

## Engineering the German Way in a Virtual Setting

Engineering the German Way in a Virtual Setting (EGW) is a 2-week Online-Summer-School in Munich at the University of Applied Sciences. It offers an in-depth study of engineering and cultural business topics with a focus on „The German Way“.

The participants of EGW will get an insight into several best practice companies and learn about their successful methods (see selected levels for engineering excellence, and discuss company-specific topics).

To get most value out of the summer school, we provide a combination of two courses:

Program Overview – 3 Credits in 2 weeks					
Module GET: German Engineering Technology			Module GEP: German Engineering Project		
Academic Courses	Extension	Hours	Academic Courses	Extension	Hours
<ul style="list-style-type: none"> <li>▪ Global German Production Footprint</li> <li>▪ Ergonomics in a German production environment</li> <li>▪ The German workforce and Innovation</li> <li>▪ Engineering Law in German Enterprises and the EU Market</li> </ul>	Online Fact.Tour	10  10  5  5	<ul style="list-style-type: none"> <li>▪ Service Business in Germany (+ off-line team work)</li> <li>▪ Solving real Engineering Problems (industry project) (+ off-line team work)</li> <li>▪ Project Work Presentations</li> </ul>	Online Project	10 (5) 5 (5)  2.5 + 2.5
		30h 5h/ day			
6 days			4 days		



### German Engineering Framework

Course 1: **German Engineering Framework** gives the Students a sound understanding of the German Way of Engineering. Participants learn about similarities and differences in work culture, find out how German companies work, and talk to management representatives while preparing themselves for International Business.

Module GET: German Engineering Technology		
Academic Courses	Extension	Hours
<ul style="list-style-type: none"> <li>■ Global German Production Footprint</li> <li>■ Ergonomics in a German production environment</li> <li>■ The German workforce and Innovation</li> <li>■ Engineering Law in German Enterprises and the EU Market</li> </ul>	Online Fact.Tour	10  10  5  5
		30h 5h/ day
6 days		

The students will understand in which areas of technology Germany has a leading position and which differences exist in business culture compared to other countries.

The course consists of **30 contact hours, industry contacts and** Teamwork with virtual meetings and tasks. The students will be graded for their presentations, the outcome of their group work, written exams and they will receive personal feedback for their work.

**Module name:** *Global German Production Footprint*

- **Credits and Contact Hours:** 10 contact hours
- **Instructor:** Prof. Dr. Reinhard Koether
- **Textbook:** none

**Optional Reading Recommendation:**

**Ferdows, K.:** Making the Most of Foreign Factories. In Harvard Business Review March-April 1997, Reprint No: 97204

**Loch, C. H.; Chick, S.; Huchzermeier, A.:** Management Quality and Competitiveness - Lessons from the Industrial Excellence Award. Berlin, Heidelberg: Springer 2008

**Posth, M., Trevis, I.:** 1,000 Days in Shanghai: The Volkswagen Story - The First Chinese-German Car Factory. John Wiley & Sons 2008

**Slack, N.; Lewis, M.:** *Operations Strategy*, 3e. Financial Times Prentice Hall, Harlow - latest edition

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

Manufacturing industry contributes a major part to Germany's welfare and export surplus. The module starts with a general introduction to manufacturing technologies and their consequences on quality, cost and make-or-buy decisions. The module provides insight in the manufacturing industry and the impacts of qualification, technology and integration of international suppliers. Managing complexity is an important success factor and explains why German products like premium cars, special machinery and business software are well accepted by international customers. This module will address complexity management for products and production processes and shows how German manufacturers use technological tools to provide customer specific products with short lead times. As manufactured goods can be shipped and marketed globally, international aspects are also addressed. This includes the integration of owned factories and of third-party suppliers in foreign countries.

Prerequisites: none

- **Specific Goals for the Module:**

- To provide an understanding of quality and cost of manufacturing technologies
- To explain the contribution of German manufacturing industry with Germany's economic model
- To show how complexity can be managed to fulfill customers' specifications
- To teach the fundamental concepts and techniques for an international production process
- To provide an understanding of how to produce and deliver customized products with a short lead time.

## Program and Module Description EGW

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** Introduction to manufacturing technologies, quality, fixed and variable cost, technologies for make or buy in production, the role of manufacturing industry for Germany's economic model, goals and configuration of an international production network, managing complexity in product and production processes, production network with suppliers, consequence of production in designing and managing the supply chain, distribution of customer specific products with short lead times.
- **Industry contact:** This module is combined with virtual experiences and industry partners.

**Module name:** *Ergonomics in a German production environment*

- Credits and Contact Hours: **10 contact hours**
- **Instructor:** Prof. Dr.-Ing. Johannes Brombach
- **Textbook: none**

**Optional Reading Recommendation:**

**Bridger, R.S.:** Introduction to ergonomics. Taylor & Francis, ISBN 0-415-27378-1

**Schlick, Bruder, Luczak:** Arbeitswissenschaft. Springer, Heidelberg 2010  
ISBN 978-3-540-78333-6

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

This module begins by giving students an overview of the basics of ergonomics with respect to legal and social demands developed in Germany. The core competences of an ergonomist are: anthropo-technics, occupational physiology, human capabilities and environmental interactions. These aspects will be used to generate basic application principles for designing products, tools, workplaces and human-machine interactions. Special attention will be paid to physiological measurements (e.g. EMG) and effects of age, noise prevention, and the design of the workplace with regard to workflow typical for the German industry.

Prerequisites: none

- **Specific Goals for the Module:**

- To provide an understanding of interaction of human beings and work in Germany
- To teach the fundamental concepts and techniques used in analyzing work situations with respect to main stress factors in the German Industry
- To evaluate strategies for goods designed, i.e. healthy and stress reduced work places and machine or product interactions
- To emphasize the social, economic and human demands on ergonomic work
- To support practical applications in lab exercises

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

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6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
  7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
- **Topics covered:** economic, social and legal aspects of ergonomic work and work safety, principle of stress and strain, fatigue and recreation, biomechanics (forces, weights), anthropometrics, environmental factors, seat design, working tools, human machine interaction, software ergonomics.

**Module name:** *The German Workforce and Innovation*

- Credits and Contact Hours: **5 contact hours**
- **Instructor:** Prof. Dr. Mathias Gabrysch
- **Textbook: none**

**Optional Reading Recommendation:**

none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

There is a special culture at German workplaces, which is different from that of an American company. An inside look on how Germans work helps to understand culture as a success factor for business and to be better prepared for a potential internship or career in a German, European or international company.

Additionally, this module provides an overview of the development process and innovation management for complex products like telecommunication equipment. Topics include a general introduction to requirements and success factors for a successful innovation process from a German perspective. Goals, inputs and expectations of all stakeholders inside and outside the company are addressed.

Prerequisites: General understanding of collaboration and interaction of between the functions, marketing and sales, – design, – manufacturing as well as, project management.

- **Specific Goals for the Module:**

- To provide an understanding of the key questions of innovation and some solutions from German best practice companies
- To teach the fundamental concepts and techniques used in product development and innovation

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:**

The students learn to analyze typical cultural aspects in order to understand differences in the social system of a company and use this knowledge to improve the processes and structures. Therefore, they work with appropriate analytical methods and apply their knowledge on real business examples, given by experienced international Managers.

The students learn to understand innovation tasks in product development, research and product development, organization of development projects, strategic product planning, planning and controlling product development processes, innovation management, managing product variants, dealing with technology and design changes, collaborative development projects.



**Module name:** *Engineering Law in German Enterprises and the EU Market*

- **Credits and Contact Hours:** 5 contact hours
- **Instructor:** Prof. Dr. Thomas Wilrich
- **Textbook:** none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

This module provides an overview on the impact of German/ European laws on the engineering and machinery industry. In addition, the impact of technical harmonization on engineering is highlighted and discussed. To complete the most important legal aspects, the responsibilities of managers and other executives when placing products on the European market are covered in detail.

Prerequisites: none

- **Specific Goals for the Module:**

- To provide an understanding of the German/ European law concerning engineering
- To teach the fundamental concepts of the legal basis in technical law in Germany/ Europe

- **Applicable ABET Outcomes:**

After having successfully finished this module, the students will have:

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, *legal* (editors note) and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

- **Topics covered:** European Technical Harmonization (*Single Market*) of company organizational trade law concerning machinery and other technical products, interface of technology and law, the legal impact of standards (ISO EN DIN), the responsibilities of the economic operators (producers, importers and distributors), the responsibilities of managers and other executives.

## German Engineering Culture

Course 2: **German Engineering Culture:** The world becomes more and more globalized. Companies are working in an environment of international competition. However, how to prepare for an international career in the engineering field? Which influences have cultural aspects and what are success factors? What is the difference to other countries?

Module GEP: German Engineering Project		
Academic Courses	Extension	Hours
<ul style="list-style-type: none"> <li>▪ Service Business in Germany (+ off-line team work)</li> </ul>	Online Project	10 (5)
<ul style="list-style-type: none"> <li>▪ Solving real Engineering Problems (industry project) (+ off-line team work)</li> </ul>		5  (5)
<ul style="list-style-type: none"> <li>▪ Project Work Presentations</li> </ul>		2.5 + 2.5
4 days		

The course includes models and methods to analyze and use cultural aspects, explains historical developments in Germany, if needed, and gives the students the opportunity to apply their knowledge and solve real engineering tasks. The Students will be supervised and supported while they are working together in teams. Special focus is given to Engineering Culture in Germany and working abroad.

The course consists of **20 contacts hours**. The students will be graded for their presentations, the outcome of their group work, written exams and they will receive personal feedback for their work.

**Module name:** *Solving Real Engineering Problems*

- **Credits and Contact Hours:** 5 contact hours
- **Instructors:** Prof. Dr. Johannes Brombach
  
- **Textbook:** none

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

In today's complex international business it is important to quickly understand the essential business kernel of an engineering company. The necessary ability and knowledge can be best acquired by solving a real case study of an international engineering company, based in Germany. The module is designed as a case study competition between several student teams. The teams get all the needed tools and methodology to do the consulting job. Based on the same background information about the company, the teams develop their individual business solutions and present their cases to the jury.

Prerequisites: none

- **Specific Goals for the Module:**

- To provide methods and tools to solve a complex business case of an international engineering company
- To analyze and understand the business models, the market specifics and the challenges of the selected business case
- To enable the students to evaluate different strategic directions regarding technology and cost position as well as market viability and success
- To enable the students to develop a short management presentation with all the key findings and their recommendations
- To learn from the other teams and give feedback to each other

- **Applicable ABET Outcomes**

After having successfully finished this module, the students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

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6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- **Topics covered:** The students get an introduction about the necessary tools and methods to solve a complex business case. The module is based on a real business case of a German engineering company in trouble. 3-4 different student teams try to understand the described scenario regarding the most important technological and business aspects and come up with a turnaround strategy. The individual strategies will be presented in a “battle” in front of a jury.
  - **Industry contact:** This module is combined with virtual experiences and industry partners.

**Module name:** *Service Business in Germany*

- **Credits and Contact Hours:** 10 contact hours
- **Instructors:** Prof. Dr. Jörg Elias
- **Textbook: none**

Supplemental materials: Extensive instructor's notes/handouts/overheads

- **Specific Module Information:**

This module is all about entrepreneurship and creative development of industrial service offerings. The module starts with an introduction to current megatrends in industrial services as well as several successful business models in Germany. The module also provides an introduction to necessary tools and techniques to create a new business idea as an entrepreneur. The students are challenged to develop a new service offering in a competition between several teams and present their business cases to a jury. These concepts may include market analysis, competitive analysis, value proposition, service processes and profit/ loss calculation.
- **Specific Goals for the Module:**
  - To analyze and understand business models, market specifics and current megatrends in industrial services
  - To provide methods and tools to create a business case for an innovative service offered in the mobility and transport area
  - To enable the students to develop future market strategies for existing services offered in the light of relevant megatrends
  - To enable the students to evaluate different strategic directions regarding technology and cost position as well as market viability and success
  - To enable the students to develop a short management presentation with all the key elements of the business model for their new business idea
  - To learn from the other teams and give feedback to each other
- **Applicable ABET Outcomes**

After having successfully finished this module, the students will have:

  2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
  3. an ability to communicate effectively with a range of audiences
  4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
  5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

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6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
  7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
- **Topics covered:** The principles of the entrepreneurship process are discussed. The students then are guided through the steps of generating, modifying, sharpening and defining business ideas. A set of tools such as Morphological Analysis, Empathy map and Blue Ocean Strategy are introduced to facilitate this process and to consecutively home in on a viable and profitable business model. The result is documented in a Business Model Canvas, a method widely used to document start-up business ideas. The individual team's service business ideas are presented in a competition in front of a jury.

**Module name:** *Project Work Presentations*

- **Credits and Contact Hours:** 5 contact hours (2.5 + 2.5)
- **Instructors:** Prof. Dr. Johannes Brombach and Prof. Dr. Jörg Elias
- **Textbook: none**

Supplemental materials: none

- **Specific Module Information:**

This module covers the final presentations regarding the two modules “Solving Real Engineering Problems” and “Service Engineering in Germany”. The students are tasked to conduct a concise and focused top management presentation to present the results of their two projects. Those presentations will be evaluated along the dimensions “content”, “fit for top management”, “presentation style” and “presentation layout”. After all presentations have been performed, a winner in each of the two subjects will be awarded.
- **Specific Goals for the Module:**
  - To experiment with different presentation styles to convey an important message in a short presentation
  - To enable the students to develop a short management presentation with all the key elements of the business model for their new business idea and engineering solution respectively
  - To enable students to capture the essence of the competing teams presentations and to select the most important issues
  - To learn to effectively find arguments to evaluate the others key messages
  - To learn from the other teams and give feedback to each other
- **Applicable ABET Outcomes**

After having successfully finished this module, the students will have:

  3. an ability to communicate effectively with a range of audiences
  4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
  5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
  7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
- **Topics covered:** Aspects of good presentations and effective argumentation are discussed and to be applied in the individual team presentations. Basic principles of respectful feedback

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are shared and to be applied in the discussions following each individual team presentation.

- **Industry contact:** This module is combined with virtual experiences and industry partners.