

# ENGLISH COURSES

## WINTER SEMESTER 2021/22

UNIVERSITY OF APPLIED SCIENCES UPPER AUSTRIA

HAGENBERG CAMPUS



# Table of Contents

## General

### German Courses

German 1	6
German 2	7
German 3	8

### General Courses

Cross Cultural Entrepreneurship	10
Presentation and Moderation Skills	11

## Bachelor

### Automotive Computing

Algorithms and Data Structures	13
--------------------------------	----

### Communication and Knowledge Media

English 1	15
English 3	16
Interaction Design	17

### Hardware-Software-Design

Introduction to Artificial Intelligence	19
---	----

### Media Technology and Design

Media Studies	21
Project Incoming Students	22
Stop Motion Animation	23
Digital Imaging	24
Audio Processing	25
Web Applications	26

### Mobile Computing

Project 4	28
Mobile Games	29
Mobile Games	30
Software Development for Android	31
Android Advanced	32
Distributed Information Systems	33

### Software Engineering

Parallel and Distributed Software Systems	36
---	----

# Table of Contents

## Master

### Data Science and Engineering

Computational Intelligence 2	38
Computational Science	39

### Digital Arts

Generative and Interactive Arts	41
---------------------------------	----

### Embedded Systems Design

Distributed Realtime Systems	43
------------------------------	----

### Energy Informatics

Physics	45
International Energy Markets and Energy Law	46
Processes and Process Modelling	47
Systems Engineering I: Fundamentals	48
Energy Consumers	49
Communication Technology	50
Cloud Computing/Big Data	51
Software Systems II: SCADA	52
Java Advanced	53
Scientific Working	54

### Human-Centered Computing

Intercultural Negotiation	56
Virtual Reality	57

### Information Engineering and Management

Intercultural Communication	59
-----------------------------	----

### Information Security Management

English 1	62
-----------	----

### Interactive Media

Writing and Typesetting with Math	64
Human-Computer Interaction	65
Software Design Methods	66
Advanced Computer Graphics	67
Hypermedia Frameworks	68
Game Architecture	69
Project 1	70
Design for Physical Prototyping	71
Semantic Text Analysis	72
In-Game Technologies	73
Special Topic: Information Visualisation	74
Academic Writing	75
Winter Semester 2021/22	3

# Table of Contents

## Master

<b>Mobile Computing</b>	<b>76</b>
Class Location-Based and Context-Aware Systems	77
Mobile Services	78
Operating Systems for Mobile Applications	79
Software Architectures and Patterns	80
Augmented Reality	81
Mobile Games	82
Advanced Project Engineering	83
Systems Engineering 1: UML and MDA	84
<b>Automotive Computing</b>	
Cloud Computing	86
Distributed Real-Time Systems	87
Home and Building Automation	88
Mobile Health and Sports	89
Short-Range Wireless Communication	90
Supply Chain Management	91
Systems Engineering 3: Metrics and Testing	92
Machine Learning	93
Scientific Working	94
<b>Software Engineering</b>	
Data Warehousing and OLAP	96
Big Data Analytics and Interactive Visualization	97
Modelling and Simulation	98
Heuristic and Evolutionary Algorithms	99
Semantic Web Technologies	100
Alternative Programming Paradigms	101
English Conversation	102
Intelligent Agent Systems	103



# Language Course

## German Courses

# German 1

<b>Course Unit Code</b> DEU1	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 2
<b>Name of Lecturer</b> Bettina Preßlauer	<b>Assessment Methods and Criteria</b> Written Exam, home-work, attendance	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Acquisition of basic German for everyday life (greeting, introducing oneself and getting into contact with others, shopping,...); development of communication skills and intercultural competence

Basic knowledge of the German language and the Austrian culture; ability to use German in simple everyday situations

Interactive learning methods, team- and group activities

basic knowledge of the German language and the Austrian culture; ability to use German in simple everyday situations

What students say about this course: "This course was excellent and not really technical. Learn German from zero. Go to the course if you want to learn the new language!"

## Recommended or required reading

Dictionary

# German 2

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
DEU2	Integrated Course	1,5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Bettina Preßlauer	Written Exam, home-work, attendance	Face to Face

## Prerequisites

started some German but did not reach A1 yet

## Course contents

Use of German in different situations of everyday life and work; development of communication skills in the target language and intercultural competence

Interactive learning methods, team- and group activities

Knowledge of the German language in everyday life and the Austrian culture

## Recommended or required reading

Dictionary

# German 3

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
DEU3	Integrated Course	1,5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Bettina Preßlauer	Written Exam, home-work, attendance	Face to Face

## Prerequisites

A2 or higher

## Course contents

Use of German in different situations of everyday life and work; development of communication skills in the target language and intercultural competence

Interactive learning methods, team- and group activities

Knowledge of the German language in everyday life and the Austrian culture

## Recommended or required reading

Dictionary





# General Courses

# Cross Cultural Entrepreneurship

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
	Integrated Course	2
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Gerold Weisz Ahu Genis-Gruber		Face to Face

## Prerequisites

## Course contents

For an effective entrepreneurial and organizational management, the analysis of recent developments and trends within hypercompetitive global arena will be carried out in the classes through text and case studies. The expanding Startup Community among the geographies, and rapidly growing economies requires new management applications and entrepreneurial spirit. Entrepreneurship-, Startup- and Cross Cultural Management Strategies will be evaluated in the context of global changes and the development of future markets.

Topics: Entrepreneurial Spirit, Thinking and Behaviour, Economical and technical trends and developments within competitive markets, Cultural and entrepreneurial differences and their boundaries, Early Stage Marketing, Business Modelling and Business Planning for Startups, ...

## Recommended or required reading

# Presentation and Moderation Skills

*Note: This course will take place in 3 or 5 blocks.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
	Integrated Course	2
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Gerold Weisz Ahu Genis-Gruber		Face to Face

## Prerequisites

## Course contents

### Learning Goals:

The design of this course enables participants to practice their presentation skills in different business concepts and be able to deliver effective speeches. Cross-cultural differences and adequate presentation techniques to various audience will be exercised throughout the course. Students develop the capability to reflect the application of concepts in practice through in-class exercises and group works.

### Learning Content:

Presentation as area of expertise: Presentation skills, Core approaches, Cross cultural differences and related literature review, Presenting Creative Ideas and Products, Teambuilding and Teamwork, Choosing the appropriate technical tools for an effective presentation

Presentation in the practice: Elevator Pitch-Training and Practicing, Sales Pitch

Presentation Challenges: Formulating Presentation in Multicultural Environments, Intercultural Communication, Intercultural Negotiation, Delivering Business Presentation to different audience segments

Overview: Effective presentation skills in business environments

## Recommended or required reading



# Automotive Computing

## AC

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/bachelor/automotive-computing/>

A revolution is currently taking place in the automotive sector before our very eyes. In addition to new drive systems, it is above all digitalization that is becoming increasingly important, both in the vehicle itself and in the surrounding road infrastructure. Innovative IT solutions allow vehicles to communicate both with each other and with their environment, thus opening up countless possibilities for making future mobility safer, more environmentally friendly and more efficient.

Technologies like these include intelligent assistance systems, self-driving cars and systems for networking road users with their environment, but also mobility-based services (e.g. UBER) will fundamentally change our understanding of mobility in the coming years.

The degree program Automotive Computing trains experts for precisely these, still very young, specialist areas. The rapid development of the industry already requires specialists who understand the interplay between information technology and mobility, who can apply this optimally and thus help to shape our future sustainably.

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ALD	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Marc Kurz	Written exam, exercise sheets	Face to Face

## Prerequisites

The students know the most important formal and practical foundations of computer science, such as the targeted selection and evaluation of data structures, design and specification of algorithms, standard algorithms and introduction to complexity analysis.

## Course contents

Focus on algorithms and data structures. Specification of algorithms; Complex dynamic data structures (trees, graphs), standard algorithms (search, sorting, dynamic search trees, hashing methods), iterative methods (conversion of sum expressions), recursive algorithms, elementary graph algorithms, calculation models and complexity measures. In the area of concrete applications, data formats for geodata (OGC SFS, GDF, ...) are treated as well as path data-graphs and routing algorithms.

## Recommended or required reading

Aho A.V., Hopcroft J.E., Ullman J.D.: The Design and Analysis of Computer Algorithms. Addison-Wesley, 1974

Aho A.V., Hopcroft J.E., Ullman J.D.: Data Structures and Algorithms. Addison-Wesley, 1983

Horowitz E., Sahni S.: Fundamentals of Computer Algorithms. Pitman, London, 1979

Knuth D.E.: The Art of Computer Programming. Band 1: Fundamental Algorithms, Band 2: Seminumerical Algorithms, Vol. 3: Sorting and Searching. Addison-Wesley, 1973

Nievergelt J., Hinrichs K.H.: Algorithms and Data Structures. Prentice-Hall, 1993

Ottmann Th., Widmayer P.: Algorithmen und Datenstrukturen. Bibliographisches Institut, 1990

Sedgewick R.: Algorithmen. Addison-Wesley, 1992

Wirth Niklaus: Systematisches Programmieren. Teubner Studienbücher Informatik, 1978

Wirth Niklaus.: Algorithmen und Datenstrukturen. Teubner Studienbücher Informatik, 1986



# Communication and Knowledge Media

## KWM

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/bachelor/communication-and-knowledge-media/>

The Internet in all its facets offers a variety of possibilities and opportunities, be it in terms of communication, collaboration, network or further education – independent of time and location. As a marketplace for information, innovation, services, and products, the Internet has become an integral part of modern economies and societies. Consequently, and in view of ever-growing digitalisation efforts, we are facing numerous apps, platforms and social networks, with new ones emerging every day.

To stay successful in an increasingly digital future, companies and organisations have to meet these new challenges. Therefore, they depend on experts, who are not only proficient in technology, but master skills that go way beyond technical expertise. Such experts are able to understand and actively shape communication, learning and working processes.

Graduates from this study programme are characterised by exactly these qualifications. Their training consists of competences from both social and computer sciences – a unique combination complemented by generic skills such as communication, cooperation, problem solving, project management, and design thinking. This set of abilities enables them to approach new media holistically and promote communication and knowledge transfer within the digital world.

**Course Unit Code**

KWM180

**Type of Course Unit**

Integrated Course

**ECTS- Credits**

1

**Name of Lecturer**

Annamaria Mähr

**Assessment  
Methods and Criteria**

Written exam, exercise  
sheets

**Mode of Delivery**

Face to Face

**Prerequisites****Course contents****Recommended or required reading**

*Note: Maximum 2 students can take this course! First come, first served!*

**Course Unit Code**

KWM270

**Type of Course Unit**

Integrated Course

**ECTS- Credits**

1

**Name of Lecturer**

Annamaria Mähr

**Assessment  
Methods and Criteria**

Written exam, exercise  
sheets

**Mode of Delivery**

Face to Face

**Prerequisites****Course contents**

What students say about this course: "This course was excellent, the professor is very cool and interesting. I liked it even more than English Communication."

**Recommended or required reading**



*Note: Still to be determined if this course will take place in WS 2020/21.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
KWM250	Integrated Course	1
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Thomas Neumayr	Final exam	Face to Face

## Prerequisites

## Course contents

The usability and user experience of many interactive products (e.g. websites, apps, entertainment devices, smart homes, ...) could be substantially improved if the creators of such technologies would think more about their users' actual needs, goals, and skills. Therefore, the course KWM250 Interaction Design is concerned with the user-centered design of user interfaces for interactive products. Students learn how to apply a user-centered design process to design, prototype, and test new user interfaces together with test users. The course teaches important methods from usability engineering and interaction design such as user observation, requirements analysis, using personas and scenarios, sketching, wireframes, prototyping, usability testing, etc. To pass the course, students have to succeed in the theoretical and the practical part. The theoretical part consists of lectures about usability, user experience, human-computer interaction and user-centered design methods. In the practical part, teams of 2-4 students apply this knowledge in a semester team project during which they design, build, and evaluate a user interface prototype.

What students say about this course:

"This course was excellent and quite technical. You will get the techniques for designing websites and games. "

"That course is better described as Human-Machine Interaction. The subject areas of usability and interaction design are dealt with, whereby the main aim is to design interactive products like websites, mobile applications, or even new devices."

## Recommended or required reading



# Hardware-Software-Design

## HSD

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/bachelor/hardware-software-design/>

What do smartphones, modern cars and robots have in common? They are 'smart' thanks to in-built computer technology that delivers functions once considered the stuff of sci-fi movies. Such smart computers depend on the perfect combination of dedicated software and hardware. This key symbiosis is the chief focus of our degree programme in Hardware-Software-Design. This full-time degree programme offers a thorough grounding in informatics, IT and electronics. Students will develop competence in the design and creation of embedded systems, software application and chip design.

# Introduction to Artificial Intelligence

Bachelor  
HSD

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
EKI5	Integrated Course	2.5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Dietmar Millinger		Face to Face

## Prerequisites

This class requires basic understanding in computer programming and mathematics. Basic knowledge in Python is preferable but not mandatory.

## Course contents

The goal of the class is to provide actionable knowledge about the basic principles and structures as well as functions of AI systems und subsystems. This class has a focus on machine learning. With this knowledge the student shall be able to select and integrate AI modules into larger software systems. Therefore the students learn about a number of common AI modules, their functions and their interfaces. A special focus lies in the lifecycle of machine learning projects from proof of concept to production situations and the use of frameworks in production projects. In the practical part 4 examples in python on jupyter are implemented and strategies for improvement of the results are developed.

A student's description of the course:

"In this class, we learnt about state-of-the-art AI and machine learning technologies. This enables engineers to solve typical machine learning tasks by selecting suitable ML methods, interconnect them, prepare data, train models and evaluate the results quality. The course had 4 practical exercises that covered different tasks of the machine training process and introduced different machine learning algorithms implemented by technologies like Python Pandas and numPy on Jupyter notebooks. The lectures and the exercises covered topics like Regression, classification, Neural networks, Loss functions, Convolutional networks, LSTMs and GRUs, Autoencoders and Reinforcement Learning. In addition, to data cleansing and features extraction."

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*

Winter Semester 2021/22



# Media Technology and Design

## MTD

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/bachelor/media-technology-and-design/>

Exploiting the unlimited opportunities in the field of digital media requires mastery of creative design, smart contents, and fluency with the latest technology. This unique, full-time degree programme provides you with the technical expertise as well as the design and communication skills to take on any challenge in your chosen area – be it on the Web, in multimedia, 3D modelling, animation, computer games, audio & video production, or cross-publishing. You will acquire a solid grounding in the theory and practice of digital media. Hands-on experience with professional equipment will provide you with the technical and creative skills for implementing innovative and exciting media projects.

**Course Unit Code**

MTD170

**Type of Course Unit**

Integrated Course

**ECTS- Credits**

2

**Name of Lecturer**

Jeremiah Diephuis

**Assessment  
Methods and Criteria**

Oral or written exam

**Mode of Delivery**

Face to Face

## Prerequisites

## Course contents

The course covers the history and development of media technologies and traditions (radio, TV, film, computer games, Internet) and current issues in the media industry.

Media Studies aims to strengthen students' oral and written communication skills, particularly within the field of digital media.

What students say about this course: "This course was interesting!"

## Recommended or required reading

# Project Incoming Students

Bachelor  
MTD

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MTD290A	Project	6
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Coordinator: Martin Harrer		Face to Face

## Prerequisites

## Course contents

Projects cover any number of topics within the field of Media, both technical- and design-oriented. Generally the student will propose a topic to the faculty of which they would like to cover. These topics generally fall somewhere in the spectrum of Game, Web, Audio/Video and Animation design/development. Some examples of technologies that might be used, depending on the project, are Java, Unity, LibGdx, Adobe Creative Cloud, PHP, HTML, and JavaScript. Each project differs, so it depends which particular skills and technologies the student wishes to improve or pick up. A couple examples of projects from past students include:

- Creating a puzzle game in which the main character finds herself lost in fictional universes.
- Creating a simple rhythm-based music game
- Developing a strategy game (Group of 3 people—2 focusing on art/graphics, 1 on sounds, visual, and programming) <http://hive-21.com/>
- Building a website which allows users to share a sort of “diary” of development projects and receive feedback from the community
- Making a music video for a local band
- 2D/3D Animation
- Short films

## Recommended or required reading

# Stop Motion Animation

Bachelor

MTD

## Course Unit Code

MTD352

## Type of Course Unit

Integrated Course

## ECTS- Credits

4.5

## Name of Lecturer

Coordinator:  
Jürgen Hagler

## Assessment Methods and Criteria

## Mode of Delivery

Face to Face

## Prerequisites

Students need to apply with a portfolio (online or pdf, youtube/vimeo links).  
Images: jpg, png, tiff, ...). Movies: (mov, avi, mpg, ....).

## Course contents

Workflow, principles and language of related analogue animation techniques: Stop Motion, Clay Animation, Cut Out, Cartoon Animation, Rotoscoping.

## Recommended or required reading

*Note: Still to be determined if this course will take place in WS 2020/21.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MTD362	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Wilhelm Burger	worked out assignments, short presentations, written exam	Face to Face

## Prerequisites

Good knowledge of Java and basic mathematics

## Course contents

This course covers fundamental methods of digital image processing, including point operations, filters, color, geometrical operations and the detection of “interesting” image structures. Image processing is different to image editing (something you would do with Photoshop) and computer graphics, which aims at synthesizing images. The key objective here is to improve images or to extract relevant information from images in a possibly fully automatic way. The focus of this course is on algorithms, practical techniques, and some simple mathematical concepts. At the end, participants should have obtained a good judgement of the potentials and limitations of digital image processing by developing their own programs in Java with the (extremely simple) ImageJ framework.

## Recommended or required reading

Burger/Burge: Digital Image Processing -- An Algorithmic Introduction Using Java, 2nd ed., Springer, 2016



<b>Course Unit Code</b> MTD370	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 4.5
<b>Name of Lecturer</b> Christoph Schaufler	<b>Assessment Methods and Criteria</b> Exercises, Course-project	<b>Mode of Delivery</b> Face to Face

## Prerequisites

**audio processing fundamentals:** operation of a modern digital audio workstation (Apple Logic, Steinberg Cubase, Avid ProTools, or the like) audio editing techniques, post processing (spectrum: equalisation/filters/etc, dynamic: gate/compression/etc., effects: frequency- and time-based effects/reverb/etc),  
**programming fundamentals:** knowledge of boolean / logic operations & basic programming skills analytical thinking and methodical procedure when tackling problems

## Course contents

Introduction to Sound Synthesis and MIDI control. Fundamentals of audio signal processing in theory and practice using node-based programming environments (e.g. Cycling74 MAX). Reproduction of substantial algorithms from the field of sound synthesis and audio effects.

## Recommended or required reading

Andy Farrell, Designing Sound, 2010

K. C. Pohlmann, Principles of Digital Audio McGraw- Hill 2005; S. W. Smith, The Scientist and Engineer's Guide to DSP Programming

<b>Course Unit Code</b> MTD380	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 4.5
<b>Name of Lecturer</b> Rimbert Rudisch-Sommer	<b>Assessment Methods and Criteria</b> Class-based activities	<b>Mode of Delivery</b> Face to Face

### Prerequisites

Foundations in Web App & DB Development (HTML/CSS, JavaScript, PHP, SQL)

### Course contents

Using serverside JavaScript- and PHP-based frameworks (eg. node.js/Express, Symfony) and development workflows to build web applications and REST backends. Foundations of SQL based object-relational mapping (ORM) libraries (Doctrine ORM) and using document databases (MongoDB) for managing/publishing structured data.

A student's description of the course:

“During the web applications course, students discussed different server-side web frameworks for data-centric web applications and services. The course varied between developing databases and back-end methods from scratch to using open-source CMS systems and modifying them. The course started with exercises on the use of Node.js and JavaScript frameworks like Express.js and nosql databases like MongoDB. After that, Developing PHP apps using Symfony, MySQL and Doctrine ORM was discussed and design patterns like MVC were also illustrated and implemented. The course exposed general concepts and offered different technologies with useful tips on how to choose the right technology to implement a specific project.”

### Recommended or required reading

Perry, Servlet and JSP Cookbook. O'Reilly, 2004. Johnson et al., Professional Java Development with the Spring Framework. Wiley & Sons, 2005



# Mobile Computing

## MC

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/bachelor/mobile-computing/>

It is obvious that smartphones and other mobile devices have become an integral part of our daily lives, enabling us to stay in touch with the digital world no matter when or where. However, the underlying technologies usually stay hidden for the users. What counts is the user experience (UX): Are the applications comprehensible and easy to use? Do they run stably? What happens in the case of a weak internet connection?

At the same time, our devices are getting more powerful. The increasing number of sensors, interfaces and specialized processors open up unprecedented possibilities for many different areas, such as Artificial Intelligence, Mobile Health and Games to mention just a few.

Students of Mobile Computing acquire in-depth knowledge of communications technology, informatics and programming. Special focus is put on application development for mobile devices.

<b>Course Unit Code</b> PRO4	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 5
<b>Name of Lecturer</b> Coordinator: Stephan Selinger	<b>Assessment Methods and Criteria</b> Oral Presentation	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

A modern and practical education is very important for us. Not only that enterprises value this fact, but also students often found a company themselves after or even already during their studies. Projects are therefore a good chance to implement their own ideas as well as to carry out interesting R&D projects and cooperations with companies.

When doing projects, students run through all steps of planning and implementing projects. This is the reason why not only the realization of the project but also techniques of project management for a smooth working process in the team as well as tools for a flawless technical implementation are taught and learned.

Overview of projects from past years is available here:

<https://www.fh-ooe.at/campus-hagenberg/studiengaenge/bachelor/mobile-computing/projekte-praktika/studienprojekte/>

## Recommended or required reading

<b>Course Unit Code</b> MOS5	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 5
<b>Name of Lecturer</b> Stephan Selinger	<b>Assessment Methods and Criteria</b> Oral or Written Examination	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Sports-related mobile devices and systems are booming as never before. Not only established industry giants such as Garmin, Polar, or Suunto thrive in this market segment, companies like Samsung (e. g. Fit Gear, Gear 2) or Apple with the Apple Watch are gearing up. Runtastic - founded by mobile computing graduates - is another prime example that you can achieve anything in this area.

The lecture shows the basics, methods, algorithms and techniques needed to successfully participate in the development of such systems. Accompanying the theory parts (see the list below), we are going to develop an app, so that at the end of the course we will have a fully functional system.

## Recommended or required reading

*Note: MOH5, MOG5 and MOS5 all take place at the same time, therefore please choose just one of these courses!*

**Course Unit Code**

MOG5

**Type of Course Unit**

Integrated Course

**ECTS- Credits**

5

**Name of Lecturer**

Christian Bartsch

**Assessment  
Methods and Criteria**

Semester project

**Mode of Delivery**

Face to Face

**Prerequisites****Course contents**

Technical topics about development of mobile games with a game engine. Students develop their own games as a semester project in groups of 2, the project submission and presentation determine the final grade.

**Recommended or required reading**

*Note: MOH5, MOG5 and MOS5 all take place at the same time, therefore please choose just one of these courses!*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
SEA	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Philipp Matthias Jahoda	exercises, micro project	Face to Face

## Prerequisites

Recommendations by former exchange students : *I liked this course a lot, it was quite technical. We mainly used Android Studio. I would recommend students to know Java in order to do this course.*

## Course contents

Development of Android applications for smartphones based on the current API version.

What students say about this course:

“This course was excellent and very technical. We used Android Studio and Java. I would recommend to have experience with Java. In this course you will learn to build an android app from zero.”

A student’s description of the course:

“A beginner’s Android development course covering the basics of the Android operating systems and how to put the available APIs to build applications. The course was taught in Kotlin and had several exercises and a final project. Students got to learn and implement how to build proper user interfaces in Android Studio and how to provide effective functionality with the use of contexts, sensors, intents, notifications, component communication, views, receivers, services, and databases. A simple application that quizzes users about information they study randomly during the day with the use of notifications was presented as the final project to this course.”

## Recommended or required reading

1. Darcey, L. and Conder, S.: Android Wireless Application Development Volume I/II. Addison-Wesley Professional 2012.
2. Künneht, T.: Android 5: Apps entwickeln mit Android Studio. Reinwerk Computing 2015.
3. Post, U: Spieleprogrammierung mit Android Studio: Programmierung, Grafik & 3D, Sound, Special Effects. Galileo Computing 2014.
4. <http://developer.android.com/index.html>

*Note: SEA, SEI and ADA all take place at the same time, therefore please choose just one of these courses!*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ADA	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Stephan Brunner, Mostafa Hassan, Markus Hintersteiner	Oral or Written Examination	Face to Face

## Prerequisites

## Course contents

In this module, students learn to develop applications for the Windows Phone platform using the programming language C# in the development environment Visual Studio. The basics of the programming language C# and the .NET framework are taught at the beginning, highlighting the most important differences and similarities to the programming language Java.

The main part of this module covers the development of XAML-based applications for the Windows Phone platform, including the general design of Windows Phone applications, side layout and navigation, the MVVM design pattern, file access, network applications, the Windows Phone application's life cycle, the use of device resources such as camera and motion sensors, location-related and Maps, Universal Apps, and the release of apps in the Windows Phone Apps + Games Store.

## Recommended or required reading

*Note: SEA, SEI and ADA all take place at the same time, therefore please choose just one of these courses!*



<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
VIS	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Jens Krösche	Final Exam, Exercises	Face to Face

## Prerequisites

good Java programming skills  
decent C++ programming skills

## Course contents

- theoretical foundations of “distributed systems”
- basic practical knowledge about client / server communication via TCP / UDP sockets (C ++ / Java) and the use of threads, taking the corresponding synchronization mechanisms into account
- Java RMI
- Java-based SOAP / REST APIs
- fundamentals in the area of frameworks and component-oriented software development

A student’s description of the course:

“Various aspects of distributed information systems were addressed in this course. The main focus of the course was to implement applications that consist of different parts that are also distributed across different locations but can still communicate and share information between each other. A theoretical introduction was given to explain why this type of applications exist and how they are monitored and maintained. The course introduced 3 heavy exercises, where each exercise represents a whole independent application. In particular, topics like communication over sockets programming, using different versions of IPs and protocols were discussed. Also, Remote Method Invocation (RMI) and how to implement proper synchronization between different nodes and within a single node was addressed. In addition, The course introduced simple HTTP servers and Java Servlets and how to deploy them over a network. Web services as SOAP and REST APIs were implemented in the exercises after studying about data exchange formats like XML and JSON.”

## Recommended or required reading

- Wilde E.: Wilde’s WWW: Technical Foundations of the World Wide Web. Springer Verlag 1998.  
Musciano C., Kennedy B.: HTML and XHTML: The Definitive Guide. O’Reilly 2006.  
Flanagan D.: JavaScript: The Definite Guide. O’Reilly 2006.  
Harold E.R., Means W. S.: XML in a Nutshell. O’Reilly 2004.  
Jones M. Tim: BSD Sockets Programming from a Multi-Language Perspective. Charles River Media (Programming Series) 2004.  
Tannenbaum Andrew S., van Stehen Marten: Verteilte Systeme - Grundlagen und Paradigmen. Pearson Studium 2006  
Hammerschall Ulrike: Verteilte Systeme und Anwendungen; Architekturkonzepte, Standards und Middleware-Technologien. Pearson Studium 2005.  
Mahlmann, P. und Schindelbauer, C.: P2P Netzwerke: Algorithmen und Methoden, Springer 2007.  
Saint-Andre, P. u.a.: XMPP: The Definitive Guide: Building Real-Time Applications with Jabber Technologies. O’Reilly 2009.  
Reussner, R. und Hasselbrink, W.: Handbuch der Software-Architektur. dpunkt.verlag 2008.  
Szyperki, C. u.a.: Component Software: Beyond Object-Oriented Programming, Second Edition. Addison-Wesley 2002.



# Secure Information Systems

## SIB

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/bachelor/secure-information-systems/>

The exchange of information, just like the amount of data and its accessibility anywhere, anytime, is matched by the exponential growth in modern technology. Experts qualified to meet the challenges of cybercrime, hacking and data theft are in increasing demand. This full-time degree programme will equip you to meet this demand, with its focus on full spectrum security protocols associated with the operation of computer systems and networks as well as mainstream data transfer, storage and archiving. Compulsory elective modules will give students the opportunity to further specialise in network, data and systems security.

**Course Unit Code**

ENG1

**Type of Course Unit**

Integrated Course

**ECTS- Credits**

2

**Name of Lecturer**

Irdonka Kretzschmar

**Assessment  
Methods and Criteria**

Oral and Written  
Examination

**Mode of Delivery**

Face to Face

**Prerequisites****Course contents**

The aim of this course is to revise grammar structures, expand vocabulary and foster presentation skills and fluency in the target language. Additionally special emphasis will be set on speaking skills, expressing of opinion and debating.

**Recommended or required reading**



# Software Engineering

## SE

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/bachelor/software-engineering/>

Software is at the heart of information technology (IT), and all applications – whether for mobile phones, PCs or even modern cars – depend on instructions based on specially written programmes. This Bachelor's degree programme provides a thorough grounding in the theory and practice of sophisticated software development, including relevant tools, methodologies, and teamwork and networking skills. Graduates will be equipped to not only develop but also implement, evaluate and adapt software at the cutting edge of all areas of application. After their first year, full-time students can choose between two key areas in which to specialise: Business Software or Web Engineering. Part-time students specialise in Web Engineering.

<b>Course Unit Code</b> VPS5	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 2
<b>Name of Lecturer</b> Stefan Wagner	<b>Assessment Methods and Criteria</b> Written exam, exercise sheet	<b>Mode of Delivery</b> Face to Face

## Prerequisites

For taking this course, you should know that you

- will have to participate in all lectures
- will have to do exercises at home
- will have to have a good knowledge of C# programming

## Course contents

This lecture concentrates on the development of multi-threaded applications using the Microsoft .NET framework. Apart from a theoretical introduction into parallel programming and an overview of different hardware architectures, different APIs, synchronization and patterns are discussed. In the exercises the theoretical knowledge is applied in several practical examples (e.g., parallel Mandelbrot set generator, parallel Water World simulation).

A student's description of the course:

"This course discussed Programming of Parallel Applications and Shared-Memory systems. The course started with the mathematical concepts behind parallel programming and explained how to calculate the speedup and the efficiency of algorithms with the help of Amdahl's law and Gustafson's law. Then, an introduction on parallelization concepts and how to use Threads to implement a proper asynchronous, concurrent, and parallel application. During the course we developed 5 practical exercises that covered different topics and asked the students to implement complex computations. Programming languages like C# and frameworks like .NET with libraries like .NET Task Parallel Library (TPL) and OpenMP for C++ were mainly used to implement the exercises."

## Recommended or required reading



# Data Science and Engineering

## DSE

<https://www.fh-ooe.at/campus-hagenberg/studiengaenge/master/data-science-und-engineering/>

In 2017, the world was generating 2.7 billion gigabytes of data per day. And by 2020 forecasts say this figure could exceed 44 trillion gigabytes per year. This veritable flood of data harbours invaluable know-how that is just waiting to be accessed. Structuring the information, identifying patterns and applying the findings in a fast, efficient way is crucial for decision-making in a multitude of sectors ranging from biomedical research to finance and manufacturing. The curriculum of this Master's degree focuses on various areas in data analytics and computer science, including statistical methods, machine learning, data mining and visualisation. Students also acquire expertise in their chosen pathway: biomedical data analytics or data analytics for marketing and production.

<b>Course Unit Code</b> 2CO2V 2CO2U	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 5
<b>Name of Lecturer</b> Stephan Winkler Karin Pröll	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Supervised machine learning: artificial neural networks, deep learning, machine learning in image analysis, support vector machines, random forests, regression, classification, white box modeling by genetic programming, and a studies project at the end of the course.

## Recommended or required reading

*Note: This course can also be chosen from Bachelor students if they meet the prerequisites.*

The main language of instruction is German, although some modules may be offered in English.

## Computational Science

supervised/unsupervised learning, hypotheses feature selection conceptual learning, candidate elimination cross-validation, case-based reasoning, rule-based reasoning nearest neighbours, decision trees classifier systems, Artificial Neuronal Networks (classic & bayesian technique), Deep Learning, Support Vector Machines & Kernel Methods, Random forest regression/classification, Bayesian Networks und Clustering, Markov Chain Monte Carlo Sampling, exercises with WEKA, HeuristicLab and SPSS/Clementine.

## Computational Intelligence 1

### Multivariate Statistics

### Numerical Methods

### Advanced Scripting

### Text Mining

### Biomedical Data Analysis

### Data Analysis Production

### Cloud Computing

### Computer Vision

### Data Protection and Privacy

### High Performance Computing

### Big Data *Note: There is also a Big Data Course in the Software Engineering Master.*





# Digital Arts

## DA

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/digital-arts/>

Design-orientated know-how and practical skills in computer animation, audio/video & games

This full-time Master's degree programme builds on a student's creative, design and technical skills with our production and design-orientated programme that focuses on computer animation, audio/video, and games. You will expand further your ability to perform innovative and professional work across the media production industry. Our degree programme also seeks to build project management skills and develop a systematic approach to conceptualising and leading media projects by focusing on practice-oriented project work modules that combine state-of-the-art theory and practice. Students can furthermore choose from a broad range of in-depth modules for further specialisation.

*Note for applicants: The main language of tuition on this study programme is German, although some modules may be offered in English.*

# Generative and Interactive Arts

<b>Course Unit Code</b> DA630	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 4.5
<b>Name of Lecturer</b> Jürgen Hagler	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b> Face to Face

## Prerequisites

Basic knowledge in Digital Arts and Programming  
Students need to apply with a portfolio (online or pdf, youtube/vimeo links).  
Images: jpg, png, tiff, ...). Movies: (mov, avi, mpg, ....).

## Course contents

The goal of the course is to provide students with a theoretical and practical understanding of interactive and generative art. The course begins with a theoretical introduction based on over 40 years of media art history from the Ars Electronica Archive. This insight provides a chronological and thematic overview of generative and interactive art.

Towards the end of the course, we will then increasingly focus on concrete projects, tools and algorithms. This is with the intention that the students themselves realize an interactive and/or generative visualization with Processing as a project in the Deep Space of the Ars Electronica Center.

### Evaluation

20% Concept and presentation of the project for Deep Space  
50% Implementation of the Deep Space project  
30% Project documentation

Group work of 2 to 4 students with clear comprehensibility of the individual performance.

## Recommended or required reading

*Note: The course is not suitable for students with a purely technical focus.*

Winter Semester 2021/22



# Embedded Systems Design

## ESD

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/embedded-systems-design/>

Embedded Systems are an integral part of many modern-day devices, from smartphones to cars and robots. Without them, there would also be no smart homes and smart cities. Developing those complex, integrated computers requires a broad set of skills: expertise in the development of hardware and software, sensors, and systems networking. Our full-time, interdisciplinary Master's degree programme in Embedded Systems Design covers all those aspects. Students choose two of the following three specialisation pathways: System-on-Chip Design, Embedded Computing (Embedded Systems, Cyber-Physical Systems), and Systems & Signals. They will also be able to develop teamworking, leadership and project management skills, and select from a wide range of elective modules for further specialisation.

<b>Course Unit Code</b> DRS3	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 6
<b>Name of Lecturer</b> Dietmar Millinger	<b>Assessment Methods and Criteria</b> Written exam	<b>Mode of Delivery</b> Face to Face

## Prerequisites

Embedded Computer Systems  
Programming language C  
Communication Systems

## Course contents

Distributed Systems and Time  
Real-Time Communication and Execution  
Architectures  
Faults and Fault-Tolerance

The goal of the lecture is to acquire a model of distributed real/time systems which allows the student to understand project requirements for distributed real/time systems, design the architecture of hierarchical distributed real/time systems, select commercial of the shelf components for use in distributed real/time systems and understand key mechanisms for fault/tolerant distributed real/time systems.

## Recommended or required reading

Text Book: Hermann Kopetz, Real-Time Systems – Design  
Principles for Distributed Embedded Applications,  
Kluwer 1997



# Energy Informatics

## ENI

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/energy-informatics/>

Energy is the underlying heartbeat of the global economy – a critical factor in the production of nearly all goods and services in the modern world. Clearly, given the critical role of energy, the driving imperatives in any economy are ensuring security of supply, maintaining competitiveness and overseeing the transition to a low-carbon future.

Key requirements in this respect are the strategic management of supply and improving its overall generation and distribution. Impacting on these challenging goals will be a variety of factors, including advances in renewables, e-mobility and green technologies, to name only a few. Managing this changing environment is no easy task. That will require intelligent IT solutions and therefore well-educated IT experts able to design and/or operate future smart grids, smart city infrastructures and enhanced energy supply systems.

Energy Informatics is the application of information technologies to this highly demanding field and the focus of this English-taught Master's degree programme.

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ENI401	Integrated Course	2
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Andreas Aichhorn	Oral or Written Examination	Face to Face

## Prerequisites

Bachelor's degree or comparable higher education; at least 60 ECTS in Informatics and advanced programming skills (Java, C/C++)

## Course contents

Fundamental definitions and units: DC and AC, current, voltage, resistor, impedance, energy and power.

Measurement technology: Fundamentals of measurements (electrical Power, electrical energy, temperature, light); measurement chain (sensor to data acquisition).

EMC: Physically principles of electromagnetically impacts; screening and coupling decreasing measures; source and sink considerations; filtering.

Measurement errors and accuracy: Error types (systematic, digitalization, random, ...); accuracy; resolution.

Data acquisition concepts

Filtering of data

Measurement amplifiers

## Recommended or required reading

1. Charles A. Gross, Thaddeus A. Roppel, Fundamentals of Electrical Engineering, CRC Press, February 2012
2. Oleg D. Jefimenko, Electricity and Magnetism: An Introduction to the Theory of Electric and Magnetic Fields, Electret Scientific, September 1989
3. John G. Webster, Halit Eren, Measurement, Instrumentation, and Sensors Handbook, CRC Press, January 2014
4. Michael Grabe, Measurement Uncertainties in Science and Technology, Springer, May 2014
5. Henry W. Ott, Electromagnetic Compatibility Engineering, Wiley, August 2009
6. Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheblé, Power Generation, Operation and Control, Wiley-Interscience, November 2013
7. Leonard L. Grigsby, Electric Power Generation, Transmission, and Distribution, CRC Press, May 2012

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ENI402	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Werner Friedl	Oral or Written Examination	Face to Face

## Prerequisites

Bachelor's degree or comparable higher education; at least 60 ECTS in Informatics and advanced programming skills (Java, C/C++)

## Course contents

Energy and Climate Policy within the EU

The 2020 climate and energy package; the 2030 framework for climate and energy policies; liberalisation of the electricity and gas markets; promotion of the use of energy from renewable sources; energy efficiency directive; the EU emissions trading system; regulation on wholesale energy market integrity and transparency (REMIT); agency for the cooperation of energy regulators; network codes.

Smart Meter

Smart meter rollout recommendation (EU); smart grid task forces (EU); homologation/verification of meters (Non EU/EU/National).

Energy pricing with respect to examples like:

Whole sale trading market, stock exchange; classical energy utilization; domestic systems; island systems.

Microgrid systems Energy trading

Market places, products, hedging, ...

Financial assessment

Overview on marketing and market development

## Recommended or required reading

1. DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC.
2. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC
3. REGULATION (EC) No 713/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators
4. Recommendation 2012/148 on preparations for smart metering roll-out Recommendation 2012/148 on preparations for smart metering roll-out: <http://eur-lex.europa.eu/LexUriServ/LexUriS-erv.do?uri=CELEX:32012H0148:EN:NOT>
5. Working Party 29 opinion 12/2011 on smart metering: [http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/2011/wp183\\_en.pdf](http://ec.europa.eu/justice/policies/privacy/docs/wpdocs/2011/wp183_en.pdf)
6. Smart Grid Task Force EG3 first year report 'options on handling smart grid data': [http://ec.europa.eu/energy/gas\\_electricity/smart-grids/doc/xpert\\_group3\\_first\\_year\\_report.pdf](http://ec.europa.eu/energy/gas_electricity/smart-grids/doc/xpert_group3_first_year_report.pdf)
7. Smart Grid Task Force EG2 regulatory recommendations for data protection, privacy: [http://ec.europa.eu/energy/gas\\_electricity/smart-grids/doc/expert\\_group2.pdf](http://ec.europa.eu/energy/gas_electricity/smart-grids/doc/expert_group2.pdf)
8. Angus Johnston, Guy Blöck: EU Energy Law. OUP Oxford, 2012.
9. M. Roggenkamp, C. Redgwell, I. Del Guayo: Energy Law in Europe: National, EU, and International Regulation, Oxford Univ Pr., 2007.
10. Benth FE., Kholodnyi V. A., Laurence P: Quantitative Energy Finance, Springer 2014.
11. Ocana C.: Regulatory institutions in liberalised electricity markets: OECD 2001
12. Organization for Economic Co-operation and Development: Security of Gas Supply in Open Markets. OECD Publishing and International Energy Agency 2004

# Processes and Process Modelling

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ENI403	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Dagmar Auer Franz Fischer	Oral or Written Examination	Face to Face

## Prerequisites

Bachelor's degree or comparable higher education; at least 60 ECTS in Informatics and advanced programming skills (Java, C/C++)

## Course contents

Market roles and processes in a liberalized energy market  
Supply contract management and related processes, such as start of supply, move-in and move-out and end of supply; grid usage contracting and billing; meter-reading services; master data distribution; energy settlement; process and communication monitoring; grid operator, supplier.

Business processes  
Rollout process  
Processes modelling  
Methodologies, tools.

## Recommended or required reading

1. Heinrich Seidlmeier: Prozessmodellierung mit ARIS®: Eine beispielorientierte Einführung für Studium und Praxis, Vieweg+Teubner Ver-lag, 2010.
2. Manuel Laguna, Johan Marklund: Business Process Modeling, Simulation and Design, CRC Press Inc., 2013.
3. Rick Sturm, Mary Jander, Wayne Morris: Foundations of Service Level Management, Sams Professional, 2000. Jakob Freund, Bernd Rucker: Real-Life BPMN: Using BPMN 2.0 to Analyze, Improve, and Automate Processes in Your Company, CreateSpace Independent Publishing Platform, 2014.
4. Christian Aichele et.al.: Smart Meter Rollout: Praxisleitfaden zur Ausbringung intelligenter Zähler, Springer Vieweg, 2012. Manuel Laguna, Johan Marklund: Business Process Modeling, Simulation and Design, Crc Pr Inc, 2013.



<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ENI404	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Stephan Selinger	Oral or Written Examination	Face to Face

## Prerequisites

Bachelor's degree or comparable higher education; at least 60 ECTS in Informatics and advanced programming skills (Java, C/C++)

## Course contents

Fundamentals of systems and software engineering; system development life cycle, life cycle management, agile and traditional processes and methods, unified process, scrum, XP, eclipse process framework project; requirements engineering, use cases; software architectures; modeling structure and behavior in UML and SysML, UML style guidelines, language architecture of UML (Metamodel, meta object facility (MOF)), XML metadata interchange format (XMI), UML profiles, object constraint language (OCL), eclipse modeling framework (EMF), graphical modeling framework, model-to-model transformation, model-to-text transformation, code generation, Xtext and Xtend; model driven architecture, domain specific languages and domain specific modeling; software configuration management (SCM), defect tracking.

## Recommended or required reading

1. G. Booch, J. Rumbaugh, I. Jacobson: The Unified Modeling Language User Guide. Second Edition. Addison Wesley. 2005.
2. J. Holt: UML for Systems Engineering: watching the wheels. Second Edition. Institution of Engineering and Technology. 2007
3. Object Management Group (OMG): Unified Modeling (OMG UML), Superstructure, Version 2.4.1. 2011.
4. Object Management Group (OMG): Unified Modeling (OMG UML), Infrastructure, Version 2.4.1. 2011
5. S. W. Ambler: The Elements of UML 2.0 Style. Cambridge University Press. 2005
6. J. Arlow, I. Neustadt: UML and the Unified Process. Practical Object-Oriented Analysis and Design. Addison-Wesley. 2002.
7. A. Cockburn: Writing Effective Use Cases. Addison-Wesley. 2001
8. I. Jacobson, G. Booch, J. Rumbaugh: The Unified Software Development Process. Addison-Wesley. 1999.
9. D. Steinberg, F. Budinsky, M. Paternostro, E. Merks: EMF: Eclipse Modeling Framework, Second Edition. Addison-Wesley 2009.
10. Object Management Group (OMG): MOF 2.0/XMI Mapping Specification, v2.1.1
11. Object Management Group (OMG): Object Constraint Language. Version 2.2. 2010.
12. J. Warmer, A. Kleppe. The Object Constraint Language: Getting Your Models Ready for MDA. Second Edition. Addison-Wesley. 2003.
13. R. C. Gronback: Eclipse Modeling Framework. A Domain-Specific Language Toolkit. Addison-Wesley. 2009.
14. L. Bettini: Implementing Domain-Specific Languages with Xtext and Xtend. Packt Publishing. 2013
15. K. S. Rubin: Essential Scrum. A Practical Guide to the Most Popular Agile Process. Addison-Wesley. 2012.
16. S. P. Berczuk: Software Configuration Management Patterns: Effective Teamwork, Practical Integration. Addison-Wesley. 2003

<b>Course Unit Code</b> ENI406	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 5
<b>Name of Lecturer</b> Wolfgang Stumpf	<b>Assessment Methods and Criteria</b> Participation, homework, written exam	<b>Mode of Delivery</b> Face to Face

## Prerequisites

Bachelor's degree or comparable higher education; interest in building energy systems, building services, energy consumers and Internet of things

## Course contents

- Knowing and understanding the technology of the main energy consumers in industry, outdoors and buildings: lighting, heating, ventilation, cooling, pumps, drives, compressed air and their applications in energy systems
- Focus on building energy: state of the art and definitions, systems, components, characteristic values and standards, calculation of energy demands, concepts for reduced heating, cooling, ventilation, air conditioning and lighting consumption
- Automation concepts and energy saving potentials due to automation
- Creating the future: smart buildings / smart cities / smart grids
- Economic aspects and environmental impacts of energy efficient technologies and load flexibility

## Recommended or required reading

Lechner, N.: Heating, Cooling, Lighting - Sustainable Design Methods for Architects. John Wiley & Sons Inc., New Jersey, 4th edition, 2015

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ENI501	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Armin Veichtlbauer	Oral or Written Examination	Face to Face

## Prerequisites

Bachelor's degree or comparable higher education; at least 60 ECTS in Informatics and advanced programming skills (Java, C/C++)

## Course contents

- Communication basics (terms, objectives, relevance for Smart Grid)
- Communication models (OSI Reference Model, TCP/IP)
- Signal Processing (Fourier analysis, analogue/digital conversion, coding)
- Modulation (pulse shapes, AM/FM/PM, complex modulation, spread spectrum)
- Medium access control (topologies, multiple access, stochastic MAC, Example: Aloha Network)
- Logical link control (error handling strategies, Hamming coding, CRC, Stop&Wait ARQ, Sliding Window ARQ)
- Network layer functionality (packet switching, link-state routing, distance-vector routing, QoS)
- Internet technologies (IPv4, IPv6, NAT, subnetting, MPLS, Internet organization)

## Recommended or required reading

1. Andrew S. Tanenbaum, David J. Wetherall: Computer Networks - 5th Edition. Pearson, 2014.
2. James Kurose, Ross Keith: Computer Networking: A Top-Down Approach – 6th edition. Pearson, 2012.
3. Kenneth C. Budka, Jayant G. Deshpande, Marina Thottan: Communication Networks for Smart Grids: Making Smart Grid Real. Springer, 2014.
4. Ekram Hossain, Zhu Han, H. Vincent Poor: Smart Grid Communications and Networking. Cambridge University Press, 2012.
5. Stephen F. Bush: Smart Grid: Communication-Enabled Intelligence for the Electric Power Grid. John Wiley & Sons, 2014.
6. Erik Dahlman, Stefan Parkvall, Johan Skold, Per Beming: 3G Evolution: HSPA and LTE for Mobile Broadband. Academic Press, 2010.
7. Bernhard H. Walke: Mobile Radio Networks: Networking, Protocols and Traffic Performance. Wiley, 2001.
8. Haniph A. Latchman, Srinivas Katar, Larry Yonge, Sherman Gavett: Homeplug AV and IEEE 1901: A Handbook for PLC Designers and Users. Wiley, 2013.

<b>Course Unit Code</b>	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b>
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b> Oral or Written Examination	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Basic principles of cloud computing (idea and motivation, opportunities and risks, application areas); architecture of cloud computing platforms (layer model for the classification of platforms, IaaS, PaaS, SaaS); architecture of cloud applications (tier architecture, AOP, stateful / stateless services, loose coupling, separation of concerns, asynchronous message processing); google app engine (architecture, memory models, task queues, integration of external services, security, programming model); microsoft windows azure (architecture, fault tolerance, programming model, memory services: blobs, tables, queues, SQL azure, windows azure service bus); amazon web services (architecture, EC2, SQS, SNS, S3, load balancing, VPC).

## Recommended or required reading

<b>Course Unit Code</b> ENI508	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 5
<b>Name of Lecturer</b> Stephan Hutterer	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

### - Power System Operation:

Supervisory control and data acquisition (SCADA); basics of power grid automation (typical functionality, real-time requirements, information flow); information architecture (CIM-reference model); protocols (IEC 61850, IEC 60870-5 standards, DNP3); deepened understanding of IEC 61850; existing software solutions and their features; power grid protection; IT security aspects in power grids.

### - Power System Analysis:

Data analysis (weather forecast, load profiles and simultaneity of loads); basic simulation/computation/analysis approaches used in power grid operation (load flow, short circuit); optimization and control of the grid (optimal power flow, load frequency control).

### - Practical Part:

Application of selected SCADA and simulation too

## Recommended or required reading

# Java Advanced

Master

ENI

## Course Unit Code

ENI515

## Type of Course Unit

Integrated Course

## ECTS- Credits

5

## Name of Lecturer

Johannes Sametinger

## Assessment Methods and Criteria

## Mode of Delivery

Face to Face

## Prerequisites

## Course contents

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*

Winter Semester 2021/22

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
ENI601	Seminar	1
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Rainhard Findling	Hand-ins, presentation	Face to Face

## Prerequisites

Knowledge of using LaTeX to write documents, basic knowledge about usage of scientific reference management software like JabRef, previous completion of a thesis (e.g. Bachelor's thesis) which included reading scientific publications.

## Course contents

Learning outcomes: after this course students will understand the scientific method, the peer reviewing process, and the organization of program committees and scientific conferences. The course furthermore facilitates improving scientific paper reading and writing skills, as well as improving scientific presentation skills.

## Recommended or required reading

\* How to Write Papers That Get Cited and Proposal That Get Funded, Joshua Shimel, Oxford Univ. Press, 2011

\* The writer's handbook: <https://writing.wisc.edu/Handbook/PlanResearchPaper.html>



# Human-Centered Computing

## HCC

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/human-centered-computing/>

IT systems of the future will need to instinctively respond to user needs and competencies. This cutting-edge, part-time degree programme gives graduates of information technology studies the chance to refine their skills in developing more accessible and user-friendly technologies. The interdisciplinary curriculum draws primarily on social sciences and IT, including areas such as interaction design, natural-user interface development, image processing, as well as prototyping. Graduates will learn problemsolving and full-spectrum consultancy skills that are key to the conceptualisation and deployment of practical applications in this dynamic field.



<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
	Integrated Course	1.5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Martina Gaisch	Continuous Assessment and final test	Face to Face

## Prerequisites

B2-level of English

## Course contents

Intercultural theory (Hofstede, Hall, Trompenaars, Hampden-Turner, Schwartz, House et al, Lewis); global awareness and intercultural negotiation techniques.

## Recommended or required reading

Hampden-Turner, C. /Trompenaars, F. (2001). Building Cross-Cultural Competence: How to Create Wealth from Conflicting Values  
Nesbitt, R. (2003) The Geography of Thought: How Asians and Westerners Think Differently ... and Why  
Schneider, S. / Barsoux, J. (2003). Managing cross Cultures  
Hofstede, G. (2001). Culture's Consequences Comparing Values, Behaviors, Institutions, and Organizations Across Nations  
Hall, E. (1990). Understanding Cultural Differences.  
Schroll-Machl, S. (2003). Doing Business with the Germans: Their Perception, Our Perception. Vandenhoeck & Ruprecht GmbH KG.

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
17_VIR3I	Integrated Course	5.5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Christoph Anthes	Project and oral exam	Face to Face

## Prerequisites

Programming skills are recommended  
profound C# programming skills

## Course contents

Virtual Reality is a technology which tries to immerse the user by stimulating the senses. Interactive stereoscopic graphics are displayed while the user's head position is tracked in order to generate perspective-correct images.

The course consists of two parts – the fundamentals, algorithms and applications will be presented in the theoretical part. Additionally, a practical part will focus on topics like Unity development basics and bindings to current VR hardware.

The topics of the course cover concepts like interaction and navigation, investigate the hardware and the underlying aspects of input and output devices like visual perception and stereoscopy. Special topics like visualisation, networked and collaborative virtual environments play an important role. Since a key aspect of the lecture is the development of VR applications, the focus is set on the applications and their development with the help of existing software packages.

## Recommended or required reading

The VR Book: Human-Centered Design for Virtual Reality, Jason Jerald, ISBN: 1-97000-112-7, 2015

Virtual Reality Technology, Grigore Burdea and Phillippe Coiffet, ISBN: 0-47136-089-9, 2003

Introduction to Virtual Reality, John Vince, ISBN: 1-85233-739-7, 2004

Understanding Virtual Reality: Interface, Application, and Design, William R. Sherman and Alan Craig, ISBN: 1-55860-353-0, 2004

3D User Interfaces: Theory and Practice, Doug A. Bowman, Ernst Kruijff, Joseph J. LaViola, and Ivan Poupyrev, ISBN: 0-20175-867-9, 2004

*Note: Limited places - An early registration is necessary.*

*Note: This course can also be chosen from Bachelor students if they meet the prerequisites.*



# Information Engineering and Management

## IEM

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/information-engineering-and-management/>

The increasing complexity of information technology is making unceasing demands on data control and co-ordination. Planning, developing and implementing sophisticated systems to meet company targets is a serious challenge for IT managers. Access to data anywhere, anytime, common usage of information and user-friendliness are prime objectives. This requires experts with software development, business intelligence and analytical IT skills as well as know-how in management, law and team leadership. This part-time Master's degree programme equips students with exactly these skills and is particularly suitable for people with a first degree in information technology, who aim at taking up management positions in the IT business.

*Note for applicants: The main language of tuition on this study programme is German, although some modules may be offered in English.*

<b>Course Unit Code</b> ENK3 S	<b>Type of Course Unit</b> Seminar	<b>ECTS- Credits</b> 2
<b>Name of Lecturer</b> Martina Gaisch	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Simulations roleplay, group works, partner works, presentations and discussions to topics like:

- Working rights
- Knowledge Management
- Business Intelligence und Data Mining
- Learning in Data Engineering
- Data Warehousing- und OLAP-Techniken
- Organisation Planning
- Semantic Systems

...

## Recommended or required reading

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
IKK3 S	Lecture	2
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Martina Gaisch		Face to Face

## Prerequisites

## Course contents

- Theories and key concepts of Intercultural Communication - Processes of intercultural adaptation according to the stage model of Milton Bennett and based on Geert Hofstede
- Examples and experiences from practical applications
- Exercises for the further development of key competences
- Based on a case study in the field of international communication, a potential conflict is worked up

What students say about this course: "This course was excellent and quite technical "

## Recommended or required reading



# Information Security Management

## ISM

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/information-security-management/>

Effective management strategies to deal with information security on a global scale

The ever-growing multiplication of diffuse data and IT systems pose serious security challenges which can only be addressed by a holistic approach to security management protocols. Likewise, applications in the area of social networks or cloud computing and 'always-on' technologies need to be increasingly taken into account when planning and implementing information and communications systems. This new, part-time Master's degree will provide students with the expertise to deploy the interdisciplinary approach that is a key element in formulating and implementing effective management strategies to deal with the imperatives of international information security on a global scale.

*Note for applicants: The main language of tuition on this study programme is German, although some modules may be offered in English.*

<b>Course Unit Code</b> ISM15.1.LAN	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 2
<b>Name of Lecturer</b> Martina Gaisch	<b>Assessment Methods and Criteria</b> Continuous Assessment	<b>Mode of Delivery</b> Face to Face

### Prerequisites

Participants need to have a sound level of English (at least B2) - both in written and oral discourse.

### Course contents

This course aims at preparing participants for the Cambridge BEC higher certificate. Students get competencies in receptive and productive language skills.

The course is structured in ways that draw on all linguistic skills required for the BEC higher examination. Reading, writing, listening and speaking competencies are conveyed by providing sufficient course material to the students.

Two face-to-face modules provide the learners with the opportunity to clarify open questions but also to engage with their cohorts and practise speaking exercises. The rest will be conveyed via BigBlueButton to ensure an interactive and assisted teaching and learning.

### Recommended or required reading

*Note: This course can also be chosen from Bachelor students if they meet the prerequisites.*  
*Note: This course already starts at the end of September.*  
*Note: Limited places - An early registration is necessary.*



# Interactive Media

## IM

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/interactive-media/>

The English-taught Master in Interactive Media offers a wide range of subjects focusing on the technology and engineering behind interactive media, computer games and cutting-edge online media. Graduates acquire the essential knowledge and professional skills necessary to take on innovative and complex projects in the media industry.

The programme features both a substantial project component and an extensive selection of specialized courses that couple theoretical concepts with practical experience at the highest level.

In addition to providing an industry-oriented education, the programme aims to develop graduates' communication skills and refine their systematic approaches to problem solving.



# Writing and Typesetting with Math

*Note: Still to be determined if this course will take place in WS 2020/21.*

Course Unit Code	Type of Course Unit	ECTS- Credits
IM060	Workshop	1
Name of Lecturer	Assessment Methods and Criteria	Mode of Delivery
Wilhelm Burger	Attendance (3 sessions) and minor homework	Face to Face

## Prerequisites

A basic understanding of LaTeX is helpful but not required (a working setup will be provided).

## Course contents

This workshop is about writing professional documents that include mathematical elements. You learn how to develop a basic mathematical notation, choose appropriate symbols and operators, define compound structures (e.g., vectors and matrices), functions, logical expressions etc. It is shown how to correctly place mathematical elements in the main text, use proper punctuation, reference equations, formulate algorithms etc. The course is mainly intended as a preparation for project and thesis work in engineering. The goal is to avoid common mistakes and to produce documents that are up to professional standards.

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register*  
Winter Semester 2021/22

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
IM400	Integrated Course	4.5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Michael Haller	homework and project	Face to Face

## Prerequisites

No previous experience in programming & design is required.

## Course contents

In this course, students will learn how to design technologies that bring people joy, rather than frustration. Students will learn several techniques for rapidly prototyping and evaluating multiple interface alternatives and why rapid prototyping and comparative evaluation are essential to excellent interaction design. Students will also learn how to conduct fieldwork with people to help getting design ideas. How to make paper prototypes and low-fidelity mock-ups that are interactive - and how to use these designs to get feedback from other stakeholders like your teammates, clients, and users. Students will learn principles of visual design so that you can effectively organize and present information with the interfaces. We will also learn principles of perception and cognition that inform effective interaction design. And finally, students will learn how to perform and analyze controlled experiments.

The course has 4 weekly units over 12 weeks, i.e., 48 units total. These are assigned as follows:

Lecture (12 x 2 = 24 units): The lectures mostly provide the theory and the background information.

Lab (12 x 2 = 24 units): In the lab sessions, we will work on small assignments to become familiar with the topics. The exact format and contents of the lab units will be discussed in class. Lab attendance is mandatory.

## Recommended or required reading

Human-Computer Interaction (3rd ed.), by Alan Dix, Janet Finlay, Gregory Abowd, & Russell Beale. Prentice Hall, 2003.

The Design of Everyday Things, by Donald Norman. Basic Books, 2002.

Research Methods in Human-Computer Interaction, Second Edition by Jonathan Lazar, Jinjuan Heidi Feng, Harry Hochheiser, Morgan Kaufmann, 2017

**Course Unit Code**

IM410

**Type of Course Unit**

Integrated Course

**ECTS- Credits**

4.5

**Name of Lecturer**

Hans Prüller

**Assessment  
Methods and Criteria**

Written Exam

**Mode of Delivery**

Face to Face

**Prerequisites****Course contents**

Modern Software Architectures and Methods of System Design, Modeling- and Design-Patterns, Development Environments, Test-cases, Use-cases, Performance vs. Elegance.

**Recommended or required reading**

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
IM420	Integrated Course	6
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Michael Haller David Schedl	homework and project	Face to Face

## Prerequisites

Ability to read simple computer programs written in the C/C++ language and a basic knowledge of computer graphics concepts (for example, depth buffering, transformations etc.). No previous experience writing graphics applications is required.

## Course contents

This course provides an accelerated introduction to programming OpenGL, emphasizing the most modern methods for using the library. In recent years, OpenGL has undergone numerous updates, which have fundamentally changed how programmers interact with the application programming interface (API) and the skills required for being an effective OpenGL programmer. The most notable of these changes, the introduction of shader-based rendering, has expanded to subsume almost all functionality in OpenGL. This course builds from demonstrating the use of the most fundamental shader-based OpenGL pipeline to introducing numerous techniques that can be implemented using OpenGL.

The course has 4 weekly units over 12 weeks, i.e., 48 units total. These are assigned as follows:

Lecture (12 x 2 = 24 units): The lectures mostly provide the theory and the background information.

Lab (12 x 2 = 24 units): In the lab sessions, we will work on small assignments to become familiar with the environment and the shader language. The exact format and contents of the lab units will be discussed in class. Lab attendance is mandatory.

## Recommended or required reading

- OpenGL Shading Language, 3rd Edition, by Randi J. Rost, Bill Liceakane, et al.
- OpenGL 4 Shading Language Cookbook: Build high-quality, real-time 3D graphics with OpenGL, GLSL, and C++, 3rd Edition, by David Wolff
- Graphics Shaders: Theory and Practice, Second Edition, by Mike Bailey

**Course Unit Code**

IM430

**Type of Course Unit**

Elective Course

**ECTS- Credits**

6

**Name of Lecturer**Rimbert Rudisch-  
Sommer**Assessment  
Methods and Criteria**

Exam

**Mode of Delivery**

Face to Face

**Prerequisites**

Foundations in Web Development (HTML/CSS), Java, and Databases (SQL)

**Course contents**

Developing Java-based multilayered Hypermedia Applications, JEE Foundations, Spring-Framework, Persistence Libraries (eg. MyBatis, Hibernate, JPA), Frontend Frameworks (eg. SpringMVC, JSF), Agile Development Methods.

**Recommended or required reading**

<b>Course Unit Code</b> IM440	<b>Type of Course Unit</b> Elective Course	<b>ECTS- Credits</b> 6
<b>Name of Lecturer</b> Roman Divotkey	<b>Assessment Methods and Criteria</b> Project work and exam	<b>Mode of Delivery</b> Face to Face

## Prerequisites

Profound programming knowledge, basic knowledge of game programming

## Course contents

Computer game genres, general software architecture of games and interactive applications, software design patterns, architectural patterns, related algorithms and data structures, representation of entities and states, real-time processing of events, game physics, game specific artificial intelligence, architecture and integration of middleware components like physics, graphics, sound, logic and artificial intelligence, quality assurance in game development, performance considerations.

## Recommended or required reading

# Project 1

Master  
IM

<b>Course Unit Code</b> IM490	<b>Type of Course Unit</b> Elective Course	<b>ECTS- Credits</b> 9
<b>Name of Lecturer</b> Coordinator: Roman Divotkey	<b>Assessment Methods and Criteria</b> Project, presentation	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Guided project work on topics provided by faculty members or proposed by the student. Working in teams (of size 1-3) is encouraged to foster project management and team collaboration skills. Each project is coached by at least one faculty member.

## Recommended or required reading

# Design for Physical Prototyping

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
IM601	Elective Course	4.5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Michael Haller Thomas Preindl	homework and project	Face to Face

## Prerequisites

Ability to read simple computer programs written in the C/C++ language. No previous experience in electronics is required.

## Course contents

Physical Prototyping is the process of making a physical representation of an idea. Early in the process physical prototypes can be made of all kinds of materials. Physical prototypes allow designers and users to interact with the idea. By building an idea, designers are challenged to “build to think” and thus gain deeper insights. This course will go beyond early physical prototyping: it is a hands-on introduction to interactive electronics prototyping for students with a variety of backgrounds, including those with no prior experience in electronics. Familiarity with programming is helpful, but not required. Participants learn basic electronics, microcontroller programming, and physical prototyping using the Arduino/ESP32 platform, then use digital and analog sensors, LED lights and motors to build, program and customize a smart prototype. Moreover, students will get enough theoretical background for developing their own physical prototypes. The course will be done together with students from the Fashion & Technology department at the University of Arts. The final project will be about a smart textile interface.

The course has 3 weekly units over 12 weeks, i.e., 36 units total. These are assigned as follows:

Lecture (12 x 2 = 24 units): The lectures mostly provide the theory and the background information.

Lab (12 x 2 = 24 units): In the lab sessions, we will work on small assignments to become familiar with the topics. The exact format and contents of the lab units will be discussed in class.

## Recommended or required reading

Make: Getting Started with Arduino by Massimo Banzi



**Course Unit Code**

IM621

**Type of Course Unit**

Elective Course

**ECTS- Credits**

4.5

**Name of Lecturer**

Andreas Stöckl

**Assessment  
Methods and Criteria**

Homeworks/small  
projects

**Mode of Delivery**

Face to Face

**Prerequisites****Course contents**

Essential components of many Web applications are methods for automatic text analysis. In this course, the (mathematical) foundations are taught to build such applications. Basic string processing methods as well as methods for cluster analysis, classification and categorization of texts are discussed. Important topics of the course are algorithms to identify objects in texts such as places, persons and other objects.

**Recommended or required reading**

<b>Course Unit Code</b> IM645	<b>Type of Course Unit</b> Integrated Course	<b>ECTS- Credits</b> 4.5
<b>Name of Lecturer</b> Roman Divotkey	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Introduction to free-to-play (F2P) business model; concepts for game monetization, in-app purchases and the necessary adaptations to game design and mechanics as well as supporting technologies. Analytics, player metrics, AB testing, key performance indicators, rapid iterations. Supporting technologies: scripting, component-based development, data-driven development, user generated content, cellular automata, voxel engine, game data persistence, security considerations.

## Recommended or required reading

# Special Topic: Information Visualisation

Master

IM

## Course Unit Code

IM646

## Type of Course Unit

Integrated Course

## ECTS- Credits

4.5

## Name of Lecturer

Doris Zachhuber  
Markus Wagner  
Alexander Rind

## Assessment Methods and Criteria

Project and presentation

## Mode of Delivery

Face to Face

## Prerequisites

## Course contents

- Principles of information- and data visualisation
- Concepts for concise and expressive representation of complex information.
- Application of color, space, animation and interactivity in visualisation.

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*

Winter Semester 2021/22

**Course Unit Code**

IM692

**Type of Course Unit**

Elective Course

**ECTS- Credits**

3

**Name of Lecturer**

Jeremiah Diephuis

**Assessment  
Methods and Criteria**

Final paper

**Mode of Delivery**

Face to Face

**Prerequisites****Course contents**

Writing efficiently and eloquently requires a great deal more than just using suitable vocabulary and the appropriate tenses. Style, register and flow can vary a great deal depending on the purpose and context of the text being written. This course addresses the challenges involved in crafting sentences that are comprehensible, precise and defensible. The main topics include the development of logical argumentative structures, describing and interpreting data, moderating claims and handling complex grammatical issues. This course is highly recommended for students who will be writing their theses in English or for researchers who would like to hone their proposal and paper writing skills. Regular writing assignments are required.

**Recommended or required reading**



# Mobile Computing

## MC

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/mobile-computing/>

Students of our international, English-taught Master in Mobile Computing will get an in-depth insight of the almost limitless possibilities of a truly global, all-pervasive, mobile computing connectivity. The challenge is adapting ever newer technological applications and environmentally sensitive automated systems across the full spectrum of everyday activities – including sport, medicine and care of the elderly – to create ever more powerful and user-friendly synergies. Taste the future here, now!

# Class Location-Based and Context-Aware Systems

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC401	Elective Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Jens Krösche	Final Exam	Face to Face

## Prerequisites

Excellent Java programming skills

## Course contents

General Aspects of Location-Based Services, Pervasive/Ubiquitous Computing, Context Definition, Personalization and Individualization, Targets, Context Acquisition, Modeling Context Derivation, Context Distribution, Context-Aware Architectures, Context-Aware Adjustment of System Structures/Contents, Rule Systems.

Since the mid 1990 the idea of computers merging with the environment and supporting the user in his daily activities has been a well known idea in many research facilities. But through the massive distribution and the processing/sensing power of today's Smartphones the idea more and more becomes reality. Therefore the need arises to utilize techniques enabling applications to react to the aspects of the ever changing environment and the user's needs/goals/tasks. This module gives an overview of the corresponding aspects/techniques/patterns to write applications which can react to a dynamic environment.

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*

*Note: The main language of instruction is German, although some modules may be offered in English.*

Course Unit Code	Type of Course Unit	ECTS- Credits
MC402	Integrated Course	5
Name of Lecturer	Assessment Methods and Criteria	Mode of Delivery
W. Wiedermann G. Pospischil	Project work, final exam	Face to Face

## Prerequisites

Mobile Computing Background

## Course contents

Survey of Services and Service Architecture, Mobile Messaging (SMS, EMS, MMS, Unified Messaging), IMS (IP Multimedia Subsystem) incl. Group List Management, Presence, Location-Based Services, SIP, VoIP

Immersion in the construction and functions of public and private mobile networks. Knowledge of architecture, protocols, interfaces and services in order to be able to develop applications in a futureoriented way. Survey of planning aspects to assure the availability of services.

## Recommended or required reading

1. M. Miller: Voice Over IP Technologies. Building the Converged Network, Hungry Minds Inc., 2002.
2. J. Bannister, P. Mather, S. Coope: Convergence Technologies for 3. G Networks, John Wiley and Sons Ltd., 2003.
3. G. Camarillo: SIP Demystified, McGraw Hill, 2001.
4. M. Poikselka, G. Mayer, H. Khartabil: The IMS, John Wiley and Sons Ltd., 2004.
5. G. Camarillo, M. Garcia-Martin: The 3G IP Multimedia Subsystem (IMS), John Wiley and Sons Ltd., 2004.
6. G.L. Bodic: Mobile Messaging, Wiley, 2005.

*Note: Elective Course - Only offered if enough students register.*

# Operating Systems for Mobile Applications

*Note: The main language of instruction is German, although some modules may be offered in English.*

Course Unit Code	Type of Course Unit	ECTS- Credits
MC403	Reading Course + Project	5
Name of Lecturer	Assessment Methods and Criteria	Mode of Delivery
Self-learning course	Project	Face to Face

## Prerequisites

advanced programming skills (preferable Java/C#/Swift)

## Course contents

Especially the strong fluctuation and heterogeneity of smartphones, together with their widespread usage, make the development of mobile applications a laborious undertaking. Students gain insight in how to develop software for different mobile devices.

As this is a “self-learning course”, every student participating in this lecture needs to announce which TWO operating systems (Android/iOS/Windows Phone) he/she wants to work with per email to the lecture coordinator. As a result, access to the lecture notes is provided.

After confirmation every student has to define (a) suitable project topic(s) with the corresponding OS advisors. In preparation to this, every student has to write a one page summary that introduces the project idea (motivation, content, requirements, possible UI-design, ...) and send it to the corresponding advisors.

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*



*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC404	Elective Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Marc Kurz	Final Exam	Face to Face

## Prerequisites

object oriented programming

## Course contents

Software Architecture Design Process, Process Models, Software Pattern, Architectural Pattern (Layers, Pipes and Filters, MVC, Blackboard, ...), Design Pattern (Builder, Factory, Command, Decorator, Strategy, ...), Idioms, Anti-Pattern

Due to the restrictive and highly dynamical environment, designing mobile applications is a feasible task. But, to develop flexible and maintainable software architecture prior knowledge of well tested software design techniques and patterns on the architectural side as well as on the component side is required. Therefore this module focuses on a survey and evaluation of common known software design techniques and software pattern.

## Recommended or required reading

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC405	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Christoph Anthes	Project and oral exam	Face to Face

## Prerequisites

profound C# programming skills

## Course contents

Augmented Reality describes the enhancement of the real environment with virtual computer generated content. The real world has to be observed and measured to determine the position and orientation of the display. Basics of computer vision and computer graphics provide the basis for AR applications. Additional requirements are appropriate interaction techniques as well as the adaptation of the virtual content on the real world.

The course consists of two parts – the fundamentals, algorithms and applications will be presented in the theoretical part. Additionally a practical part will focus on topics like Unity development, usage of AR hardware and programming with an AR software package. The practical components are important for the final project, which has to be handed in after the completion of the course.

The goal is to teach the interested student the technology and the creation of successful AR applications. The students should be able to develop AR applications for mobile devices and the HoloLens on their own.

## Recommended or required reading

Schmalstieg, D. & Hollerer, T., Augmented Reality: Principles and Practice, Addison-Wesley Professional, 2015

Grubert, J. & Grasset, R., Augmented Reality for Android Application Development, Packt Publishing, 2013

Craig, A. B., Understanding Augmented Reality: Concepts and Applications, Morgan Kaufmann, 2012

Kipper, G. & Rampolla, J., Augmented Reality: An Emerging Technologies Guide to AR, Syngress, 2012

Hainich, R. R. & Bimber, O., Displays - Fundamentals and Applications, CRC Press, 2011

Bimber, O. & Raskar, R., Spatial Augmented Reality -- Merging Real and Virtual Worlds, A K Peters LTD, 2005

IEEE Transactions on Visualization and Computer Graphics/ Proceedings of IEEE/ACM ISMAR (International Symposium on Mixed and Augmented Reality)

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC406	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Florian Lettner	Final Exam	Face to Face

## Prerequisites

## Course contents

Computer game genres, Game Design for the Mobile Games Market, general software architecture of games and interactive applications, software design patterns, architectural patterns, related algorithms and data structures, representation of entities and states, real-time processing of events, game physics, game specific artificial intelligence, architecture and integration of middle ware components like physics, graphics, sound, logic and artificial intelligence, quality assurance in game development, performance-oriented game programming, software project management, game development with Scrum, software testing. The theoretical fundamentals of game programming are put into practice on current mobile platforms.

Within the framework of this module, all of the important components of mobile infotainment will be examined.

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*

Winter Semester 2021/22

# Advanced Project Engineering

Master

MC

*Note: The main language of instruction is German, although some modules may be offered in English.*

Course Unit Code	Type of Course Unit	ECTS- Credits
MC407	Integrated Course	5
Name of Lecturer	Assessment Methods and Criteria	Mode of Delivery
Maurer Walter	Post-Module Case Study	Face to Face

## Prerequisites

Have fulfilled the educational requirements of the University of applied sciences  
Basic knowledge in project management  
Being team member or manager of a project is a benefit.  
No certification in project management needed  
Be open minded for international aspects and different aspects of business culture

## Course contents

Project Management Basics, International Project Management, Risk Management, Managing Cultural Diversity/(International), Teamwork, Organisational Culture and Management Structures, General Agile Project Management Methods, Agile Processes (eXtreme Programming (Pair Programming), Scrum, Crystal, Dynamic System Development Methods, Feature Driven Development, etc.), Test Driven Development, Frequent Code Reviews, etc.)

Due to the rapidly changing IT world and based on a real life scenario (in the best case the students master project) deeper knowledge about modern “agile” project engineering technologies and advanced project management skills will be acquired. Which help improve software development, speedup development cycles, foster maintainability, and on the same time provide flexibility for changing project requirements.

## Recommended or required reading

- \* Philip Kotler – Marketing Management – Prentice Hall
- \* A Guide to the Project Management Body of Knowledge – PMI
- \* Jim Highsmith - Agile Project Management - Pearson Education
- \* Terry Schmidt Strategic Project Management Made Simple: Practical Tools for Leaders - John Wiley & Sons

*Note: Elective Course - Only offered if enough students register.*  
Winter Semester 2021/22

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC408	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Stephan Selinger	Final Exam	Face to Face

## Prerequisites

## Course contents

Introduction to Systems Engineering, Modeling Using UML, Unified Process, Structure and Behavior Diagrams, UML Style Guidelines, Language Architecture of UML2 (Metamodel, Meta Object Facility (MOF)), XML Metadata Interchange Format (XMI), UML Profiles, Domain Specific Languages and Domain Specific Modeling, Model Driven Architecture, Object Constraint Language (OCL), Eclipse Modeling Framework (EMF), Graphical Modeling Framework, Modelto- Model transformation, Model-to-Text transformation, Code Generation.

Graduates possess advanced knowledge in the area of UML Modeling and in the area of Domain-Specific Languages (DSLs) with a special focus on secure, mobile and embedded systems. The knowledge of software metrics, as well as the methodical testing of software systems, completes this know-how.

## Recommended or required reading

*Note: The main language of instruction is German, although some modules may be offered in English.*

Course Unit Code	Type of Course Unit	ECTS- Credits
MC502	Integrated Course	5
Name of Lecturer	Assessment Methods and Criteria	Mode of Delivery
Christopher Schwarzmüller	Project Assignment and Final Exam	Face to Face

## Prerequisites

- Basic programming skills in C++ or C# and Java
- Basic know-how of Android/iOS application principles
- Interest in modern computer graphics systems

## Course contents

- Overview and architecture of vehicles and automotive computer systems: functional domains (power train, chassis, body, HMI, telematics), ECUs, head units, instrument cluster displays
- Developing trends in Automotive Systems and feature evolution
- AUTOSAR (AUTomotive Open System Architecture) and bus system interfaces LIN, CAN, TTCAN, Flexray, MOST, OBD, Kline
- Communication and Information Systems: Instrumentation, automotive sound systems, parking systems, trip recorders, navigation systems, telematics
- Advanced Driver Assistance Systems (ADAS): Adaptive Cruise Control (ACC), lane departure warning, blind spot detection, automatic parking
- Vehicular Communication Systems (Car to car, Car to Infrastructure...)
- Automotive Software Engineering: product lines, re-use, modelbased development of automotive embedded systems
- Car infotainment systems design using state of the art solutions and tools for HMI design

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*

*Note: Might be held in English if students show interest.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC503	Elective Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Michael Maurer		Face to Face

## Prerequisites

## Course contents

Basic principles of cloud computing (idea and motivation, opportunities and risks, application areas), architecture of cloud computing platforms (layer model for the classification of platforms, IaaS, PaaS, SaaS), architecture of cloud applications (tier architecture, AOP, stateful / stateless Services, loose coupling, separation of concerns, asynchronous message processing), Microsoft Windows Azure (Architecture, Fault Tolerance, programming model, memory services: Blobs, tables, queues, SQL Azure, Windows Azure service bus), Amazon Web Services (architecture, EC2, SQS, SNS, S3, load balancing, VPC), Google Cloud Platform (GCE, App Engine, GCS, Cloud Datastore).

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*

Winter Semester 2021/22

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC508	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Stephan Selinger	Final Exam	Face to Face

## Prerequisites

## Course contents

Fundamentals of RT Systems (hard/soft RT systems, scheduling etc.), Distributed Systems, Distributed Scheduling Algorithms, Holistic Scheduling, Global Time, Clock Synchronization, Network Time Protocol (NTP), Real-Time Communication (Event- and Time-Triggered Solutions), Real-Time Java, Real-Time CORBA, Real-Time Transport Protocol (RTP).

Immersion in real-time design and programming with a special focus on real-time communication.

## Recommended or required reading

1. H. Kopetz: Real-Time Systems: Design Principles for Distributed Embedded Applications, Springer, 1997
2. W. S. Liu: Real-time Systems, Prentice Hall, 2003.
3. E. J. Bruno, G. Bollella: Real-Time Java Programming With Java RTS, Prentice Hall 2009.
4. C. Perkins: RTP: Audio and Video for the Internet, Addison- Wesley, 2003.
5. A. S. Tanenbaum, M. van Steen: Distributed Systems, Prentice Hall, 2003.
6. P. Rybaczky: Expert Network Time Protocol: An Experience in Time with NTP, Apress, 2005
7. D. Mills: Computer Network Time Synchronization: The Network Time Protocol on Earth and in Space, Second Edition, CRC Press, 2010.
8. J. Sales: Symbian OS Internals: Real-Time Kernel Programming, Wiley, 2005.
9. Q. Li, C. Yao: Real-Time Concepts for Embedded Systems, CMP Books.



# Home and Building Automation

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC509	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Christoph Schaffer	Oral or Written Examination	Face to Face

## Prerequisites

- technical bachelor
- programming knowledge
- git
- agile team-based programming
- Linux basics

## Course contents

Home and building automation has been around for a long while. It is a viable solution for equipping of and controlling industrial buildings with lighting, HVAC, security, audio/video, and computer networks. There are also plenty of solutions starting to become viable for the consumer.

In this class, we will learn to critically reflect, assess, and employ the solutions available. We will also focus on the integration of building automation technology and develop our own creative solutions.

The class has 5 ECTS. This means that you should budget on average an amount of 180 hours of effort for this class. This is in contrast to 30 hours presence in class. It means that only a sixth of the expected hours is class time. Therefore, expect to work outside of the class approximately 5-6 hours extra for each classroom hour.

## Recommended or required reading

1. Sauter T., Dietrich D., Kastner W.: EIB Installation Bus System, Publicis Corporate Publishing, 2001.
2. Jeronimo M, Weast Jack: UPnP\* Design by Example: A Software Designer's Guide to Universal Plug and Play, Intel Press, 2003
3. Zahariadis T.B.: Home Networking Technologies and Standards, Artech House Publishers, 2003.

*Note: The main language of instruction is German, although some modules may be offered in English.*

Course Unit Code	Type of Course Unit	ECTS- Credits
MC511	Integrated Course	5
Name of Lecturer	Assessment Methods and Criteria	Mode of Delivery
Mark A.M. Kramer	Participation, group work, presentation, final project	Face to Face

## Prerequisites

The desire to learn and experience how mobile technologies and services can support, augment and extend connected health-care scenarios and sports (Quantified Self) contexts. Also, it is essential to be confident in reading, writing and working (speaking) in English.

## Course contents

Fundamentals of Biosignal Analysis, EEG, ECG, EMG, , Measuring Blood Pressure, Measuring Blood Flow, Measuring Cardiac Output, Pulsoximetry, Functional Electro-Stimulation (FES), Lactate Measurement, Heart-Rate Variability, Estimation of VO<sub>2</sub>, Biomedical Sensor, Pervasive Computing and Healthcare, Wireless Health Monitoring Systems, Ambient Assistive Health, Fall Detection, Security and Privacy in Telemedicine.

Exploration of the fundamental concepts, methods and practices of using modern mobile, information and communication technologies for connected health and sports scenarios; Identifying and using mobile applications and services designed for healthcare and sports; Conceptualizing, designing and developing a mobile solution.

Assessment methods: In class participation, 20%; Group work 30%; Group Presentation 10% Final Project (prototyping of a mobile application.) 40%

## Recommended or required reading

# Short-Range Wireless Communication

Master  
MC

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC514	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
		Face to Face

## Prerequisites

## Course contents

Regulatory Framework Conditions, Spectral Areas, Standardization, Security, Bluetooth, WLAN (802.11), HomeRF, DECT, ZigBee, UWB, RFID, NFC

## Recommended or required reading

*Note: Elective Course - Only offered if enough students register.*  
Winter Semester 2021/22

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC515	Elective Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
	Final Exam & Exercises	Face to Face

## Prerequisites

some programming skills in C or Java

## Course contents

Mobile computing technologies as well as computer algorithm play a very important role in the logistics. The course starts with an overview of Supply Chain Management and its importance for todays enterprises, showing theIT as “Enabler” of Supply Chain Processes. Following an introduction about Warehouse Management Systems (WMS) will be given, including the technologies used in modern warehouses: Mobile Computer Devices,Enterprise Application Integration (EAI) Tools, Automatic Identification (Barcode, RFID), Warehouse Automation (Robotics, Shuttle-Systems). Beside theoretical input and basic knowledge two programming examples will be executed by the students in teams during the course. Both will deal with practical topics from supply chain management and familiarize the students with the algorithms and constitute awareness of possible challenges.

## Recommended or required reading

1. R. Melzer-Ridinger: Supply Chain Management, Fortis,
2. H. Arndt: Supply Chain Management, Gabler, 2. Auflage, 2005.
3. D. Pfaff, B. Skiera, J. Weiss: Financial Supply Chain Management, Galileo Press, 2003.
4. Axel Kuhn, Bernd Hellingrath: Supply Chain Management, Springer, 2002.
5. Helmut Baumgarten: Logistik im E-Zeitalter. Die Welt der globalen Logistik-Netzwerke, Frankfurter Allgemeine Buch, 2002.
6. Dirk Seifert: Efficient Consumer Response. Category Management, Supply Chain Management und CPFR als neue Strategieansätze, Rainer Hamp Verlag, 2004.
7. Michael Ten Hompel, Thorsten Schmidt: Warehouse Management, Springer, 2005

*Note: Elective Course - Only offered if enough students register.*  
Winter Semester 2021/22

# Systems Engineering 3: Metrics and Testing

Master  
MC

*Note: The main language of instruction is German, although some modules may be offered in English.*

Course Unit Code	Type of Course Unit	ECTS- Credits
MC517	Integrated Course	5
Name of Lecturer	Assessment Methods and Criteria	Mode of Delivery
Rudolf Ramler Mario Winterer	Final Exam	Face to Face

## Prerequisites

- \* Systems Engineering 1+2
- \* Software Architectures and Patterns
- \* Object-oriented Programming (Bachelor)
- \* Project Engineering (Bachelor)

## Course contents

Software metrics (e. g., code coverage, kloc, bugs/kloc, cyclomatic complexity, function points, cohesion and coupling,...), black box and white box testing, unit tests, integration tests, system test, regression tests, testing of non-functional properties, test plans, testing tools, automated testing, testing and the software development process, test-driven development, model-based testing, GUI-testing, UML Testing Profile, Continuous Integration and Delivery, certifications

This course is a step by step description of the software metrics. It includes introduction to foundations of measurement theory, models of software engineering measurement, software products metrics, software process metrics and measuring management.

## Recommended or required reading

- \* S. H. Kan: Metrics and Models in Software Quality Engineering. Addison-Wesley Professional, 2003
- \* N. Walkinshaw: Software Quality Assurance: Consistency in the Face of Complexity and Change. Springer, 2017
- \* A. Spillner, T. Linz, H. Schaefer: Software Testing Foundations: A Study Guide for the Certified Tester Exam. Rocky Nook; 4 Ed., 2014
- \* S. Freeman: Growing Object-Oriented Software, Guided by Tests. Pearson Professional, 2009
- \* R.C. Martin: Clean Code: A Handbook of Agile Software Craftsmanship. Prentice Hall, 2008
- \* J. Humble, D. Farley: Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation. Pearson Professional, 2010

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC520	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Rainhard Findling	Hand-ins, presentation, final examination	Face to Face

## Prerequisites

This course requires good programming skills in languages for statistical computing/data analysis, like R or Python.

## Course contents

Learning outcomes: understanding and practical applicability of data analysis and machine learning methods in mobile environments. After this course, students will be able to perform/apply data recording, graphical/visual data analysis, data preprocessing and feature extraction, basic regression and classification, data partitioning and resampling techniques, as well as model tuning and selection. Students will further know details concerning practical applicability of specific models, like neural networks, support vector machines, regression and classification trees, and ensembles, including bagging, boosting, and random forests.

## Recommended or required reading

- \* Kuhn, M. and Johnson, K.: Applied Predictive Modeling. Springer-Verlag New York, 2013
- \* Golemund, G. and Wickham H.: R for Data Science. O'Reilly, 2017
- \* Witten, I. H.: Data Mining: Practical Machine Learning Tools and Techniques. Morgan Kaufmann, 2011
- \* Hastie, T.; Tibshirani, R. & Friedman, J. The elements of statistical learning: Data Mining, Inference, and Prediction Springer, 2011

*Note: The main language of instruction is German, although some modules may be offered in English.*

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
MC601	Integrated Course	2
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Rainhard Findling	Seminar paper and oral presentation	Face to Face

## Prerequisites

## Course contents

Understanding the scientific method, the peer reviewing process, and the organization of program committees and scientific conferences. Improving scientific paper reading and paper writing skills. Improving scientific presentation skills.

Course participants learn the techniques of writing a scientific work and implement these into their own work. Through support and feedback of the advisor, a successive advancement with continuous improvement in quality is assured.

## Recommended or required reading



# Software Engineering

## SE

<https://www.fh-ooe.at/en/hagenberg-campus/studiengaenge/master/software-engineering/>

Most devices that shape our everyday lives – from computers and smartphones to coffeemakers and jet planes – depend on a guiding software code. This full-time degree programme takes graduates in practical and applied informatics to the next level. You will expand expertise in developing, implementing and evaluating highperformance software to meet the demand for an ever-expanding range of applications. Creation of high-end software is akin to building a house: you need both the skills of a craftsman and the inspiration of an architect. This symbiotic combination is what defines the software architect. Our Master's degree programme will empower students to become exactly that.



# Data Warehousing and OLAP

<b>Course Unit Code</b> DWO	<b>Type of Course Unit</b> Elective Course	<b>ECTS- Credits</b> 4.5
<b>Name of Lecturer</b> Henryk Maciejewski	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b> Face to Face

## Prerequisites

## Course contents

Analytical vs. direct data processing - different architectures for different requirements; Data Warehouse as a holistic depot of analytical data; real application examples of OLAP (Online Analytical Processing ) data warehouse systems. Building a data warehouse: methodology of data warehouse implementation process, maintaining data integrity, accuracy and completeness, ETL ( extract- transform- load), purpose and meaning of metadata. Database design for Date Warehouse: requirements concerning multidimensional queries to databases. Database technologies for OLAP.

Exercise part : Training in the use of a commercial OLAP development environment .

## Recommended or required reading

# Big Data Analytics and Interactive Visualization

Master  
SE

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Christoph Heinzl Barbara Traxler		Face to Face

## Prerequisites

Must have successfully finished the courses “Data Warehousing and OLAP“ (winter semester) and “Machine Learning and Data Mining“ (summer semester).

## Course contents

This course is an elective subject module and consists of three parts:

- Part 1: Interactive Data Visualization
- Part 2: Interactive Visualization Using D3
- Part 3: Big Data Analytics

Each part comprises 14 units à 45 min.

To pass this course, all three parts have to be completed successfully.

Evaluation:

- Part 1: State of the art report on a topic of your choice in the field of big data analytics and interactive visualization
- Part 2: Programming exercise in D3
- Part 3: Programming exercise in Big data analytics

## Recommended or required reading

<b>Course Unit Code</b>	<b>Type of Course Unit</b>	<b>ECTS- Credits</b>
	Integrated Course	5
<b>Name of Lecturer</b>	<b>Assessment Methods and Criteria</b>	<b>Mode of Delivery</b>
Stephan Winkler		Face to Face

## Prerequisites

## Course contents

continuous modeling and simulation by numeric integration, systems theory basics, growth and decay models, predator-prey models, epidemiology basics, control circuits, parameters optimization by heuristic algorithms, discrete modeling and simulation, discrete event specified systems, agent based modeling and simulation; software frameworks: MATLAB / Simulink, AnyLogic, HeuristicLab

## Recommended or required reading

*In Wintersemester 2021/22 this course will be in German!*

*Note: Modelling and Simulation and Heuristic and Evolutionary Algorithms take place at the same time, therefore please choose just one of these courses!*

# Heuristic and Evolutionary Algorithms

## Course Unit Code

NHL1ILV

## Type of Course Unit

Integrated Course

## ECTS- Credits

5

## Name of Lecturer

Michael Affenzeller  
Stefan Wagner

## Assessment Methods and Criteria

## Mode of Delivery

Face to Face

## Prerequisites

## Course contents

Taxonomy of optimization algorithms, demarcation between numerical and heuristic optimization, examples of combinatorial optimization problems and complexity theory, search space behavior and P and NP problems. Heuristic methods: Problem specific methods vs. metaheuristics, construction vs. improvement heuristics, neighbourhood and distance of solutions, local search, trajectory based methods, simulated annealing, taboo search. Population-based methods: Ant-Colony Optimization, Swarm Intelligence, Genetic Algorithms, Evolutionary Strategies, Genetic Programming and Scatter Search. In exercises use, parameter setting, analytical and empirical analysis of different optimization techniques using HeuristicLab, a generic development and test environment for heuristic optimization procedures.

## Recommended or required reading

*In Wintersemester 2021/22 this course will be in English!*

*Note: Modelling and Simulation and Heuristic and Evolutionary Algorithms take place at the same time, therefore please choose just one of these courses!*

**Course Unit Code****Type of Course Unit****ECTS- Credits**

Integrated Course

5

**Name of Lecturer****Assessment  
Methods and Criteria****Mode of Delivery**

Thomas Kern  
Viktoria Dorfer

Face to Face

**Prerequisites****Course contents****Recommended or required reading**

# Alternative Programming Paradigms

**Course Unit Code****Type of Course Unit****ECTS- Credits**

Integrated Course

5

**Name of Lecturer****Assessment  
Methods and Criteria****Mode of Delivery**Erik Pitzer  
Stephan Dreiseitl

Face to Face

**Prerequisites**

Knowledge of object-oriented programming; interest in abstraction, problem decomposition, and how these aspects pertain to algorithmic problem solving.

**Course contents**

Paradigms are in the foreground, not the learning of new programming languages; the main focus is on the comparison of alternative problem-solving possibilities by the different paradigms (and languages). Imperative and object-oriented programming are assumed to be known; various forms of the object-oriented paradigm are discussed based on the peculiarities of languages such as Java, C# and Smalltalk. The focal points are the functional aspects of the logical programming paradigm:

Functional P. : the differences between purely functional programming (e. g. Scheme & ML without assignments, with functions as first-class values) and imperative programming languages are worked out; Logical P. : using prologue it is shown how to get a different view of programming by separating program logic and executing control. Finally, relatively new paradigms such as the generative or the aspect-oriented are briefly presented and compared with the others.

**Recommended or required reading**

The course is inspired by the book “Seven languages in seven weeks” by Bruce Tate. Reading the book, however, is not required for the course.

# English Conversation

Master  
SE

## Course Unit Code

## Type of Course Unit

## ECTS- Credits

Integrated Course

5

## Name of Lecturer

## Assessment Methods and Criteria

## Mode of Delivery

Isabella Moser

Face to Face

## Prerequisites

## Course contents

## Recommended or required reading

**Course Unit Code****Type of Course Unit****ECTS- Credits**

Integrated Course

5

**Name of Lecturer****Assessment  
Methods and Criteria****Mode of Delivery**

Georg Weichhart

Face to Face

**Prerequisites****Course contents****Recommended or required reading**