



Data Science: Description of modules for incoming students

Fall Semester

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1. English taught modules – Overview and Remarks

The ZHAW - School of Engineering offers numerous English taught modules open for Incoming Exchange Students - some clarifying remarks.

For Bachelor Exchange students, in this document the modules open for the fall semester are listed. The exchange students can choose modules out of all programs. In section 4 you will find explanations of the module descriptions

Students who have German language skills level B2, can of course attend all modules. <https://www.zhaw.ch/de/engineering/studium/bachelorstudium/>

For Master Exchange students, the program is entirely taught in English. ZHAW School of Engineering offers the following eleven master profiles: Aviation, Business Engineering, Civil Engineering, Computer Science, Data Science, Electrical Engineering, Energy and Environment, Mechanical Engineering, Mechatronics and Automation, Medical Engineering, Photonics. Detailed information is available under:

<https://www.zhaw.ch/en/engineering/study/masters-degree-programme/profiles/>

If you need any further information, please feel free to contact: ZHAW School of Engineering Exchange exchange.engineering@zhaw.ch

2. Description of modules

Basics of Statistics

| | |
|----------------------------|------------------------|
| IDAnlass: | 1692459 |
| No.: | t.BA.XX.GSTAT-EN.20HS |
| Title: | Basics of Statistics |
| Organized by: | T IDP |
| Credits: | 4 |
| Module coordinator: | Hofer Christoph (hofc) |
| Teaching language: | German |
| Part of IP: | No |
| Module structure: | Type 2a |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|--|--------------------|------------------------|
| Students know and understand the fundamental concepts of applied statistical inference. | F, M | K1, K2 |
| Students know different approaches to point and interval estimation and can apply these to a sample to make inferences about unknown population parameters and assess statistical accuracy of the estimates. | F, M | K2, K3 |
| Students know and understand fundamental concepts of statistical hypothesis tests and are able to apply suitable tests to practical problems. | F, M | K2, K3 |
| Students are aware of the specifics of academic writing and speaking in English. | D, M, SE | C1-C6 |

Short description

Basics of Statistics introduces students to the fundamentals of statistical inference, i.e. techniques that allow inferences to be drawn about a population from a sample. Special emphasis is put on computational methods that allow the theoretical concepts to be applied in practice.

Module content

Students learn to distinguish between theoretical models and their parameters on the hand, and empirical data (samples) and quantities calculated from these on the other. Fundamental concepts and techniques for point and interval estimation and hypothesis testing are introduced. In addition to classical (analytical) solutions, the module emphasises modern computational techniques (numerical techniques, resampling) that allow for the methods to be widely applied in more complicated practical situations.

Sampling and estimation:

- sampling distributions
- statistics and estimators
- properties of estimators
- different approaches to point estimation
- confidence intervals and their properties

Statistical hypothesis tests:

- Basic principles of hypothesis tests (null and alternative hypotheses, errors of the first and second kind, level and power of a test)
- Special parametric and non-parametric tests for one- and two-sample problems

Students learn to apply the concepts and techniques in practical exercises using the R environment for statistical computing.

Teaching materials

Lecture notes, slides presented in class, exercises

Supplementary literature

Chihara, L.M., Hesterberg, T.C. (2019). *Mathematical Statistics with Resampling and R*, 2nd edition, Wiley, Hoboken. Rice, J.A. (2007). *Mathematical Statistics and Data Analysis*, 3rd edition, Brooks/Cole.

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|----------------|---------|-----------|-------|-----------|
| Graded assignments during teaching semester | Online Quizzes | Written | 2 Quizzes | 1- 6 | 10% |
| End-of-semester exam | Exam | Written | 90 min. | 1- 6 | 90% |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

Digital Assistive Technologies

| | |
|----------------------------|--------------------------------|
| IDAnlass: | 1653939 |
| No.: | t.BA.WM.DAST-EN.19HS |
| Title: | Digital Assistive Technologies |
| Organized by: | T InIT |
| Credits: | 4 |
| Module coordinator: | Alireza Darvishy (dvya) |
| Teaching language: | English |
| Part of IP: | Yes |
| Module structure: | Type 2a |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|---|-------------|-----------------|
| Raise awareness of barriers faced by elderly persons and persons with disabilities. | SK | K1, K2 |
| Familiarity with state of the art in digital assistive technologies. | FK | K1, K2 |
| Familiarity with emerging digital assistive technologies. | FK | K1, K2 |
| Carrying out independent mini-projects to tackle barriers for the target groups. | MK | K3, K4, K6 |

Short description

Students acquire an overview of the applications for current and emerging digital assistive technologies in areas such as healthcare, mobility, habitation, information and communication and also transport, for elderly persons and persons with special needs.

Module content

- Introduction to digital assistive technologies
- Digital assistive technologies in healthcare (robotics, exoskeleton, etc.)
- Digital assistive technologies in information and communication (web and mobile accessibility, speech recognition, conversational user interfaces)
- Digital assistive technologies in habitation (smart homes)
- Digital assistive technologies for mobility (self-driving cars, smart cities, etc.)
- Emerging digital assistive technologies (brain-computer interface, AI-based solutions)
- Mini-project design and development (students), according to service engineering methodology

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|---|------------------|-------|---------|-----------|
| Graded assignments during teaching semester | Mini-project development and presentation | Written and oral | 20 | 4= pass | 20 |
| End-of-semester exam | Final exam | Written | 30 | 4= pass | 80 |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

Digital Health

| | |
|----------------------------|--------------------------|
| IDAnlass: | 1653946 |
| No.: | t.BA.WM.DHEAL-EN.19HS |
| Title: | Digital Health |
| Organized by: | T InIT |
| Credits: | 4 |
| Module coordinator: | Ackermann Philipp (acke) |
| Teaching language: | English |
| Part of IP: | Yes |
| Module structure: | |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|---|-------------|-----------------|
| You understand the healthcare ecosystem and the specific requirements of data-driven applications in personal, clinical, and public health. | F | K2 |
| You know the technical background of IT systems and data standards used in medical/clinical software. | F, M | K2 |
| You have the competencies necessary to support digitalization initiatives in the context of medicine and health care. | F | K2 |
| You are capable of analysing eHealth requirements, of designing parts of digital health solutions, and of planning eHealth projects. | F, M | K2, K3, K4 |

Short description

Healthcare is one of the largest segments of our economy. Digital health is regarded as having a high potential benefit, including improved efficiency and health care quality, personalised medicine, prevention of medical errors, reduction in unnecessary tests, increased patient engagement, etc.

Module content

The “Digital Health” module does provide introductory overviews to the following topics:

- Medical and clinical IT systems
- Electronic Health Records (EHR, “Elektronisches Patientendossier”)
- Medical imaging
- Medical ontologies / data interoperability / HL7 & SNOMED-CT standards
- Medical knowledge management / medical decision support systems in diagnosis, therapy and healthcare
- Mobile eHealth (mHealth) / wearable biosensors / health self-monitoring
- Data analytics and machine learning in medical applications, bioinformatics, and life science (e.g. genomics)

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|---|------------------|-------|---------|-----------|
| Graded assignments during teaching semester | Mini-project development and presentation | Written and oral | 20 | 4= pass | 20 |
| End-of-semester exam | Final exam | Written | 30 | 4= pass | 80 |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

Introduction to Computer and Communication Security

| | |
|----------------------------|---|
| IDAnlass: | 1654938 |
| No.: | t.BA.WM.INCSEC-EN.19HS |
| Title: | Introduction to Computer and Communication Security |
| Organized by: | T InIT |
| Credits: | 4 |
| Module coordinator: | Stephan Neuhaus (neut) |
| Teaching language: | English |
| Part of IP: | Yes |
| Module structure: | Type 2a |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|---|-------------|-----------------|
| Participants can say who wants to hack their systems and why ("threat landscape"). | F, S | K2 |
| Participants know how to obtain an overview of the threat landscape and attack patterns, can name examples of current attacks and have applied attacks themselves in the lab (e.g., hacking passwords, breaking connections). | F | K2, K3 |
| Participants understand how confidentiality, authenticity and integrity of data can be obtained at rest and in flight, and what to look out for. | F, M | K2 |
| Participants know different approaches to analyse the security of services, systems, or products, and have applied some of these in the lab (e.g., vulnerability scanner). | F | K2, K4 |

Short description

The Introduction to Computer Security elective module provides students with an introduction to what to secure, against whom, from what and, above all, how. It also gives tips on where to obtain reliable information.

Module content

- Threat Landscape
- Data security
- Encryption, authentication, integrity
- Protection
- Secure communication
- Anti-Virus, Firewall, IDS, Data-Loss-Prevention
- Analysing and testing security
- Threat-Modeling
- Automatic Security-Testing
- Penetration-Testing («Hacking»)
- Using Information Systems safely
- Humans in the loop

Teaching materials

Slides, labs

Supplementary literature

Will be dealt with separately

Prerequisites

Basic programming (e.g. Java or Python)

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|-----------------------|---------|------------------|-----------|-----------|
| Graded assignments during teaching semester | Multiple-choice tests | Written | 10-15 min. | Pass/fail | 60 % |
| End-of-semester exam | Presentation | Oral | Ap-prox. 10 min. | Pass/fail | 40 % |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

International Management - Asia

| | |
|----------------------------|---------------------------------|
| IDAnlass: | 1653066 |
| No.: | t.BA.WM.INTMAN-EN.19HS |
| Title: | International Management - Asia |
| Organized by: | T IDP |
| Credits: | 4 |
| Module coordinator: | Müller Udo (muud) |
| Teaching language: | English |
| Part of IP: | Yes |
| Module structure: | Type 5b |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|---|-------------|--------------------|
| Understanding of intercultural as well as technical and economic aspects for consumption, manufacturing, purchasing and sales in Asia. Autonomy in evaluating marketable products and services for/ from Asian markets. | F, M | K4, K6 |
| Explore and understand communication norms in the Asian region, knowing styles of communication. Knowing appropriate use of communication and developing an adapted communication style for Asia. | FM, SO, SE | K1, K2, K3, K4, K5 |
| Documentation or development of product or service concepts or potential analysis for/from the Asian market. Documentation of intercultural aspects of life in Asia. Knowledge of demands on products and services in the Asian consumer context. | F, M, SE | K1, K4, K5 |
| Learning the characteristics of digitalisation in Asia. Providing impulses from applications of Asian digitalization. | F, M, SE | K1, K5 |

Short description

Students identify product and management requirements, plus intercultural and economic circumstances in Asia. They acquire the basics for doing business in/with Asia, and study digitalisation and its applications in/ for/with Asia. An 8 to 10-day excursion to Asia ensures the transfer of knowledge.

Module content

- aspects of International Marketing (strategy / market-research)

- Intercultural Management (Communication / Culture & Society)
- International product-policy (p-concept)
- Start-up management (concept / profitability / operational implementation)
- Digitalisation and applications in Asia
- Teaching materials

Teaching materials

Associated presentations

Selected scripts/literature/publications

Tutorial material

Supplementary literature

Intercultural Business Psychology ISBN 978-3662584460 e.g. Fundamentals of Business Studies (Thommen)
e.g. Fundamentals of International Marketing

Prerequisites

Basic knowledge English

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|--|--|--|---------------|-----------|
| Graded assignments during teaching semester (excursion) | Alternative: web posts / documentation / exercise / concept / analysis | Individual or group work (written / digital) | Depending on project | Participation | 40% |
| End-of-semester exam | Documentation of projects / presentation | Individual or group work (written / digital) | PowerPoint project documentation + 15 min project presentation | 1- 6 | 60% |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

Remarks

Mode of knowledge transfer / scheduling: The course takes place as an excursion to Asia, within the first 2 weeks of the lecture-free period. (Directly following the current semester). The course does not take place as a weekly lecture during the semester.

Organisation Procedure: An introduction event takes place at the beginning of the semester (see timetable). There you will receive information on: project topic, contents, procedures, planning, options, group formation, expectations, excursion destination, arrival, visa, preparation, performance record. In addition, a consultation hour will be set up.

Destination Asia: The destination of the Asia excursion is primarily China or, depending on the situation (pandemic, politics, entry regulations, current topics, economy, strong majority of participants' wishes), alternatively Singapore, Malaysia, Indonesia, Vietnam, India or others (a change of destination (depending on the situation) can be done up to and including the first week of the semester).

Number of participants: Limited number of participants per excursion: maximum 30-40 participants (target country China).

Alternative scheduling: Can be agreed in exceptional cases (pandemic-related or for particularly urgent reasons) and in consultation with participants.

Costs: CHF 450. Costs for flight, accommodation, food and visa must be paid by the participants.

Others: Participants book flights on their own, hotels are booked centrally, participants apply for visas on their own. See introduction event.

Risk / Liability / No-Show /: Participants travel at their own risk. For further information see introduction event.

Course completion without trip: Should registered participants are not able to take part in the excursion for a special reason, the course can be completed by means of an alternative service. The same applies to unforeseen total cancellation of the excursion for a special reason, such as the impossibility of implementation due to a pandemic. For further information see Introduction-event.

Language: The excursion language is English. All external conversations during the excursion will be in English. Documents and presentations will be in English. Guest lectures and presentations during the excursion will be in English. Templates and sources are mainly in English. If all participants understand German, conversation within the group can take place in German.

Principles and Applications of the IoT

| | |
|----------------------------|---|
| IDAnlass: | 1653228 |
| No.: | t.BA.WM.PRIAP-EN.19HS |
| Title: | Principles and Applications of the IoT |
| Organized by: | T InES |
| Credits: | 4 |
| Module coordinator: | Rüst Andreas (ruan), Ostertag Martin (ostt) |
| Teaching language: | English |
| Part of IP: | Yes |
| Module structure: | Type 2a |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|--|-------------|-----------------|
| Students can describe how the "Internet of Things" differs from the conventional Internet. Which are the challenges when communicating with things? | F | K2 |
| Students can explain essential communication layers in a TCP/IP stack and can describe how data and web pages are accessed. Furthermore, they understand the role of a service platform (cloud) concerning data storage and aggregation as well as device management. | F, M | K2 |
| Students have an overview of selected IoT technologies on different layers and can discuss their suitability for given applications. They can identify strengths and weaknesses and briefly assess the impact on their own field of work. | F | K2, K3 |
| Students gain hands-on experiences in dedicated lab sessions, both for wireless and wired technologies. They can connect wireless sensors to a database and visualize the variables to gain insight. They have a basic knowledge of what a protocol analyser (wireshark) is and how it can be applied. | F, M | K2, K3 |

Short description

Students acquire a basic understanding of how to connect 'things' to the Internet. How does the IoT work, and what can it achieve? Which technologies do I use for which application? The labs provide hands-on experience on how to connect sensor devices to a cloud-based service platform.

Module content

Lecture

- Internet-of-Things
 - Introduction, fundamental properties, types of applications, types of devices, system architecture
 - Business centred approach: From ‘connecting things’ to ‘taking actions’.
- Resource-constrained devices
 - Embedded systems, MEMS sensors (Micro Electro Mechanical Systems)
- Communication Basics
 - Layering, accessing resources through the Internet (IP/TCP/HTTP)
- Connecting Resource-Constrained Devices to the Internet
 - Wireless Sensor Networks with Gateways, Constrained Application Protocol (CoAP), Message Queue Telemetry Transport (MQTT)
- Service Platforms (Cloud)
 - Processing and storage, databases, visualization, device management
- Personal Networks
 - Connecting devices to your smartphone: Bluetooth Low Energy
- Smart Commercial Buildings
 - Challenges and selected technologies: WiFi, Thread, Bluetooth Mesh
- Smart Factories
 - Challenges and selected technologies: Real-time Ethernet, Time Sensitive Networks (TSN), 5G, OPC-UA
- Smart Cities and precision farming
 - Challenges and selected technologies: LoRaWAN, NB-IoT (Narrow Band-IoT), Sub-GHz technologies
- IT-Security in the context of IoT
 - Threats and countermeasures

Labs

4 labs in groups of 2

- Wireless communication (Bluetooth low energy, Thread, NB-IoT)
- Structuring and accessing data: CoAP, MQTT
- Connecting Sensors to a database and visualization

Teaching materials

Slides and Lab descriptions in Moodle

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|--|---------|---------|-----------|-----------|
| Graded assignments during teaching semester | 4 Labs in groups of 2 with lab reports | Written | report | Pass/fail | 20 % |
| End-of-semester exam | Test | Oral | 20 min. | 1- 6 | 80 % |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

Rapid Software Prototyping for Engineering Science

| | |
|----------------------------|--|
| IDAnlass: | 1654942 |
| No.: | t.BA.WM.RASOP-EN.19HS |
| Title: | Rapid Software Prototyping for Engineering Science |
| Organized by: | T InIT |
| Credits: | 4 |
| Module coordinator: | Spielberger Jürgen (spij) |
| Teaching language: | English |
| Part of IP: | Yes |
| Module structure: | Type 2a |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|--|-------------|-----------------|
| Evaluate the current state of the art in tools for software prototyping. | F, M | K3 |
| Application of requirements engineering techniques for the creation of software prototypes. | F, M | K3 |
| Apply software prototyping tools to solve real-world use cases from a selected field like mechanical engineering, computer science, management, etc. (appealing to students' expertise). | F, M | K3 |
| Identify the most important characteristics of appropriate rapid software prototyping tools for given application scenarios. | F, M | K2 |

Short description

Students acquire tools and techniques for the quick setup of software systems without previous programming knowledge. They use these to solve real-world use cases in various fields like computer science, mechanical engineering and management. They know the most important features of suitable tools.

Module content

Theme 1: Identifying end-users' needs

The first theme of the course provides students with the necessary tools and techniques to be able to properly identify and describe existing or potential end-users' needs. In particular, the following topics will be discussed:

- Requirements engineering techniques for software prototypes specification.
- Conceptual modelling.
- Information systems abstraction.

Theme 2: Automatic generation of software prototypes

After having described potential or existing end-users' needs, this information is used as input for automatically generating software prototypes. For this, we explore tools and technologies that involve:

- Model-driven Engineering.
- Rapid software prototyping tools like inMendix, Zoho Creator, Posity, Kissflow, Outsystems, Airtable, etc.

Theme 3: Exploring practical use cases of digital transformation

Towards the end of the course, students and teachers explore different practical use cases where rapid software prototyping fosters digital transformation. For this, we plan to conduct a world café session for discussing application scenarios. Students are equipped for:

- Presenting and using prototypes for evaluation of products with end-users.
- Discussing how to keep evolving prototypes to reach final products.

Teaching materials

Set of slides

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|--------------|---------|---------|-------|-----------|
| Graded assignments during teaching semester | Report | Written | 1 | 1- 6 | 20% |
| End-of-semester exam | Presentation | Oral | 20 min. | 1- 6 | 80% |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

Remarks

This module is suitable for all courses of study: Aeronautics, Electrical Engineering, Energy and Environmental Engineering, Mechanical Engineering, Systems Engineering, Transportation Engineering, Industrial Engineering and Computer Science.

Safety and Systems Engineering

| | |
|----------------------------|--------------------------------|
| IDAnlass: | 1653061 |
| No.: | t.BA.WM.SASEN-EN.19HS |
| Title: | Safety and Systems Engineering |
| Organized by: | T IAMP |
| Credits: | 4 |
| Module coordinator: | Reif Monika (reif) |
| Teaching language: | English |
| Part of IP: | Yes |
| Module structure: | Type 2a |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|---|-------------|-----------------|
| They understand how to identify hazards and assess the risks of socio-technical systems | D, M | C4 |
| They know the role of standards and how to work with them for the development and homologation of safety related systems | D | C2 |
| They know the basics of systems engineering for the development of safe systems | D | C3 |
| They understand how to develop a product based on requirements and how to show complete traceability of the development process | M | C3 |
| They know the steps of the system safety life cycle and will be able to execute the corresponding work packages for those steps (selection) | M, D | C6 |
| They are familiar with different verification and validation techniques and methods and be able to apply some of them | M | C6 |

| | | |
|---|----|----|
| They learn that safety is an emergent system property requiring an interdisciplinary team and experience this personally through the self-assigned case studies | SO | C5 |
|---|----|----|

Short description

This course introduces students to the most important concepts and methods of safety-related product development through systems engineering approaches. The focus of the course is on the development of electrical, electronic and programmable electronic systems.

Module content

Complete safety lifecycle of technical systems:

- Concept
- Hazard and risk assessment
- System Architecture
- Implementation (HW/SW)
- Verification and Validation
- Commissioning, Operation, Decommissioning

Different aspects within the safety lifecycle:

- Requirement, standards, orders, laws and directives
- Verification in form of methods (qualitative as well as quantitative) such as FMEA, FMEDA, FTA,...
- Verification and Validation in form of techniques such as reviews, audit, test,...
- Development processes (Hardware and Software)
- Technical solutions (Hardware and Software)
- Further input relevant for working on the self assigned case study.

Application within a case study in small groups

Teaching materials

Lecture notes and slides

Supplementary literature

will be given at the beginning of the course

Prerequisites

none

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|------------|---------------|-------------------------|-------|-----------|
| Graded assignments during teaching semester | Case study | Written, oral | Report and presentation | 1- 6 | 40% |
| End-of-semester exam | Exam | Oral | 15 min. | 1- 6 | 60% |

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

Bionics

| | |
|---------------------------|-----------------------|
| IDAnlass | 1684352 |
| No. | t.BA.WVK.BION-EN.20HS |
| Title | Bionics |
| Organized by | T INE |
| Credit | 2 |
| Module coordinator | Musiolik, Jörg (musi) |
| Teaching language | English |
| Part of IP | No |
| Module structure | Type 1a |

Learning objectives

| Objectives | Competences | Taxonomy levels |
|--|--------------|-----------------|
| Students understand the problems of industrial product design and why nature provides sustainable design ideas | F, M | K1, K2 |
| solutions should be systematically analysed using the "Biomimicry" framework | F, M | K3 |
| Own ideas must be developed in multidisciplinary teams | F, M, SO, SE | K5 |
| You will learn and practice cross-curricular cooperation with other students. | SO, SE | K5 |

Short description

Students learn concepts and a process model for applying biomimicry/bionics thinking to the development of sustainable (product) solutions. They work on their own challenge, e.g. developing new drone designs inspired by nature, and expand their English language skills in a scientific context.

Module content

In this module you will:

- discover the ideas behind biomimicry and bionics
- know how to develop a project according to biomimicry principles
- learn to apply the relevant tools
- develop a personal idea along the biomimicry path
- work on your interdisciplinary team skills and be inspired by other students of different curriculums
- expand your English language skills within a scientific context

Teaching materials

Baumeister, D., Tocke, R., Dwyer, J., Ritter, S., Benyus, J., 2013. Biomimicry Resource Handbook: A seed bank of knowledge and best practices. CreateSpace Independent Publishing Platform: Missoula, MT, USA.

Prerequisites

English skills

Exams

| Description | Type | Form | Scope | Grade | Weighting |
|---|--------------|--------|-------|-------|-----------|
| Graded assignments during teaching semester | Presentation | Poster | | | 30% |

| | | | | | |
|--------|--------------------------------|--------|--|--|-----|
| Thesis | Report on Biomimicry Challenge | Report | | | 70% |
|--------|--------------------------------|--------|--|--|-----|

Legal basis

The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.

3. English taught modules – Overview all Programs

Marked in blue, is a suggested set of modules you should not encounter any conflicts in schedule.

| Aviation | | | | |
|--|--|--------------|------|-------------|
| Modules in English for Bachelor Exchange Students | | | | |
| Fall Semester Study year 2021-2022 | | | | |
| Modules / Courses | Module Code | ECTS Credits | Term | Level |
| Aircraft Systems - Structure and Mechanical Systems | t.BA.AV.ACSYS-SM-EN.19HS | 4 | Fall | 3. semester |
| Human Factors | t.BA.AV.HF-EN.19HS | 4 | Fall | 3. semester |
| Physics 3: Atmospheric Physics and Applied Meteorology | t.BA.AVP.PHYMET-EN.19HS | 4 | Fall | 3. semester |
| Maintenance, Airworthiness Management, Regulations and Operator Organisation | t.BA.WV.MARO-EN.20HS | 4 | Fall | 5. semester |
| Numerical and Experimental Aerodynamics | t.BA.WV.NEA-EN.19HS | 4 | Fall | 5. semester |
| Systems Reliability, Availability, Maintainability and Safety | t.BA.WV.RAMS-EN.19HS | 4 | Fall | 5. semester |
| Project Thesis: Aviation | t.BA.AV.PA-EN.19HS | 6 | Fall | 5. semester |
| Aircraft Systems - Control Systems | t.BA.WV.ACSYS-CS-EN.19HS | 4 | Fall | 5. semester |
| Advanced Mechanics | t.BA.WV.ADV-MECH-EN.19HS | 4 | Fall | 5. semester |
| Flight Operations | t.BA.WV.FL-OPS-EN.19HS | 4 | Fall | 5. semester |
| Total Credits | | 42 | | |

Summer Schools – Restricted places available. Please contact Christoph Regli (christoph.regli@zhaw.ch) to check options and requirements once accepted for the exchange semester:

| | | | |
|--------------------------------------|---------------------------------------|---|----------------------------------|
| ATM Summer School | t.BA.WV.ATMSS-EN.19HS | 4 | During the summer semester break |
| Flight Test Laboratory Summer School | t.BA.WV.FTL-EN.19HS | 4 | During the summer semester break |

| Options from other Engineering Programs | | | | |
|--|--|---|------|-------------|
| due to the structure of the curriculum, you can only choose one module from this group | | | | |
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

| Context modules | | | |
|--|---------------------------------------|---|-------|
| Bionics | t.BA.WVK.BION-EN.20HS | 2 | Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | *Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | *Fall |
| Total Context Modules_availability depending on number of students | | 8 | |

*availability depending on number of students

| Computer Science | | | | |
|---|--------------------------------------|--------------|------|-------------|
| Modules in English for Bachelor Exchange Students | | | | |
| Fall Semester Study year 2021-2022 | | | | |
| Modules / Courses | Module Code | ECTS Credits | Term | Level |
| Cloud Computing 1 | t.BA.WV.CCP1-EN.19HS | 4 | Fall | 5. semester |
| Software and System Security 1 | t.BA.WV.SWS1-EN.19HS | 4 | Fall | 5. semester |
| Artificial Intelligence 1 Starts at KW37 | t.BA.WV.AI1-EN.19HS | 4 | Fall | 5. semester |
| Internet of Things 1 | t.BA.WV.IOT1-EN.19HS | 4 | Fall | 5. semester |
| Communication Networks and Services 1 | t.BA.WV.CNS1-EN.19HS | 4 | Fall | 5. semester |
| Scientific Computing | t.BA.WV.SCC-EN.19HS | 4 | Fall | 5. semester |
| Project Thesis: Computer Science | t.BA.IT.PA-EN.19HS | 6 | Fall | 5. semester |
| System on Chip Design | t.BA.WV.SCD-EN.19HS | 4 | Fall | 5. semester |
| Serverless and Cloud Application Development | t.BA.WV.SCAD-EN.20HS | 4 | Fall | 5. semester |
| Digital Image Processing 1 | t.BA.WV.DIP-EN.19HS | 4 | Fall | 5. semester |
| Total Credits | | 42 | | |

| Options from other Engineering Programs | | | | |
|--|--|---|------|-------------|
| due to the structure of the curriculum, you can only choose one module from this group | | | | |
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

| Context modules | | | |
|--|---------------------------------------|---|-------|
| Bionics | t.BA.WVK.BION-EN.20HS | 2 | Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | *Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | *Fall |
| Total Context Modules_availability depending on number of students | | 8 | |

*availability depending on number of students

Electrical Engineering

Modules in English for Bachelor Exchange Students

Fall Semester Study year 2021-2022

| Modules / Courses | Module Code | ECTS Credits | Term | Level |
|--|---------------------------------------|--------------|------|-------------|
| Digital Image Processing 1 | t.BA.WV.DIP-EN.19HS | 4 | Fall | 5. semester |
| Internet of Things 1 | t.BA.WV.IOT1-EN.19HS | 4 | Fall | 5. semester |
| System on Chip Design | t.BA.WV.SCD-EN.19HS | 4 | Fall | 5. semester |
| Communication Networks and Services 1 | t.BA.WV.CNS1-EN.19HS | 4 | Fall | 5. semester |
| Project Thesis: Electrical Engineering | t.BA.ET.PA-EN.19HS | 6 | Fall | 5. semester |
| Automation 1 | t.BA.WV.AUT1-EN.19HS | 4 | Fall | 5. semester |
| Electronics Project 1 | t.BA.ET.PM3-EN.19HS | 4 | Fall | 3. semester |
| Computer Engineering 1 | t.BA.XX.CT1-EN.13HS | 4 | Fall | 3. semester |
| Signals and Systems 1 | t.BA.XX.SISY1-EN.13HS | 4 | Fall | 3. semester |
| Total Credits | | 38 | | |

Options from other Engineering Programs

due to the structure of the curriculum, you can only choose one module from this group

| | | | | |
|---|--|---|------|-------------|
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

Context modules

| | | | |
|--|---------------------------------------|---|-------|
| Bionics | t.BA.WVK.BION-EN.20HS | 2 | Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | *Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | *Fall |
| Total Context Modules_availability depending on number of students | | 8 | |

*availability depending on number of students

Engineering and Management

Modules in English for Bachelor Exchange Students

Fall Semester Study year 2021-2022

| Modules / Courses | Module Code | ECTS Credits | Term | Level |
|--|---------------------------------------|--------------|------|-------------|
| Financial Enterprise Modeling | t.BA.WI.FUM-EN.19HS | 4 | Fall | 3. semester |
| Probability and Statistics 3 | t.BA.WI.WAST3-EN.19HS | 4 | Fall | 3. semester |
| Physics 3: Factory Physics | t.BA.WIP.FAP-EN.19HS | 4 | Fall | 3. semester |
| Advanced Regression Modelling | t.BA.WV.ARM-EN.19HS | 4 | Fall | 5. semester |
| Databases | t.BA.WV.DB-EN.19HS | 4 | Fall | 5. semester |
| Service Engineering Basics | t.BA.WV.SEG-EN.19HS | 4 | Fall | 5. semester |
| Simulation of Business Processes | t.BA.WV.SIM-EN.19HS | 4 | Fall | 5. semester |
| Project Thesis: Engineering and Management | t.BA.WI.PA-EN.19HS | 6 | Fall | 5. semester |
| Total Credits | | 34 | | |

Options from other Engineering Programs

due to the structure of the curriculum, you can only choose one module from this group

| | | | | |
|---|--|---|------|-------------|
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

Context modules

| | | | |
|--|---------------------------------------|---|-------|
| Bionics | t.BA.WVK.BION-EN.20HS | 2 | Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | *Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | *Fall |
| Total Context Modules_availability depending on number of students | | 8 | |

*availability depending on number of students

Mechanical Engineering

Modules in English for Bachelor Exchange Students

Fall Semester Study year 2021-2022

| Modules / Courses | Module Code | ECTS Credits | Term | Level |
|---|---------------------------------------|--------------|------|-------------|
| Thermodynamics | t.BA.XX.FTH2-EN.19HS | 4 | Fall | 3. semester |
| Mechanical Vibrations | t.BA.MT.MDYN-EN.19HS | 4 | Fall | 5. semester |
| Smart Products and Production 1 | t.BA.WV.SPP1-EN.19HS | 4 | Fall | 5. semester |
| Systems and Automation Technology 1 | t.BA.WV.SYAT1-EN.19HS | 4 | Fall | 5. semester |
| Numerical and Experimental Aerodynamics | t.BA.WV.NEA-EN.19HS | 4 | Fall | 5. semester |
| Additive Manufacturing (3D printing) | t.BA.WV.AFV-EN.19HS | 4 | Fall | 5. semester |
| Project Thesis: Mechanical Engineering | t.BA.MT.PA-EN.19HS | 6 | Fall | 5. semester |
| Measurement and Control Systems 1 | t.BA.MT.MRT1-EN.19HS | 2 | Fall | 3. semester |
| Industrial Design: Basic Principles | t.BA.WV.INDE-EN.19HS | 4 | Fall | 5. Semester |
| Total Credits | | 36 | | |

Options from other Engineering Programs

due to the structure of the curriculum, you can only choose one module from this group

| | | | | |
|---|--|---|------|-------------|
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

Context modules

| | | | |
|---|---------------------------------------|---|-------|
| Bionics | t.BA.WVK.BION-EN.20HS | 2 | Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | *Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | *Fall |
| Total Context Modules_ availability depending on number of students | | 8 | |

*availability depending on number of students

System Engineering

Modules in English for Bachelor Exchange Students

Fall Semester Study year 2021-2022

| Modules / Courses | Module Code | ECTS Credits | Term | Level |
|---|---------------------------------------|--------------|------|-------------|
| Product Development for Systems Engineering 3 | t.BA.ST.PM3-EN.19HS | 4 | Fall | 3. semester |
| Computer Engineering 1 | t.BA.XX.CT1-EN.13HS | 4 | Fall | 3. semester |
| Signals and Systems 1 | t.BA.XX.SISY1-EN.13HS | 4 | Fall | 3. semester |
| System on Chip Design | t.BA.WV.SCD-EN.19HS | 4 | Fall | 5. semester |
| Automation 1 | t.BA.WV.AUT1-EN.19HS | 4 | Fall | 5. semester |
| Industrial Design: Basic Principles | t.BA.WV.INDE-EN.19HS | 4 | Fall | 5. semester |
| Project Thesis: Systems Engineering | t.BA.ST.PA-EN.19HS | 6 | Fall | 5. semester |
| Additive Manufacturing (3D printing) | t.BA.WV.AFV-EN.19HS | 4 | Fall | 5. semester |
| Digital Image Processing 1 | t.BA.WV.DIP-EN.19HS | 4 | Fall | 5. semester |
| Total Credits | | 38 | | |

Options from other Engineering Programs

due to the structure of the curriculum, you can only choose one module from this group

| | | | | |
|---|--|---|------|-------------|
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

Context modules

| | | | |
|---|---------------------------------------|---|--------|
| Bionics | t.BA.WVK.BION-EN.20HS | 2 | Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | * Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | * Fall |
| Total Context Modules_ availability depending on number of students | | 8 | |

*availability depending on number of students

Energy and Environmental Engineering

Modules in English for Bachelor Exchange Students

Fall Semester Study year 2021-2022

| Modules / Courses | Module Code | ECTS Credits | Term | Level |
|--|------------------------------------|--------------|------|-------------|
| Project Thesis: Energy and Environmental Engineering | t.BA.EU.PA-EN.19HS | 6 | Fall | 5. semester |
| Total Credits | | 6 | | |

Options from other Engineering Programs

due to the structure of the curriculum, you can only choose one module from this group

| | | | | |
|---|--|---|------|-------------|
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

Context modules

| | | | |
|--|---------------------------------------|---|-------|
| Bionics | t.BA.WWK.BION-EN.20HS | 2 | Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | *Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | *Fall |
| Total Context Modules_availability depending on number of students | | 8 | |

*availability depending on number of students

Transport Systems

Modules in English for Bachelor Exchange Students

Fall Semester Study year 2021-2022

| Modules / Courses | Module Code | ECTS Credits | Term | Level |
|-----------------------------------|------------------------------------|--------------|------|-------------|
| Project Thesis: Transport systems | t.BA.VS.PA-EN.19HS | 6 | Fall | 5. semester |
| Total Credits | | 6 | | |

Options from other Engineering Programs

due to the structure of the curriculum, you can only choose one module from this group

| | | | | |
|---|--|---|------|-------------|
| Digital Assistive Technologies | t.BA.WM.DAST-EN.19HS | 4 | Fall | 5. semester |
| Digital Health | t.BA.WM.DHEAL-EN.19HS | 4 | Fall | 5. semester |
| Introduction to Computer and Communication Security | t.BA.WM.INCSEC-EN.19HS | 4 | Fall | 5. semester |
| Rapid Software Prototyping for Engineering Science | t.BA.WM.RASOP-EN.19HS | 4 | Fall | 5. semester |
| Safety and Systems Engineering | t.BA.WM.SASEN-EN.19HS | 4 | Fall | 5. semester |

Context modules

| | | | |
|--|---------------------------------------|---|---------|
| Bionics | t.BA.WVK.BION-EN.20HS | 2 | ** Fall |
| German for Beginners | t.BA.XX.GFB.17HS | 2 | * Fall |
| Introductions to Swiss Society and Politics | t.BA.XX.ISSP-EN.20HS | 2 | * Fall |
| Total Context Modules_availability depending on number of students | | 8 | |

*availability depending on number of students

**elective courses: availability for next study year will be published in May

4. Module descriptions - Explanatory Notes

General

- The module descriptions provide, beside the overall background specific information on the module learning objectives, the competence and taxonomy levels. Together with the requirements, the students are enabled to select right courses according to their interests and background.
- The module's learning objectives define the direction and intent of the competences the module is designed to impart to students from the teacher's point of view. The learning objectives describe the competences that the students are expected to acquire from the module.
- Competences are defined as a person's capacity to act in a given situation. They thus comprise a statement regarding
- what a learner, in a specific context requiring action on his part, should know, understand (the dimension of knowledge in this context being theoretical and conceptual) and
- be able to do (the dimension of ability and skill in this context being that of principles and techniques), provided that
- the requisite attitude (the dimension of volition in this context being that of appreciation/attitude/motivation)

Competence levels

In all cases where this makes sense and the competences being taught are ones which will be put into concrete effect, the module's learning objectives should cover the following four aspects of competence:

1. Discipline-specific competence (D): the acquisition of various types of knowledge and cognitive ability
2. Methodological competence (M): the ability to put discipline-specific knowledge to use in a planned and purposeful manner. The development of methodological competence should take account of the results and courses of action derived from "graduate qualification" project.
3. Social competence (SO): the ability to shape interpersonal processes effectively and in a manner appropriate to the given situation

Personal competence (P): the ability to organize owns one learning, to manage oneself and to reflect on one's actions.

Taxonomy levels

Using Bloom's taxonomy, these competences can be classified according to six requirement levels (C1 to C6). Bloom's taxonomy serves to reproduce learning objectives and the competences associated therewith in as standardized a manner as possible. It is a prerequisite for accreditation purposes.

| Level | Information | Taxonomy | Process / behavior |
|-------|-------------------------|---------------|--|
| C1 | Remembering Information | Knowledge | Recognizing, remembering Known information can be remembered. |
| K2 | Processing information | Comprehension | Interpreting, illustrating, classifying, summarizing, deducing, comparing, explaining New information can be processed and classified in a broader context. |
| C3 | | Application | Executing, implementing Rules and principles can be applied in defined situations. |

| | | | |
|----|------------------------|------------------------|---|
| C4 | Generating information | Analysis | Differentiating, organizing, assigning A set of facts can be broken down into its component parts. |
| C5 | | Synthesis/ creation | Generating, planning, developing Parts or elements can be combined to create a (new) whole. |
| C6 | | Assessment/ evaluation | Checking, evaluating Judgments can be made as to whether specific criteria have been met. |

Graded assignments

The graded assignment are related to the learning objectives. This requirement applies both with regard to the competences the student is expected to acquire and the level of difficulty of the assignment

| Grade assignments: | As defined in table or as required in writing by teacher at beginning of semester | | | | | |
|--------------------|---|--------------------------|---------|-----------|--------|-----------|
| | description | type | form | scope | grade | weighting |
| | Graded assignments during teaching semester | Field-assignment reports | written | 1 reports | graded | 20% |
| | End-of-semester exam | End-of-modul exam | written | 90 min. | graded | 80% |

Type of assignment

- End-of-module exam
- Wrap-up tasks, project documentation
- Field-assignment reports, minutes of meetings, contributions to online forums, websites
- Examination-review interviews, interviews to review current state of progress
- Talks, poster presentations
- Work samples, scientific / practical, discipline-specific activities, exercises, field experiments, laboratory tests, series of practical tasks to be completed sequentially
- Log books, study diaries, learning journals, e-portfolios
- Group puzzles, group examinations
- Test-question development assignments

Form of assignment

- Written
- Oral
- Execution-based (e.g. for discipline-specific practical activities), demonstrating solution strategies, demonstrating specific skills.