

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

Sunday, 08.06.25

Location

Tba

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

1.1. Dynamic Simulation

Lecturer(s)

Prof. Dr. Hannsjörg Freund

Time

Mondays 15:00 – 18:00

Location

CT Zentralbereich – PC-Pool 1

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:

Biochemical and Chemical Engineering

- 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

Exam

Written (computer-based) or oral exam.

Website

<https://rec.bci.tu-dortmund.de/lehre/lehveranstaltungen/sommersemester-2023/dynamic-simulation/> (not updated)

Moodle Classroom (online learning platform)

<https://moodle.tu-dortmund.de/course/view.php?id=45449>

Biochemical and Chemical Engineering

1.2. Drops, Bubbles and Films

Lecturer(s)

Prof. Dr.-Ing. Norbert Kockmann

Time

Wednesdays 10:00 – 14:00

Single Appointment Wednesday 17.07.24 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.

Biochemical and Chemical Engineering

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

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.

Biochemical and Chemical Engineering

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>

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

Hörsaalgebäude II – HS7

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.

Biochemical and Chemical Engineering

Requirements

Basic knowledge of genetic and biotechnological engineering.

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=44915>

Section 2: Automation and Robotics

2.1. Data-Based Dynamic Modeling

Lecturer(s)

Prof. Dr.-Ing. Sebastian Engell

Prof. Dr. Sergio Lucia Gil

Time

Lecture Wednesdays 10:00 – 12:00

Tutorial Thursdays 15:45 – 17:15

Location

Wednesdays Hörsaalgebäude I – HS5

Thursdays CT Zentralbereich – SR ZE 07/PC Pool 3

Course Goal(s)

- Concepts of models, which can be identified from data
- Graphical approaches for system identification from step responses
- System identification using optimization (Black-Box Models)
- Judging the quality and the limitations of data-based models
- Theory and basic calculations of the z-transformation

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. The students know the concept of the z-transformation. They

Automation and Robotics

know the structure of nonlinear black box models and can judge the quality and the limitations of data-based models.

Requirements

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

Lecture Content

This lecture deals with different linear and non-linear black-box models.

The identification of the parameters of these models is the first topic, beginning with the identification of simple models from step responses. The goal here is to find a model of a system by looking at its step response. Stable or unstable systems, systems with over- and/or undershoot or oscillating systems can be modeled by simple transfer functions in the Laplace-domain. Methods like Kupfmüller, Schwarze or Strejc can be applied to given step responses. The identifiability of poles and zeros of transfer functions also depends on their position in the complex plane.

The next types of models, which are covered in this lecture, are linear transfer functions in the (sampled) z-domain. An introduction to sampling and problems which arise from sampling are discussed (e.g. Shannon theorem). The z-transformation is introduced and calculation rules e.g. for inverse transformations are discussed and applied. The relation between transfer functions in the s- and z-domains (position of the poles, transformation) is discussed.

An important class of black-box models is described as prediction error methods. The theory behind ARX, ARMAX and OE models is explained in detail. Different methods for the numerical parameter estimation (linear and nonlinear numerical least squares

Automation and Robotics

estimation) are discussed. The capability of representing a systems behavior by such models is highly dependent on the model order. Accuracy and overfitting are discussed.

The last part is about modeling using nonlinear black box models (perceptron neural nets, radial-basis-function nets). Concepts of training and the usage of neural networks as dynamic models are introduced. The quality of neural net models is discussed.

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 (Methods of Kupfmüller, Strejc and Schwarze)
- Computer lab: step response identification (validation of graphical methods / 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)
- Frequency response estimation from data using DFT (with MATLAB)
- 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.

Automation and Robotics

Exam

The students are graded with an assignment (15%) and one written or oral exam (85%). The assignment is an application example, which has to be solved using a computer. The solution has to be described and submitted.

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=45908>

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 3

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/course/view.php?id=45906>

Section 3: Applied Mathematics

3.1. Intensive Course in Statistics for Researchers in Engineering Sciences

Lecturer(s)

Prof. Dr. Paul-Christian Bürkner

Time

Lecture:	Wednesdays	12:00 – 14:00
	Thursdays	12:00 – 14:00
Tutorial:	Wednesdays	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 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.

Applied Mathematics

- Venables, W.N. and Ripley, B.D. (2002): Modern Applied Statistics with S, 4th ed., Springer, New York.

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

tba

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

tba

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

tba

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.

Courses for Track B

Moodle Classroom (online learning platform)

tba

Website

tba

4.4. Democratic Theory

Lecturer(s)

Rika Althoff

Time

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

Location

tba

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 surpanational 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

Section 4:

Courses for Track B

Moodle Classroom (online learning platform)

tba

Website

tba

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 coffeeshouses 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 including a short presentation and short essay

Moodle Classroom (online learning platform)

tba

Website

tba

<https://anglistik.kuwi.tu-dortmund.de/current-students/courses/american-studies/soundtracks-of-fear/>

Part III:
Track C –
Entrepreneurship

Section 5: Business and Entrepreneurship

5.1. Business Model Innovation

Lecturer(s)

Prof. Dr. Tessa Flatten

Theresa Mentzel

Time

tba (3-4 dates)

Location

tba

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

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.

Business and Entrepreneurship

Website

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

Moodle Classroom (online learning platform)

Tba