Syllabus

TECHNISCHE UNIVERSITÄT DARMSTADT

International Summer University

German Engineering and Language
July 05 to August 01, 2020

1. Program Goal

The International Summer University 2020 program is an intensive interdisciplinary four-week program where students will take academic courses in different fields of German engineering, while simultaneously attending intensive German Language classes. This program is primarily designed to provide an insight into the broad field of German cutting-edge engineering, help improve the participants' German language skills and to allow students to discover and understand more about the German culture. Students will focus on selected and highly relevant problem areas, whereby tailor-made modules allow students to develop a deeper understanding in the chosen field of study by focusing specifically in these areas of engineering. In the first two weeks, students will be able to choose between automotive engineering and aeronautical engineering courses; in the last two weeks, students can choose between mechatronic engineering and production engineering.

During the International Summer University Program, students will work together with other students from around the world to enhance their communication skills, problem-solving skills and team-working skills to find solutions to complex practical tasks. The various engineering courses offer students the opportunity to gain an insight into the latest research findings by combining lectures with interactive workshops and group presentations. In addition, students will have several opportunities during company visits, such as Mercedes-Benz, Continental AG, Merck Chemical Engineering Company and EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites) to get hands on experience within the field of engineering. By participating in such activities, students are able to not only improve their cross-cultural communication skills but also get a first look into future employment opportunities within the field of German engineering.

2. Program Prerequisites

The International Summer University: German Engineering and Language Program has no formal pre-requisites, however, please note the following: The participants must be enrolled as students at their home university.

German Language

No German language skills are required. However, for participants with advanced German language skills, classes with a higher level of German will be offered.

Cross-Cultural Competencies Training for Engineers

Cultural awareness is an asset, but not required.

This program will be most useful to undergraduate students with an interest or previous knowledge in Mechanical Engineering. Students studying in similar subject areas within the field of Engineering and Sciences are however also welcome.

3. Program Structure and Course Descriptions

Outside of class time, students are expected to complete the assigned reading and complete homework assignments as well as prepare for workshops and final examinations.

Basic German I – CEFR Level A1, A2 & B1 / 4 ECTS – 2 US/CAN Credits

Course Description:
These courses are designed to teach German speaking, reading, writing and listening skills as well as to introduce vocabulary based on the topics covered in the engineering courses. Texts within the given subject areas will be accompanied by various controlled speaking and writing exercises as well as a number of open discussions.

Level A1 is the lowest level of generative language use. The learner will be able to interact in a simple way to fulfill their everyday basic needs. This course serves as a first introduction to the German language.

Course Goals and Objectives: Level A1 / CEFR
Based on the Common European Framework of Reference (CEFR), the goal of this course is for students to be able to understand and use familiar expressions and very basic phrases aimed at meeting their everyday needs.

Students will be able to introduce themselves and others and can ask and answer questions about personal details such as, where they live, people they know and things they have.
Students will be able to interact through basic conversation in a simple way, provided the other person talks slowly and clearly and is prepared to help.

Level A2 is the level of basic language use. The learner will be able to understand and produce common sentences and phrases of every day communication in familiar contexts.

Course Goals and Objectives: Level A2 / CEFR
Based on the Common European Framework of Reference (CEFR), the goal of this course is for students to be able to understand and use familiar everyday expressions and phrases aimed at the exchange of simple information.

Students will be able to converse about themselves, their families, shopping, work and their environment. Students will be able to exchange information in routine situations about their basic needs in a grammatically simple yet efficient way.

Level B1 reflects the level specification for a visitor to a foreign country. The learner is able to communicate coherently about familiar topics and experiences.

Course Goals and Objectives: Level B1 / CEFR
Based on the Common European Framework of Reference (CEFR), the goal of this course is for students to be able to understand main points of clear standard input on familiar matters regularly encountered in work, school, leisure, etc.

Students will be able to deal with most situations that are likely to arise in every day routines and situations likely to arise whilst travelling in an area where the language is spoken.

Students will be able to produce simple connected texts on topics, which are familiar, or of personal interest. They will also be able to describe experiences and events, dreams, hopes and ambitions, and briefly give reasons and explanations for opinions and plans.

Course Structure: 14 units / 4 weeks = 56 units of 45 minutes each.

Prerequisites: none/A1/A2, depending on the class the student chooses.

Learning Outcomes:

Functions	Grammar	Lexis	Discourse Markers	Topics/Content
Directions Describing habits and routines Giving personal information Greetings Telling the time Understanding and using numbers Understanding and using prices	Adjectives: in their predicative function Comparatives and superlatives Common (un)countable nouns Imperatives (+/-) Modal verbs: “können”, “dürfen”, “müssen” Past simple of “sein” and “haben” Possessive articles Prepositions of place and time Pronouns: simple, personal Questions (alternative and information questions) Statements (positive and negative)	Actions of daily life Food and drink Nationalities and countries Personal information Things in the town, shops and shopping Verbs – basic, separable, regular and irregular	Connecting words: und, aber, oder, dann, danach	Family life Health and body Hobbies and pastimes Holidays Leisure activities Shopping Work and Jobs

Grading:
The final grade is determined in three parts: final exam (50%), oral exam/presentations (25%) and active participation/homework (25%)

- The grade for the final exam is determined as follows: 25% grammar, 25% listening comprehension, 25% reading comprehension and 25% text production (writing).

- The grade for the oral exam/presentation is determined as follows: pronunciation, fluency and lexis and correct usage of grammar (each count for 25% of the oral exam grade).
- 25% of the grade is based on active, thoughtful participation in class activities, demonstrating the student's willingness to learn and preparation for each class ahead of time. The participation grade will be reduced if the student is demonstrably unprepared for, or unwilling to participate in class activities.

Teaching Material:
Motive A1 Kursbuch ISBN 978-3-19-001880-2
Motive A1 Arbeitsbuch ISBN 978-3-19-061880-4

Motive A2 Kursbuch ISBN 978-3-19-001881-9
Motive A2 Arbeitsbuch ISBN 978-3-19-031881-0

Motive B1 Kursbuch ISBN 978-3-19-001882-6
Motive B1 Arbeitsbuch ISBN 978-3-19-031882-7

Cross-Cultural Competencies Training for Engineers / 2 ECTS – 1 US/CAN Credit

Course Description:
Multicultural and often virtual teams have become an indispensable part of the professional life of engineering graduates. (Virtual) cross-cultural negotiation games from business-related contexts are enjoying increasing popularity in professional and educational contexts, especially in higher education. These negotiation simulations represent a profitable as well as innovative action-oriented learning experience to not only broach the issue of cross-cultural competence in the field of work but also to practice it oneself. Together with all actors involved, plausible rules must be formulated across cultural boundaries to enable them to act in a constructive manner. In this seminar, we reflect upon these cross-cultural negotiation processes and then analyze these in order to be able to develop optimal strategies for cultural overlapping situations in a professional engineering contexts. This serves to secure results and transfer learning to other future negotiation situations.

Heterogeneous groups of engineering students must be able to act cross-culturally competent in any international setting to achieve among others the following goals: to negotiate and define cooperation conditions with team members from other cultures and at the same time being able to joint projects virtual cross-cultural meetings.

The aim of this training session is to make people aware of the opportunities, potentials and possible problems of cross-cultural interaction in everyday international engineering life. To this end, we address aspects that are necessary for improving cross-cultural interaction competencies (e.g. recognition of misunderstanding and synergy potentials, ability to conduct multilingual negotiations, empathy). The training language will be mainly in English, sometimes German or Chinese, depending on the group composition of the students and their language preferences.

An additional aim of this training session is introducing students from all over the world to the study engineering experience at German universities and the unique and interesting lifestyle of the Germans in Germany.

Part 1: Cross-Cultural Competence – An Introduction
- Culture with an upper-case or lower-case "C?"

- Dimensions of culture and cultural standards
- Culture shock - myth or fact?
- Cultural competence – how to get along

Part 2: Working in Germany

- German time management – a key to success
- Integration, inclusion or segregation, how to meet local people and to take part in non-university events and activities
- Topics and taboos in Germany – traps and pitfalls in everyday life and behavior
- Germans like to speak English – but who understands their Germish or Denglish?

Part 3: Studying in Germany

- How to communicate with your professors and your co-students: learning the different levels of (in)formality in speaking and writing to different people
- How to study in Germany successfully – become familiar with German students' study strategies and comparisons and contrasts to students' study habits in different areas of the world

Company visits (such as):

- Mercedes-Benz (German automobile manufacturer)
- Continental AG (German automotive manufacturing company)
- EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites)
- MERCK (German chemical, pharmaceutical and life sciences company)

Course Goals and Objectives:

Recognition of cross-cultural similarities and differences between Germany and the home country of the students, and understanding the reasons for those similarities and differences based on academic analysis.

Course Structure: 4 units of in-class lectures and discussions, 5 field trips to corporations.

Prerequisites: none

Learning Outcomes:

- Understanding of different European definitions of the term "culture"
- Understanding and critical reflection on the concepts of "cultural dimensions" and "cultural standards"
- Identifying, judging, and solving critical incidents in cross-cultural situations
- Getting acquainted with and understanding the German university system and its autonomous learning requirements

Grading:

The students' final grade is based on the participation in the seminar as well as a presentation that shows the obtained knowledge can be usefully applied in a real-world context.

The student's presentation will be evaluated on its clarity and organization, the demonstrated understanding of cross-cultural competence, and the ability to apply that understanding to a specific element of cross-culturality. The students are encouraged to select their own topics.

Teaching Material: Hard copies handed out by the teacher in class

Lecture Series: Engineering Courses / 4 ECTS – 2 US/CAN Credits

Academic head: Prof. Dr.-Ing. Heinz-Peter Schiffer

I.) Automotive Engineering: Prof. Dr. rer. nat. Hermann Winner, Prof. Dr. techn. Christian Beidl

Course Description:
The course gives an introduction into automotive engineering by typical problems in this field. In the first session, lectures provide the basics of driving dynamics and Advanced Driver Assistance Systems. The problems are demonstrated by driving experiments and demonstrations. In the second session, lectures give a prospective view of future mobility using regenerative energy in order to fulfil future CO2 targets in 2050. Different powertrain solutions will be introduced and analyzed by explaining the technologies and discussing the advantages and disadvantages.

Contents:
Session 1: Institute of Automotive Engineering (FZD)

- Driving Resistance (Theory and Experiments)
- Braking Dynamics (Theory and Experiments)
- Introduction to Advanced Driver Assistance Systems (ADAS)
- Introduction to research projects at FZD

Session 2: Institute for Internal Combustion Engines and Powertrain Systems (VKM)

- Characterization of different energy storage systems and energy converters
- Analysis of efficiency chains and carbon footprints for Tank-to-Wheel (TTW) and Well-to-Wheel (WTW) approaches
- Introduction in combined powertrain systems

Course Structure:

- Lectures: “Theory of Driving Resistance”, “Theory of Braking Dynamics”, “Introduction to Advanced Driver Assistance Systems (ADAS)”, “Introduction to research projects at FZD”; “Regenerative energy and alterations”, “Energy carrier and respective powertrain systems”, “Technologies of key powertrain components”, “Combined powertrain systems”, “Fuel cell”
- Experiments: Introduction to Griesheim Airfield, experiments and driving demonstrations ADAS; Introduction of hybrid powertrains in RDE scenarios and fundamental researches of E-Fuels on the test benches of vkm
- Analysis of experiments and written exam

Prerequisites:
None

Learning Outcomes:
The students know the basics of driving resistances, braking dynamics and advanced driver assistance systems. In addition, they have received an insight into the research projects of an automotive engineering institute. Furthermore, the students will know the basic functions of different energy storage concepts and the operating modes of various energy converters. In addition, they will be able to carry out

an efficiency and CO2 analysis for powertrain systems as well as for particular powertrain components. Based on the fundamentals and the analysis, the students will understand the advantages and disadvantages of individual and combined systems.

Grading:
A written exam at the end of the last lecture tests the student's knowledge with respect to the theory-lessons.

II.) Aeronautical Engineering, Prof. Dr.-Ing. Jeanette Hussong, Prof. Dr.-Ing. Uwe Klingauf

Course Description

The course deals with the design, function and operation of wind tunnels and the use of basic measurement techniques in fluid mechanics, aerodynamics and flight mechanics. The main course aspects are the preparation of wind tunnel experiments, the use and calibration of pressure measurement sensors and hot-wire anometry. Measurement uncertainties will be discussed, and suitable measurement programs and data analysis methods will be applied using a commercial data processing program (LabVIEW). These fundamentals will be expanded on by carrying out wind tunnel experiments. In the second session, an overview of flight mechanics and flight testing will be given. Students will conduct practical experiments in the institute's research flight simulators to determine the performance of an airplane.

Learning Outcomes

The students will be taught the basics of wind tunnel testing, data acquisition and the use of measurement technology in the field of fluid mechanics, aerodynamics, flight mechanics and flight testing. The benefits and disadvantages of each of these methods can be understood under consideration of physical interrelationships. In addition, an insight into the research work at the Institute of Fluid Mechanics and Aerodynamics as well as the Institute of Flight Systems and Automatic Control can be gained.

Content:
- Introduction of the Institutes and presentation of research work
- Theory of flight mechanics and flight testing
- Theory of pressure measurement methods in wind tunnels
- Theory of hot-wire anemometry
- Practical exercises and wind tunnel tests
- Introduction to and practical experiments in flight simulators
- Data acquisition in the experiments
- Data interpretation and discussion

Course structure

Week 1:

- Introduction of the Institute of Fluid Mechanics and Aerodynamics
- Laboratory tour and presentation of research work at the institute
- Lecture about "Wind tunnels" and "Application of pressure measuring technology in wind tunnels"
- Practical exercise and wind tunnel test: "Preparation and use of the Prandtl tube to determine the wind tunnel velocity".
- Theoretical exercise: "Evaluation of measurement data"
- Lecture about "Hot wire anemometry"
- Practical exercise: "Calibration of hot wire probes for the wind tunnel test"
- Practical exercise and wind tunnel test: "Hot wire measurement of wind tunnel velocity profile"
- Theoretical exercise: "Evaluation of measurement data"

Week 2:

- Introduction of the Institute of Flight Systems and Automatic Control
- Lecture about "flight mechanics and flight testing"
- Practical experiments in the research flight simulators (data acquisition)
- Lab tours
- Lecture about “automatic control”
- Lab tours
- Data analysis and evaluation
- Preparation of oral presentations
- Written exam and oral presentations

Grading
At the end of the course, the acquired knowledge is assessed in a written examination. Students will also present their results from the second session (flight mechanics and flight testing).

III.) Mechatronic Engineering, Prof. Dr.-Ing. Stephan Rinderknecht

Course Description:
The course gives a mechatronic systems engineering perspective on automotive drive trains, which focuses on system integration. We present design methods and system integration techniques in a lecture and convey additional insights in small exercises and a visit in our lab.

Content:

- Design process and documentation
- V model design and quality aspects
- Geometric and functional integration
- Interrelations to automatic control

Course structure:

- Lectures: “Engineering design methods” & “Mechatronic system integration”
- Lab tour: Mechatronic research at IMS
- Theoretical exercise & laboratory experiment: “Investigation of an automated electric drive train”

Prerequisites:
None

Learning Outcomes:
The students understand mechatronic engineering design methods at different levels, i.e., component and system level of automotive drive trains. They are able to apply design methods to improve the system integration of mechatronic systems regarding geometry and function.

Grading:
The knowledge of the students will be assessed in a written exam.

IV.) Production Engineering, Prof. Dr.-Ing. Dipl.-Wirtsch.-Ing. Peter Groche, Prof. Dr.-Ing. Matthias Weigold

Course Description:
The course aims at giving a deeper insight into production technology, production management and energy efficiency as it is developed at the institutes PTW and PtU. Thus, the course focuses, on the one hand, on the special applications of lasers in manufacturing. Laser welding and laser cutting processes will be studied as examples. On the other hand, the use of new, innovative digital technologies in forming technology is demonstrated with respect to process monitoring. Furthermore, workshops in the Process Learning Factory CiP and in the ETA-Factory will give a first, hands-on insight into Lean Production and energy efficiency techniques.

Content:
Session 1: Lasers in manufacturing (PtU), Campus Lichtwiese
- Lecture and introduction: Laser systems in manufacturing
- Cutting and welding with the laser system
- Assessment of the manufactured parts

Session 2: Value Stream Mapping (PTW), Campus Lichtwiese, CiP-Factory
- Value Stream Mapping theory in classroom
- Hands-on application of learned theory in the Learning Factory

Session 3: Digitalization in forming technology (PtU), Campus Lichtwiese
- Applications of Industrial Internet and Industrie 4.0 at shop-floor level
- Value-adding to products through digitalization of forming processes
- Development of autonomous manufacturing processes

Session 4: Energy Value Stream Mapping (PTW), Campus Lichtwiese, ETA-Factory
- Energy Value Stream Mapping theory in classroom
- Hands-on application of learned theory in the ETA-Factory

Course Structure:
- Theoretical Lectures – “Laser systems in manufacturing”, “Digitalization in forming technology”, “Value Stream Mapping”, “Energy Value Stream Mapping”
- Learning Factory/Laboratory/theoretical exercises
- Lab/experimental field tour (PTW, PtU)
- Exam

Prerequisites:
None

Learning Outcomes:
In this course, the theory of laser technology will be taught including the relevant factors of influence. In addition, the acquired theoretical knowledge will be deepened in a short research project executed at the laser processing centre. As a second topic, a theoretical knowledge of the integration of sensor and actuator technology in forming tools will be taught. A practical demonstration of forming tools equipped with sensors for real time process monitoring will deepen the theoretical knowledge. Furthermore, the students will get in touch with the topic “Value Stream Mapping”, a core concept of Lean Production, and with the “Energy Value Stream Mapping”, a suitable tool for detecting energy losses in industrial value streams.

Grading:
The grade will be based on an examination comprising comprehension questions (short questions and multiple-choice questions) and/or a presentation of project results (5-6 students per group).

4. Scheduled Program Plan 2020

TECHNISCHE UNIVERSITÄT DARMSTADT

International Summer University "German Engineering and Language" 2020*

05 July – 01 August 2020

Arrival: Sunday, 05 July

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week I	**July 06**	**July 07**	**July 08**	**July 09**	**July 10**	**July 11**	**July 12**
08:30 – 12:00	Welcome Studying and Living in Hesse	German Language Course	Automotive or Aeronautical Engineering	German Language Course	Cross-Cultural Competencies Training for Engineers	Excursion Munich	Excursion to Munich
Break	Lunch Break	Lunch break	Lunch break	Lunch break	Lunch break		
13:30 – 17:30	City Tour SIM-Cards	Automotive or Aeronautical Engineering	Automotive or Aeronautical Engineering	Automotive or Aeronautical Engineering	Cross-Cultural Competencies Training for Engineers		
	Heinerfest (Fireworks)				Start Excursion to Munich		
Week II	**July 13**	**July 14**	**July 15**	**July 16**	**July 17**	**July 18**	**July 19**
08:30 – 12:00	German Language Course	Company Visits Automotive Engineering Track: Mercedes-Benz (Sindelfingen) Aeronautical Engineering Track: European Transonic Wind Tunnel (Cologne)	German Language Course	Company Visits Automotive Engineering Track: Continental Aeronautical Engineering Track: Sightseeing Flight	German Language Course		Excursion
Break	Lunch break		Lunch break	Lunch break	Lunch break		
13:30 – 17:30	Automotive or Aeronautical Engineering		Automotive or Aeronautical Engineering	Automotive or Aeronautical Engineering	Automotive or Aeronautical Engineering		
			Barbecue/ International Cooking				

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week III	**July 20**	**July 21**	**July 22**	**July 23**	**July 24**	**July 25**	**July 26**
08:30 – 12:00	German Language Course	German Language Course	Technology Museum Speyer and Speyer Old Town	German Language Course	German Language Course	Excursion t.b.c.	
Break	Lunch break	Lunch break		Lunch break	Lunch break		
13:30 – 17:30	Mechatronic or Production Engineering	Mechatronic or Production Engineering		Mechatronic or Production Engineering	Mechatronic or Production Engineering		
				Mathildenhöhe & Rosenhöhe	University Cinema		
Week IV	**July 27**	**July 28**	**July 29**	**July 30**	**July 31**	**July 01**	**July 28**
08:30 – 12:00	German Language Course	German Language Course	Visit to Heppenheim	German Language Course	Handover of Certificate	Departure	
Break	Lunch break	Lunch break	Lunch break	Lunch break	Lunch break		
13:30 – 17:30	Mechatronic or Production Engineering	Mechatronic or Production Engineering	Mechatronic or Production Engineering	Mechatronic or Production Engineering	Farewell		
	Dinner at Ratskeller						

The four-week International Summer University Programme 2020 consists of four components:

1. Intensive German Language Course / mandatory
2. Cross-Cultural Competencies Training for Engineers/ mandatory
3. Engineering Courses and Workshops / mandatory
4. Social Program / voluntary

* Date of issue: 4 December 2019 (individual elements of the program may vary)

5. Grading and Credit Points

The grades are calculated as follows:

Credit Points International Summer University 2020 at TU Darmstadt					
Sessions	**Amount of sessions**	**Workload in hours**	**25-30 h = 1 ECTS**	**1 ECTS = 0,5 US Credit**	**% Grade**
Engineering Credit Points			**6**	**3**	**50**
Lecture Serie: Engineering Courses					
> Automotive Engineering incl. homework and preperation	7	50	2	1	
> Aeronautical Engineering incl. homework and preperation	7	50	2	1	
> Mechatronic Engineering incl. homework and preperation	7	50	2	1	
> Production Engineering incl. homework and preperation	7	50	2	1	
Total: Lecture Serie: Engineering courses	14	100	4	2	25
Cross-Cultural Competencies Training for Engineers					
> Intercultural Training	2	8	0,32	0,16	
> Project work and presentation	2	4	0,16	0,08	
> Homework and preparation		4	0,16	0,08	
Intercultural Experience					
> Company visits	4	12	0,48	0,24	
> Excursions	3	10	0,4	0,2	
> Social Events	4	12	0,48	0,24	
Total: Cross-Cultural Competencies Training for Engineers		50	2	1	25
German Language Credit Points			**4**	**2**	**50**
German Intensive Language Course					
> Class hours	14	42	1,68	0,84	
> Homework, preparation and exam		58	2,32	1,16	
Total: German Intensive Language Course	14	100	4	2	50
Total		**250**	**10**	**5**	**100**