers	Prof. Dr. Andreas Berl Prof. Dr. Peter Jüttner
Semester	7
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

-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

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

Entrance Requirements

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

Learning 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

Type of Examination

part of module exam

O-45 Mandatory Elective II

Module code	O-45
Module coordination	Prof. Dr. Peter Jüttner
Studienrichtung	Eingebettete Systeme
Course number and name	Introduction to Advanced Driver-Assistance Systems C in Automotive Software Development Introduction to Artificial Intelligence O7112 Mandatory Elective II ES
Lecturers	Prof. Dr. Andreas Fischer Prof. Dr. Peter Jüttner Prof. Thomas Limbrunner
Semester	6, 7
Duration of the module	2 semester
Module frequency	
Course type	compulsory course
Level	
Semester periods per week (SWS)	8
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Weight	
Language of Instruction	German

Module Objective

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

Entrance Requirements

Learning Content

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

Introduction to Advanced Driver-Assistance Systems

Type of Examination

written student research project, written ex. 90 min.

C in Automotive Software Development

Type of Examination

written student research project, written ex. 90 min.

Introduction to Artificial Intelligence

Type of Examination

written student research project

O7112 Mandatory Elective II ES

Type of Examination

part of module exam

O-60 Spatial Sciences

Module code	O-60
Module coordination	Prof. Dr. Roland Zink
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O3125 O3126
Lecturers	Johann Gerner Andreas Weber Prof. Dr. Roland Zink
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O3125

Type of Examination

part of module exam

O3126

Type of Examination

part of module exam

O-61 Introduction GIS

Module code	O-61
Module coordination	Prof. Dr. Roland Zink
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O3127 Introduction to Geographic Information Systems (GIS) O3128
Lecturers	Prof. Dr. Wolfgang Dorner Prof. Dr. Roland Zink
Semester	3
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project
Language of Instruction	German

Module Objective

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.

O3127 Introduction to Geographic 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.

Learning Content

1 Introduction 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

Type of Examination

part of module exam

O3128

Type of Examination

part of module exam

O-62

Module code	O-62
Module coordination	Prof. Dr. Roland Zink
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O4123 O4124
Lecturers	Prof. Dr. Wolfgang Dorner Javier Valdes Andreas Weber Prof. Dr. Roland Zink
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O4123

Type of Examination

part of module exam

O4124

Type of Examination

part of module exam

O-64 Geographic Informatics 1

Module code	O-64
Module coordination	Prof. Dr. Wolfgang Dorner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O4125
Lecturers	Prof. Dr. Wolfgang Dorner Markus Eider
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

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.

O4125

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.

Entrance 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.

Learning 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
9.3 VBA Programming in GIS
9.4 Customizing user Interfaces
9.5 Creating Controls
9.6 language syntax and controlling alternatives
9.7 Visual Basic Editor in ArcGIS
9.8 Object-oriented programming and introduction Arc Objects

10. Summary and Outlook

Type of Examination

part of module exam

O-65

Module code	O-65
Module coordination	Prof. Dr. Roland Zink
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O4126 O4127
Lecturers	Johann Gerner Rajan Paudyal Prof. Dr. Roland Zink
Semester	4
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

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.

O4126

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.

Entrance Requirements

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.

Learning 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

Type of Examination

part of module exam

O4127

Type of Examination

part of module exam

O-66 Internship

Module code	O-66
Module coordination	Prof. Dr. Peter Jüttner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O5121 Internship O5122 Practice Seminar MRS O5123 Additional Reinforcement Practice MRS
Lecturer	Prof. Dr. Peter Jüttner
Semester	5
Duration of the module	1 semester
Module frequency	annually
Course type	PLV, required course
Level	
Semester periods per week (SWS)	4
ECTS	30
Workload	Time of attendance: 90 hours self-study: 90 hours virtual learning: 720 hours Total: 900 hours
Weight	
Language of Instruction	German

Module Objective

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.

Entrance 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.

Learning Content

Individual and studies related topics.

O5121 Internship

Type of Examination

O5122 Practice Seminar MRS

Type of Examination

written student research project

O5123 Additional Reinforcement Practice MRS

Type of Examination

O-67 Special Algorithms

Module code	O-67
Module coordination	Prof. Dr. Wolfgang Dorner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O6128 O6129
Lecturers	Prof. Dr. Wolfgang Dorner Dr. Peter Hofmann
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

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.

O6128

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.

Learning 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

Type of Examination

part of module exam

O6129

Type of Examination

part of module exam

O-68 Programming Mobile Systems

Module code	O-68
Module coordination	Prof. Dr. Goetz Winterfeldt
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O6122 Programming Mobile Systems
Lecturers	Prof. Dr. Marcus Barkowsky Prof. Dr. Udo Garmann Prof. Dr. Goetz Winterfeldt
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

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

O6122 Programming Mobile 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

Learning 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

Type of Examination

part of module exam

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.

O-69 Extendet Informatics

Module code	O-69
Module coordination	Prof. Dr. Wolfgang Dorner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O6133 O6134
Lecturers	Prof. Dr. Wolfgang Dorner Rainer Pöschl
Semester	6
Duration of the module	1 semester
Module frequency	
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O6133

Learning Content

Type of Examination

part of module exam

O6134

Type of Examination

part of module exam

O-71 Special Topics in Geoinformatics and Remote Sensing

Module code	O-71
Module coordination	Prof. Dr. Wolfgang Dorner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O7123 Unmanned Aerial Systems O7124 Augmented Reality and Graphics Processing
Lecturers	Prof. Dr. Peter Faber Dr. Peter Hofmann NN NN PK AI/IAS/CS Prof. Dr. Roland Zink
Semester	7
Duration of the module	1 semester
Module frequency	
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project

Language of Instruction	German

Module Objective

O7123 Unmanned Aerial Systems

Type of Examination

part of module exam

O7124 Augmented Reality and Graphics Processing

Type of Examination

part of module exam

O-72 Mandatory Elective I

Module code	O-72
Module coordination	Prof. Dr. Wolfgang Dorner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O6126 Mandatory Elective I MRS
Semester	6
Duration of the module	1 semester
Module frequency	
Course type	compulsory course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O6126 Mandatory Elective I MRS

Type of Examination

part of module exam

O-73 Mandatory Elective II

Module code	O-73
Module coordination	Prof. Dr. Wolfgang Dorner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O7121 Mandatory Elective II MRS
Semester	6
Duration of the module	1 semester
Module frequency	
Course type	compulsory course
Level	
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Weight	
Language of Instruction	German

Module Objective

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

Entrance Requirements

Learning Content

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

O7121 Mandatory Elective II MRS

Type of Examination

part of module exam

O-74 Mandatory Elective III

Module code	O-74
Module coordination	Prof. Dr. Wolfgang Dorner
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O7122 Mandatory Elective III MRS
Lecturer	Prof. Dr. Peter Jüttner
Semester	7
Duration of the module	1 semester
Module frequency	
Course type	compulsory course
Level	
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Weight	
Language of Instruction	German

Module Objective

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

Entrance Requirements

Learning Content

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

O7122 Mandatory Elective III MRS

Type of Examination

part of module exam

O-75

Module code	O-75
Module coordination	Prof. Dr. Roland Zink
Studienrichtung	Mobile und räumliche Systeme
Course number and name	O6130 O6131
Lecturers	Prof. Dr. Wolfgang Dorner Prof. Dr. Melanie Kappelmann-Fenzl Markus Tremmel Prof. Dr. Roland Zink
Semester	6
Duration of the module	1 semester
Module frequency	annually
Course type	required course
Semester periods per week (SWS)	4
ECTS	5
Workload	Time of attendance: 60 hours self-study: 90 hours Total: 150 hours
Type of Examination	written student research project, written ex. 90 min.
Duration of Examination	90 min.
Language of Instruction	German

Module Objective

O6130

Type of Examination

part of module exam

O6131

Type of Examination

part of module exam