Book of modules

International Business and Engineering (M.Eng.)

School of Engineering and Architecture

Heidelberg, June 1\textsuperscript{st} 2019
Overview Module “International Business and Engineering (M.Eng.)”

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<tr>
<td>Business Theory &amp; Research</td>
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<td>Business Law</td>
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<td>Market Analysis</td>
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<td>Mechanics</td>
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<td><strong>PT 2 - Technical Essentials II</strong></td>
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<td>Constructive design</td>
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<td>Electrical engineering</td>
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<td>Different Approaches to Sustainability</td>
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<td><strong>M4 International Framework</strong></td>
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<td><strong>M5 Modern Technologies and Development</strong></td>
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<td><strong>M6 International Collaboration</strong></td>
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<td><strong>M10 Master Thesis</strong></td>
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Module description and module number: Prep. Course Business – 02 – Business Essentials I

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Requirements for enrolment

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<th>Teaching and learning methods</th>
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Learning objectives

This course helps improve general studying capability of students from the very beginning of studies. There is a clear focus on modern learning and teaching methods to optimally prepare students for examinations and enhance later career prospects.

This module is designed to give an introductory overview on business economics for graduated BEngs of mainly Mechanical Engineering. The overall concept of the 20 weeks introductory course is to give the students all the instruments they need in order to successfully study the main program in Business and Engineering. The first half of the preparation course deals with the legal framework of companies and introduces business elements in a logic that one would follow when starting a company. Consequently, the students work in this module on a project that simulates a start-up company.

After completing this module, students have a fundamental understanding of several structures in business management and their associated elements as listed in the subsequent courses. Students have an overview of issues, methods, and approaches of modern economics.

Learning outcomes professional competence

Students are able to name essential influential economic theories and discuss elements of these in a comparative manner. They can show how some theories are related to each other. They are able to research data and fulfill academic standards when writing reports and papers.

Students can explain the German legal system including the actors and institutions and can tell basic principles of the legal system and the content of the relevant laws. They can tell where to get legal assistance from and which legal institution is responsible for what. Students are able to name characteristics of legal company forms as far as they exist in Germany. Furthermore, they can consider and choose a form that fits their purpose regarding representation and profit distribution given circumstances when starting their own company.

The students are able to analyze the potential demand for a product as a tool for market entry and are able to predict the consumer’s behavior in this context. They are able to create a market entry concept in a given situation. They know the basic concepts in marketing and the forces influencing the environment of the company. This module takes into account...
the different activities in marketing such as export and the changes in the marketing mix. The students know the strategic importance of international activities in multinational companies and recognize options for reducing the risk in international business.

After completing the module, the participants are able to transfer best practice models from real life startup companies into a given scenario and are effectively able to found a company themselves.

**Learning outcomes methodology**

The students are able to apply scientific methods, such as the correct use of sources and citation standards so they can successfully complete the Master program and write assignments according to scientific standards.

The students are able to do a target group research in connection with Market Analysis. By means of a case study, students will know how the methodology and the resulting structures can be validated in an organizational setting.

**Learning outcomes social skills**

Being mostly Mechanical Engineers, for many students it will be the first time that they will do group assignments. They are able to engage themselves in discussions and organize as well as finalize a group effort.

**Learning outcomes personal skills**

They are able to organize themselves so that they can finish several different assignments in time. Accordingly, they are able to work in self-organized groups.

**Constructive alignment**

The underlying idea is to ensure individual progress in studies while working on a larger, complex project together with other students. Most competences are tested in an all-in-one major group assignment where the task is to do the first steps in founding a company. Hence, the Startup course plays the major role in providing the relevant information about opening a business. The assignment consists of a demand analysis in the potential market, the legal choice for a company and the first marketing stages. The groups will deliver a report which is written, structured and designed in a scientific manner, which is ensured by the teaching in academic writing during the Business Theory and Research class. The successful development of the group task is ensured by contact times during the Project I course.

Business Theory has a lesser significance therefore a small research task will be carried out to pass the course. The quality of academic writing is assessed in the documentation of the group work. Since business law plays a minor role in the group assignment as well, there shall be an individual effort by the students that deals with legal matters. Actual Marketing and Sales play a smaller role in the project, therefore there shall be a separate written assignment to prove the study efforts. Since the students need to show how to apply the knowledge, an exam is not the appropriate evaluation form, similar to the Business Law arrangements. On the other hand, Market analysis is largely covered by the group project, therefore a protocol is sufficient for passing the course. Finally, the business start-up class is evaluated through a learning diary which ensures regular commitment.

**Course contents**

**Business Theory and Research**

This course is a hybrid: gives an overview on the evolution of Business Economic Theories and the most relevant contents. The other purpose is to convey the principles of academic writing, the style, structure of scientific texts including the rules
Business Law

Students will be introduced to the primary and secondary sources of law, including legislation, case law and the German law system as essential knowledge underpinning any examination of legal principles. The focus will then seek to provide students with the critical knowledge in relation to the main elements of law relevant to business.

This module facilitates the acquisition of knowledge and understanding of contract law principles governing transactions between commercial parties and consumers. This will involve examining the principles governing formation of a business contract and the elements of such principles as offer, acceptance, consideration, and capacity. The module will examine the contractual obligations assumed by the parties, the ability to exclude or limit liability and other restrictions on permissible terms, as well as the law relating to some of the vitiating factors, such as misrepresentation and mistake, undue influence, illegality etc. enabling contractors to escape from a contract.

The module will then go on to look at elements of the law of tort, in particular, the law of negligence as well as employer liability and aspects of employment law.

Market Analysis

Market Analysis teaches students how to describe markets in a quantitative manner. It provides the basis for understanding and carrying out marketing research. Lectures cover theory and potential applications for different analysis tools. Analysis tools include standard tools such as Factor Analysis, Cluster Analysis, Discriminant Analysis, but also basics of more advanced techniques such as Conjoint Analysis (including Hierarchical Bayes Choice Based Conjoint), Structural Equation Modeling, Latent class analysis etc. Students will have a comprehensive overview of:

- Different data analysis techniques and tools
- Factors that are critical for success in Marketing, especially skills needed for sound analysis and decisions about product design, market segmentation and communication
- Factors relevant for a quality market research
- Market Segmentation
- Product Classification
- Target Group analysis
- Market Evaluation

Marketing

This is an overview course with primary focus on marketing products and services to the ultimate consumer. Emphasis is placed on the basic marketing premise that customer needs must be satisfied in order to achieve company objectives. The student gains insight into the complex and interdependent variables involved in developing successful marketing strategies. The strategic marketing planning process is introduced, along with the specific concepts and principles involved in the four key components of the marketing plan - product, price, distribution, and promotion strategies. The content in this introductory course deals with a cross-section of concepts that provide the basics for understanding the marketing planning process, and all of the components of the marketing plan. Topics that will be discussed are:

- Consumer Behavior
- Sinus Milieus
### Sales

This course builds on the important role that the sales function plays and describes how marketing and sales relate to each other. It outlines the roles and responsibilities of a sales department, what makes for effective sales, and the trends affecting sales today.

The course also provides insight into the importance of the sales cycle and how it affects sales planning and business development. Students will examine the elements of an effective sales force as a key component of the organization’s total marketing effort. The course will extend student’s understanding of marketing’s reach and potential impact in achieving its overarching goals. Course objectives include understanding the sales process, the relationship between sales and marketing, sales force structure, customer relationship management (CRM), use of technology to improve sales force effectiveness, and issues in recruiting, selecting, training, motivating, compensating and retaining salespeople. Students learn to apply the discussion topics through an interactive project worked on throughout the course. Topics that will be discussed include:

- Distribution Partner Concepts
- Customer Qualification
- Sales Funnel
- Buying Motives
- Types of Focus Groups
- Elevator Speech
- AIDA Model
- The Four Basic Types of Personalities
- MEDDIC Sales Method

### Business Start-up

This course is designed to provide students with knowledge that enables them to found their own company in the German context. It builds on knowledge that is previously delivered by the other courses in this module and combines the things learned before in terms of legal background, market analysis and marketing. It completes the previous classes with, a creative design thinking the evaluation of ideas and providing best practice examples. Finally, the course will instruct the students how to look for start-up subsidies. Topics include:

- Evaluation and selection of ideas
- Business Modelling
- Best practices
- Design thinking
• Canvas (Value Proposition, Business Model, Strategic Invitation)
• Customer Segments Value Proposition
• Pitchdeck
• Subsidies
• Elements of Financing

Recommended literature for preparation and follow-up


Optional information: Lecturers for the courses in the module:

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<thead>
<tr>
<th>Lecturer</th>
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<tr>
<td>Dr. T. Seidel</td>
<td>Business Theory &amp; Research</td>
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<tr>
<td>N. Balotch</td>
<td>Business Law</td>
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<tr>
<td>C. Appari, D. Friedrich</td>
<td>Market Analysis, Marketing &amp; Sales</td>
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<tr>
<td>F. Kirschstein</td>
<td>Business Startup</td>
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<td>Dr. T Seidel</td>
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## Module description and module number: Prep. Course Business – 02 – Business Essentials II

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### Learning objectives

This module is a continuation of the last one and simulates a running company. In this phase the virtual enterprise is up and running. The students learn about the general tasks of managers and are given the tools to understand how a company works. They understand documentation and learn about the everyday tasks and decisions made by managers on a basic level and start to optimize a running system. In this module, students will acquire well-founded knowledge of accounting and controlling techniques, as well as a fundamental understanding of the principles of orderly bookkeeping. They learn about the basis of investment decisions and the sources of finance. As an auxiliary participants learn necessary business math skills. Finally, the firm is viewed as a place for human interaction where social networks exist, communication problems arise and negotiations take place.

### Learning outcomes

In this module, students understand the flow of money and goods within a production company. They are able to account for the money and values and categorize goods into current and fixed assets and liabilities. They also categorize the money flow based on activities, e.g. operative or financial. Students learn to create and evaluate company data. They are able to write an annual report including a Profit and Loss statement, a balance and a cash flow statement. Furthermore, they are able to interpret the figures and identify potential problems that the firm is facing at the moment and in the future. Additionally, they are able to suggest solutions to these problems and learn how to optimize a company performance. The participants are able to calculate the value on an investment and select the best one among several based on indicators which they are calculating themselves. They are also able to calculate the cost for financing and suggest different sources of money. They are able to tell the advantages and disadvantages of financial sources based on their origin. Finally, they are able to calculate the true cost of finances as a basis for investment decisions.

About controlling, the objective is to understand the instruments as well as the methods of controlling and applying these in the workplace. For this, students will have the ability to apply extensive mathematical skills for calculating key economic indicators of corporate management, which demonstrate the necessary action that needs to be taken to find the adequate solution.

### Learning outcomes methodology

In this module, students learn how to calculate business performance indicators and use them as a basis for evaluation and consequently for optimizing a company. The participants are able to apply accounting and controlling techniques by the end of the class.
Learning outcomes social skills

Students are able to work cooperatively and productively with others. Students openly exchange information and support other students to achieve a common goal. This module teaches students persuasiveness, expressing feelings and thoughts, and ability to actively deal with criticisms. In addition, students are able to participate in discussions using sufficient English vocabulary used in finance.

Especially the part of Human Resources focuses on Social competence. Students are able to mediate between interests, and communicate goals as superiors. They are able to lead negotiations and solve problems in group dynamics. They learn how to select applicants for a position. Students are able to give feedback and to evaluate the performance from the perspective of a manager.

Learning outcomes personal skills

The students will improve their ability to organize their time, to express ideas and thoughts persuasively and to deal with criticism.

Constructive alignment

Given the idea that students shall understand how a company is running with both every day issues and large decisions, the best way to ensure this is to show the understanding by a case study simulation. Students are given a case study to show the ability to analyze data and to use own logic reasoning to consider the strengths and weaknesses of potential courses of actions. The main task here is a continuation from the Business Essentials I course when the case companies are forwarded some years into the future and given a financial framework data. This data needs to be analyzed for systematic weaknesses and a choice for a future investment is being made.

In order to ensure that all the students have the technical skills to carry out these tasks, there is an exam in Business Management and Investment & Finance. The difference in the group task and hence an added value is a documented qualitative discourse in the work groups.

Else, this module teaches students persuasiveness, expressing ideas and thoughts, and ability to actively deal with criticisms. Discussion skills and rhetoric are improved through real life communication situations in Human Resources as well as in Business Management role play.

Course contents

Business Management

Business Studies

This course is designed to engage students with the key concepts, models, debates and problems in the study of business and management. Students will learn about of business organizations, how they function, and how they interact with the environment. The course also considers how these business organizations are managed, including the strategies used to guide them and the decisions involved in the role of the manager. Developing this foundation will be beneficial to the subsequent study of specialized subjects. It is helpful to view this introductory course as an opportunity to develop a solid framework of knowledge, as well as a critical academic approach. Lectures will be given on the following topics:

- Financing – Equity, Bonds, Debts
- Depreciation and Amortization of Fixed Assets (Linear, Dynamic)
- Annual Report (Cash Flow, Balance Sheet, Profit/Loss)
- Key Performance Indices (ROE, ROA, CT)
- Break-Even Point Investment
- Production Costs
- Just-In-Time-Delivery
Controlling and Accounting

This course contributes to the development of students’ managerial potential by explaining the techniques of financial and management accounting and examining their relevance to the broader issues of management decision-making and control. This course outlines and structures the basic challenges and assumptions for companies in the field of Controlling. After laying this foundation together, this course will deduce the "Objectification-Orientated Controlling Approach". With this knowledge, students will understand the need for objectified information, as well as the appropriate quality and quantity, in order to inform proper decision-making as a baseline for successful company management. Topics that will be discussed are:

- General Introduction to Controlling
- Goals, Benefits, Instruments
- Budgeting
- ABC Analysis
- Break-Even
- Make or Buy
- Optimal Batch Quantity
- Optimal Pricing
- Optimal Production Plan
- Planning – Net Plan
- Variable Gross Margin
- Investment Control
- Instruments
- Capital Needs
- Experience Curve
- SWOT Analysis
- Leverage Effect

Bookkeeping

This course is an introduction to the use of accounting information by managers for decision-making, performance evaluation and control. It teaches basic concepts of corporate financial accounting and reporting. This information is widely used in making investment decisions, corporate and managerial performance assessment, and valuation of firms. Students perform economic-based analysis of accounting information from the viewpoint of the users of accounting information (especially senior managers) rather than the specialist (the accountant).

- Controlling cycle
- Operational and strategic controlling
- Targets and Instruments
- Role of the controller
- Financial Accounting
- Double entry bookkeeping (doppelte Buchführung)
- Cost calculation (positions, types)
- Operation Research
- Business Mathematics
Investment, Finance & Business Mathematics

Investment
The focus of this course is on the financial theory and empirical evidence that are useful for investment decisions. The topics covered in this course are:

- Investment Decision Criteria
- Life Cycle
- Asset Management
- Capital Budgeting /Investment Appraisal
- Dynamic Key Figures (Capital Value, IRR, EVA, FCF)
- Continuous Investments

Financing
This course serves as an introduction to finance (corporate financial management and investments). The primary objective is to provide a framework, concepts, and tools for analyzing financial decisions based on fundamental principles of modern financial theory. The approach is rigorous and analytical. The course will analyze corporate financial policy, including capital structure, cost of capital, dividend policy, and related issues. Topics that will be covered include:

- Liquidity Management
- Cash Flow Criteria
- Dividend Policies
- Corporate Financing (Equity capital versus borrowings)
- Weighted Average Capital Costs
- Capital Markets/Financial Markets

Business Mathematics
This course is designed to introduce the mathematics of management. Students learn such concepts as simple interest, discounts, present value, time value of money, compound interest, annuities, sinking funds, capitalized costs, and bonds and stocks. Each of these topics assumes no prior knowledge of the mathematics of finance. Students are introduced to each of the topics in a step-by-step manner with many examples provided.

Human Recourses
- Leadership (Styles, techniques)
- Job interview
- Motivation
- Evaluation
- Feedback
- Work Description
- Organization Chart
- Managing conflicts (Mediation, Moderation)
- Continuous Education
- Change Management
Recommended literature for preparation and follow-up

Mankiew and Taylor (2011): Economics. South Western

Optional information: Lecturers for the courses in the module:

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<th>Lecturer</th>
<th>Title of the course in the module</th>
<th>Contact hours</th>
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<td>Dr. T. Seidel, H. Brenner</td>
<td>Investment &amp; Finance</td>
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<td>Dr. T. Seidel</td>
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<td>H. Brenner</td>
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<td>Flemming, Ljusic, Gontier</td>
<td>German Language (Module 1-2)</td>
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MODULES
TECHNICAL PRECOURSE

MASTER
INTERNATIONAL BUSINESS
AND ENGINEERING
### Module description and module number: Prep Course Technics - 01 Technical Essentials I

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<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
</tr>
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<tr>
<td></td>
<td>Written Exam</td>
<td>Interactive lecture</td>
<td>Prof. Dr.-Ing. Eckart</td>
<td></td>
</tr>
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<td>Student Research</td>
<td>Problem based learning</td>
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<tr>
<td></td>
<td>Project</td>
<td>Group Work</td>
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</tr>
</tbody>
</table>

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### Learning objectives

After completion of this 10-week module, the students on the Master’s program are able to apply basic technical principles in the fields of material sciences, technical mechanics and mathematics to a current technical problem in the context of product development (e.g., design of an e-bike), and to come to an appropriate solution.

The students learn how to use particular tools to solve problems. Thus, they compile or extend their engineering methodology toolbox which they will continue to use in the course of their engineering master’s program and which is essential for the successful completion of the course. Hence, they also train their engineering thought processes towards finding solutions. The technical prep course is developed in line with a relevant design project (e.g., construction of an e-bike).

Students also get to improve their competence in a foreign language.

### Learning outcomes: Professional expertise and methodical skills

After completion of the **Mathematics** module, students can describe forces, torques and other mechanical parameters for the product in question using scalars and vectors. They can calculate with vectors and scalars (triple product, cross product). They can solve systems of mathematical equations. Students can carry out curve sketching, explain the terms (limit, derivation, integral, Riemann integral), and calculate these. They are able to determine the area under a curve and calculate the volume of a solid figure by rotating a plane curve around a straight axis. They can derive and integrate functions with several variables. Furthermore, students can rank and solve differential equations (ordinary differential equations). They can apply the fundamentals of numerical methods.

On the basis of **technical mechanics**, students acquire the ability to solve problems concerning the statics of rigid bodies for planar and three-dimensional cases in the central and the general force system. They specifically apply the mathematical methods they have learnt, such as vector calculations, to solve the problem. Students are able to define the statics of certain systems and train this ability by performing calculations for a given project (e.g. frame of e-bike). In addition, students can calculate the deformation of elastic bodies and develop and solve material structure equations for torsion, bending and normal forces. They are familiar with the fundamentals of kinetics and fluid mechanics, and can apply the law of energy conservation to a current topic (e.g., e-bike). Students are able to handle terms such as the “finite element method” and to apply them appropriately.

In **materialscience** students acquire the ability to make decisions on which material groups are relevant to the given problem. It enables them to classify and describe materials e.g. in relation to their properties or their applications. The students can describe the properties of metal materials and are able to select suitable materials for industrial products (e.g., frame of e-bike), and to determine the required material finishes. Students are able to describe the essential failure mechanisms of metal materials and to assess damaged or destroyed components e.g. on the basis of the fracture surface.
Students can describe the essential material testing procedures, in particular static and vibration testing, and use the material parameters thus derived as a basis for argument.

**Learning outcomes: Social skills**

The students are able to discuss topical issues in the group, reach a consensus agreement and take responsibility for the solution.

**Learning outcomes: Personal skills**

The students can target their work approach and time management in a specific and complex research project, thus ensuring full independence and responsibility for successful completion.

**Constructive alignment**

The module length of 10 weeks is chosen deliberately to enable students on the one hand to master the mathematical principles and to complete the course with a consistent examination (written exam), and on the other to handle a technical problem in the context of a research project.

**Course contents**

**Subject area: Mathematics**
- forces, torques
- units
- scalars, vectors
- triple product, cross product
- equation systems, curve sketching (limit, derivation, integral, Riemann integral)
- ordinary differential equations
- introduction to numerical methods

**Subject area: Materials science**
- classification of materials
- atomic structure, bonds, crystalline structures and faults, diffusion
- alloys
- elasticity/plasticity of materials, strengthening mechanisms
- failure mechanisms
- material testing
- non-metal materials

**Subject area: Technical mechanics**
- statics of rigid bodies
- deformation of elastic bodies
- material structure equations for torsion, bending, normal forces
- fundamentals of kinematics
- fundamentals of fluid mechanics
- law of energy conservation
- basic terms and applications of the finite element method (FEM)

**Recommended literature for preparation and follow-up**

- Engineering Mechanics Statics, by Hibbeler, R.C., Pearson-Prentice Hall. (Latest ed.)
2013

- Ryan: Calculus for Dummies, For Dummies Publ., ? (2012)

Optional information: Lecturers for the courses in the module:

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Title of the course in the module</th>
<th>Weekly hours</th>
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<tr>
<td></td>
<td>Materials science I</td>
<td>40</td>
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<tr>
<td></td>
<td>Mechanics</td>
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SRH Hochschule Heidelberg, Degree Program: International Business & Engineering (M.Eng.)

Module description and module number: Prep Course Technics - 02 Technical Essentials II

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<th>Frequency</th>
<th>Duration of the module</th>
<th>Type (* details or exceptions in the “Use” field)</th>
<th>ECTS points</th>
<th>Student's workload</th>
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<tr>
<td></td>
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<td></td>
<td></td>
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<td>200 hrs.</td>
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Note: the basis for calculation is generally 1 ECTS = 25 hrs. Deviations are covered exclusively by Appendix 2 (Bachelor) and 2a (Master) of the SPO

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<th>Requirements for enrolment</th>
<th>Use / Restrictions</th>
<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
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<td>Written Exam</td>
<td>Interactive lecture</td>
<td>Prof. Dr.-Ing. Eckart Theophile</td>
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<td></td>
<td></td>
<td>Project Work</td>
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<tr>
<td></td>
<td></td>
<td>student research project</td>
<td>Group Work</td>
<td></td>
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</table>

Learning objectives

After completion of this 10-week module, students can design essential components of a topical technical product (e.g., an e-bike) and create a CAD model thereof. Building on the previous module, the students can apply the results gained (material used, strengths, force calculations) and implement them in the design (e.g., construction of the e-bike frame). The students extend their language competence in the same foreign language as that taught in technical essentials I.

Learning outcomes: Professional expertise and methodical skills

After the electrical engineering course, the students are able on the one hand to apply the basic electrical engineering principles required for engineering professions to everyday problems, and on the other to generally apply the principle of energy storage technology to the current project (e.g., e-bike).

Materials sciences II enables students to utilize fundamental knowledge of innovative materials (e.g., ceramics, polymers, fiber reinforced composites) in selecting alternative materials for a given product.

After completion of the manufacturing course, students are able to identify the principal production methods of metal materials and innovative materials, and to take the strengths and risks of the production technologies into account. The Design course enables them to create graphical representations of geometrical bodies and simple components both as multiview projections and as three-dimensional views. Apart from solid bodies, the students can also produce sections through such bodies in technical drawings complying with the standards. Furthermore, they can depict dimensions, tolerances, joints, surface finishes and typical properties of cast components in accordance with the standards. The students are able to apply what they have learnt to the creation of various types of drawings (e.g., production and assembly drawings). After introduction to the structure and methodology of a CAD system (e.g., Autocad, CATIA V5, Inventor) students are able to use their knowledge of technical drawing and design systems in the context of simple construction tasks using this software.

The Electrical engineering course enables students to describe the basic principles of electrical charges and fields. The rules of electrical resistance are explained, and coils, capacitors and memristors demonstrated. Forces exerted on charges are calculated. Students are able to calculate and design simple, passive circuits, they are introduced to the concepts of the electrical and the magnetic field. Time varying electrical and magnetic fields, as well as selected principles of energy storage are introduced.

In Materials science II, students can enhance and apply their knowledge of aluminum alloys, steel materials, ceramics and fiber reinforced composites in the context of a topical product (e.g., e-bike). Thus, they hone and strengthen their problem-oriented thinking abilities.
In Manufacturing, the students are enabled to determine suitable production methods for the manufacture of the product in question (e.g., e-bike), select the appropriate production techniques, and plan the actual production of the product using these techniques.

**Learning outcomes: Social skills**

The students are able to discuss topical issues in the group, reach a consensus agreement and take responsibility for the solution.

**Learning outcomes: Personal skills**

The students can target their work approach and time management in a specific and complex research project, thus ensuring full independence and responsibility for successful completion.

**Constructive alignment**

The module length of 10 weeks is chosen deliberately to enable students to tackle a technical problem in-depth and using interdisciplinary methods in the context of a written exam and a research project.

**Course contents**

**Subject area: Design**
- depiction of geometrical bodies with multi-view projection and 3-dimensional views
- sections through geometrical bodies
- dimensions
- tolerances
- surface qualities
- representation of joint connections
- introduction to CAD systems (e.g. Inventor or Catia)

**Subject area: Materials science II (selection of material groups varies according to the given topic)**
- steel materials (in-depth)
- aluminum alloys and ceramics
- fiber reinforced composites

**Subject area: Manufacturing**
- classification and systematization of manufacturing processes
- primary forming (overview of the various casting processes and molds)
- transforming (milling processes)
- separating techniques (geometrically defined and undefined processes)
- joining processes (overview)
- coatings (overview)
- changing material properties (overview, sintering)

**Subject area: Electrical Engineering**
- basic principles of electrical charges and fields
- basic principles of electrical resistance
- coils and capacitors
- memristors in conjunction with voltage sources
- power sources in linear and nonlinear circuits
- magnetic fields and electromagnetic induction
- alternating and direct current circuit
Recommended literature for preparation and follow-up

- Fundamentals of modern manufacturing by M.P. Goover, 4th edition or higher, Wileys

Optional information: Lecturers for the courses in the module:

<table>
<thead>
<tr>
<th>Lecturer</th>
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<th>Weekly hours</th>
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<tr>
<td></td>
<td>Electrical engineering</td>
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<td></td>
<td>Materials science II</td>
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<td></td>
<td>Manufacturing</td>
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<td>German language</td>
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MODULES MAIN COURSE

MASTER
INTERNATIONAL BUSINESS
AND ENGINEERING
Module description and module number: M1+2 Energy and Sustainability

<table>
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<th>5-week block</th>
<th>Frequency</th>
<th>Duration of the module</th>
<th>Type (* details or exceptions in the &quot;Use&quot; field)</th>
<th>ECTS points</th>
<th>Student's workload</th>
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<tr>
<td></td>
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<td>In class</td>
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<td>400 hrs. (100 %)</td>
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<td>220 hrs. (55 %)</td>
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Note: the basis for calculation is generally 1 ECTS = 25 hrs. Deviations are covered exclusively by Appendix 2 (Bachelor) and 2a (Master) of the SPO

<table>
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<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
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Learning objectives

Learning outcomes

After this module students are able to explain the role of energy as well as its social, legal and economic scopes. Students can independently identify complex issues, develop appropriate models and develop solutions, taking into account the technical, economic, environmental and social dimension into the solution processes of tasks related to energy supply and production. At the end of this course, students will have acquired the skills needed to structure, analyze and evaluate energy-related problems.

Students will be able to state relevant scientific theories, ideas, methodologies and the newest technologies in renewable energy science, and use this new required knowledge to excel in their professional development.

Students will acquire a solid foundation in the field of renewable energy science and technology, and will be equipped with the necessary theoretical and technical skills to advance its future use and potential. They will be able to demonstrate and to explain the technical and practical aspects of renewable energy utilization, methods of minimizing environmental impacts of energy use, and in energy economics and energy policies. They can specify the interrelationship between the various disciplines necessary for successful execution of renewable energy projects, from the initial exploration to the stages of implementation and utilization.

After this module, students are able to use engineering, biological and chemical principles to design and operate pollution control and impact mitigation systems. Students will have a broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and social context.

Learning outcomes methodology

Students are able to use techniques, skills, and modern engineering tools necessary for engineering practice and evaluate the results in a way that is goal-oriented, appropriate, and scientific.

Students will be able to use their advanced knowledge, newly required methodologies, analysis and problem-solving skills to demonstrate solutions to new types of problems, or problems initiated by new conditions or circumstances. They will be able to evaluate which research methodologies and theoretical analysis applies in each case.

After this course, students will be able to independently analyze alternative energy policy options in terms of benefits and costs, have a good understanding of energy markets and be able to analyze the risks associated with energy options.
Students will be able to use their acquired knowledge to perform a detailed study, scientific analysis, and conduct research on renewable energy and technologies, from exploration, exploitation and technical aspects of utilization to environmental, social and economic considerations. They will be able to use this practical knowledge to support local industry and community organizations in utilizing renewable energy technologies, as well as help supporting increased use of renewable energy on a nationwide level. Focus is on applying innovative technical solutions to real-world problems.

**Learning outcomes social skills**

Students are able to demonstrate high levels of oral and written communication skills, critical thinking, responsibility, ethical behavior, and leadership. Students will function effectively both as a leader and as a member of project team and demonstrate an appreciation for diversity.

The student is able to work effectively in an interdisciplinary context with other people in different situations and international environment. The student is able to articulate logically and persuasively in both oral and written form on the content and problems of each discipline with and is familiar with the discussion within this research field.

Students will have the competence to take active part in discussions on energy technologies and are able to promote the use of renewable energy sources in different locations, as well as the ability to arrive at joint solutions to complex energy problems.

The student is able to work effectively in an interdisciplinary context with other people in different situations and international environment.

**Learning outcomes personal skills**

Students are able to engage in independent learning and recognize the need for continual professional development. They can understand the impact of engineering solutions in a global, economic, environmental, and social context.

**Constructive alignment**

The contents of the course are delivered in interactive lectures that involve group exercises, case studies and presentations. Students will be assessed through an integrated Research Project involving all components of this module. The course presents practical skills for participants in the area of integrating sustainability into business practices, operations, policies, and research and development through case studies and group works.

As one form of assessment, students will be asked to make a research project based on different case studies.

The student will demonstrate his ability to relate Energy issues to an interdisciplinary context. This form of knowledge evaluation is fit to test the awareness of Energy related problems and show the understanding of basic concepts and contexts. The excursion will give an practical example for the study material and enable the student to test and apply their own newly gained expertise. This kind of practical experience supports the theoretical input by lectures. The Student Research Project integrates all components of the module into an assignment to show the students understanding of the topic.

**Course contents**

**Environmental Engineering**

Society's demand for essentials such as clean air, food and water, sustainable land use and consumer products pose large-scale, practical problems. This course deals with the control of pollution in the environment and the protection of public health through provision of services such as water supply, wastewater treatment, air pollution control and waste management. Students will learn the importance of the Environmental Risk Assessment (EIA). Different types of pollutants, their environmental impacts, and methods of waste treatments will also be discussed.

This course will cover topics that include:

- Basic Chemistry and Biology
Different Approaches to Sustainability

This course introduces participants to the goals, principles, and practical applications of sustainability from science/engineering, policy, and business perspectives. In this course, we will examine the major environmental issues and trends happening in modern society from a scientific and practical perspective, including energy and resource use, pollution, climate change, water, and population. An overview of sustainability and sustainability plans from organizations and institutions will be discussed and critiqued. Corporate Social Responsibility (CSR) will be discussed in detail.

Introduction to Energy

Energy is a vital part of our daily lives. This course examines where that energy comes from, and the advantages and disadvantages across different fuels. The formal laws governing energy will be introduced including natural limits on energy use and how energy moves through the Earth system. The contextual analysis of energy decisions for transportation and electricity generation around the world will be discussed in detail. Energy resources that will be covered in this course include coal, oil, natural gas and nuclear.

The aim is that the students have a basic understanding for following concepts and topics:

- Recapitulation: Difference and similarities between force, energy, heat and work (including their units)
- Energy supply chain terminologies of primary energy, secondary energy, final energy, useful energy and energy carrier
- Drivers of research and development for energy (increasing population, increasing demand for energy related activities, availability of resources, environmental problems and health issues)
- Reserves and resources for fossil energy deposits (Mc Kelvey Box) including static range of these fuels and depletion mid-point
- Theoretical, technical, economic and deducible potential concepts for renewable energy sources
- Main pollutants and greenhouse gases related to energy activities and their environmental and health effects.
- Energy system and sustainability
  - Importance of energy sector in the modern economy
  - Different definitions and understandings of sustainability
  - Sustainability measurement methods (disaggregated indicators, guard rails, MCDA, social cost approach, ecological footprint analysis)
- Energy use in different sectors (transport, industry, households, commerce)
- Coal (classification of coal, mining, global coal market, conventional coal power plant, stoichiometric combustion, advanced coal power plant concepts – e.g. IGCC, CCS etc., coal for synfuels)
- Natural gas (classification of natural gas, unconventional resources, preparation, transportation (pipeline, LNG and GTL), natural gas power plants (Gas turbine and combined cycle), natural gas market in US and Europe
- Nuclear energy (Pros and cons, principals of nuclear energy, power plants, nuclear security, current market and electricity generation costs)
- Crude oil (classification, un conventional oil resources, oil processing, internal combustion engines and alternative fuels, oil market)
- Renewable energy (classification of RE, pros and cons, concepts of equivalent full load hours, availability factor, some example renewable energy technologies: solar energy and PV, Biomass and wood)
- Life cycle Assessment (Theory with goal and scope definition, inventory, impact assessment; LCA-Examples)
- Optional: Advanced energy technologies (e.g. fuel cells, ORC plants)

Energy Market and Management

This course offers a comprehensive introduction to the field of energy markets and management, leaving students with a rounded and complete knowledge of all core areas. Students will be introduced to the renewable energy policies particularly in Germany, EU and developing countries.
Upon completion of the course, students will have a good knowledge of power markets and electricity tariffs. The need of electricity storage with the increased share of renewable electricity and technological alternatives for electricity storage will be discussed in detail. Students will have a good understanding of how energy investments should be evaluated with the investor (or energy consultant) perspective with different case studies. Furthermore, an introduction to energy management with the perspective of a city administrator or an energy minister will be given.

Students will be given a comprehensive overview of:

- Power market (Residual load, Introduction of laws for the liberalized market, whole sale market (EEX), ancillary services, further products, prices at the power market, future market designs)
- Renewable energy policies (Background, Policies supporting the Renewable Energy in Germany – EEG with several amendments, policies in EU and for developing countries)
- Matching the demand with the supply for electricity
  - Flexibility need for increased share of renewable electricity
  - Technological options to store electricity (Pumped hydro, CAES, Battery, flywheel etc.)
  - PtX storage options (Power to gas – Hydrogen, Power to gas – Methane, Power to heat)
  - Demand-side management
- Energy management and assessing renewable energy investments
  - Investor and energy consultant view point.
  - City administration and ministry view point
- Electricity grid
  - Historical grid development
  - Different network levels
  - Grid assets and topology
  - Stakeholders
  - Grid calculation and future trends

Renewable Energy

This is an intensive course about renewable energy systems. Each lecture contains several examples from real world applications and in-progress industrial developments. The module deals with general information about energy supply and its technical, political, environmental and economic backgrounds.

Building on this overview, the students are provided with a deepening knowledge on the following individual forms of regenerative energy sources covering the topics below:

I. Energy balance of the world and renewable energy potential

- Global energy balance
- Potential of renewable energy (definitions, potential in Germany and in the world)

II. Solar Energy

- Sun as the energy source and solar radiation
- Use of solar energy
  - Solar-thermal (passive, solar water heater, Concentrated solar power - CSP, Solar updraft tower, etc.)
  - Photovoltaic (mono, poly, and amorphous cells)
- Costs, potentials and use of solar energy

III. Wind-energy

- Wind Systems – Global and Local
- Ideal wind turbine (Betz law) and characteristic curve for wind power
- History and types of wind turbines (horizontal, vertical, onshore, offshore, power control systems)
- Wind-parks (spacing, repowering, examples)
- Costs, potentials and use of wind-energy

IV. Hydro-energy

- Hydrologic cycle
Principles of hydro-energy
Costs, potentials and use of hydro-energy
Other options (wave energy, current energy, tidal plants etc.)

V. Geothermal energy
Principals of geothermal energy
Geothermal resource assessment, exploration, drilling, development, and power production
Different types of geothermal systems
Costs, potentials, environmental effects and use of geothermal energy

VI. Bioenergy
Definition and generation of biomass
Bioenergy utilization options
- Direct combustion of solid biomass (e.g. wood)
- Physical-chemical conversion (vegetable oils, and biodiesel)
- Thermo-chemical conversion (gasification, coking, pyrolysis etc)
- Bio-chemical conversion (alcohols, biogas etc)
Costs, potentials, environmental effects and use of bioenergy

Recommended literature for preparation and follow-up


Optional information: Lecturers for the courses in the module:

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<thead>
<tr>
<th>Lecturer</th>
<th>Title of the course in the module</th>
<th>Hours / Module</th>
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<tbody>
<tr>
<td>Prof. Dr. U. Gayh</td>
<td>Environmental Engineering</td>
<td>20</td>
</tr>
<tr>
<td>Prof. Dr. D. Özdemir et al.</td>
<td>Different Approaches to Sustainability</td>
<td>20</td>
</tr>
<tr>
<td>Prof. Dr. D. Özdemir et al.</td>
<td>Introduction to Energy (conventional)</td>
<td>40</td>
</tr>
<tr>
<td>E. Yaman</td>
<td>Energy Policy and Energy Markets</td>
<td>20</td>
</tr>
<tr>
<td>Prof. Dr. D. Özdemir et al.</td>
<td>Renewable Energy</td>
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SRH Hochschule Heidelberg, Degree Program: International Business & Engineering

Module description and module number: M3 Top Management

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<th>Duration of the module</th>
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<th>ECTS points</th>
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<td>Private studies 125 hrs. (62 %)</td>
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Requirements for enrolment

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<tr>
<th>Use / Restrictions</th>
<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
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<tbody>
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<td>MIBE</td>
<td>Case study</td>
<td>1. Interactive lecture</td>
<td>Prof. Dr. Nils Albrecht</td>
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<td></td>
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<td>2. Case study</td>
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<td>3. Group Work</td>
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<td>4. Role play</td>
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<tr>
<td></td>
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<td>5. Simulation</td>
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</table>

Learning objectives

After completion of this module, students should be able to explain the complex relationships with which decision makers in international corporations are confronted on a daily basis, and to duly take these into account in their solutions. They can develop and discuss various strategic solutions, and finally arrive at well-founded decisions. Based on the expertise gained as a result of the individual learning outcomes described below, the students are able to initiate specific actions.

Learning outcomes

The students are able to identify the essential tasks in the three disciplines "Strategic Management", "Risk Management" and "Project Management". They can describe and explain the functions of these three management forms. They can employ the necessary terminology appropriately in discussions. Based on specific case studies, the students can apply the knowledge gained to new cases and extend it independently.

Learning outcomes methodology

The students are able to employ the essential methods in the three disciplines. These include:

- BGC Matrix / SWOT-Analysis / Competitor Analysis / Porter's Five Forces Model / Blue Ocean Strategy / Ansoff Matrix / PESTLE / Fault Tree Analysis / Event Tree Analysis / FMEA / Delphi Method / Bow-Tie / Network Plan Scheduling / MS Project etc.

Learning outcomes social skills

The students are able to discuss several fundamental strategic approaches in the group, reach a consensus agreement and take responsibility for the solution. In individual work, they are able to flesh out the results of the group work, create a design and carry out the necessary calculations.

Learning outcomes personal skills

The students can target their work approach and time management in a specific and complex case study, thus ensuring full independence and responsibility for successful completion.
### Constructive alignment

This module teaches the students professional expertise, methodical skills, social skills and self-competence. Special emphasis is placed on the development of decision-making competence, which is based on the aforementioned competencies. For this reason, the case study (CS) has been chosen as the examination format for testing these competencies (cf. J. Rozsa et al.: Core-Gerechte Modulkonzeption - Ein Leitfaden, Band 3, Tabelle 5, Heidelberger Hochschulverlag, 1. Auflage 2017). In the case study, the students in this module should prove that they have a command of the complex relationships with which decision makers in international corporations are confronted on a daily basis.

The starting point of the case study is the continued strategic alignment of a reality-oriented company in the energy sector. The students put themselves in the position of a C-level manager (top management CEO, COO, CTO, CSO, CFO), interpret the case, analyze the circumstances, research supplementary information and on this basis elaborate potential solutions for safeguarding the future of the company by a process of internationalization of the business field. This involves performing a risk analysis and drafting a plan of action on how such a major project (project management) is to be implemented.

### Course contents

#### Strategic Management


#### Risk Management


#### Project Management

- Project Objectives / Smart Criteria / Functions and Tools of Project Management / Project Organization Structure / Project Planning / Main Features of Risk Management / Stakeholder Management / Network Plan Scheduling / MS Project

### Recommended literature for preparation and follow-up

#### Strategic Management


#### Risk Management

1. ISO 31000:2009, Risk management
2. ISO/TR 31004:2013, Risk management — Guidance for the implementation of ISO 31000
4. ONR 49000 Risk management for organisations and systems

#### Project Management


- Exploring strategy: Gerry Johnson; Richard Whittington; Kevan Scholes, Harlow; Munich [et.al.]: Financial Times Prentice Hall, 2011

- Project Management for the Built Environment : Study Notes / by Low Sui Pheng, Singapore : Springer, 2018


Becoming a Project Leader : Blending Planning, Agility, Resilience, and Collaboration to Deliver Successful Projects / by Alexander Laufer, Terry Little, Jeffrey Russell, Bruce Maas, Cham : Palgrave Macmillan, 2018


Enterprise System Renewal - The Divergence Between Perception and Reality, Haake, Phillip; Schacht, Silvia; Mueller, Benjamin; Maedche, Alexander, Institut für Informationswirtschaft und Marketing (IISM), KarlsruheService Research Institute (KSRI), 2017


Optional information: Lecturers for the courses in the module:

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<th>Lecturer</th>
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<th>Hours / Module</th>
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<td>Prof. J. Beckman / Prof. Dr. B. Leisenheimer</td>
<td>Strategic Management / Change Management</td>
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<tr>
<td>Prof. Dr. N. Albrecht</td>
<td>Risk Management</td>
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<tr>
<td>Prof. Dr. U. Gayh</td>
<td>Project Management</td>
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Module description and module number: M4 International Framework

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<td>5. Data research and analysis</td>
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Learning objectives

This module prepares the company for going international with their business

Learning outcomes

The aim of this module is to provide students with an understanding the background economics framework when doing business on a global scale. Participants are able to name the different economic regions worldwide and name the distinctive traits of each region. Students know instruments of trade policy such as tariffs and subsidies and are able to analyze their economic effects. Additionally, they are able to evaluate advantages and disadvantages of several trade policies and the implications on the individual company. The students can explain the content of existing trade agreements regulating the global market like GATT, OECD, WTO, monetary agreements e.g. and are able to derive the consequences for companies in different sectors.

Additionally, they are able to explain the characteristics of the different markets and to analyze them in order to enter an international market as a company. They will be able to forecast future prospects for a market entry of a company by analyzing and evaluating the risks and advantages. They can explain and discuss the actual development of the global markets, especially the Emerging Market (e.g. BRICS) and are able to define the risks and chances for a global acting company.

Students will be able to use both statistical and qualitative methods for doing market research in order to figure out demands of customers.

Learning outcomes methodology

Inevitably, international markets module lays an emphasis on theoretical knowledge, but the theory is grounded in the real world and each mode of analysis can be used to inform the students’ understanding of real events in the world economy. A major aim of this module is that students acquire a toolbox of analytical methods to apply these accordingly:

With respect to Research Methods, the students learn how to apply various methods of data collection and data processing. They are able to name the advantages and disadvantages of each approach. Students will be able to use both statistical and qualitative methods for doing market research in order to figure out demands of customers.

Furthermore they are able to select the suitable method according to the availability and feasibility of data. The participants will be able to align research problems with research questions and pick the suitable methods of data collection and evaluation and thus be enabled to do a scientifically correct research work. They are able to reflect researchers’ bias and the influence of research philosophy on the interpretation of qualitative research.
Learning outcomes personal skills

This module raises reflective awareness about the various possible individual attitudes towards knowledge and reality. Students are able to recognize and distinguish the differences. Furthermore, they learn to evaluate their own approach and relate it to alternative views.

Constructive alignment

This module utilizes a seminar-type combination of lectures and case studies to deliver the knowledge. As the content is fairly theoretical and focuses on the testing of knowledge, the examination type is a written exam. Further controlling of successfully applying the methodological competence happens through voluntary exercises.

Course contents

**International Markets**

- Markets as both physical places where goods and services are exchanged, or relate to particular goods and services
- Factors of production, production processes and distribution.
- Markets for land (raw materials to components), labor (of most kinds) and capital (cash or other assets).
- Intellectual property, management and government.
- Managers run organizations and government controls or can control virtually all aspects of organizational life.
- R&D, production and supply chain management/logistics as production processes.
- Distribution as selling the final goods/services to the ultimate user.
- The decision of outsourcing and inhouse productions.
- The 11th market as indicator for company value, when product lines are divided into separate firms.
- The business models of modern internet forms, e.g. Google as an exotic advertising actor and Yahoo! as investor
- Case studies, e.g. Siemens and Bosch as companies that add value by their manufacturing, rather than R&D and marketing,
- Global competition as driving force for structural reforms in companies so that business models are reinvented.
- Speed of organizational response as factor
- Financing in both cost and quantity as selecting component supporting ‘winning’ entries

**Global Economics**

This course offers an overview of various aspects of global economy within the field of economic geography and its linkages to related issues of resources, development, international business and trade. It investigates the phenomenon of globalization and seeks to provide understanding of today’s increasingly interdependent world.

This course will cover topics that include:

- How does the economy work?
  - How people take decisions:
    - Marginal Thinking
    - Responding to Incentives
    - Taxes, Subsidies, Incentives, Externalities
  - International Trade Theories
    - Comparative Advantages
    - Labor-Capital Model (Heckscher-Ohlin)
    - The Gravity of Global Economics
  - Markets and Market Actors
Research Methods & Statistics

Students will learn qualitative and quantitative methods in business research. In the qualitative section the course teaches quality criteria of good research, research design, creating a hypothesis and research questions. The class contains elements of thesis writing and writing research proposals. The students learn about creating, handling and evaluating qualitative data. Included are open and closed questioning techniques, structured, semi-structured and open interviews. They learn how to conduct an interview. Regarding text analysis and interpretation the participants learn about content analysis, discourse analysis, Hermeneutics and Grounded Theory. Reliability and Validity of data is being discussed. Finally, students learn how to conduct cases studies.

Statistics are widely used in social sciences, business, and daily life. In this course, an overview of key concepts of statistics and how these concepts relate to the scientific method and research will be discussed. Students will learn the proper application of statistical procedures, the concepts that govern these procedures, common errors when using statistics, and how to get the best analysis out of the data. In this course, the basic research methodology and statistics, which are essential prior to taking up any research-related endeavor, will be discussed accordingly. Students will learn about population and sampling, research problem and hypothesis, dependent and independent variables, the normal curve and its properties, probability, and correlation. This course will give a comprehensive overview of:

- Finding apparent relations through measurements
- In physical science “how” is the important next question. In economics, we are often more interested in the motive, “Why”
- Either “How” or “Why” leads us to the causality for the observed “What” We use statistical inference to find relations.
- “What” does help us predict the current “What”, as in time series: normally, multi-causalities between “how”, “what” and “why.”
- Target populations and random samples done repeatedly by various observers is the basis for data generation
- Repetition of precise, explicit procedures is absolutely critical to good science.
- Gauss-Markov Theorem, known as “ordinary least squares” when making linear relations with implicit causality.
- The Central Limit Theorem, drawing in part on Carl Friedrich Gauss, allows us to make inferences, based on Normal “Bell” Curve and is a generalization of Binomial Function.
- Errors of the first and second level for hypothesis rejection

Recommended literature for preparation and follow-up

Silverman (2013): Doing Qualitative Research, Sage
Yin (2014): Case study Research, Sage
George Stonehouse, David Campbell, und Jim Hamill (2003): Global and Transnational Strategy and Management
Samuel P. Huntington (1996): The Clash of Civilizations,

Thomas, Friedman (2005), The world is flat. A brief history of the globalized world in the 21st century,


International business / Alan M. Rugman ; Simon Collinson, Harlow ; Munich [u.a.] : Pearson, 2012


Marketing : a relationship perspective / by Svend Hollensen and Marc Oliver Opresnik, München: Vahlen, 2010

**Optional information:** Lecturers for the courses in the module:

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<th>Hours / Module</th>
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<td>O. Schmidt</td>
<td>Global Economics</td>
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<tr>
<td>M. Naar</td>
<td>International Markets</td>
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<tr>
<td>Dr. T. Seidel / Prof. Dr. E. Schmidt</td>
<td>Research methods for Business Economics</td>
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Module description and module number: M5 Modern Technologies and Development

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Requirements for enrolment

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<td>Prof. Dr. Ulrike Gayh</td>
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<td></td>
<td>2. Presentation</td>
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</table>

Learning objectives

Learning outcomes

Students are able to apply their academic knowledge to real-world problems and develop products that meet a specific need, while factoring on business considerations. They are able to apply general and specific methods of product lifecycle management, from the initial product idea up to product disassembly and recovery cycle. This means that they're able to plan, organize, steer and control the lifecycle of industrial products. They are able to apply common key tools of product management on industrial cases. Thereby students are able to consider the impact that current market conditions can have on the product portfolio and lifecycle. Upon completion, students typically can assess, plan and monitor a product life cycle within their company. In addition, they develop the skills to evaluate existing processes to align them with emerging industry best practices.

Students are able to propose and to review material selection for a defined application considering technical as well as economical aspects. They can assess the applicability of materials down to the basic understanding of materials properties and behavior. Material selection and design optimization are two key factors in the Product Life Cycle. The Students are able to propose and to review the way how materials are applied in realization of industrial products. They can assess the combination of materials with design approaches and manufacturing processes in terms of technical as well as economical suitability.

(Students are able to define, plan and execute Rapid Prototyping processes as a modern instrument to steer and actively manage iterative design optimization processes considering the requirements of material application and design restrictions coming from environmental and sustainability aspects.)

Students can apply enhanced concepts of product design, material processing and manufacturing due to a basic understanding of typical applications in engineered products.

Learning outcomes methodology

Students can conduct a systematic approach of material selection leading to technically and economically reasonable specifications for materials applied for products and machinery.

Students can use the Design of Experiments methodology and have literature searching skills to find relevant patent and scientific literature and information regarding competing technologies.

Learning outcomes social skills

Collaborating with other students in a team enables them to make connections necessary to develop working partnerships necessary for successful businesses in the global marketplace. Students are empowered to discuss with and to mediate between experts for material, design, manufacturing and sustainability management on a general level typically needed in
project teams. This helps them to overtake leadership roles in substantial processes and projects. Students are empowered to discuss with material experts on a general level typically needed in project teams. This helps them to overtake leadership roles in substantial technical processes and projects.

**Learning outcomes personal skills**

The students develop a high sensibility for the importance of effectiveness and efficiency in all processes of product development and product management and they can identify and overcome typical barriers within this context. Students are able to acquire knowledge of enhanced materials due to a basic understanding of typical engineering materials.

**Constructive alignment**

The module teaches and refreshes some fundamental knowledge and specific scientific methods. Within project work the students can demonstrate that they are able to transfer this knowledge in realistic scenarios.

Real-life practical work prepares students to conduct competitive analysis, develop product specifications, use modeling tools, and develop product launch plans. Students can conduct a systematic approach to select and optimize product design manufacturing processes for defined materials considering the material properties as well as the economical frame conditions of producing industry.

The technical part from modern material and modern applications will be tested in a written exam.

This modul is closely involved in the engineering design project (M8). A presentation as introduction and status of the project serves as intermediate examination of the engineering design project and tests the basic understanding of the subjects innovation management and applied research/product development.

**Course contents**

**Modern Materials/Modern Application**

The students will discuss the meaning of “modern” in the context of Material Science which means they’ll acquire a basic understanding of the scientific approach in today’s Material Science. After that they’ll review the fundamentals of material science like classification of materials, atomic structure, interatomic bonding, crystal structures, imperfections in solids and diffusion. The meaning of these aspects is demonstrated in adequate technological examples showing how the materials’ properties are used to fulfill technical specifications. The students will broaden their material knowledge in terms of other materials.

The students will proceed consecutively with applying modern materials in design and manufacturing processes for industrial products. Here the focus is on a holistic understanding of the interplay between material properties, design approach and manufacturing processes in order to realize an industrial product. After the introduction to this integrated way of thinking the course will demonstrate it for industrial products within exemplarily applications.

Students will learn the scientific and technical vocabulary corresponding to the classes given in this module. The ability to read and comprehend authentic technical and economic texts is strengthened.

The advantages and disadvantages of modern manufacturing methods will be explained to enable students to analyze specific situations. A simulation of an assembly process (production management/ production control documentation, machine availability, etc.) will be discussed in detail.

(Furthermore the students will be familiar with the methodology of construction, forming, and generative manufacturing method (CAD Rapid Prototyping.) They will also learn how to use optimization processes in existing production and assembly facilities.)

**Applied Research & Product Development**

The students can distinguish the spectrum of activities from basic research to applied research to product development.

The focus of the course is on gathering knowledge with the goal of producing useful materials, devices or products to meet specific, recognized requirements. The students learn how to develop a specific product involving refining the solution to a
product that will be effective, safe and attractive and that can be manufactured in a timely and cost-effective way.

The students will learn by exemplary projects the different steps / job duties in applied research and product development:

- Literal and patent background research, laboratory and technological research
- Design of experiments - methodology
- Reformulating existing products in response to changes in regulations or availability of raw materials
- Scale up processes and making a new product in larger quantities for commercialization

The students learn the inclusion of science and business as the business manager and the manufactures must be convinced by the idea of the new product. They learn about the key points profitability and cost-efficient manufacturing process. Thereby the product lifecycle management is taught which shows how to integrate product management, engineering, manufacturing, sales, marketing, sustainability and other departments in order to streamline processes. Students will learn process preparation and processing of data as well as the final quality generation to ensure that products are ‘fit for purpose’. The product development timeline will also be discussed in the course.

Advanced Innovation Management

Students acquire the ability to steer the innovation process from idea generation to market entry as an overall approach integrating all relevant disciplines. They’ll be able to select and apply various methodologies of Innovation Management depending on the industry sector and the enterprise size. Additionally Students will acquire soft skills which are necessary to steer innovation projects in a manifold environment as typically found in globally acting companies. Focus topics of the course are:

- Innovation in the industrial context
- Overall Innovation process
- Organizational view
- KPIs for Innovation processes
- Creativity techniques
- Systematic idea development
- Product development
- Meaning of patents for innovative companies
- Market entry strategies

Recommended literature for preparation and follow-up


Optional information: Lecturers for the courses in the module:

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<td>Modern Materials/ Modern Application</td>
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<td>Prof. Dr. A. Gerber</td>
<td>Advanced Innovation Management</td>
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<tr>
<td>Prof. Dr. U. Gayh</td>
<td>Applied Research &amp; Product Development / Prototyping</td>
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### Module description and module number: M6 International Collaboration

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**Note:** the basis for calculation is generally 1 ECTS = 25 hrs. Deviations are covered exclusively by Appendix 2 (Bachelor) and 2a (Master) of the SPO

#### Requirements for enrolment

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<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
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#### Learning objectives

**Learning outcomes**

The students can describe the basic differences between the German Business Law and others, such as Anglo-American Case Law or from the BRIC countries. They know and are able to discuss legal questions regarding international acting companies, eg. Which law is valid for setting a branch office abroad. They can explain the different aspects of contract law dealing with international partners and are able to define and compare the implications of different legal systems on business activities.

The students know recent research findings on the topics of communication and cultural dimension and can discuss their usefulness for every-day-situation in a private or company context. They can name the different criteria for analyzing cultures as time, gender-orientation, individuality, distance-orientation and others. They are able to analyze critical situations in international business topics using the tools.

**Learning outcomes methodology**

The students are able to apply analytical methods to business situations and personal encounters by finding the connection between the culture and the behavior in business life, including on the legal aspects like contracts. They have the methods to compare basic judicative questions in international context with the German law. They know the different tactics in cross-cultural communication and can develop a multitude of hypothesis and strategies in order to reduce the irritations in the finding process of business partners from different cultural background.

**Learning outcomes social skills**

The students are able to work in an intercultural team and to have cross-cultural negotiations. They can adapt themselves to the different cultural situations and improve the interaction with other actors by changing the personal perspective. They are able to avoid or reduce conflicts which can appear in international teams.

**Learning outcomes personal skills**

The students improve their communication abilities and are able to reflect their own communication and intercultural skills in a critical way. They gain awareness of the possible irritations while dealing with business partners in an international context and improve their skills to deal with intercultural situations. They can reflect on their non-explicit knowledge concerning other cultures and their business behavior. They integrate some different cultural aspects in their personal identity and are flexible to act between and within the cultures (ability of “Code Switching”).
**Constructive alignment**

The students gain knowledge on different law systems and get the ability to communicate and work in international teams. The theoretical input of the topics will be supplemented and extended by comparing case studies, simulations of business situations and exercises. The transfer of knowledge will be verified by analyzing of case studies as examination for international law. Since successful Intercultural Communication is based on personal experience rather than theoretical knowledge, there is a role play as an achievement simulating a real-life-situation in the intercultural context in order to test the ability of the students to handle unknown and irritating settings and develop problem-solving strategies.

Preparing a Report and a presentation the students show their ability to interact in a foreign language and to discuss business or technical topics in a meeting.

**Course contents**

**Intercultural Communications**

Intercultural Communication focuses on the importance of culture in our everyday lives, and the ways in which culture interrelates with and effects communication processes. This course will begin by looking at the fundamental connection between culture and communication. Different communication behaviors that can interfere with effective intercultural communication will be identified, as well as the stages people go through as they adjust to other cultures, and ways to minimize culture shock.

Main topics that will be discussed are:

- Different cultures
- Communication Theories
- Nonverbal communication
- Culture Theories / Cultural dimensions (such as E.T. Hall, Hofstede, Lewis etc)
- Cultural standards (Thomas)
- Stereotypes
- Models of intercultural behavior and communication
- Critical intercultural situations in organizational setting
- Conflict solution in intercultural setting

**International Law**

This course introduces those elements of international law, which directly affects the economic activity of a company abroad. It includes international patent law. It also reviews different legal systems, such as Napoleonic Code Civil vs. British legal system. It also contains trade law on business level including taxation aspects and Labour Law, environmental aspects and financial issues.

**Language II**

This course integrates language skills, emphasizing reading and writing to develop language proficiency. The curriculum aims to refine the proficiency and fluency in speaking and writing in academic settings. This course will focus on helping students improve their oral communication skills for academic and daily life. Emphasis will be on increasing confidence and fluency through realistic and practical activities both in and out of class. Content will include such topics as pronunciation, active listening skills, and conversation strategies. Students will be encouraged to bring in real or hypothetical situations that they are not quite sure how to handle. These classes also guide students though the process of doing library research, debating a topic, and producing a research paper.

Language classes are held during the entire semester and as a form of assessment, students are asked to do a presentation on selected topics.
Recommended literature for preparation and follow-up

Liu, Volcic, Gallois (2014): Introducing Intercultural Communication

Meyer (2016). The Culture Map

Lewis (2005): When Cultures Collide: Leading Across Cultures: Leading, Teamworking and Managing Across the Globe

Hofstede (2010): Cultures and Organizations

UNIDROIT Principles of International Commercial Contracts von Eckart J. Brödermann

Advanced Introduction to International Sales Law von Clayton p. Gillette

Optional information: Lecturers for the courses in the module:

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Title of the course in the module</th>
<th>Hours / module</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Balotch</td>
<td>International Law</td>
<td>30</td>
</tr>
<tr>
<td>K. Prutek</td>
<td>Intercultural Communication</td>
<td>20</td>
</tr>
<tr>
<td>Flemming, Ljusic, Gontier</td>
<td>German Language (Module 5-8)</td>
<td>80</td>
</tr>
</tbody>
</table>
Module description and module number: M7 Middle Management

<table>
<thead>
<tr>
<th>5-week block</th>
<th>Frequency</th>
<th>Duration of the module</th>
<th>Type (* details or exceptions in the “Use” field</th>
<th>ECTS points</th>
<th>Student’s workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>2 x per year</td>
<td>5 weeks</td>
<td>6</td>
<td>Total workload</td>
<td>150 hrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In class</td>
<td>70 hrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Private studies</td>
<td>80 hrs.</td>
</tr>
</tbody>
</table>

Note: the basis for calculation is generally 1 ECTS = 25 hrs. Deviations are covered exclusively by Appendix 2 (Bachelor) and 2a (Master) of the SPO.

**Requirements for enrolment**

<table>
<thead>
<tr>
<th>Use / Restrictions</th>
<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIBE</td>
<td>Practical Work</td>
<td>1. Interactive lecture</td>
<td>Prof. Dr.-Ing. Nils Albrecht</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Case study</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Group Work</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Role play</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Simulation</td>
<td></td>
</tr>
</tbody>
</table>

**Learning objectives**

After completion of this module, the students are able to handle change processes in the company. They can answer the question of why changes in the company are necessary and can identify the signs pointing to a necessity for change. In addition, the students have understood why it is so important to devote special attention to the “human factor” in this context.

**Learning outcomes**

The students are able to name the crucial factors influencing change processes in companies. They can differentiate between the various levels of leadership, meta leadership (“I” level), macro leadership (“we” level) and micro leadership (“you” level).

**Learning outcomes methodology**

The students can identify the various methods of determining personality (Carol Ritberger, Merrill & Reid, DISC, DOPE, Drucker, Meyer-Briggs), and can use these methods to determine their own and the personality of others.

**Learning outcomes social skills**

The students can initiate measures for team building and understand the associated demands placed on executives. In addition, the students can give constructive feedback in the context of an interview (e.g. employee appraisal, target agreement meeting, etc.) taking into consideration the expertise and methodology they have been taught.

**Learning outcomes personal skills**

The students can compare their personal requirements towards a leadership role with the personality traits of a middle-management executive. They can develop their personal competencies through continuous observation and reflection.

**Constructive alignment**

This module teaches the students professional expertise, methodical skills, social skills and self-competence. For this reason, the practical assignment (PrA) has been chosen as the examination format for testing these competencies (cf. J. Rozsa et al.: Core-Gerechte Modulkonzeption - Ein Leitfaden, Band 3, Tabelle 5, Heidelberger Hochschulverlag, 1. Auflage 2017). In the practical assignment (PrA) the students in this module should prove their ability to handle changes within the
company. In the practical assignment, the students are assigned a task that could be encountered on a normal working day in a company.

The PrA enables the students to reflect on what might be the underlying causes of processes of change. They identify these causes and understand the behavior of the actors involved. This understanding helps them in their role as management executives to introduce and implement processes of change. The students gain an awareness of which communication strategy they will need to pursue and how they themselves will have to deal with the changes.

### Course contents

#### Organisational Behaviour

Definition / Diversity and Individual Differences / Individual Behaviour / Team Behaviour / Organizational Behaviour

#### Leadership and Influence Processes - Change Management

Individual Change / Team Change / Organizational Change / Leading Change / Restructuring / Mergers and Acquisitions / Culture and Change / Complex Change

#### Self-Management

Competencies / Performance Dimensions / Career Stallers and Stoppers

### Recommended literature for preparation and follow-up

#### Organisational Behaviour


#### Leadership and Influence Processes - Change Management


#### Self-Management


### Optional information: Lecturers for the courses in the module:

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Title of the course in the module</th>
<th>Hours / Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dipl.-Kauf. F. Christiansen</td>
<td>Organisational Behaviour</td>
<td>20</td>
</tr>
<tr>
<td>Prof. Dr. B. Leisenheimer</td>
<td>Leadership and Influence Processes – Change Management</td>
<td>20</td>
</tr>
<tr>
<td>Prof. Dr. N. Albrecht</td>
<td>Self-Management</td>
<td>30</td>
</tr>
</tbody>
</table>
SRH Hochschule Heidelberg, Degree Program: International Business & Engineering (M.Eng.)

Module description and module number: M8 Electives

<table>
<thead>
<tr>
<th>5-week block</th>
<th>Frequency</th>
<th>Duration of the module</th>
<th>Type (* details or exceptions in the “Use” field)</th>
<th>ECTS points</th>
<th>Student's workload</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: the basis for calculation is generally 1 ECTS = 25 hrs. Deviations are covered exclusively by Appendix 2 (Bachelor) and 2a (Master) of the SPO</td>
</tr>
<tr>
<td>8</td>
<td>2 x per year</td>
<td>5 weeks</td>
<td></td>
<td>6</td>
<td>Total workload 150 hrs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>In class 60 hrs. (40 %)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Private studies 90 hrs. (60 %)</td>
</tr>
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Requirements for enrolment

<table>
<thead>
<tr>
<th>Use / Restrictions</th>
<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIBE</td>
<td>Various</td>
<td>1. Interactive Lecture</td>
<td>Prof. Dr.-Ing. Bert Leisenheimer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Practical Work</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Problem-Oriented Learning</td>
<td></td>
</tr>
</tbody>
</table>

Learning objectives

The elective module gives the chance to specialize in certain aspects of Engineering or Business. Content and competence varies.

Constructive alignment

Interactive lecture, practical work, group work, problem-oriented learning, problem analysis and correlation. The examination depends on the content of the course.

Course contents

The elective gives the students the possibility of choosing and sharpening their own profile within the degree program. Students can choose electives from a large array of courses offered by SRH School of Engineering and can be either focusing on engineering aspects or on business economics and management. The course offers elective classes that allow students to immerse themselves in specialized topics with lecturers who are experts in their respective fields of innovation and practitioners who bring real-world, real-time experience to the classroom. The topics are defined by current technical or economic state of the art themes. Therefore, the content varies over time.

Detailed information about current elective offers will be given to the students by the faculty. Previously, elective classes have been offered on for example:

- Entrepreneurship
- Plasma Technology
- LCA Life Cycle Assessment
- Value Management (Extended M2)
- Business Strategies (Silicon Valley)
- Foreign Languages
- Industry 4.0
- Innovation Management

Recommended literature for preparation and follow-up

To be announced by the supervisor.
Optional information: Lecturers for the courses in the module:

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Title of the course in the module</th>
<th>Hours/Module</th>
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<tbody>
<tr>
<td>Various</td>
<td>Electives</td>
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Module description and module number: M9 Engineering Design Project

<table>
<thead>
<tr>
<th>5-week block</th>
<th>Frequency</th>
<th>Duration of the module</th>
<th>Type (* details or exceptions in the &quot;Use&quot; field)</th>
<th>ECTS points</th>
<th>Student's workload Note: the basis for calculation is generally 1 ECTS = 25 hrs. Deviations are covered exclusively by Appendix 2 (Bachelor) and 2a (Master) of the SPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-8</td>
<td>2 x per year</td>
<td>20 weeks</td>
<td></td>
<td>6</td>
<td>Total workload 150 hrs. In class 30 hrs. Private studies 120 hrs. (100 %) (20 %) (80 %)</td>
</tr>
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</table>

Requirements for enrolment

<table>
<thead>
<tr>
<th>Use / Restrictions</th>
<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIBE</td>
<td>Project Work</td>
<td>Project Work</td>
<td>Prof. Dr.-Ing. Andreas Gerber</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group Work</td>
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<tr>
<td></td>
<td></td>
<td>Data research and analysis</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Presentation</td>
<td></td>
</tr>
</tbody>
</table>

Learning objectives

Learning outcomes methodology

Based on the competences acquired in Module 5 (Modern Technologies and Development) the students are able to identify and to develop an innovative product and the business model behind. They can prove the feasibility of their product and can demonstrate a customer benefit vs. cost analysis based on a target group investigation. They are able to increase the maturity grade of the proposed product idea and they can develop an industrial product within a structured product development process considering material selection, manufacturing aspects, cost calculation etc.

Learning outcomes social skills

Students are able to administrate a complex project work by an appropriate split of work and a reliable scheduling in order to achieve the expected project results in time and quality. They are able to plan ahead the project proceeding and to account for decision making at project conditions. They are skilled in presenting their project results to experienced audience and to react competently and adequately to critical questions. They deal confidently with constructive critics and they can consider external advice in their own work.

Learning outcomes personal skills

The Engineering Design Project demands highest transfer of competencies acquired in other lectures to the own project work (especially Module 5, Modern Technologies and Development). Collaboration within an interdisciplinary team developing an industrial product demonstrates the students real industrial conditions with all aspects of human factors.

Constructive alignment

The teamwork is regularly reported and presented to the guiding lectures acting like investors who must be convinced of the product developed by the team. The results of the initial development phase which will be closed after five weeks will be the basis for the assessment and the grading of Modul 5. The Engineering Design Project will continue for further 10 weeks in which the student teams will further increase the maturity grade of their product. After a total of 15 weeks the teams will supply a written final report as well as a final investor presentation.
Course contents

The teams will pass all typical phases of an industrial product development sequence:

- Team Building
- Identification and development of a product idea and the related business model
- Proof of technical feasibility and market potential
- Technical design and development of a prototype
- Detail design of an industrial product considering material selection, production setup and cost calculation

Recommended literature for preparation and follow-up

Compare recommended readings of Module 5 (Modern Technologies and Development)

Optional information: Lecturers for the courses in the module:

<table>
<thead>
<tr>
<th>Lecturer</th>
<th>Title of the course in the module</th>
<th>Hours / Module</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Dr. A. Gerber</td>
<td>Engineering Design Project</td>
<td>30</td>
</tr>
<tr>
<td>Prof. Dr. U. Gayh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Panneer Selvam</td>
<td></td>
<td></td>
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### Module description and module number: M10 Master Thesis

<table>
<thead>
<tr>
<th>5-week block</th>
<th>Frequency</th>
<th>Duration of the module</th>
<th>Type (* details or exceptions in the “Use” field)</th>
<th>ECTS points</th>
<th>Student's workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4 (3. Sem.)</td>
<td>2 x per year</td>
<td>18 weeks</td>
<td></td>
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<td><strong>Total workload</strong></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>650 hrs.</strong></td>
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<td></td>
<td></td>
<td></td>
<td><strong>(100 %)</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>In class hrs.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>0 %</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>Private studies</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>650 hrs.</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>(100 %)</strong></td>
</tr>
</tbody>
</table>

**Requirements for enrolment**

<table>
<thead>
<tr>
<th>Use / Restrictions</th>
<th>Type / Duration of exam</th>
<th>Teaching and learning methods</th>
<th>In charge of module</th>
</tr>
</thead>
<tbody>
<tr>
<td>MIBE</td>
<td>Thesis Colloquium (Presentation)</td>
<td>1. Interactive Lecture 2. Practical Work 3. Problem-Oriented Learning</td>
<td>Prof. Dr.-Ing. Bert Leisenheimer</td>
</tr>
</tbody>
</table>

**Learning objectives**

**Learning outcomes**

The purpose of the master thesis is to enable the student to develop deeper knowledge, understanding, capabilities and attitudes in the context of the program of study. The thesis should be written at the end of the program and offers the opportunity to delve more deeply into and synthesize knowledge acquired in previous studies.

Students should considerably demonstrate more in-depth knowledge of the major subject/field of study, including deeper insight into current research and development work. Students should have the capability to use a holistic view to critically, independently and creatively identify, formulate and deal with complex issues.

The Master thesis gives students the opportunity to present and discuss the knowledge in the respective field and argue these findings in written and spoken English. Students are prepared and have the foundations to conduct independent empirical research, present and evaluate their results responsibly, critically and objectively.

**Learning outcomes methodology**

The student integrates their knowledge and abilities which they accumulated during the Master course into the thesis. Additionally, they do independent research under the guidance of a supervisor, so that the thesis extends existing knowledge by new professional insights. They demonstrate the ability to investigate, discuss, evaluate and verify information on scientific level.

The student demonstrates the ability to apply research methods to their own project, select an appropriate research question and give a suitable, logical structure to the thesis project.

**Learning outcomes social and personal skills**

The aim of the thesis is for the student to display the knowledge and transfer it to the topics of the thesis. Students are able to formulate issues, plan and carry out advanced tasks within specified time limits. They can show a successful time-management and motivate themselves to finish their thesis successfully, even throughout difficult periods.

**Constructive alignment**

The main focus of the thesis project is the scientific content of the work, which will be submitted in written form. A written elaboration of a thesis project is the best way to show a detailed understanding of a subject and demonstrate the ability of structured thinking. This way the student is also able to prove their ability of applying scientific methods, which is not
restricted to a written text only. Additional elements such as experiments or modelling can be included. The candidate demonstrates the capability to apply logic thinking onto gathered information and draw valid results from it, so to earn the title Master of Engineering. Finally, the student is required to present his findings to the supervisors. In the presentation, the candidate proves his ability to summarize the most important content of his thesis coherently and comprehensively. During this examination, the student needs to justify his choices and conclusions. Additionally, the candidate is required to put the thesis into a larger context and transfer the insights.

Master Thesis Guidelines

The master’s thesis is a carefully argued scholarly paper of approximately 20,000 words (roughly 80 pages). It should present an original argument that is carefully documented from primary and/or secondary sources. The thesis must have a substantial research component and a focus that falls within arts and science, and it must be written under the guidance of an advisor. As the final element in the master’s degree, the master thesis gives students an opportunity to demonstrate expertise in the chosen research area.

After doing the initial research on their topic, students prepare a 1-2 paragraph abstract, a preliminary bibliography (approximately ten to fifteen books or journal articles), and a brief outline before approaching a possible advisor. These will help students to convince their future advisor of the value and interest of their project. Once a faculty member has agreed to be the advisor, students need to discuss the anticipated graduation date and agree on a timetable for meetings and submission of drafts. It is each student’s responsibility to keep his/her advisor apprised of the work’s progress.

After a student has refined his/her topic and his/her advisor has approved it, the student needs to complete the Application for Approval of Master’s Thesis Topic, have the advisor sign it, and submit it to the office.

In most cases, students and advisors need to meet three or four times: initially, to finalize a topic, and to review the first or second draft. Keep in mind that the advisor must have enough time to read and evaluate the work before returning it to the student with comments, and that the student must have time to incorporate those comments. Don’t expect the advisor to return the thesis in a day or two, whether it is an early draft or the final copy. Students should also be prepared for the possibility that their advisor will request substantial changes in the thesis. Do not expect that the draft thesis will require only minor corrections, or that the proposed final version will necessarily be approved without further changes. It is each student’s responsibility to see that the final copy is free from spelling and grammatical errors; the advisor is not responsible for line-by-line editing.

Recommended literature for preparation and follow-up

To be announced

Optional information: Lecturers for the courses in the module:

| Courses |
|-----------------|-----------------|-----------------|
| Lecturer | Title of the course in the module | Hours/ Module |
| Various    | Master Thesis    | 650             |