

## Engineering the German Way

Engineering the German Way (EGW) is a 4.5-week 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 at first hand (see selected levels for engineering excellence at work, and discuss company-specific topics with the managers in charge).

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

Program Overview – 6 Credits in 4.5 weeks			
Course GET: German Engineering Framework		Course GEC: German Engineering Culture	
Academic Modules	Extension	Hours	
<ul style="list-style-type: none"> <li>▪ Global German Production Footprint</li> <li>▪ The Digital Factory</li> <li>▪ Service Engineering in Germany (modeling frameworks &amp; perform. metrics)</li> <li>▪ Ergonomics in a German production environment</li> <li>▪ Engineering Law in German Enterprises</li> </ul>	<ul style="list-style-type: none"> <li>Fact.Tour</li> <li></li> <li>Fact.Tour</li> <li>Fact.Tour</li> </ul>	<ul style="list-style-type: none"> <li>12,5</li> <li>11</li> <li>9,5</li> <li>12,5</li> <li>5</li> </ul>	50,5
&			
<ul style="list-style-type: none"> <li>▪ The German workforce</li> <li>▪ German workplace culture</li> <li>▪ Engineering in a foreign country - survive in discussions!</li> <li>▪ R&amp;D Management in a German context</li> <li>▪ Case Study Competition</li> <li>▪ Entrepreneurs for industrial services</li> </ul>	<ul style="list-style-type: none"> <li></li> <li></li> <li></li> <li>Fact.Tour</li> <li></li> <li></li> </ul>	<ul style="list-style-type: none"> <li>5</li> <li>6</li> <li>4</li> <li>12,5</li> <li>10</li> <li>10</li> </ul>	47,5
Social and Cultural Program			
<ul style="list-style-type: none"> <li>▪ Group airport pickup and drop-off</li> <li>▪ Welcome dinner</li> <li>▪ Team building event</li> <li>▪ 3-4 Events (Touring Upper Bavaria, Concentration Camp, Lake Tegernsee, ...)</li> </ul>			
17 calendar days			
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## 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, find out how German companies work during guided tours (e.g. BMW and Siemens), and talk to management representatives while preparing themselves for International Business.

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<b>17 calendar days</b>		

The Student will understand in which areas of technology Germany has a leading position and which differences exist in comparison with other countries.

The course has **50.5 contacts hours** (including labs, which count 50%) and factory tours. The students will be graded by their presentations, the outcome of the group work, written exam tasks and they will receive personal feedback on their work.

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

- **Credits and Contact Hours:** 12.5 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:

- (a) An ability to apply knowledge of management, science and engineering
- (b) An ability to analyze and interpret complex management situations
- (c) An ability to analyze national preferences by historical development
- (d) An ability to identify, formulate and solve problems of engineering management
- (e) An ability to use modern tools necessary for engineering management practice

- **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.
- **Factory tour:** This module is combined with a factory tour.

**Module name:** *The Digital Factory*

- **Credits and Contact Hours:** 11 contact hours
- **Instructors:** Prof. Dr. Andreas Rieger, Prof. Dr. Jürgen Spitznagel
- **Textbook: none**

**Optional Reading Recommendation:**

- **Canetta, L., Redaelli, C.:** “Digital Factory for Human-oriented Production Systems: The Integration of International Research Projects”, 2011.
- **Rother, M. & Shook, J.:** “Learning to See”, latest edition.

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

- **Specific Module Information:**

This module provides an overview of digital factory planning (processes and layout), factory simulation as well as methods and principles of lean production from a German perspective. In addition, the students experience the use of a simulation tool for digital factory planning. Finally, the students are asked to run their own production shop and learn how to improve productivity through lean methods and principles. The integrated module concept supports a systematic analysis, simulation and real practice of processes and structures in a factory environment.

Prerequisites: none

**a) Specific Goals for the Module:**

- To provide students with an understanding of the concept behind digital factory
- To teach methods and tools to plan and test a product and the related production processes from the early design phase to the operative control of the factory
- To use discrete event simulation tools for plant-, line- and/or process-simulation and
- To enable students to learn effective methods to implement lean work systems in production

Thus, the students are able to build up and test a simulation model of a real plant/ production line. They are also able to evaluate the output and the results of plant-, line- and/or process-simulations.

**b) Applicable ABET Outcomes:**

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

- (a) An ability to apply knowledge of mathematics, science and engineering
- (b) An ability to analyze and interpret data
- (c) An ability to identify, formulate and solve engineering problems
- (d) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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- **Topics covered:** Global Challenges for Production, factory targets and factory planning, introduction to Lean Thinking, test of a product and the related production processes, plant-, line- and/or process-simulation, run and improve a production shop.

**Module name:** *Service Engineering in Germany (modeling frameworks & perform. metrics)*

- **Credits and Contact Hours:** 9.5 contact hours
- **Instructors:** Prof. Dr. Jörg Elias
- **Textbook:** none

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

- **Specific Module Information:**

Service businesses are getting more and more important in today's engineering environment. High productivity targets in the automotive Industry can only be achieved by excellent planning of the value chain from Engineering to End-Of-Life. The highest profit margins are also required in service businesses. This module covers the most important aspects and success factors for service excellence in Germany.

Prerequisites: none

- **Specific Goals for the Module:**

- To enable the students to understand the entire automotive value chain from Engineering to End-Of-Life vehicle as an area for service businesses
- To detail the business models, the market specifics and the challenges of the most relevant of the service offerings
- To enable the students to evaluate different service offerings regarding their market viability and future prospects
- To introduce the students to some selected German legal regulations governing relevant service business areas
- To contrast, where effective, the differences of the German service market vs. the US service market

- **Applicable ABET Outcomes**

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

- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (j) a knowledge of contemporary issues

- **Topics covered:** An introduction to the specifics of service business is given covering some important areas for the future development of the offerings. The German automotive sector is quickly introduced and an overview of services along the value chain is presented. Some legal specifics for the European Market regarding car sales, car maintenance and car operation are discussed. New service offerings in the area of mobility and transports are

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given and discussed. This covers the areas of E-mobility, car sharing and autonomous vehicles.

- **Factory tour:** This module is combined with a factory tour to an engineering service provider in the automotive industry.



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

- Credits and Contact Hours: **12.5 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:
  - (a) An ability to apply knowledge of mathematics, science and engineering
  - (b) An ability to analyze and interpret data
  - (c) An ability to identify, formulate and solve engineering problems
  - (d) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

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- **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.
- **Factory tour:** This module is combined with a factory tour.

**Module name:** *Engineering Law in German Enterprises*

- **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 impacts of German/ European laws concerning machinery and other technical products. In addition, the impacts of technical harmonization on engineering are 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:

- (a) An ability to identify the essential aspects of European technical law for foreign manufacturers
- (b) An ability to avoid pitfalls in selling technical products in Germany

- **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), the responsibilities of the economic operators (producers, importers and distributors), the responsibilities of managers and other executives.