

# International Summer Program (ISP)

Track A: Engineering

Track B: Humanities

Track C: Business and Entrepreneurship



Course Catalog 2025

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# German Language Course

(Compulsory class for all tracks)

## Lecturer(s)

N.N.

## Time

03.06.2024 - 19.07.2024

Mondays 10:00 – 13:00

Wednesdays 16:00 – 19:00

## Location

Mondays Emil-Figge-Straße 59, Seminarraum 2/3 (IBZ)

Wednesdays Emil-Figge-Straße 61, Raum 201

## Course Description

For beginners of German we will offer the German A1.1 course. This class focuses on the introduction to the German language, simple oral and written communication, and basic German grammar. The following competences are imparted: Students who pass the course successfully will be able to provide information about themselves and their country of origin; to greet and to say goodbye; to talk about their family; to express their condition, preferences and resentments; to talk about their hobbies and leisure time; to make and understand time designations; to name prices and quantities; to name things of everyday life (groceries, furniture); to phrase simple questions; to talk about simple activities and events in the past tense.

The textbook "Schritte plus: Deutsch als Fremdsprache" (1 through 6 according to the course level) will be used in class.

## Credits

The German language course meets twice a week throughout the 7 weeks of the lecture period. This corresponds to 4.5 ECTS credit points or 3 credit hours.

### **Exam**

There will be a final written or oral exam.

### **Website**

<https://cms.zhb.tu-dortmund.de/fs2/Anmeldung/index.php#kurscontent>

## **Germany – Politics, Culture and Society**

(Compulsory Class for Tracks A&C, Elective Class for Track B)

### **Lecturer(s)**

Iris-Aya Laemmerhirt

### **Time**

Saturday, 07.06.25, 9 am – 6 pm

Sunday, 08.06.25, 9 am – 6 pm

### **Location**

Emil-Figge-Straße 50, Room 0.406

### **Course Materials**

Information regarding the organization of the course and course materials can be found in the Moodle Classroom (online learning platform)/Website.

### **Course Goal(s)**

The German culture course “Germany – Politics, Culture and Society” is designed to introduce students to Germany’s cultural landscapes and political life. You will gain insights into your host country’s past and present and will be encouraged to contribute your own first-hand experiences to class discussions.

## **Course Description**

The compact seminar covers the following topics:

- General introduction to Germany
- Topic specific workshops on German politics (including short student presentations)
- German history before and after World War II, including reunification (the material includes nonfiction, historical texts and visual material)
- German literature (short overview and some examples)
- German culture (including German food culture, sports, music)
- Migration in Germany: introduction to the topic; discussion of migration including a contemporary German film on the topic
- The Ruhr Area (focus on this specific region, its history and culture)

This course is a mandatory seminar for students who take classes exclusively from Track A – Engineering. If you attend classes from Track B – German and European Studies, you may choose whether to take part in this course. You will meet on two separate days at the beginning and at the end of the program for one day of compact seminar each.

## **Requirements**

Interest in Germany.

## **Credits**

The course will be taught 2 hours/week over a partial semester. This corresponds to 1 credit hour(s) for a regular semester or 1.5 ECTS credits.



Part I:  
Track A – Engineering

# Section 1: Biochemical and Chemical Engineering

**Biochemical and Chemical Engineering**

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## **1.1. Dynamic Simulation**

### **Lecturer(s)**

Prof. Dr. Hannsjörg Freund

### **Time**

Mondays                      13:00 – 16:00

### **Location**

CT Zentralbereich – PC-Pool 3

### **Course Goal(s)**

The aim of the course is that the student obtains an understanding how dynamic process simulators work and is able to formulate, solve and analyze problems in advanced dynamic process simulators.

### **Lecture Content**

The course dynamic simulation teaches the theoretical and practical use of advanced dynamic process simulators. The software used is gPROMS, a commercial equation-oriented modeling and optimization framework, which is widely used in the chemical industry. In order to teach the students the handling and implementation in gPROMS, the following topics are dealt with:

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**Biochemical and Chemical Engineering**

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- Basics of numerical mathematics:
  - Types of dynamic systems
  - Numerical stability
  - Numerical solution of ODEs
- Basics of gPROMS
  - Implementation of basic models
  - Solving basic models in gPROMS
- Object oriented programming in gPROMS
  - Theory of object oriented programming
  - Realization in gPROMS
- Logical conditions and scheduling in gPROMS
- Numerical solutions of partial differential equations
  - Discretization methods
  - Initial and boundary conditions
- Implementation of partial differential equations in gPROMS
- Dynamic optimization
  - Basics of optimization theory
  - Solving of dynamic optimization problems
  - Dynamic optimization of chemical processes in gPROMS

**Requirements**

The students should be able to derive models of chemical processes and to understand given process models.

**Credits**

The course will be taught 3 hours/week over a partial semester. This corresponds to 1.5 credit hour(s) for a regular semester or 1.5 ECTS credits.

**Biochemical and Chemical Engineering**

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**Exam**

Written (computer-based) or oral exam.

**Website**

<https://rec.bci.tu-dortmund.de/lehre/lehveranstaltungen/sommersemester-2024/dynamic-simulation/>

**Moodle Classroom (online learning platform)**

<https://moodle.tu-dortmund.de/course/view.php?id=51418>

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**1.2. Drops, Bubbles and Films**

**Lecturer(s)**

Prof. Dr.-Ing. Norbert Kockmann

**Time**

Wednesdays 10:00 – 14:00

Single Appointment: Wednesday 16.07.25 10:00 – 11:00

**Location**

CT Geschossbau III – G3 – 5.25

CT Zentralbereich –SR ZE 07 for Single Appointment Wednesday

**Course Goal(s)**

Methods of generation, application and basics of discrete multiphase systems

**Lecture Content**

Basics and multiple methods of drops and bubbles formation in liquid/gas and liquid/liquid systems, atomization and gas dispersing systems, application of spray processes. Basics of forming, behavior and application of liquid films. Measurement methods to characterize these systems.

**Requirements**

Basic knowledge in Fluid Mechanics.

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## Biochemical and Chemical Engineering

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### **Tutorials**

Calculation of typical applications in process engineering.

### **Laboratory**

Demonstration of capillary flow and two phase columns.

### **Credits**

The course will be taught 4 hours/week over a partial semester. This corresponds to 2 credit hour(s) for a regular semester or 3 ECTS credits.

### **Exam**

Written exam.

### **Recommended Reading**

All slides presented, will be given to attendants of the course together with recommendations of the literature.

### **Website**

<https://ad.bci.tu-dortmund.de/teaching/lectures-and-exercises/summer-term/bubbles-and-drops-in-chemical-and-biochemical-processes/>

### **Moodle Classroom (online learning platform)**

<https://moodle.tu-dortmund.de/course/view.php?id=35456>

## **1.3. Essentials of Micro Process Engineering**

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**Lecturer(s)**

Prof. Dr.-Ing. Norbert Kockmann

**Time**

Thursdays                      12:00 – 15:30

**Location**

CT Geschoßbau III – G3 – 5.25

**Lecture Content**

Micro-structured apparatuses allow intensified processes with excellent heat transfer, fast mixing and continuous process control. Applications in chemistry, analytics, process engineering and energy technology are covered. Special attention is given to single-phase and multi-phase flows, micromixers, mass and heat transfer, micro heat exchangers, microcontactors, chemical reactions, micro-reactors, continuous production processes and various applications. Manufacturing and design, application, laboratory and miniplant equipment, process intensification.

**Requirements**

Basic knowledge in Fluid Mechanics.



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**Credits**

The course will be taught 4 hours/week over a partial semester. This corresponds to 2 credit hour(s) for a regular semester or 3 ECTS credits.

**Exam**

Written or oral final exam.

**Recommended Reading**

All slides presented, will be given to attendants of the course together with recommendations of the literature.

**Website**

<https://ad.bci.tu-dortmund.de/teaching/lectures-and-exercises/summer-term/essentials-of-micro-process-engineering/>

**Moodle Classroom (online learning platform)**

<https://moodle.tu-dortmund.de/course/view.php?id=19807>

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**1.4. Fundamentals of Synthetic Biology**

**Lecturer(s)**

Prof. Dr. Markus Nett

**Time**

Tuesdays 16:00 – 18:00

+ 7\*2 hours of recorded videos

**Location**

CT Geschoßbau 1 615

**Lecture Content**

Synthetic biology is a young scientific field that seeks to rationally engineer biological systems using approaches and methods common to well established engineering disciplines. In the last 15 years, researchers turned genes and other genetic elements into programmable parts with predictable functions. With these parts, it has become possible to create complex genetic systems that are capable of a wide range of tasks: from the production of sustainable food, fuel and therapeutic drugs to the development of medical diagnostics and treatment tools. This course introduces the basic concepts and techniques of synthetic biology.

When the ISP begins, already 7 lectures will be hold. However, they are recorded and posted online, so you will be able to watch them during or prior to the ISP. The topics are separated from each other, so they are not relevant for later lectures.

**Requirements**

Basic knowledge of genetic and biotechnological engineering.

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**Credits**

The course will be taught 2 hours/week over a full semester. This corresponds to 3 ECTS credits.

**Exam**

Written

**Moodle Classroom (online learning platform)**

<https://moodle.tu-dortmund.de/enrol/index.php?id=51112>

# Section 2: Automation and Robotics

## 2.1. Data-Based Dynamic Modeling

### Lecturer(s)

Prof. Dr. Sergio Lucia Gil

### Time

Lecture                      Wednesdays              10:00 – 12:00

Tutorial                      Thursdays 15:45 – 17:15

### Location

Wednesdays              CT Zentralbereich – HS ZE02

Thursdays                  CT Zentralbereich – SR ZE 07/PC Pool 3

### Lecture Content

Identification of simple models from step responses. Parameter identification: Basic idea, mathematical description of sampled systems, AXR, ARMAX and OE estimation. Modeling using nonlinear black box models (perceptron neural nets, radial-basis-function nets), training. Structures of dynamic nonlinear black box models, quality of neural net models. Model errors: Sources of errors, limits of model accuracy, model accuracy and controller performance.

### Requirements

The students should know basic concept of the Laplace-transformation and transfer functions.

#### Learning Goals

The students can identify the dominant dynamics of a process from step responses and can apply modern methods and algorithms to identify the parameters of linear process models from measured data. They understand the concept of sufficient excitation and the sources of errors in parameter estimation. The students understand the structure of nonlinear black box models and can judge the quality and the limitations of data-based models.

#### Tutorials

The lectures are supported by tutorials, in which the concepts are applied. Some of the tutorials are computer-based and are carried out in a computer lab. The tutorial contents are listed below:

- Step response identification
- Computer lab: step response identification (Optimization-based step response identification (with MATLAB))
- Discrete-time systems / z-Transform
- Computer lab: ARX parameter estimation (with MATLAB)
- Computer lab: prediction error methods (with MATLAB)
- Computer lab: Subspace Identification
- Computer lab: Non-linear black box modeling

#### Credits

The course will be taught 4 hours/week over a partial semester. This corresponds to 2 credit hour(s) for a regular semester or 2.5 ECTS credits.

#### **Exam**

The students are graded with one written exam.

#### **Recommended Literature:**

"System Identification: Theory for the User" by Lennart Ljung

"Filtering and System Identification: A Least Squares Approach" by Michel Verhaegen and Vincent Verdult

#### **Website**

<https://pas.bci.tu-dortmund.de/teaching/teaching-offer/data-based-dynamic-modeling/>

#### **Moodle Classroom (online learning platform)**

<https://moodle.tu-dortmund.de/course/view.php?id=51193>

## Controller Design Fundamentals

### Lecturer(s)

Prof. Dr.-Ing. Sebastian Engell

### Time

Lecture: Tuesdays 16:00 – 18:00

Tutorial: Fridays 14:00 – 16:00

### Location

Lecture: HGII HS4

Tutorial: CT PC-Pool 1

### Lecture Content

- Basic tools for the analysis and design of control systems: Stability definitions, frequency response, Nyquist criterion.
- SISO controller design: Relations of time domain and frequency domain responses, controller types, tuning rules for P/I/D-controllers, loop shaping, robustness.
- Stability criteria for feedback systems with static nonlinearities.



#### **Course Goal(s)**

The students are able to analyse and to solve industrial single loop controller design problems for plants with predominantly linear dynamics. The students understand the basic trade-offs and limitations of controller performance and are able to choose a suitable controllers and to design them for given process dynamics as well as to analyse the reasons for controller malfunctions.

#### **Requirements**

Basic knowledge in single loop controller design for plants with linear dynamics. The concepts of transfer functions should be known.

#### **Credits**

The course will be taught 4 hours/week over a partial semester. This corresponds to 2 credit hour(s) for a regular semester or 2.5 ECTS credits.

#### **Exam**

Written or oral exam.

#### **Website**

<https://pas.bci.tu-dortmund.de/teaching/teaching-offer/controller-design-fundamentals/>

#### **Moodle Classroom (online learning platform)**

<https://moodle.tu-dortmund.de/enrol/index.php?id=52973>

# Section 3: Applied Mathematics

Prof. Dr. Paul-Christian Bürkner

## Time

[illegible]

Tutorial:                      Wednesdys          10:00 – 12:00

## Location

Wednesdays (10:00-12:00) CDI/ZHB – 121

Wednesdays (12:00-14:00) & Thursdays      Mathematik - E 27

### Course Goal(s)

The course gives an introduction to statistical concepts that are useful for research projects in various fields of application and areas of science.

## Lecture Content

The lecture is largely based on the book “Montgomery, D.C. and Runger, G.C. (2007): Applied Statistics and Probability for Engineers, 4th ed., Wiley, New York”.

#### Table of contents:

1. Introduction (random experiments, random variables, sample space)
2. Empirical distributions and exploratory data analysis (frequency tables, bar charts, histograms, distribution characteristics)
3. Probability theory (probability, conditional probability, independence, total probability, Bayes rule)
4. Random variables and their distribution (discrete distributions (Uniform, Bernoulli, Binomial, Hypergeometric, Poisson), continuous distributions (Uniform, Normal), expectation and variance, sampling distribution theory, joint distributions, covariance and correlation)
5. Estimation and confidence intervals (properties of estimators, Maximum Likelihood estimator, confidence intervals)
6. Hypothesis testing (Test of statistical hypotheses (Binomial test, Gaussian test, t-test, approximate tests), power, p-value)
7. Regression (simple / multiple regression, tests concerning regression)
8. Time series analysis (descriptive time series analysis (moving average, differencing), stationarity)

#### Requirements

Except for basic mathematical calculus no prior knowledge is necessary.

#### Tutorials and Laboratory

The tutorial will be used to practice the course material by solving statistical problems and to further discuss student questions. The statistical computer package R will be introduced for statistical programming and used by the

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students to analyze small data sets. This includes theoretical tutorials and software labs.

#### Exam

Written or oral exam.

#### Credits

The lecture/tutorial will be taught 6 hours/week over a partial semester. This corresponds to 3 credit hour(s) for a regular semester or to 5 ECTS credits.

#### Recommended Reading

Basics of Probability and Statistics:

- Bain, L.J., Engelhardt, M. (1992): Introduction to Probability and Statistics, Duxbury Press, Pacific Grove.
- Montgomery, D.C. and Runger, G.C. (2007): Applied Statistics and Probability for Engineers, 4th ed., Wiley, New York.
- Fahrmeir, Künstler, Pigeot, and Tutz (2007) Statistik (6th ed.) (in German).

Basics of R:

- Dalgaard, P. (2008): Introductory Statistics with R, 2nd ed., Springer, New York.
- Venables, W.N. and Ripley, B.D. (2002): Modern Applied Statistics with S, 4th ed., Springer, New York.

#### Moodle-Page

<https://moodle.tu-dortmund.de/enrol/index.php?id=51996>

**Section 3:**

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**Applied Mathematics**

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Part II:  
Track B – Humanities

# Section 4: Courses for Track B



## **4.1. Theories of Literature, Culture, Media**

### **Lecturer(s)**

Sascha Pöhlmann

### **Time**

Tuesdays                      8:30 – 11:45

### **Location**

Emil-Figge-Straße 50 - 0.406

### **Course Description**

The seminar focuses on a selection of the most important texts of literary, cultural, and media theory of the twentieth and twenty-first century. We will introduce a different topic each week to cover as many perspectives as possible—from poststructuralism to queer theory, from ethnicity to remediation. Our critical discussion of these demanding texts will be tied to concrete methodological issues in order to show what it means to put these theories to use. All texts will be provided as a reader.

### **Credits**

3 ECTS will be awarded on the basis of group work and short written assignments.

### **Website**

<https://moodle.tu-dortmund.de/course/view.php?id=51364>

## **4.2. Video Games Literacy**

### **Lecturer(s)**

Burak Sezer

### **Time**

Mondays                      16:00 – 19:30

### **Location**

Emil-Figge-Straße 50 - 0.406

### **Course Description**

This seminar will introduce the concept of „literacy“ to investigate its applications to the genre of video games. We will start with a critical examination of „New Literacy Studies,“ covering media-specific fields („literary literacy,“ „media literacy“) and other topical subjects (such as „climate change literacy“). We will then approach video games to evaluate to what extent the concept of „literacy“ can be extended to video games, and how video games can meaningfully contribute to the discussions on literacy.

### **Credits**

3 ECTS will be awarded on the basis of group work and short written assignments.

### **Website**

<https://moodle.tu-dortmund.de/course/view.php?id=52458>

### **4.3. Advanced Studies II: Biographical Research**

#### **Lecturer(s)**

Holly Patch

#### **Time**

Fridays: June 6, June 13, June 27, July 4, July 11, July 18 from 8:30 am-12:00 pm  
(includes 30-minute break)

Monday: June 16 from 2:00-5:30 pm (includes 30 minute break)

#### **Location**

Monday, June 16: Hörsaalgebäude II – HS 8

Fridays: Emil-Figge-Straße 50 – 0.512

#### **Course Description**

In this advanced seminar on biographical research, students will deepen their understanding of how social structures and historical processes contextualize and help shape individual lives and collective experiences. Discussing methodological approaches and empirical studies, students will learn about how life histories are (re)constructed and narrated. Students will actively engage with the method of “walking biographies,” and this research-based learning will serve as the foundation for the short essay.

#### **Credits**

4 ECTS points will be awarded for active participation, and 2 additional ECTS points will be awarded for completing a short essay.

## **4.4. Democratic Theory**

### **Lecturer(s)**

Rika Althoff

### **Time**

Tuesdays                      10:00 – 14:00 (03.06. - 15.07)

### **Location**

South Campus: Pavillon 2a, room 016

### **Course Description**

In this class, we will explore and discuss what democracy means – and has meant throughout human history. We will look at key texts that have informed what we understand democracy to mean, explore values like equality and liberty and their meaning for democracy, and discuss areas of special interest that might challenge modern democratic institutions in specific ways, for example, indigenous-state relations or supranational organizations.

### **Credits**

3 ECTS for active participation in class which will most likely include a short (group) presentation

Additional 3 ECTS possible for a written paper

## **4.5. Coffee & Cafés – A Beverage & Its Cultural Impact**

### **Lecturer**

Bernd Eßmann

### **Time**

June 5 – July 17, Thursdays 10am - 2pm

### **Location**

Emil-Figge-Straße 50, classroom 0.420

### **Course Description**

Coffee is a ubiquitous beverage that we usually take for granted without reflecting on the impact it has on our culture(s). We will take a closer look at it, specifically the places that it is frequently – & publicly – consumed in, the cafes. Be those traditional cafes (the coffeehouses in Vienna come to mind) or rather recent developments such as Starbucks. In this course we will try to find out their function in our culture(s), to find out whether cafes are, as Ray Oldenburg puts it, "hangouts at the heart of a community". For this we will take a look at the US and Germany, but especially also the perspective of the International Summer Program participants will give us valuable insights.

### **Credits**

3 ECTS for active participation in class which includes a short presentation and a short essay.

# Part III:

## Track C – Entrepreneurship

# Section 5: Business and Entrepreneurship

## **5.1. Business Model Innovation**

### **Lecturer(s)**

Prof. Dr. Tessa Flatten

Theresa Mentzel

### **Time**

June 03, 2-4pm

June 06, 2-6pm

July 14, 2-5pm

July 22, 2-6pm

### **Location**

Seminarraumgebäude 2.028 (Friedrich-Wöhler-Weg 6)

### **Course Content**

In the bachelor seminar Business Model Innovation students get to know the process of business development. In addition to the theoretical teaching of tools for the identification of business ideas, the focus is on practical application. Students develop their own business ideas in teams using the Business Model Canvas and present their results in a final presentation designed to convince potential investors of your idea.

### **Credits**



**Business and Entrepreneurship**

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The course will be taught 8 hours/week over a partial semester. This corresponds to 4 credit hour(s) for a regular semester or 7.5 ECTS credits.

**Website**

<https://tie.wiwi.tu-dortmund.de/en/teaching/summer-term/bmi/>