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German A1/ Parts 3 and 4

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<th>German A1/ Parts 3 and 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECTS</td>
<td>4</td>
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<td>SWS</td>
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<tr>
<td>Semester</td>
<td>Winter and Summer</td>
</tr>
<tr>
<td>Workload in hours</td>
<td>60 hrs</td>
</tr>
<tr>
<td>Lecturer</td>
<td>Dr. Virginia Wallner</td>
</tr>
</tbody>
</table>

Course objectives

- Can understand and use familiar expressions and very basic phrases aimed at meeting concrete everyday needs
- Can introduce themselves and others and ask other people questions about their person
- Can communicate in a simple way if the other person speaks slowly and clearly and is willing to help

http://www.europaeischer-referenzrahmen.de

Course contents

- Grammar
  - Prepositions
  - Possessives
  - Dative verbs
  - The imperative-Simple past ‘war/ hatte’
  - The perfect form
  - Word formation
  - Subjunctive II
- Topics
  - Apartments and houses
  - Parts of the body
  - Describing people and their character
  - Household activities
  - Weather
  - Holidays and celebrations
## Recommended literature


## Teaching methods

- Partner and group work
- Explanation of topics by the lecturer
- Presentations and discussions
- Feedback from the lecturer
- Listening exercises

## Assessment method

Written examination, 90 min.

## Language of instruction

German

## Prerequisites

Successful completion of Level A1/Parts 1 and 2 (88121)

Course descriptions for German language courses at higher levels:
https://th-deg.de/en/students/language-electives#german
English in Technical Contexts B2

<table>
<thead>
<tr>
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<th>English in Technical Contexts B2</th>
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</thead>
<tbody>
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<tr>
<td>Course type</td>
<td>Language training course</td>
</tr>
<tr>
<td>SWS</td>
<td>2</td>
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<td>Semester</td>
<td>Winter and summer</td>
</tr>
<tr>
<td>Course level</td>
<td>B2</td>
</tr>
<tr>
<td></td>
<td>• Can understand the main ideas of complex text on both concrete and abstract topics, including technical discussions in his/her field of specialization</td>
</tr>
<tr>
<td></td>
<td>• Can interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party</td>
</tr>
<tr>
<td></td>
<td>• Can produce clear, detailed text on a wide range of subjects and explain a viewpoint on a topical issue giving the advantages and disadvantages of various options</td>
</tr>
</tbody>
</table>

http://www.europaeischer-referenzrahmen.de/

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Neal O'Donoghue, MA</th>
</tr>
</thead>
</table>

Course objectives

This course aims to deepen students’ encounter with the English language in a technical context by giving practical training in specialized vocabulary, grammar and language usage. The four cardinal language skills – listening, speaking, reading, and writing – will play an integral role in this training. The course is designed to be relevant and interesting for engineering students and will be adapted to their learning needs and study areas. By the end of the course, participants should have a more comprehensive understanding of, and enhanced fluency in, the English language in an engineering context.
Course contents

Obligatory topics (60 %):
- Numbers and mathematical operations
- Shapes and dimensions
- August 2017
- Basic physics and the scientific worldview
- Materials and their properties
- Case study on an area related to technology
- /physics/engineering
- Grammar/ communication skills

Variable content (40 %):
Variable content will be determined on the basis of a student survey conducted in the first session.
Current world events (including news events and popular culture) and recent technological innovations may be used as a basis for discussions.

Teaching methods

Teaching methods focus on improving the four cardinal language skills and include group discussions and group projects; individual work; mini-presentations; role-plays; close reading and listening activities; dictation; grammar games; and various follow-up viewing and writing activities.
Work not completed in class should be done at home. Self-study assignments will be set on a weekly basis.

Assessment method

Written exam (60 min)
No dictionaries are allowed.

Exam structure:
- Part 1: Listening comprehension(s)
- Part 2: Reading comprehension(s)
- Part 3: Vocabulary and technical content
- Part 4: Grammar (maximum 10% of total exam points, excluding writing exercise)
- Part 5: Writing composition (150-200 words)

The exam will be based on topics covered during the semester.

Recommended Literature


<table>
<thead>
<tr>
<th>Language of instruction</th>
<th>English</th>
</tr>
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<tbody>
<tr>
<td>Prerequisites</td>
<td>B1 / Abitur (A-levels/ school leaving certificate giving right of entry to higher education) / 7-9 years of English</td>
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Intercultural Training for Germany and Bavaria

<table>
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<td>ECTS</td>
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<td>Semester</td>
<td>Winter and summer</td>
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<td>Workload in hours</td>
<td>30 hours</td>
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<tr>
<td>Name of Instructor</td>
<td>Lisa Werner</td>
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</table>

Course objectives:
Participants get an understanding of the different theories of “culture” and learn about stereotypes and traditions in Bavaria. Furthermore, the participants get information on Germany and Bavaria as well as the Deggendorf Institute of Technology.

Course contents:
I. Culture (theories)
II. Customs and Rituals in Germany/Bavaria
III. Information on Germany and Bavaria and the DIT
IV. Quiz and Presentation
V. Culture Shock

Recommended literature:
Bolten J. und Ehrhardt C., Interkulturelle Kommunikation, Verlag Wissenschaft & Praxis 2003;
Bolten J, Einführung in die interkulturelle Wirtschaftskommunikation, Vandenhoeck & Ruprecht 2007

Teaching methods:
The course is organized according to four pillars:
1. Culture
2. Customs and Rituals
3. Information on Germany/Bavaria
4. Culture Shock
Whereas hard facts are taught in a classical lecture style, students will do lots of role-plays, critical incidents, short movies and do a quiz.

<table>
<thead>
<tr>
<th><strong>Assessment method</strong></th>
<th>Paper</th>
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<tbody>
<tr>
<td><strong>Language of instruction</strong></td>
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<td><strong>Prerequisites</strong></td>
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Asian Emerging Economies and Doing Business in the Asian Region

<table>
<thead>
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<tr>
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<td>299</td>
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<td>SWS</td>
<td>2</td>
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<tr>
<td>Semester</td>
<td>Winter and summer</td>
</tr>
<tr>
<td>Lecturer</td>
<td>Ms. Dr. (rer.pol.) Wei Manske-Wang</td>
</tr>
</tbody>
</table>

**Course objectives**

- Establishment of global horizons
- Learning knowledge holistically about Asia: political, economic and social; Past, current development up to the future prognosis
- Awareness of foreign cultures and understanding their causes
- Preparing for the challenges of future professional life in a global environment

**Course contents**

- Institutions and strategic arrangements in Asia: ASEAN, APEC, BRICS, BRI etc.
- PEST country analysis: Japan, China, India etc.
- Profound background: culture and philosophy etc.
- Hot topics in Asia: industrialization, digitization, megacities, mobility, M&A in Europe etc.

**Recommended literature**


<table>
<thead>
<tr>
<th><strong>Teaching methods</strong></th>
<th>Lecture, Press Monitoring, Case Studies, Group Work, Dialogue</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment method</strong></td>
<td>Written exam (60 minutes)</td>
</tr>
<tr>
<td><strong>Language of instruction</strong></td>
<td>English</td>
</tr>
<tr>
<td><strong>Prerequisite</strong></td>
<td>Thinking outside the box and willingness to learn</td>
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# Basics of International Sales and Business Development

<table>
<thead>
<tr>
<th><strong>Course title</strong></th>
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<tbody>
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<td>268</td>
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<tr>
<td><strong>ECTS</strong></td>
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<tr>
<td><strong>Course type</strong></td>
<td>Lecture with group work and presentations</td>
</tr>
<tr>
<td><strong>SWS</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Semester</strong></td>
<td>Winter and summer</td>
</tr>
<tr>
<td><strong>Lecturer</strong></td>
<td>Ibrahim Waked</td>
</tr>
<tr>
<td><strong>Course objectives</strong></td>
<td>General knowledge of international sales and strategic business development mechanisms. As well as profound analysis of practical case studies.</td>
</tr>
</tbody>
</table>
| **Course contents** | - Basics of sales and business development  
- Analysis of market potential including cultural & political aspects, correlation between microeconomic and demographic aspects, (PESTELO analysis)  
- Relevancy of world bank reports on general economic performance and their implementation in company BD strategy  
- Market entry and risk management |
| **Recommended literature** | **Strategic Management** by Richard Lynch von Pearson Longman  
**Business Development Management** By Lutz Becker, Walter Gora, Tino Michalski |
| **Teaching methods** | Lecture with integrated project development examples |
| **Assessment method** | Presentation and seminar paper |
| **Language of instruction** | English |
Basics of Management Consulting

<table>
<thead>
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<th>Course title</th>
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<tbody>
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<td>Semester</td>
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<tr>
<td>Workload in hours</td>
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<tr>
<td>Lecturer</td>
<td>Prof. Dr. Christian Mandl</td>
</tr>
</tbody>
</table>

The work of a management consultant is very broad and requires a diverse set of skills. In this course we focus on those skills particularly focusing on
- Problem definition
- Data handling and analysis
- Presentation
- Synthesis
- Communication

Students of this course get prepared for the challenges of a complex business world. They learn how to structure a problem, ask for the right data, analyze the data, draw conclusions from data, present their results and communicate with top-management level. After a successful completion, students are well-prepared for working as strategy consultants, IT consultants or consultants in the engineering field.

The course particularly focuses on the challenges of digitalization as a majority of today’s consulting projects focus on digital transformation.
## Course contents
The course gives an overview of state-of-the-art methods that consultants work with. This includes design thinking, brainstorming, structuring techniques, data analysis, slide creation and communication.

## Recommended literature

## Teaching methods
The course consists of seminars and a project. During the seminars students get an overview of the major methods for each chapter. They are asked to apply those methods in a project based on provided datasets and to present the results to a management board.

## Assessment method
Seminar paper and presentation

## Language of instruction
English

## Prerequisites
None
# Bavarian Culture

<table>
<thead>
<tr>
<th><strong>Course title</strong></th>
<th>Bavarian Culture</th>
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<tbody>
<tr>
<td><strong>Course ID</strong></td>
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<td><strong>Semester</strong></td>
<td>Winter and summer</td>
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<tr>
<td><strong>ECTS</strong></td>
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</tr>
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<td><strong>Course type</strong></td>
<td>Elective</td>
</tr>
<tr>
<td><strong>Language of instruction</strong></td>
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</tr>
<tr>
<td><strong>Name of lecturer</strong></td>
<td>Jennifer Hauer</td>
</tr>
<tr>
<td><strong>Course objectives</strong></td>
<td>Participants get a deeper understanding of the traditional and contemporary Bavarian culture by integrating knowledge about customs, language, and history with culturally routed events.</td>
</tr>
</tbody>
</table>
| **Course contents** | 1. Hard facts  
| | 1.1. History  
| | 1.2. Demographics  
| | 1.3. Geography  
| | 2. Customs and rituals  
| | 2.1. Traditional  
| | 2.2. Contemporary  
| | 3. Language  
| | 4. Events |
| **Teaching methods** | The course is organized according to four pillars:  
| | 1. Hard Facts  
| | 2. Customs and Rituals  
| | 3. Language  
| | 4. Events  
| | Whereas hard facts are taught in a classical lecture style, students should experience aspects of the culture in a lively manner through knowledge dissemination of cultural experts, off-campus seminars at events of traditional cultural |
origin, as well as learning and engaging in cultural rituals themselves. The aim is to deepen and complement the contents taught in the Orientation Week.

<table>
<thead>
<tr>
<th>Recommended literature</th>
<th>Jonas, B., Gebrauchsanweisung für Bayern, Piper Verlag, 2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment methods</td>
<td>Seminar paper</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Participants should have attended the introductory Intercultural Training during the Orientation Week.</td>
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</table>
Business Analytics for Data-Driven Decision-Making

<table>
<thead>
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<tr>
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<td>Course type</td>
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<td>SWS</td>
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<tr>
<td>Semester</td>
<td>Winter</td>
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<td>Workload in hours</td>
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<tr>
<td>Lecturer</td>
<td>Prof. Dr. Christian Mandl</td>
</tr>
</tbody>
</table>

The work of a consultant is increasingly driven by data such as macroeconomic indicators, tracked customer data or sensor data from machines. In the course of digitization, consultants (but also company leaders) from business, engineering and IT need to be able to handle and interpret this data carefully.

Therefore, they need to know standard data analytics techniques.

Course objectives

Students of this course get prepared for the challenges of a data-driven business world. They learn **standard data analytics methods** and are able to **implement** them with simple and widely available IT tools (e.g., Excel Solver, Python, R)

Furthermore, after successfully completing the course, students are able to **derive recommendations** for business decisions from their analysis output.
Institute for International Affairs

Last but not least, students learn how to present their data-driven recommendations to top management in the most appropriate way.

The course gives an overview of state-of-the-art methods for analytics to derive data-driven decisions for typical business problems such as financial planning, project management, resource allocation, capacity planning, demand forecasting or production planning.

The course is divided into 3 core topics:

**Course contents**

1. Descriptive Analytics
2. Predictive Analytics
3. Prescriptive Analytics

All methods are illustrated based on daily business decisions to be made.

Furthermore, the course consists reporting and presentation skills to present their data-driven recommendations to management boards.

**Recommended literature**


**Teaching methods**

The course consists of seminars and a project. During the seminars, students get an overview of the major methods for each chapter. They are asked to apply those methods in a project based on provided datasets and to present the results to a management board.

**Assessment method**

Seminar Paper + Presentation

**Language of instruction**

English

**Prerequisites**

Basics in Mathematics/ Statistics and MS Excel
Business Storytelling

**Course title**  
Business Storytelling

**Course ID**  
296

**ECTS**  
2

**Course type**  
Elective

**SWS**  
2

**Semester**  
Winter and summer

**Workload in hours**  
Total: 60 / In-class: 30 / Self-study: 30

**Lecturers**  
Diego and Raphael Fiche

At the end of this course, students will be able to:

- Recognize key elements that go into persuasive storytelling
- Identify types of stories and their purposes
- Create compelling stories to achieve business goals
- Apply acquired knowledge to develop a compelling story to persuade others to think or act in a different way.

**Course objectives**

**Course contents**

- Introduction to Business Storytelling
- Power of Business Stories: when and why to tell them
- Types of Business Stories and Their Purposes
- Structuring Your Story to Engage the Audience
- Storytelling techniques
- Enhance Your Storytelling Skills

**Recommended literature**

- Janis Forman (2013), Storytelling in Business: The Authentic and Fluent Organization
- Seth Godin(2005), All Marketers Are Liars
| **Teaching methods** | • Lectures  
• Group work  
• Case studies  
• Presentation  
• Exercises |
<table>
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<tbody>
<tr>
<td><strong>Assessment method</strong></td>
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<tr>
<td><strong>Language of instruction</strong></td>
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<tr>
<td><strong>Prerequisites</strong></td>
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## Cross-Cultural Team Building

<table>
<thead>
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<th>Cross-Cultural Team Building Workshop</th>
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<tbody>
<tr>
<td><strong>Lecturer</strong></td>
<td>Prof. Dr. Johann Nagengast</td>
</tr>
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<td><strong>Course type</strong></td>
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<tr>
<td><strong>SWS</strong></td>
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<tr>
<td><strong>Semester</strong></td>
<td>Winter and summer</td>
</tr>
<tr>
<td><strong>ECTS</strong></td>
<td>2</td>
</tr>
<tr>
<td><strong>Assessment method</strong></td>
<td>Seminar paper</td>
</tr>
<tr>
<td><strong>Course language</strong></td>
<td>English</td>
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</tbody>
</table>

Globalisation demands that managers possess the basic skills required to work together in international teams. Many companies actively encourage the development of these skills through teambuilding or team development programs. Especially for change management, team development plays an increasingly important role. Here the critical goal is to optimise how the group members work together as a team. Key factors affecting a team’s success include organisation, structures, processes, culture and relationships.

International Team Building is conducted at the beginning of the semester as a three day off-campus seminar. The hands-on, outdoor training gives the students intensive exposure to the multifaceted nature of group dynamics.

By working together to solve complex problems and through structured feedback sessions, the participants become sensitised to the roles they assume in group interactions, to the limitations imposed by the German and their own cultures, and to the conditions required for effective team work.
The course supports the integration of foreign students into campus and social life and helps build lasting working relationships among all participants.

The skills of giving and receiving of feedback are learned in the protective atmosphere of small groups through intensive exchanges between instructors and participants. This leads to improved observation and communication skills.

Moreover, the group members continually switch roles. This promotes a deeper understanding of social interaction, helps members to reflect on their contribution to the group process, encourages members to experiment with new behavioural concepts, and improves the group’s capacity to co-operate and perform. Final feedback rounds offer the possibility to align the members’ self-images with the perception others have of them, to reduce “blind spots”, to increase self-confidence and their ability to reflect.

The capacity to give appropriate feedback in various situations, to monitor one’s self image as well as the consequences of one’s own behaviour form the basis for a successful career in management.

Group dynamics, processes and structures in groups; Roles in groups (roles in tasks and supporting roles); Group leadership; Effect of one’s actions in groups; The “give and take” of feedback; Self-image and how others see you; Communication levels (content versus relationship); Conditions for successful co-operation; Cultural influences on teamwork.

Note: The main emphasis of this course is not the conveyance of theoretical knowledge, but rather learning directly from experience. The theories on which the intervention and evaluation sessions are based are taught in the course “Human Resources Management”.

This course is organised as an interactive experience and activity-based training program. With the help of complex tasks, timed interaction activities combined with elements of surprise, classical outdoor training exercises, moderated feedback and reflection sessions, participants are taught the necessary conditions for effective teamwork.

The teaching methods are based on the principles of self-organised learning. The instructors define their roles in terms of Schein’s model of process consulting.
They intervene by questioning the participants in a manner
designed not only to examine their perspectives, but to in-
troduce new perspectives and stimulate the group’s creative
process.

The responsibility for these process remains with the partic-
ipants.

In the context of the learning environment, the students
enjoy the opportunity to increase their observation, com-
munication, co-operation, self-reflection, teamwork and
management skills as well as their self-confidence.

In addition, the course offers the students the chance to
network and develop sustainable work relationships at the
start of their studies.

Baron, R. S.: Group Process, Group Decision, Group Action,
2nd Ed., Buckingham, 2003;

Buchanan, D., Huczynski, A.: Organizational Behavior, 5th
Ed., Harlow, 2004;

Wagner, M., Waldmann, R.: Vom Outdoor-Training zur Tea-
mentwicklung, Welchen Beitrag leisten Hochseilgärten? in:
Jagenlauf, M./Michl, W. (Hrsg.) Erleben und Lernen – Inte-
nationale Zeitschrift für handlungsorientiertes Lernen,
1/2004

The weekend seminar is characterised by team teaching in
a mountain hostel. The team consists of Prof. Dr. Nagengast
and trained tutors selected from participants in the course
„Train the Trainer“. The tutors make it possible to conduct
the training in small „protected“ groups (around 8) and to
give qualified feedback.
# Databases

<table>
<thead>
<tr>
<th><strong>Course title</strong></th>
<th>Databases</th>
</tr>
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<tbody>
<tr>
<td><strong>ECTS</strong></td>
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<td><strong>Course type</strong></td>
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<td><strong>Semester</strong></td>
<td>Winter and summer</td>
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<td><strong>Workload in hours</strong></td>
<td>In-class: 60 hrs. / Self-study: 90 hrs / Total: 150 hrs</td>
</tr>
<tr>
<td><strong>Lecturer</strong></td>
<td>Prof. Dr. Wolfgang Dorner / Prof. Dr.-Ing. Udo Garmann</td>
</tr>
</tbody>
</table>

**Course objectives**
- be able to describe the database design process,
- know the elements of the Entity-Relationship-Model,
- can build an Entity Relationship Model for a specific case,
- can normalize a database design,
- be able to manage a database through a database management system,
- be able to query a database using SQL,
- know the core components and functionalities of a database management system.

**Recommended literature**
- Conolly, Thomas M.; Begg, Carolyn E.: Database systems - A practical approach to design, implementation, and management. 4th edition. Addison-Wesley, an imprint of Pearson Education, 2005

**Teaching methods**
- Classes with exercises and practical training
- Course and document management through E-Learning System iLearn
<table>
<thead>
<tr>
<th><strong>Assessment method</strong></th>
<th>Written examination, 90 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language of Instruction</strong></td>
<td>English</td>
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<tr>
<td><strong>Prerequisites</strong></td>
<td>Basics in Computer Science</td>
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### Informatics I

<table>
<thead>
<tr>
<th><strong>Course title</strong></th>
<th>Informatics I - Intro to Unix and Python</th>
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<tbody>
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<tr>
<td><strong>SWS</strong></td>
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<td><strong>Semester</strong></td>
<td>Winter</td>
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<td><strong>Workload in hours</strong></td>
<td>Total: 150</td>
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<td></td>
<td>In-class: 60 / Self-study: 45 / virtual learning: 45</td>
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<tr>
<td><strong>Lecturer</strong></td>
<td>Prof. Dr. Gökçe Aydos</td>
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</table>

After successful accomplishment, the students can:

**Professional competences**
- summarize the challenges of biomedical text analysis
- list various scientific text resources and differentiate them
- outline the motivation behind ontologies for knowledge representation

**Methodological competences**
- implement shell scripts for automating information retrieval, text processing, and semantics processing
- breakdown given shell scripts into various components, tweak it for further purposes, and localize errors
- apply XPath expressions to extract data from XML files
- evaluate a shell script regarding performance considerations and suggest improvements
- apply regular expressions on text to extract relevant information
- find correlations between concepts (e.g., does caffeine lead to malignant hyperthermia?)
- implement Python programs which can solve simple text processing and automation problems

**Course objectives**
Social competences
- give constructive feedback to peers in context of peer-assessed exercise

Course contents
- data and text processing using the shell
  - biomedical text resources
  - semantics
  - data retrieval
  - data extraction
  - task repetition
  - XML processing
  - text retrieval
  - text processing
  - pattern matching
  - regular expressions
  - tokens & entities & relations
  - semantics processing
  - classes
  - entity linking
  - performance considerations
- programming with Python
  - control structures
  - data structures
  - objects & algorithms

Recommended literature
- Couto, Data and Text Processing for Health and Life Sciences

Teaching methods
Seminar-like classes, interactive exercises during lecture

Assessment method
Written examination, 90 min.

Language of instruction
English

Prerequisites
Introduction to Informatics
Digital Systems Design using FPGAs

<table>
<thead>
<tr>
<th>Course title</th>
<th>Digital Systems Design using FPGAs</th>
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<td>Semester</td>
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<td>Prof. Dr.-Ing. Gökçe Aydos</td>
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<tr>
<td>Course contents</td>
<td>Covered topics:</td>
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<tr>
<td></td>
<td>- Introduction to digital logic</td>
</tr>
<tr>
<td></td>
<td>- Introduction to RISC-V architecture</td>
</tr>
<tr>
<td></td>
<td>- Creating your own RISC-V-based CPU</td>
</tr>
<tr>
<td></td>
<td>- Implementation of the CPU on an FPGA</td>
</tr>
<tr>
<td></td>
<td>- Writing drivers for the CPU</td>
</tr>
<tr>
<td></td>
<td>The course culminates in an individual project implemented on hardware.</td>
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<td>Recommended literature</td>
<td>tba</td>
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<td>Teaching methods</td>
<td>tba</td>
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<tr>
<td>Assessment method</td>
<td>FPGA project and written report</td>
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</table>
**Computer Science**

<table>
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| **Prerequisites** | None |
## Innovation Management for Artificial Intelligence

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<td>Prof. Dr. Patrick Glauner</td>
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### Course objectives
In recent years, plenty of companies have started to invest in AI in order to remain competitive. However, some 80% of AI project fail in reality. There is clearly an acute need in industry for experts that get the big picture of what needs to be done so that AI adds value to companies. This novel course addresses that need. Students will learn a number of challenges, both technical and managerial, that companies typically face when becoming AI-driven companies. They will also learn respective best practices along the entire data journey and how these lead to deployed applications that create real business value.

### Course contents
- Introduction: how AI is changing our society, selected examples of successful and unsuccessful AI projects and transformations
- History and promises of AI: Dartmouth conference, AI from 1955 to 2011, AI winters
- Deep learning era: breakthroughs, DeepMind, promises and hypes, no free lunch theorem, AI innovation in China, technological singularity
- Contemporary problems: regulation, explainable AI, ethics
- AI transformation of companies: opportunities, challenges, best practices
- Case studies on how to turn companies into AI-driven companies
### Recommended literature


### Teaching methods

- Lecture and seminar

### Assessment method

- Seminar presentation

### Language of instruction

- English

### Prerequisite

- None
# Quantum Computing

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<td>Lecturer</td>
<td>Prof. Dr. Patrick Glauner, Prof. Dr. Horst Kunhardt</td>
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## Course objectives
This class provides students with an introduction to Quantum Computing (QC), which looks promising to solve certain computational problems substantially faster than classical computers. QC began in the early 1980s and in recent years, investment into QC research has increased in both the public and private sectors. Students will acquire knowledge in QC and its applications in various domains such as machine learning and cryptography. They will also be able to elaborate it further in the future, for example in projects or further studies. Overall, QC is a cutting-edge field, with many high-pay opportunities for graduates.

## Course contents
- Introduction: history, comparison to traditional computing, applications, business potentials
- Foundations: complex numbers, complex vector spaces
- Systems: deterministic systems, probabilistic systems, quantum systems, assembling systems
- Quantum theory: states, superposition, observables, measuring, dynamics, assembling quantum systems, entanglement
- Architecture: bits and qubits, classical gates, reversible gates, quantum gates, no-cloning theorem
- Selected algorithms: Deutsch's, Deutsch-Jozsa, Simon's, Grover's, Shor's
- Theoretical computer science: limits of quantum computing, complexity classes
Computer Science

- Quantum computers and programming: goals and challenges, decoherence, physical realizations, quantum annealing, adiabatic quantum computing
- Applications: quantum machine learning, quantum cryptography, quantum information theory

**Recommended literature**


**Teaching methods**

- Lecture and seminar

**Assessment method**

- Seminar presentation

**Language of instruction**

- English

**Prerequisite**

- None
Big Data

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<td>Lecturer</td>
<td>Prof. Dr. Patrick Glauner</td>
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</table>

Course objectives
This class provides students with an introduction to the field of big data. Students will acquire a solid foundation in how to design and implement big data systems. They will also learn hands-on how to use industrial big data tools. Furthermore, they will understand the limitations of big data-driven approaches and how they can recognize and solve typical issues in big data, such as data quality and biases. As an outcome, they will be able to work on real-world problems that not only require knowledge in AI, but also an expertise in how to use big data infrastructures, frameworks, libraries and tools.

Course contents
- Introduction: 3 Vs, history of big data, selected big data use cases
- Complexity analysis: time complexity, Ω, Omega, Theta, o and O tilde notations, space complexity, recurrence relations, master theorem, dynamic programming
- Multithreading: parallelism and concurrency, creating threads, global interpreter lock (GIL)
- Databases: ER diagrams, relational databases, database management systems, queries, indexes, normalization, transactions
- Big data architectures: distributed systems, MapReduce, CAP theorem, speedup through GPUs and FPGAs
- Big data, small data, all data: data quality, biases in data sets, small sample size problems
### Computer Science

- **MLOps**: project lifecycle, challenges, operations, principal components, pipelines, best practices
- Quantum computing: qubits, quantum logic gates, quantum computers, quantum algorithms
- Selected big data infrastructures, frameworks, libraries and tools

<table>
<thead>
<tr>
<th>Recommended literature</th>
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<table>
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Industry 4.0

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<td>Prof. Dr. Patrick Glauner</td>
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**Course objectives**

This class provides students with an introduction to Industry 4.0 - the Fourth Industrial Revolution, which is the ongoing automation of traditional manufacturing and industrial practices, using modern smart technology. Students will acquire a solid foundation in how large-scale machine-to-machine communication (M2M) and the internet of things (IoT) are integrated for increased automation, improved communication and self-monitoring and production of smart machines that can analyze and diagnose issues without the need for human intervention. As an outcome, students will be able to work on real-world problems in Industry 4.0. Overall, Industry 4.0 is a cutting-edge field, with many high-pay opportunities for graduates.

**Course contents**

- Introduction: history of the industrial revolution, digital transformation of industry, cyber-physical systems, use cases
- Foundations of industrial automation: automation pyramid, ERP systems, MES, SCADA and HMIs, PLCs, sensors and actuators
- Introducing Industry 4.0: smart factories, main characteristics, value chain, design principles, building blocks, challenges
- Selected research papers
### Computer Science

#### Recommended literature

#### Teaching methods
Lecture and seminar

#### Assessment method
Seminar presentation

#### Language of instruction
English

#### Prerequisite
None
Advanced Automation

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<td>Semester</td>
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<tr>
<td>Lecturer</td>
<td>Prof. Dr. Terezia Toth</td>
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</tbody>
</table>

In the subject Advanced Automation, students obtain an overview on how programmable logic controllers (PLCs) work, as well as basic hardware and software requirements.

They learn the standardized (IEC61131-3) and manufacturer-specific (TIA Portal) programming options. They learn how to use visualization software for the user interface.

The students acquire the basic competence to understand automated processes in the automotive industry, power plants, chemical industry, building technology and transportation. Thus, the students are able to shape the digital transformation of the industry.

**Professional Skills**

The students are familiar with the concepts and components of a modern automation system including the structure and functionality of industrial communication systems, also with regard to safety and security.

They are able to analyse, classify and solve simple tasks in automation technology.
The students know the requirements of hardware and software for a Programmable Logic Controller (PLC). They know the structure and the way a PLC operates. They are able to create PLC programs. By using visualization software, they can demonstrate the processes.

Methodological Skills
The application-oriented knowledge allows the students to compare advantages and disadvantages of the individual industrial bus systems, to examine in contrast the advantages and disadvantages of the individual programming languages to find optimal solutions.

Soft Skills
The students work on problems in a focused and independent way.

They can communicate their solutions both verbally and in writing in appropriate technical language.

They learn from mistakes, can assess and improve their own abilities.

They are able to work actively as a team.

Course contents
1. Function of SPS
   1.1. Hardware requirements
   1.2. Current embodiments
   1.3. Environmental conditions
   1.4. Real-time requirements
2. Programming languages
3. Presentation of automation technology with regard to industrial communication
   3.1. ISO / OSI model in industrial communication
   3.2. Automation pyramid
   3.3. Vertical communication
   3.4. Structure and functionality of common communication systems
| **Teaching methods** | Seminars with practical experience  
Work studies in the lab |
| **Assessment method** | Written examination, 90 min. |
| **Language of instruction** | English |
| **Prerequisites** | None |