Hochschule Reutlingen
Reutlingen University

Curriculum & Syllabi Handbook

BSc Internationales Wirtschaftsingenieurwesen - Operations (IWI)

www.esb-business-school.de

Study and Examination Regulations: 26.02.2020
Summer Term 2022/23
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AACSB ACCREDITED

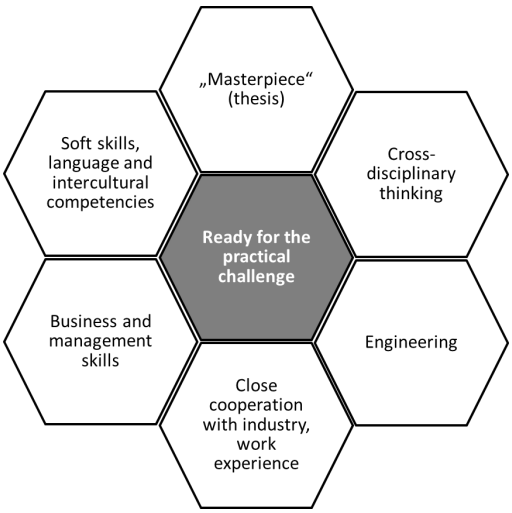
ESB BUSINESS SCHOOL

Contents

1 Qualification Profile

1.1 Aims of the programme

The study programme Internationales Wirtschaftsingenieurwesen - Operations (IWI; English: International Business and Engineering – Operations) focuses on applicants who have a high affinity both to engineering and mathematics as well as to business subjects. The programme follows the German concept of a "Wirtschaftsingenieur" (business engineer) and puts a special emphasis on international and cross-disciplinary aspects. Students acquire competencies and skills in six complementary fields:



Besides teaching fundamental concepts of business and engineering that are needed by future business engineers, the IWI programme puts a special emphasis on the dynamic field of production and logistics.

Special emphasis is put on the international and intercultural aspects of problem solving in the field of operations management and on a comparative view to business and engineering concepts in different world regions. Students deepen their language proficiency and intercultural competencies as well as their methodological and instrumental skills at the interface of business and technology.

1.2 Degree awarded

Bachelor of Science (BSc.)

1.3 Duration of studies

7 semesters (3.5 years)

1.4 Competence Goals and Objectives

The overall Competence Goals and objectives of all ESB study programmes are derived from the mission of ESB Business School and are subject to continuous quality assurance processes. The IWI course follows the mission of ESB Business School to develop leaders in an international environment who will shape our global economy and society in a socially responsible way. Its mission-derived Competence Goals are as follows:

1.5 Competence Goals*

LANGUAGE PROFICIENCY	INTERCULTURAL COMPETENCE	ETHICAL BEHAVIOR	DOMAIN-SPECIFIC PROBLEM SOLVING COMPETENCIES	DOMIAN-SPECIFIC FUNCTIONAL COMPETENCIES	DOMAIN-SPECIFIC METHODOLOGICAL COMPETENCIES
COMPETENCE GOAL 1	COMPETENCE GOAL 2	COMPETENCE GOAL 3	COMPETENCE GOAL 4	COMPETENCE GOAL 5	COMPETENCE GOAL 6
IWI graduates are proficient in at least one foreign language	… are interculturally competent	… are able to manage ethical and legal issues in given situations	… are skilled problem solvers in the domain of business engineering	… are able to use mathematics and statistics for engineers	… possess enhanced digital literacy
COMPETENCE OBJECTIVE 1.1	COMPETENCE OBJECTIVE 2.1	COMPETENCE OBJECTIVE 3.1	COMPETENCE OBJECTIVE 4.1	COMPETENCE OBJECTIVE 5.1	COMPETENCE OBJECTIVE 6.1
IWI graduates communicate proficiently in spoken and written word (2nd language)	… demonstrate an awareness and understanding of cultural issues in a business context	… are aware of the main ethical and legal issues in their professional field and able to analyze these issues based on normative theory or models. They are able to develop viable solutions that conform to ethical behavior in given situations	… apply economical and technical knowledge to create, control and optimize networks in production and logistics	…are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering	…are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering
Measure embedded in Module Colloquium and Scientific Work on Internship, Semester 4, assessment by evaluation of a written scientific work and the oral presentation	Measure embedded in Module Study Abroad Semester, Semester 5, assessment by way of IES (Intercultural Efficiency Scale) test	Measure embedded in Module Technical Planning Project, Semester 7, assessment by group presentation	Measure embedded in Module Interdisciplinary Project, Semester 7, assessment by learning portfolio	Measure embedded in Module Advanced Mathematics II, Semester 2, assessment by exam question	Measure embedded in Module Interdisciplinary Project, Semester 7, assessment by learning portfolio

* not in order of priority

These mission-derived Competence Goals are further complemented by IWI-specific goals as implemented in the curriculum.

The programme is focused on the design, controlling and optimization of networks. In particular it educates business engineers who design, control and optimize flows of material, information and finances in global value-adding networks.

Graduates possess a comprehensive knowledge of fundamental business and engineering topics and are domain experts in the fields of production and logistics. They are able to apply major management and engineering concepts / tools in complex problem settings and have first hands-on experience in managing cross-disciplinary projects.

Graduates' Competences:

- Knowledge that is necessary for the control of cross-company coordination processes,
- The ability to plan cross-company strategic production and logistics projects
- The ability to use necessary extended decision-making strategically and tactically
- Skills to manage expanded outsourcing
- Knowledge and ability to master and implement the technical requirements

Graduates' Skills:

- Graduates are able to understand technical correlations, to plan and constantly optimise dynamic processes from a technical perspective.
- They are team players skilled in problem solving due to extensive project experience acquired during the study programme
- They are flexible (both regarding finding the right solution and their working place) and demonstrate intercultural experience due to diverse international project and study experience.
- They are able to think and work analytically and process-oriented due to tailored study programme curricula.
- They are familiar with planning, implementation, and management methods and are able to apply them.
- They are well-acquainted with topics and trends which will influence operations management in the future.
- They are able to shape the future by combining scholarship with current research topics.

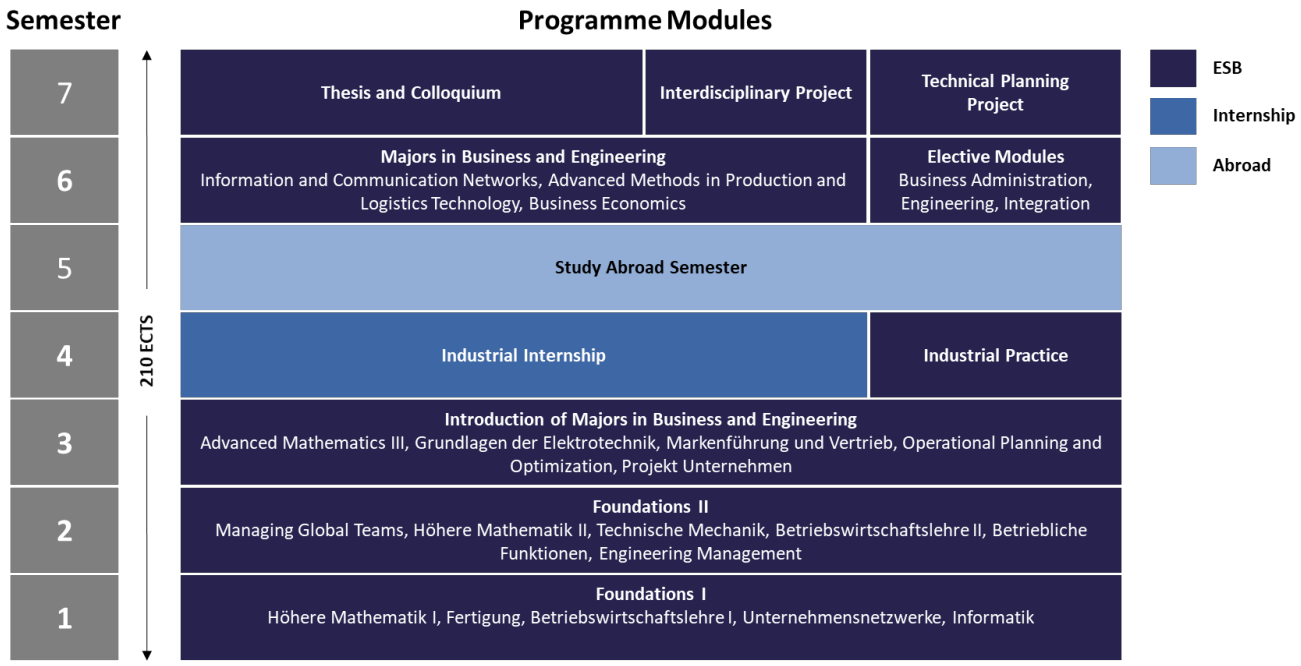
Graduates have broad international experience both in an academic and in an industry environment (technical as well as business experience) and are used to working in a culturally diverse environment. Their pronouncedly interdisciplinary and practice-oriented education qualifies them for positions at the interface between business and engineering in an international work environment.

Their profile makes them ideally suited as process and project experts in an international production and logistics context. Graduates can assume functions in internationally active manufacturing companies as well as in international consulting.

2 Curriculum Structure

The programme „Internationales Wirtschaftsingenieurwesen - Operations“ (International Business and Engineering – Operations) is an undergraduate study programme leading to the academic degree of Bachelor of Science. The programme comprises 7 semesters, including an internship semester, a compulsory study abroad semester and a final thesis semester which is usually done in close cooperation with a company.

Students can start the study abroad semester only after having attained at least 66 ECTS credits in the first three study semesters. The bachelor thesis can be started only after at least 165 ECTS credits have been earned.



3 Overview: Modules and Courses

Table 1: Curriculum B.Sc. Internationales Wirtschaftsingenieurwesen - Operations

Modul	Module / Vorlesungen	ECTS in Semester							Workload								
		1.	2.	3.	4.	5.	6.	7.	Weekly Contact hours	Total Contact hours	Self study	Total Work-load	Type of Lesson	Lan-gu-age	Type of Assessment	graded/ ungra-ded	Weighting of Grade
MAT1	**Höhere Mathematik I / Advanced Mathematics I**	**5**							**4**	**60**	**90**	**150**	**Vorlesung**	**G**	**KL2**	**b**	**5/156**
FER	**Fertigung / Manufacturing**	**5**							**4**	**60**	**90**	**150**	**Vorlesung**	**G**	**KL2**	**b**	**5/156**
FET	Fertigungstechnik								2	30	60	90	Vorlesung				
WSK	Werkstoffkunde								2	30	30	60	Vorlesung				
BWL1	**Betriebswirtschaftslehre I / Business Economics I**	**6**							**5**	**75**	**105**	**180**	**Vorlesung**	**G**	**KL2**	**b**	**6/156**
BWL	Grundlagen der BWL								3	45	75	120	Vorlesung				
MAR	Marketing								2	30	30	60	Vorlesung				
UNW	**Unternehmensnetzwerke / Corporate Networks**	**6**							**4**	**60**	**120**	**180**	**Vorlesung/Labor**	**G**	**KL2**	**b**	**6/156**
LOG	Beschaffungs- und Produktionslogistik								2	30	60	90	Vorlesung/ Labor				
REC	Wirtschaftsrecht								2	30	60	90	Vorlesung				
INF	**Informatik / Computer Science**	**5**							**4**	**60**	**90**	**150**	**Vorlesung**	**G**	**KL2**	**b**	**5/156**
MGT	**Managing Global Teams**		**6**						**5**	**75**	**105**	**180**	**Seminar**	**E**	**CA**	**b**	**6/156**
ICB	Intercultural Business Communication and Business English								3	45	75	120	Seminar				
OBH	Organizational Behaviour								2	30	30	60	Seminar				
MAT2	**Höhere Mathematik II / Advanced Mathematics II**		**5**						**4**	**60**	**90**	**150**	**Vorlesung**	**G**	**KL2**	**b**	**5/156**
TME	**Technische Mechanik / Technical Mechanics**		**6**						**4**	**60**	**120**	**180**	**Vorlesung/Labor**	**G**	**KL2**	**b**	**6/156**
BWL2	**Betriebswirtschaftslehre II / Business Economics II**		**5**						**4**	**60**	**90**	**150**	**Vorlesung**	**G**	**KL2**	**b**	**5/156**
KOS	Kostenrechnung								2	30	60	90	Vorlesung				
VER	Investitionsrechnung und Finanzierung								2	30	30	60	Vorlesung				
BFU	**Betriebliche Funktionen / Operational Functions**		**5**						**4**	**60**	**90**	**150**	**Vorlesung**	**G**	**KL2/CA**	**b**	**5/156**
ISE	Informatik und Softwareentwicklung								2	30	30	60	Vorlesung				
TEZ	Technisches Zeichnen								2	30	60	90	Vorlesung				
EMG	**Engineering Management**		**6**						**6**	**90**	**90**	**180**	**Vorlesung/Labor**	**G**	**KL3**	**b**	**6/156**
IEN	Industrial Engineering								4	60	60	120	Vorlesung/Labor				
QMA	Qualitätsmanagement								2	30	30	60	Vorlesung				
MAT3	**Advanced Mathematics III**			**5**					**4**	**60**	**90**	**150**	**Vorlesung**	**E**	**KL2**	**b**	**5/156**
SCO	Scientific Computing								2	30	30	60	Vorlesung				
MLD	Maschine Learning and Data Analytics								2	30	60	90	Vorlesung				
GET	**Grundlagen der Elektrotechnik / Electrical Engineering**			**6**					**4**	**60**	**120**	**180**	**Vorlesung/Labor**	**G**	**KL2**	**b**	**6/156**
GEV	Grundlagen der Elektrotechnik - Vorlesung								3	45	75	120	Vorlesung				
GEL	Grundlagen der Elektrotechnik - Labor								1	15	45	60	Labor				
BWL3	**Markenführung und Vertrieb / Brand Management and Sales**			**5**					**4**	**60**	**90**	**150**	**Vorlesung**	**G**	**KL2**	**b**	**5/156**
OPO	**Operational Planning and Optimization**			**6**					**6**	**90**	**90**	**180**	**Vorlesung/Labor**	**E**	**KL3**	**b**	**6/156**

Curriculum and Syllabi Handbook
BSc Internationales Wirtschaftsingenieurwesen - Operations

Modul	Module / Vorlesungen	ECTS in Semester							Workload								
		1.	2.	3.	4.	5.	6.	7.	Weekly Contact hours	Total Contact hours	Self study	Total Work-load	Type of Lesson	Lan-gu-age	Type of Assessment	graded/ ungra-ded	Weighting of Grade
ORE	Operations Research								2	30	30	60	Vorlesung				
OMS	Operations Management Systems								2	30	30	60	Vorlesung/Labor				
PJM	Project Management								2	30	30	60	Vorlesung				
PRO1	**Projekt Unternehmen / Company Project**			**5**					**4**	**60**	**90**	**150**	**Seminar/Vorl./Labor**	**G**	**KL1/PA**	**b**	**5/156**
PZM	Prozessmanagement								2	30	30	60	Vorlesung/Labor				
UPR	Unternehmensprojekt								2	30	60	90	Seminar				
PRO2	**Industrial Practice**			**6**					**4**	**60**	**120**	**180**	**Seminar**	**E**	**PA/CA**	**b**	**6/156**
PSW	Problem Solving Skills and Academic Writing								2	30	60	90	Seminar				
BUS	Business Simulation								2	30	60	90	Seminar				
PRO3	**Industrial Internship**				**27**				**4**	**60**	**750**	**810**	**Internship/Kolloquium**	**G/E**	**PA/CA**	**b**	**3/156**
INC	Intercultural Competencies and Preparation for Internship								2	30	30	60	Seminar				
INT	Internship								0	0	660	660	Ind. Assignment				
CSW	Colloquium and Scientific Work On Internship					3			2	30	60	90	Kolloquium				
SAS	**Study Abroad Semester**								**0**	**0**	**900**	**900**	**Partner**	**E**	**Partner**	**u**	
ICN	**Information and Communication Networks**						**6**		**4**	**60**	**120**	**180**	**Vorlesung/Labor**	**E**	**KL2**	**b**	**6/156**
ICV	Information and Communication Networks - Lecture								3	45	75	120	Vorlesung				
ICL	Information and Communication Networks - Laboratory								1	15	45	60	Labor				
PLT	**Advanced Methods in Production and Logistics Technology**						**8**		**6**	**90**	**150**	**240**	**Vorlesung**	**E**	**KL1/PA/RE**	**b**	**8/156**
APT	Advanced Production Technology								2	30	60	90	Vorlesung				
ALT	Advanced Logistics Technology and Automation								2	30	60	90	Vorlesung				
TWP	Technical Warehouse Planning								2	30	30	60	Vorlesung				
BEC	**Business Economics**						**6**		**4**	**60**	**120**	**180**	**Vorlesung**	**E**	**KL1/PA**	**b**	**6/156**
CCG	Controlling And Corporate Governance								2	30	60	90	Vorlesung				
LEG	Legal Aspects of International Business Transactions								2	30	60	90	Vorlesung				
Elective Module Business Administration																	
WBUA1	**Human Resources**						**4**		**2**	**30**	**90**	**120**	**Vorlesung**	**E**	**CA/HA**	**b**	**4/156**
WBUA2	**Supply Chain Management, Logistics and Sourcing**						**4**		**2**	**30**	**90**	**120**	**Vorlesung**	**E**	**KL1**	**b**	**4/156**
Wahlpflichtmodul Ingenieurswissenschaften																	
WING1	**Automatisierung und Mechatronik / Automation and Mechatronics**						**4**		**2**	**30**	**90**	**120**	**Vorlesung/Labor**	**G**	**KL1**	**b**	**4/156**
WING2	**Digitales Engineering und Tools / Digital Engineering and Tools**						**4**		**2**	**30**	**90**	**120**	**Vorlesung/Labor**	**G**	**KL1**	**b**	**4/156**
Elective Module Integration																	

Modul	Module / Vorlesungen	ECTS in Semester							Workload								
		1.	2.	3.	4.	5.	6.	7.	Weekly Contact hours	Total Contact hours	Self study	Total Work-load	Type of Lesson	Lan-gu-age	Type of Assessment	graded/ ungra-ded	Weighting of Grade
WINT1	**Process Optimization**						**4**		**2**	**30**	**90**	**120**	**Vorlesung**	**E**	**KL1**	**b**	**4/156**
WINT2	**Circular Economy**						**4**		**2**	**30**	**90**	**120**	**Vorlesung**	**E**	**KL1**	**b**	**4/156**
PRO4	**Technical Planning Project**							**6**	**4**	**60**	**120**	**180**	**Projektarbeit**	**E**	**PA**	**b**	**6/156**
PRO5	**Interdisciplinary Project**							**8**	**6**	**90**	**150**	**240**	**Projektarbeit**	**E**	**PA**	**b**	**8/156**
BAT	**Bachelor Thesis und Kollquium / Bachelor Thesis and Colloquium**							**14**	**0**	**0**	**420**	**420**	**Thesis/Kolloquium**	**G/E**	**BT/RE**	**b**	**14/156**
THE	Bachelor Thesis								0	0	360	360	Ind. Assignment				
KOL	Kolloquium zur Thesis								0	0	60	60	Kolloquium				

4 Modules and Courses

4.1 Module: Höhere Mathematik I

Module Registration No.	4.1.
Semester	1
Duration of module	1 Semester
Type of module	Compulsory
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Dirk Schieborn
Lecturers name (contact details see ESB-website)	Prof. Dr. Dirk Schieborn
Teaching language	German
Credits (ECTS)	5
Total work load	150 hours
Contact hours per week	4 SWS
Examination/ Type of assessment	Written exam (2hrs.)
Graded/ungraded	Graded
Weighting of Grade within overall programme	According to credits
Learning outcomes	The aim of the course is to acquire basic mathematical skills through practical examples which need to be used during the time of study. After these coursees, students should: • have understood the mathematical terms, their context and uses for the economics part of the programme • have understood engineering maths as a basis for working as an engineer and also to have laid the foundations for electrical engineering and mechanics through practical examples

Module-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students understand engineering maths and learn to use matrices, functions, differentiation and integration and adapt them to practical problems.) • **Competence Goal 5.1.: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1.: introduced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	Topics: • Sequences and series • Number systems • Complex numbers • Real functions of real numbers • Differentiation and Integration • Matrices and determinants
Teaching and learning methology	Lecture and tutorials
Miscellaneous	None
Indicative reading list	Basics: • Papula, Lothar: Mathematische Formelsammlung für Ingenieure und Naturwissenschaftler, Vieweg Verlag, 2003. • Knut Sydsaeter, Peter Hammond, Arne Strom: Essential Mathematics for Economic Analysis, Prentice Hall, 2012. • Karl Bosch: Mathematik für Wirtschaftswissenschaftler: Einführung. Oldenbourg, 2011. • Knut Sydsaeter, Peter Hammond: Mathematik für Wirt-schaftswissenschaftler, Pearson, 2002.

4.2 Module: Fertigung

Module registration No.	4.2.
Semester	1
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Fertigungstechnik • Werkstoffkunde
How frequently is the module offered	Every semester
Admission requirements	None

Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Dominik Lucke
Total number of ECTS	5
Examination/ Type of assessment	Projektarbeit
Learning outcomes (module)	**Professional competencies:** • Knowledge of the essential production technologies and common materials. • Knowledge to select production technologies holistically • Knowledge of material structure, microstructure and relevant properties and important material groups (metals, polymers, ce-ramics). • Knowledge of typical material properties and their determination. **Interdisciplinary competencies:** • Courseification and assessment of production technology and the corresponding processes and their basic functionalities • Courseification and assessment of materials and their basic characteristics **Social competencies, key competencies:** • Assessment of the areas of application of production technologies according to sustainability and health hazards aspects • Knowledge of possibilities and limits of materials and production technologies • Assessment of the materials according to sustainability and health hazards aspects **Personal competencies:** • Holistic assessment of different production technologies • Knowleedge of materials and their application in products
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.2.1 Course: Fertigungstechnik

Type of course	Compulsory
Lecturers name; contact details see ESB-website	O. Grohmann
Teaching language	German

Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	**Professional competencies:** • Description of various production technologies and their functions • Knowledge to select production technologies **Interdisciplinary competencies:** • Courseification of production technologies and their basic functionality • Assess the interrelationships of production technologies holistically **Social competencies, key competencies:** • Assessment of the areas of application of production and manufacturing processes according to sustainability and health hazards • Knowleedge of possibilities and limits of innovative production technology and evaluate production processes and their application **Personal Competencies** • Holistic assessment of different production technologies
Course-specific contribution to AoL competence goals	• **Competence Goals 4.1: introduced** (the students acquire knowledge of production technology in order to assess and select manufacturing processes holistically.)

Contents/ Indicative syllabus	• The production as a value-adding process
	• Selection of manufacturing processes
	• Overview of manufacturing processes:
	  • Primary shaping processes: Casting and additive manufacturing processes,
	  • Forming,
	  • Cutting: turning, milling, grinding,
	  • Joining: soldering, welding, riveting,
	  • Coating,
	  • Changing material properties)
	• Quality characteristics of products (dimensions, technical surfaces)

Teaching and learning methology	Lecture
Miscellaneous	---
Indicative reading list	• Fritz, A. Herbert [Hrsg.]: Fertigungstechnik, 12.Auflage, Springer Vieweg Berlin, Heidelberg 2018, ISBN 978-3-662-56535-3 • Westkämper, Engelbert, Warnecke, Hans-Jürgen: Einführung in die Fertigungstechnik Vieweg+Teubner, Wiesbaden, 2010, ISBN 978-3-8348-9798-5

4.2.2 Course: Werkstoffkunde

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Dozent Herr Dr.-Ing. René Poss
Teaching language	German
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	**Professional competencies:** • Knowledge of material structure, microstructure and relevant properties and important material groups (metals, polymers, ceramics). • Knowledge of the essential manufacturing processes of commonMaterials. • Knowledge of typical material properties and their determination. • Knowledge of common standards for materials courseification. **Interdisciplinary competencies:** • Courseification of materials and their characteristics **Social competences, key competencies:** • Assessment of the areas of application of materials in according to sustainability and health hazards aspects • Knowledge of possibilities and limits of materials and their application in products **Personal competencies:** • Knowledge of materials and their application in products
Course-specific contribution to AoL competence goals	• **Competence Goal 4.1: introduced** (students understand the structure and characterisics of materials and learn to adapt them to industrial application fields.)

Contents/ Indicative syllabus	• Structure of materials
	• Structure of metals:
	  • Crystalline structures
	  • State diagrams
	  • Alloys
	• Structure of polymers and ceramics
	• Material properties and testing methods
	• Standards for material courseification and identification

Teaching and learning methology	Lecture
Miscellaneous	---
Indicative reading list	• Läpple, Drube, Wittke, Kammer: Werkstofftechnik Maschinenbau, Europa Lehrmittel, Haan-Gruiten, 5. Auflage 2015 • Bargel, Schulze: Werkstoffkunde, Springer Verlag, 12., bearb. Aufl. 2018, Korr. Nachdruck 2018

4.3 Module: Betriebswirtschaftslehre I

Module registration No.	4.3
Semester	1
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Grundlagen der BWL • Marketing
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	no
Responsible professor/ Module coordinator	Prof. Dr. Kristina Steinbiß and Prof. Dr. Johanna Bath
Total number of ECTS	6
Examination/ Type of assessment	Written exam (2hrs.)
Learning outcomes (module)	• **Professional competencies**: Die Studierenden erhalten einen grundlegenden Einblick in die marktorientierte Führung von Unternehmen. Sie können grundsätzlich erklären, wie ein Betrieb zielorientiert handelt. Sie erkennen die zugrundeliegende Systematik und wissen um die Bedeutung von Planung, Durchsetzung und Kontrolle. • **Methodological competencies:** Die Studierenden lernen die wichtigsten Methoden zur strategischen Kernentscheidungen zur marktorientierten Unternehmensführung anzuwenden. Sie sind damit grundsätzlich in der Lage, komplexe betriebswirtschaftliche Problemstellungen zu analysieren, Lösungsvorschläge zu entwickeln und (theoretisch) auszuführen. • **Social competencies**: Durch Fallstudien und Gruppenarbeiten steigern die Studierenden ihre Teamfähigkeit und verbessern die Präsentationstechnik. • **Personal competencies:** Durch Diskussionsrunden steigern die Studierenden ihr Selbstbewusstsein und können marktorientierte Aspekte der Betriebswirtschaft kritisch hinterfragen und beurteilen. Darüber hinaus wird das Verantwortungsbewusstsein sowie die Selbstorganisation durch eigenverantwortliches Lernen erhöht.
Graded/ungraded	Graded

Weighting of grade within overall programme	According to credits

4.3.1 Course: Grundlagen der BWL

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Johanna Bath (Dozent: Dumancic)
Teaching language	German
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	3 SWS
Learning outcomes	• **Professional competencies**: Get an overview of the theoretical background of the different know-how areas of business studies. Get to know the basic functions necessary to run a modern company, get to know trends of business research, basic insight into business decision making from the perspective of management. • **Methodological competencies**:– Students know basic tools to support strategic decision making in the business context. They will learn to apply these tools in case studies throughout the course. • **Extended competencies/preparation for working environment:** Students get to know real live cases and will systematically improve their approach, by learning efficient information gathering, structuring information appropriately and presenting their line of thought with different presentations techniques. They learn how to apply new business know-how to real live examples and get to now methods and instruments to tackle business questions. • **Social competencies**: Case study groups are mixed throughout the semester enhancing the opportunity to form new collaboration groups each week. Group discussions are used in order to help improve presentations skills and to defend one´2 opinion against different lines of thought. • **Personal competencies**: Ethical aspects within the business context are discussed and conflicts of interest within a company as well as company´s environment are put into the centre of critical discussions. Students learn to be critical and think through business decision making as well as develop a good understanding of possible consequences of those decision.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 2.1: introduced** (differences between German and international regulations and procedures in business practice are pointed out to the students) • **Competence Goal 3.1: reinforced** (specific exercices and mandatory case studies point out the conflicts of interest between profit optimization and ethical behavior)

	• **Competence Goal 4.1: reinforced** (the exam is case study based and assesses therefore methodological problem solving skills in the business context) • **Competence Goal 5.1 (introduced)** (Students understand the connection between finances, investment decisions and the product development and realisation processes.) • **Competenc Goal 6.1 (introduced)** (students get to know the digital tool sets companies use for business process management)
Contents/ Indicative syllabus	• Introduction to business management • Business management functions within a company (management, HR, Controlling, Accounting) • Introduction to cost accounting • Introduction to profit and loss calculation as well as balance sheet • Introduction to strategy formation
Teaching and learning methology	Inverted course room concept, videos/lecture material for home study, case studies to work on in the course, know-how testing via online votings performed in course
Miscellaneous	---
Indicative reading list	• Wöhe, G.: Einführung in die Betriebswirtschaftslehre. 26., überarbeitete und aktualisierte Auflage, München 2016 • Junge, P.: BWL für Ingenieure: Grundlagen - Fallbeispiele – Übungsaufgaben, 2012 • Müller, D. Betriebswirtschaftslehre für Ingenieure: Grundlagen - Fallbeispiele - Übungsaufgaben, 2013

4.3.2 Course: Marketing

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Kristina Steinbiß
Teaching language	German
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	After the successful completion of the module the students should have developed the following competencies: • **Professional competencies:** critically discuss the relevance and success factors of different marketing approaches; recapitulate and apply the value-based marketing concept in business situations; understand the importance of calculating and capturing the value of the customer. • **Methodological competencies:** develop a marketing strategy; transfer and apply theoretical marketing knowledge to real-life business cases;

	develop presentation skills, familiarize with basic research methodology. • **Social competencies:** refine their oral communication skills; improve their ability to work in teams in order to solve a given complex marketing situation; give and receive feedback by fellow students in a structured manner. • **Personal competencies:** develop the ability to think and act proactively as well as customer/marketing oriented
Course-specific contribution to AoL Competence Goals	• **Competence Goal 3.1: reinforced** (Students develop the ability to think and act proactively taking under consideration ethical behavior as well as customer/marketing oriented practical problems) • **Competence Goal 4.1: reinforced** (Students develop a marketing strategy; transfer and apply theoretical marketing knowledge to real-life business cases; develop presentation skills, familiarize with basic research methodology.)
Contents/ Indicative syllabus	The course is an introduction to the language and issues of marketing with an emphasis on learning to develop responsive marketing strategies that meet customer needs. The course focuses on basic marketing concepts, the role of marketing in the organization, and the role of marketing in society. Topics include market segmentation, product development, promotion, distribution, and pricing. Other topics, which will be incorporated into the course, are external environment (which will focus on integrative topics with marketing, such as economics, politics, government, and nature), international/global marketing with relevance to cultural diversity and ethics.
Teaching and learning methology	The course is highly interactive between the course and the instructor. Through case studies/presentations, problems, and specific company client activities, students will have the opportunity to use the concepts, ideas, and strategies presented in course. Problem-solving sessions occur in both individual (primarily) and team (occasionally) settings. This course will incorporate a lecture and project-based approach to the principles of marketing.
Miscellaneous	---
Indicative reading list	• Principles of Marketing, Fourteenth Edition, by Kotler/Armstrong, Pearson Education 2012 • Marketing by Fröhlich/Lord/Steinbiß/Weber, 2018

4.4 Module: Unternehmensnetzwerke

Module registration No.	4.4.
Semester	1
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Beschaffungs- und Produktionslogistik • Wirtschaftsrecht

How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competencies.
Responsible professor/ Module coordinator	Prof. Dr. Joachim Gschwinder
Total number of ECTS	6
Examination/ Type of assessment	Written exam (2hrs.)
Learning outcomes (module)	The module provides students with knowledge in the field of procurement and production logistics as well as business law. Students will understand the principles of procurement and production logistics in an international business environment as well as legal problems arising in the business environment.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.4.1 Course: Beschaffungs- und Produktionslogistik

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr.-Ing, Vera Hummel
Teaching language	German
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	Students learn the meaning of the logistics, international procurement as well as the production logistics and can comprehend the tasks involved in this. They are also taught to think about integral planning, organisation and control of logistics systems. • After completing the course students will be able to • Explain with examples the elements and structures of systems of logistics procurement and be able to propose solutions from practical examples with a global background.

	• Recognise through the choice of procurement strategies and the organisation of long-term cooperation relationships with suppliers, that market-driven logistics concepts decisively shape logistics systems. • Carry out an evaluation and selection of suitable suppliers in order to implement a logistics strategy in the international procurement process. • Evaluate organisational options for cross-border procurement processes. • Plan and calculate the logistics of systems of production according to market requirements. • Calculate, plan and optimise material flow systems
Course-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students learn to systematically apply diverse concepts of procurement and logistics to typical real-life questions. They understand strengths and weaknesses of different concepts in logistics management.)
Contents/ Indicative syllabus	Procurement logistics: • Limiting factors in international procurement logistics • Elements of systems of logistics procurement • Aims and areas of decision-making in international procurement logistics (delivery/distribution service; costs; key data) • Logistics strategies in the procurement process (selection criteria, support in decision-making) • Organisation of supplier-client relationships (sourcing models) • Planning and organisation of procurement logistics processes • Supplier selection and development • International routes of distribution and types of business (Incoterms) • Customs (trade restrictions, imports which require an authorisation, clearance for goods) Production logistics: • Production flow, material flow, information flow • Material flow planning and control • Information flow planning and control • Critical parameters, deviated parameters, key data, calculations • Analysis, diagnosis, strategy key data systems and logistics measurement criteria • Material flow • Strategic planning of a company and of production logistics • Organisation and control concept • Manufacturing control method, scheduling method • Industrie 4.0, self steering and self optimization
Teaching and learning methodology	Interactive lecture and demonstration in Werk150 – factory of the ESB Business School on the campus of Reutlingen University
Miscellaneous	---

Indicative reading list	• Grundlagen der Logistik: Begriffe, Strukturen und Prozesse (Deutsch) Lehrbuch, Claus Muchna (Autor); Springer – 10. November 2017 • Grundzüge der Beschaffung, Produktion und Logistik;; Sebastian Kummer (Autor), Oskar Grün (Autor), Werner Jammernegg (Autor), Auflage: 4, Pearson Verlag, (1. Dezember 2018) • Logistik 4.0: Die digitale Transformation der Wertschöpfungskette (essentials) (Deutsch), Thomas Bousonville, Springer Gabler– 15. Dezember 2016

4.4.2 Course: Wirtschaftsrecht

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Joachim Gschwinder (Dozent: M. Conrads)
Teaching language	German
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	On successful completion of this course, students will: • be able to identify and formulate basic legal issues that apply to the facts of a given case (professional competencies) • have a basic understanding of the steps of finding legal decisions and have basic knowledge of legal research (methodological competencies); • will refine oral and written communication skills (social competencies); • promote fairness and justice by recognizing and addressing legal dilemmas and generating alternative solutions (personal competencies).
Course-specific contribution to AoL Competence Goals	• **Competence Goal 3.1: introduced** (Awareness of ethical aspects of legal frameworks and decisions is raised) • **Competence Goal 4.1: introduced** (Students get familiar with general and business law and develop an understanding of the relevant German legal framework. They are able to work on practical cases and apply the law to the particular cases in the business environment.)
Contents/ Indicative syllabus	• Contract Law • Company organization • Intellectual property rights • Labour Law • Public commercial law
Teaching and learning methodology	Interactive lecture with case studies

Miscellaneous	---
Indicative reading list	• Führich, Ernst: Wirtschaftsprivatrecht, Verlag Vahlen, München (current edition); • Niedostadek, André: Wirtschaftsrecht, Wiley Verlag, Weinheim (current edition) • Hassenpflug, Helwig/Schwind, Hans-Dieter/Melchior, Robin: Wirtschaftsrecht leicht gemacht, Ewald v. Kleist Verlag, Berlin (current edition). • Further material (script) will be provided in course.

4.5 Module: Informatik

Module Registration No.	4.5
Semester	1
Duration of module	1 Semester
Type of module	Compulsory
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Volker Reichenberger
Lecturers name (contact details see ESB-website)	Prof. Dr. Volker Reichenberger
Teaching language	German
Credits (ECTS)	5
Total work load	150 hours
Contact hours per week	4 SWS
Examination/ Type of assessment	Written exam (2hrs.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	Basic understanding of

	• Computer architecture • Operating systems • Programming with Python • Procedural programming • Object oriented programming • Data structures and algorithms
Module-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: introduced** (Students acquire the competence to write and analyze computer programs in a systematic way. They have a basic understanding of computer hardware and operating systems as well as data structures and algorithms.) • **Competence Goal 5.1.: reinforced** (Sudents are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Computer architecture • Operating systems • The programming language Python • Procedural programming • Object oriented programming and UML • Data structures and algorithms • Algorithmic complexity • Computer security
Teaching and learning methodology	Lecture and exercises
Miscellaneous	None
Indicative reading list	• Helmut Balzert: Grundlagen der Informatik • Helmut Herold: Grundlagen der Informatik • Robert Sedgewick und Kevin Wayne: Computer Science: An Interdisciplinary Approach • John M. Zelle: Python Programming: An Introduction to Computer Science • Abelson und Sussman: Structure and Interpretation of Computer Programs

4.6 Module: Managing Global Teams

Module registration No.	4.6
Semester	1 /2
Duration of module	2 Semesters

Type of module	Compulsory
Courses included in the module	• Intercultural Business Communication and Business English • Organizational Behaviour
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any international programme requiring students to have a general competence of managing or working in global teams.
Responsible professor/ Module coordinator	Prof. Dr. Hazel Grünewald
Total number of ECTS	6
Examination/ Type of assessment	Continuous Assessment (CA)
Learning outcomes (module)	The key aims of this module is raising awareness of foreign cultures and behaviour patterns, understanding of key concepts, models and practices within the field of organisational behaviour as well as the introduction to business subjects in English.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.6.1 Course: Intercultural Business Communication and Business English

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Hazel Grünewald (Dozenten: Ogden, Riha, Coetzer)
Teaching language	English
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	3 SWS
Learning outcomes	Raising awareness of foreign cultures and behaviour patterns is the primary aim of the course. After this course students should be in the position to: • Evaluate the influence of intercultural differences in international business relationships and adapt their behaviour according to these differences.

- Prepare themselves appropriately in advance for new intercultural situations.

After successful completion of this course the students should have gained the following knowledge and developed the following competencies:

Professional competencies:

- knowledge and application of current intercultural management concepts and approaches; competence to analyse the influence and the consequences of cultural differences in specific international business situations.
- Ability to talk and write about business topics relevant to their business degree programme in the target language using appropriate business vocabulary, register and structures.
- Understanding of the current business, political and economic environment of the country in which they will spend the second part of their studies.
- Development of an appreciation of the cultural differences between Germany and Anglo-Saxon countries and how these impact doing business.
- Acquisition of the academic writing skills necessary for the second part of their studies in the foreign country.

Methodological competencies:

- problem-solving skills (how to use theoretical concepts to solve problems in case studies).
- Students will identify and select communication methods bestsuited for specific business scenarios.
- Students work in teams, sometimes even virtual teams. They have a chance to use a variety of presentation, facilitation and meeting methods.
- E-learning elements are part of some of the courses and these require good self-organisation and discipline

Social competencies:

- advanced presentation and teamworking skills (through group discussions and group presentations);
- basic competence to interact successfully in an intercultural business environment.
- Students will have to present complex topics in the chosen target language and will gain more self-confidence in expressing themselves and making themselves understood.

Personal competencies:

- awareness of the own cultural profile, the individual strength and weaknesses in intercultural business situations.
- Students will improve self-confidence using their foreign-language business skills for different purposes

Graded/ungraded	Graded
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: introduced** (Students get familiar with specific terms from the field of Culture in an international context. They are constantly able to practice their written and oral language skills in English. They identify and select communication methods best suited for specific business and technical scenarios. They get familiar with specific terminology in the field of business and operations management) • **Competence Goal 2.1: introduced** (Students evaluate the influence of intercultural differences in international business relationships and adapt their behaviour according to these differences. They prepare themselves appropriately in advance for new intercultural situations. They improve their language competency which helps them understand cultural traits such as habits, customs, proverbs, etc.) • **Competence Goal 3.1: introduced** (Students get an awareness of the own cultural profile, ethical behaviour, the individual strengths and weaknesses in intercultural business situations. They seek advice, integrate suggestion and reflect what they are doing. The learn how to cope with conflict situations.)
Contents/ Indicative syllabus	• Fundamentals of intercultural communication; approaches to intercultural management, culture-specific examples, intercultural communication and management in practice • Introduction to business subjects in English; development of Business English vocabulary for degree subjects (International Business Engineering) as well as vocabulary necessary to read relevant business publications; Writing skills: business correspondence and report writing, including reading comprehension and responding critically. Special focus will be given to verb tense and register. Business Soft Skills: • Development of business soft skills combined with sensitivity to international business cultures. • Intercultural Competence/Intercultural Communication: • Preparation of students for living, working and studying abroad; insights into the national and business cultures of these countries; identification of differences to Germany • Introduction to intercultural terminology. How we perceive ourselves and how others see us. • Dealing with stereotypes critically. Comparison of educational objectives. • Introduction business culture, differences in styles of business negotiations
Teaching and learning methodology	Seminar (lecture, discussions, case studies, film extracts, movies, E-Learning, simulations and exercises)
Miscellaneous	---
Indicative reading list	Intercultural Business Communication: • Adler, Nancy J. (2008): International Dimensions of Organizational Behavior. 5thEdition. Stanford: Cengage Learning Services.

	• Bennett, M.J. (Ed.) (1998): Basic Concepts of Intercultural Communication. Yarmouth: Intercultural Press. • Bolten, J. (2007): Einführung in die Interkulturelle Wirtschaftskommunikation. UTB. • Browaeys, Marie-Joëlle; Price, Roger (2011): Understanding Cross-Cultural Management. Second Edition. Essex: Pearson. • Chhokar, J.S.; Brodbeck, F.C.; House, R.J. (Eds.) (2008): Culture and Leadership Across the World: The GLOBE Book of In-Depth Studies of 25 Societies. New York: Lawrence Erlbaum. • Deardorff, Darla K. (2009): The SAGE Handbook of Intercultural-Competence. Thousand Oaks: Sage. • Deresky, Helen (2011): International Management, Managing • Across Borders and Cultures, 7th ed., Pearson • Hofstede, Geert; Hofstede, Geert Jan, Michael Minkov: Cultures and Organizations –Software of the Mind, 2010 • Schein, Edgar H. (2010): Organizational Culture and Leadership. 4th Edition. San Francisco: Jossey-Bass • Schmidt, Wallace V.; Conaway, Roger N.; Easton, Susan S.; Wardrope, William J. (2007): Communicating Globally. Intercultural Communication and International Business. Thousand Oaks: Sage. • Thomas, Alexander; Kammhuber, Stefan; Schroll-Machl, Sylvia (Editor) (2010): Handbook of Intercultural Communication and Cooperation. Basics and Areas of Application. Göttingen: Vandenhoeck & Ruprecht. Business English: Students will receive all necessary literature online. These may include extracts, for example, from magazine or newspapers such as The Economist, Time, Business Spotlight. Access to good grammar book is recommended: • Murphy, Raymond: English Grammar in Use, 4th Edition; Klett, 2012

4.6.2 Course: Organizational Behaviour

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Dr. Michiel Frederick Coetzer
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	After the successful completion of this course, students should have gained the following knowledge and developed the following competencies:

	Professional competencies: Understanding of key concepts, models and practices within the field of organisational behaviour such as personality, motivation, team dynamics and effectiveness, decision-making, organisational design, culture and change; appreciation of how theories can be translated into practical applications. **Methodological competencies:** Competence to identify business challenges and to prepare a paper and a presentation according to scientific standards. The ability to be able to stand back and view complex situations in perspective and to think critically about organisations and what happens in them. **Social competencies:** Presentation and teamwork skills (through group work and group presentations). **Personal competencies:** Awareness of the own skills in realising an experiential project.
Course-specific contribution to AoL Competence Goals	**Competence Goal 1.1** (reinforced) Students design and deliver a paper and presentation in English. Competence Goal 2.1 (reinforced) Students consider international perspectives of organisational behaviour. **Competence Goal 3.1** (reinforced) The students discuss organisational behaviour from different ethical perspectives.
Contents/ Indicative syllabus	The general objective of this course is to understand the dynamics of organization behaviour and to distinguish the individual, behavioral, social, group, and organizational processes that affects organizational effectiveness. **Module 1: Introduction to Organizational Behaviour** 1.1. An overview of organizational behaviour 1.2. The changing environment of organizations **Module 2: Individual Behaviors and Processes in Organizations** 2.1. Individual differences and personality dynamics 2.2. Individual values, perceptions, and reactions 2.3. Motivating behaviour and theories of motivation 2.4. Job design, performance management and remuneration **Module 3: Social and Group Processes in Organizations**

	3.1. Groups and teams 3.2. Managing conflict and negotiation
Teaching and learning methodology	**Foundational learning methods:** Lectures and self-study. **Social learning methods:** Group discussions and group problem solving. **Experiential learning methods:** Case studies, simulations, videos, in-class activities, gamification, experiential group project. **Personal learning:** Personal assessments and reflection.
Miscellaneous	---
Indicative reading list	In-depth reading: Griffen, R. W., Phillips, J. M., & Gully, S. M. (2020). Organizational behavior: Managing people and organizations. Boston, MA: Cengage Learning, Inc. Supplementary reading: Coetzer, M. F. (2019). Leading business beyond profit: A practical guide to lead business to profit and significance. Bloomington, USA: WestBow Press. Northouse, P. G. (2021). Leadership: Theory and practice (9th ed.). Canada: Sage Publications, Inc. Klemich, S. & Klemich, M. (2020). Above the line: Leading and living with heart. USA: HarperCollins Publishers. Lussier, R. N., & Achua, C. F. (2016). Leadership: Theory, application and skill development (6th ed.). Boston, USA: Cengage Learning, Inc. McShane, S., & Von Gilnow, M. (2021). M: Organizational Behavior (5th ed.). McGraw Hill.

4.7 Module: Höhere Mathematik II

Module Registration No.	4.7

Semester	2
Duration of module	1 Semester
Type of module	Compulsory
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Dirk Schieborn
Lecturers name (contact details see ESB-website)	Prof. Dr. Dirk Schieborn
Teaching language	German
Credits (ECTS)	5
Total work load	150 hours
Contact hours per week	4 SWS
Examination/ Type of assessment	Written exam (2hrs.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	The aim of the course is to obtain mathematical skills through practical examples which will be used more deeply during the course of study. After this course students will be able to • understand the mathematical terms and their context and use, as required for the economics part of the degree programme. • understand engineering mathematics as the basis for engineer-ing work and to master the basic skills of electrical
Module-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students understand more complex mathematical concepts such as vector analysis, Fourier and Laplace transforms etc. in order to master subsequent electrical and mechanical engineering tasks through practical examples.) • **Competence Goal 5.1: assessed** (students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: introduced** (students are able to apply advanced digital tools for collaboration, analysis and communication and/or are

	able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Complex numbers • Differential equations (inkl. numerical approaches) • Functions of several variables • Fourier transformation • Descriptive statistics (incl. regression) • Probability theory • Combinatorics • Conditional probabilities
Teaching and learning methodology	Lecture and tutorials
Miscellaneous	None
Indicative reading list	• Papula, Lothar: Mathematische Formelsammlung für Ingenieure und Naturwissenschaftler, Vieweg Verlag, 2003. • Knut Sydsaeter, Peter Hammond, Arne Strom: Essential Mathematics for Economic Analysis, Prentice Hall, 2012. • Karl Bosch: Mathematik für Wirtschaftswissenschaftler: Einführung. Oldenbourg, 2011. • Knut Sydsaeter, Peter Hammond: Mathematik für Wirt-schaftswissen-schaftler, Pearson, 2002.

4.8 Module: Technische Mechanik

Module Registration No.	4.8
Semester	2
Duration of module	1 Semester
Type of module	Compulsory
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any industrial engineering programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr.-Ing. Anja Braun
Lecturers name (contact details see ESB-website)	Prof. Dr.-Ing. Anja Braun

Teaching language	German
Credits (ECTS)	6
Total work load	180 hours
Contact hours per week	4 SWS
Examination/ Type of assessment	Written exam (2hrs.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	After this lecture students should have the following knowledge and competencies: • **Technological knowledge**: acquisition of the basic theories of Engineering Mechanics for rigid bodies in the areas Statics and Dynamics. • **Methodological knowledge**: acquisition of the competence to attack in a systematic way simple tasks of Statics and Dynamics, which can be found in production and logistics operations. This includes the analysis of the problems, the modelling and the necessary calculations. • **Practical competencies/skills/abilities**: the lecture is accompanied by close to practise exercises which serve the students to analyse and model physical processes in production and logistics operations and finally perform numerical calculations. Students will be able after this course to solve simple tasks out of the industrial context. • **Social competencies**: students are encouraged to solve the above-mentioned exercises in small groups in order to stimulate and to promote the ability to work in a team. Execution of small experiments in the laboratory environment.
Module-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students acquire the competence to attack in a systematic way simple tasks of Statics and Dynamics, which can be found in Production and logistics Operations. This includes the analysis of the problems, the modelling and the necessary calculations.) • **Competence Goal 5.1: reinforced** (students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: introduced** (students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	Engineering Mechanics in the context of production and logistics operations: Statics • Rigid-body, forces, action-reaction-principle, • Equilibrium of forces and momentums, free body diagram. • central planar and general force systems • support requirements, moment of forces

	• internal force variables • adhesion and friction Mechanics of materials • Tension, deformation and elasticity laws, • Tension, compression, shear stress, bending and torsion. Dynamics • Rectilinear Kinematics of a particle, • Kinematics of planar motion of rigid bodies, • Kinetics of planar movements of concentrated masses and bodies, • Law of inertia, accelerated motion • Energy laws • Power and Efficiency
Teaching and learning methodology	Lecture (70%), practical examples and exercises in a laboratory environment, which are taylored for the production and logistics operations area (30%).
Miscellaneous	None
Indicative reading list	• Gross, D. et al. (2016): Technische Mechanik 1, Springer Vieweg, Auflage 13, aktualisierte Aufl. 2016, ISBN: 978-3662494714 • Gabbert, U. et al. (2013): Technische Mechanik für Wirtschaftsingenieure, Fachbuchverlag Leipzig, München-Wien, 7. Auflage, ISBN13 978-3446432536 • Hibbeler R. C. (2013): Engineering mechanics: statics and dynamics, Pearsons Education, Upper Saddle River, NJ, 13th edition, ISBN 978-0-13-291548-9

4.9 Module: Betriebswirtschaftslehre II

Module registration No.	4.9
Semester	2
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Kostenrechnung • Investitionsrechnung und Finanzierung
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate

Transferability of the module to other programmes	This module is transferable to any international programme requiring students to possess good knowledge of the fundamentals of cost ac-counting and corporate finance.
Responsible professor/ Module coordinator	Prof. Dr. Andreas Taschner
Total number of ECTS	5
Examination/ Type of assessment	Written exam (2hrs.)
Learning outcomes (module)	The module familiarizes students with the basic concepts and main methods of cost accounting and corporate financial management. After successful completion of the module students know how to solve practical problems by applying cost accounting and investment appraisal tools.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.9.1 Course: Kostenrechnung

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Andreas Taschner
Teaching language	German
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	After having attended the course students will have a thorough understanding of the principles of cost accounting and will be able to apply these principles in typical practical business settings. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: **Professional competencies:** • Understand basic cost accounting concepts and apply them in real-life examples • Understand relevance of cost accounting concepts in business life and identify appropriate costing method in a given situation **Methodological competencies:** • transfer theoretical costing concepts to real-life applications • reflect strengths and weaknesses of different cost accounting approaches and their applicability in business practice

	Social competencies: • co-operatively solve problems in small teams **Personal competencies:** • critically analyse conflicts between commercially attractive op-tions and ethical behaviour
Course-specific contribution to AoL Competence Goals	• **Competence Goal 3.1: introduced** (Students critically analyse conflicts between com-mercially attractive options and ethical behaviour) • **Competence Goal 4.1: introduced** (Students transfer theoretical costing concepts to real-life applications. They reflect strengths and weaknesses of different cost accounting approaches and their applicability in business practice) • **Competence Goal 5.1: Introduced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering)
Contents/ Indicative syllabus	**Introduction to Cost Accounting – an overview** • Differentiate between Cost Accounting, Management Accounting, Financial Accounting and Corporate Finance • The role of cost accounting in business **Cost Accounting - Cost terms and cost purposes** • Different accounting measures (“Auszahlung, Ausgabe, Aufwand, Kosten”) • Cost behavior and cost terms: Variable costs vs. fixed costs, cost functions, direct costs vs. indirect costs, total costs vs. unit costs, capitalized costs vs. period costs • Definition cost of goods sold (COGS), Manufacturing costs **Cost accounting – Product Costing, Cost Allocation** • Principles of cost allocation • The basic cost accounting system (Allocation according to cost types (Kostenartenrechnung), according to cost centers (Kostenstellenrechnung), according to cost objects (Kostenträgerrechnung)) • Marginal costing, direct costing (“Teilkostenrechnung”), cost-vol-ume-profit analysis, break-even analysis **Applying costing concepts for decision making** • Relevant information for decision making • One-time only special order, • Customer emphasis (customer profitability analysis), • Equipment replacement, • Insourcing vs. outsourcing • Product-mix decisions
Teaching and learning methodology	The course combines lecture-type sessions with small exercises and an ac-companying case study that is used to exemplify the concepts presented and discussed.

Miscellaneous	---
Indicative reading list	• Coenenberg, Adolf / Fischer, Thomas / Günther, Thomas: Kostenrechnung und Kostenanalyse, 9. Aufl., Stuttgart 2016 • Friedl, Gunther / Hofmann, Christian / Pedell, Burkhard: Kostenrechnung – Eine entscheidungsorientierte Einführung, 3. Aufl., München 2017 • Taschner, Andreas / Charifzadeh, Michel: Management and Cost Accounting - Tools and Concepts in a Central European Context, Weinheim: Wiley-VCH 2016 Further reading suggestions will be made available to participants at the beginning of the course.

4.9.2 Course: Investitionsrechnung und Finanzierung

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Andreas Taschner
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	After having attended the course students will have a thorough understanding of the principles of investment appraisal and corporate finance. They will be able to apply these principles in typical practical business settings. Special emphasis is put on the application in an international context. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: **Professional competencies:** • Understand basic concepts of investment appraisal and corporate finance and apply them in real-life examples • Understand relevance of investment and financing decisions in business life and identify possible alternatives in a given situation **Methodological competencies**: • transfer theoretical investment and finance concepts to real-life applications • reflect strengths and weaknesses of different investment and finance approaches and their applicability in business practice **Social competencies**: • co-operatively solve problems in small teams **Personal competencies:**

	• critically analyse conflicts between commercially attractive options and ethical behaviour
Course-specific contribution to AoL Competence Goals	• **Competence Goal 2.1: introduced** (Differences between German and international context are actively pointed out) • **Competence Goal 3.1: introduced** (Conflict of interest between business optimization and ethical behavior are pointed out) • **Competence Goal 4.1: reinforced** (Students listen to real live examples on business podcast and transfer der know-how, case studies as well as practive calculations from real business data are introduced and part of the exam) • **Competence Goal 5.1: introduced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering)
Contents/ Indicative syllabus	• The role of finance and investment decisions in the enterprise, relevance of finance and investment for company management and company goals • Fundamentals of corporate financial management • Management of corporate capital, types of capital • Cost of capital • Financing options, overview of main sources of capital • Investment appraisal techniques • Measures of investment attractiveness (NPV, IRR, pay-back, etc.) • Fundamentals of capital budgeting • The role of risk in corporate finance
Teaching and learning methodology	The course combines lecture-type sessions with small exercises and live voting for knowledge check.
Miscellaneous	---
Indicative reading list	• Brealey, Richard A./ Myers, Steward C. / Marcus, Alan J.: Fundamentals of Corporate Finance, McGraw-Hill, latest edition • Perridon, L. / Steiner, M.: Finanzwirtschaft der Unternehmung, Vahlen, latest edition • Götze, U. / Northcott, D. 7 Schuster, P.: Investment Appraisal – methods and Models, Springer, latest edition Further reading suggestions will be made available to participants at the beginning of the course.

4.10 Module: Betriebliche Funktionen

Module registration No.	4.10
Semester	2
Duration of module	1 Semester
Type of module	Compulsory

Courses included in the module	• Informatik und Softwareentwicklung • Technisches Zeichnen
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same frame-work and teaching the same level of competences.
Responsible profes-sor/ Module coordinator	Prof. Dr. Volker Reichenberger
Total number of ECTS	5
Examination/ Type of assessment	Written exam (2hrs.) Coninuous Assessment (CA)
Learning outcomes (module)	Knowledge of software development and application areas of computer science as well as knowledge of engineering drawings and the ability to rad engeneering drawings
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.10.1 Course: Informatik und Softwareentwicklung

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Volker Reichenberger
Teaching language	German
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	• Software Engineering • Design Patterns • Version management • Blockchain • Management of software projects

Course-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: introduced** (Students learn to develop software based on engineering principles and software best practices. Special focus on the development of software in teams.) • **Competence Goal 5.1: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Software Engingeering, structured software design • Design patterns for design simplification • Version management systems for security and collaboration • Understanding and applying blockchain technology • Management of software projects
Teaching and learning methodology	Lecture and exercises
Miscellaneous	---
Indicative reading list	• Helmut Balzert: Grundlagen der Informatik • Helmut Herold: Grundlagen der Informatik • Robert Sedgewick und Kevin Wayne: Computer Science: An Interdisciplinary Approach • John M. Zelle: Python Programming: An Introduction to Computer Science • Abelson und Sussman: Structure and Interpretation of Computer Programs • Bertrand Meyer: Agile Agile! The Good, the Hype and the Ugly

4.10.2 Course: Technisches Zeichnen

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Jochen Orso
Teaching language	German
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS

Learning outcomes	Ability to read and understand engineering drawings including drawing annotations e.g. dimensions, tolerances etc. and to provide drawings by hand sketching.
Course-specific contribution to AoL Competence Goals	**Competence Goal 4.1: introduced** (Students learn to describe technical objects with hand sketches. They develop a spatial imagination and can read and understand technical drawings. They learn howto adapt these concepts inreal business life situations.)
Contents/ Indicative syllabus	Fundamentals of engineering drawings, including: • line styles and types • the arrangement of multiple views and projections • scales • dimensions • sectioning Freehand sketches for engineering drawings
Teaching and learning methodology	Lecture with practical exercises
Miscellaneous	---
Indicative reading list	• Labisch, S. and Wählisch, G. (2017) Technisches Zeichnen. Eigenständig lernen und effektiv üben. Springer Vieweg • Hoischen, H. and Fritz, A. (2016) Technisches Zeichnen. Grundlagen, Normen, Beispiele, darstellende Geometrie: Lehr-, Übungs- und Nachschlagewerk für Schule, Fortbildung, Studium und Praxis, mit mehr als 100 Tabellen und weit über 1.000 Zeichnungen. Cornelsen • Viebahn, U. (2017) Technisches Freihandzeichnen. Lehr- und Übungsbuch. Springer Vieweg • Regeln und Normen im technischen Zeichnen (Diverse)

4.11 Module: Engineering Management

Module registration No.	4.11
Semester	2
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Industrial Engineering • Qualitätsmanagement
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate

Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Manfred Estler
Total number of ECTS	6
Examination/ Type of assessment	Written exam (3 hrs.)
Learning outcomes (module)	The students learn to design, realize and optimize industrial work systems for different enterprise environments. They also get familiar with the theoretical basis of modern quality management and will be able to apply selected quality management methods within an enterprise context.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.11.1 Course: Industrial Engineering

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr.-Ing. Vera Hummel/Hensel
Teaching language	German
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	4 SWS
Learning outcomes	The students learn to design, realize and optimize industrial work systems for different enterprise environments. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: **Professional competencies:** • Systematically develop production- and work systems, understand foundations of work place and work system design • Understand the interconnections of economic, organizational and technical aspects of work systems • Understand chances and risks innovative methods and tools of advanced Industrial Engineering • Understand the impact of the initiative “Industry 4.0” on the future work environment **Methodological competencies:**

	• Apply typical methods and tools of Industrial Engineering • Test and assess different human-machine-interfaces (HMI) in hybrid work systems **Social competencies:** • Co-operatively solve problems in an industry-like environment (Werk150 – the factory of the ESB Business School on the campus) **Personal competencies:** • Experience and reflect own performance in an industry-like environment (Werk150 – the factory of the ESB Business School on the campus)
Course-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students build on their available domain knowledge and learn to systematically develop production and work systems, understand foundations of work place and work system design. They apply typical methods and tools of Industrial Engineering. They test and assess different human-machine-interfaces (HMI) in hybrid work systems.)
Contents/ Indicative syllabus	Design, planning and optimization of changeable work systems • Introduction • Production and work systems • Time determination and measurement systems • Part lists and working plan • Work place design, ergonomics and environmental influences • Physical work load and stress • Work place analysis • Motivation • Industry 4.0 • Hybride working systems • Technical assistance systems • Digital Engineering – holistic approach, overview, examples and demonstrations, digital twin
Teaching and learning methodology	Lecture and practical exercises in Werk150
Miscellaneous	---
Indicative reading list	• Arbeitswissenschaft (Deutsch), Christopher Schlick (Autor), Ralph Bruder (Autor), Holger Luczak (Autor), Springer Vieweg; Auflage: 4. Aufl. 2018 (21. Mai 2018), ISBN-10: 3662560364, ISBN-13: 978-3662560365 • Kleine ergonomische Datensammlung, Hrsg. von der Bundesanstalt für Arbeitsschutz (16. überarbeitete Auflage 2017); ISBN978-3-7406-0132-4 • Vom Taylorismus zur Humanisierung der Arbeit. Möglichkeiten und Grenzen moderner Arbeitsplatzgestaltung [Taschenbuch]; Verlag: Grin Verlag Gmbh (19. Juli 2013); ISBN-13: 978-3640693443 Additionally:

	Ergonomie (Technologiemanagement - Wettbewerbsfähige Technologieentwicklung und Arbeitsgestaltung) from Hans-Jörg Bullinger, Vieweg+Teubner Verlag (31. Dezember 2013); ISBN-13: 978-3663120957

4.11.2 Course: Qualitätsmanagement

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Manfred Estler
Teaching language	German
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	Aim of the course is the acquirement of the theoretical basis of modern quality management with its most important methods and tools as well as their practical application within an industrial environment. At the end of the course, students shall be able to cope with the fundamentals of modern quality management and understand the importance of quality management for organisations and companies. In addition, students can select and apply important methods and tools of quality management corresponding to a specific problem. At the end of the course, students have achieved the following competences: • **Professional competences**: acquisition of the theoretical fundamentals of modern quality management including important statistical methods of quality management • **Methodological competences**: acquisition of the ability to select and properly apply adequate methods of QM corresponding to a specific problem • **Practical competences**: During practical exercises, students learn the application of selected QM methods and therefore will be able to apply these methods within an industrial context • **Social competences**: group work during practical exercises and lab experiments support to ability to work in teams • **Normative competences**: students recognize that quality is a matter of course, which can be expected from everybody and which is nothing else than probity („Qualität ist das Anständige“, Theodor Heuss, 1884-1963).
Course-specific contribution to AoL Competence Goals	• **Competence Goal 2.1: reinforced** (the term „quality“ and its understanding is dependent on the cultural background) • **Competence Goal 3.1: reinforced** (the term “quality” and its understanding ist based upon values and attitudes)

	• **Competence Goal 4.1: reinforced** (quality has a tremendous importance with the collaboration in supply networks. It is therefore important to possess the competencies to apply important methods and tools of quality management.) • **Competence Goal 5.1: reinforced** (students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering)
Contents/ Indicative syllabus	• introduction to quality management according to ISO 9000:2015 • management and supervision of measurement systems • measurement system analysis, R&R Gage Analysis • introduction to various quality methods (QFD, FMEA, etc.) • application of the continuous improvement process • performance figures, performance management systems, Balanced Scorecard • Total Quality Management (TQM)
Teaching and learning methodology	Lecture and group exercises applying selected QM methods (e.g. QFD, FMEA)
Miscellaneous	---
Indicative reading list	Fundamentals: • Linß, G.: Qualitätsmanagement für Ingenieure, Hanser Fachbuchverlag, Leipzig, 2018. • Schmitt, R., Pfeifer, T.: Qualitätsmanagement, Hanser Verlag, München, 2015 • Kamiske, G.: Handbuch QM-Methoden, Hanser Verlag, München, 2015. Further reading: • Dietrich, E., Schulze, A..: Eignungsnachweis von Prüfprozessen, Hanser Verlag, München, 2017.

4.12 Module: Advanced Mathematics III

Module registration No.	4.12
Semester	3
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Scientific Computing • Machine Learning and Data Analytics
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate

Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Volker Reichenberger
Total number of ECTS	5
Examination/ Type of assessment	Written exam (2hrs.)
Learning outcomes (module)	Competencies in applied mathematics and the basics of machine learning, artificial intelligence and data analytics, including the ability to apply methods using software.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.12.1 Course: Scientific Computing

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Volker Reichenberger
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	• Matrix Analysis • Numerical Mathematics
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: introduced** (Students get familiar with English notions of scientific computing.) • **Competence Goal 4.1: introduced** (Students learn to apply mathematical methods for solving scientific problems and understand the fundamantels behind machine learning.) • **Competence Goal 5.1: reinforced** (students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Matrix Analysis • Eigenvalue problems

	• Numerical Integration • Numerical solution of matrix problems • Numerical solution of ordinary differential equations • Fast Fourier Transform
Teaching and learning methodology	Lecture with exercises
Miscellaneous	---
Indicative reading list	• Murphy: Machine Learning

4.12.2 Course: Machine Learning and Data Analytics

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Dirk Schieborn
Teaching language	English
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	• Machine Learning with Python • Data Analytics with Python
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: introduced** (Students get familiar with English notions of machine learning and data analytics.) • **Competence Goal 4.1: introduced** (Students learn to apply machine learning and statistics practically with Python.) • **Competence Goal 5.1: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Supervised Learning with Python: k-NN, neural networks, support vector machines, boosting, bagging • Unsupervised learning • Data analytics: applying descriptive statistics with Python, visualisation
Teaching and learning methodology	Lecture with exercises
Miscellaneous	---

Indicative reading list	• McKinney: Python for Data Analysis

4.13 Module: Grundlagen der Elektrotechnik

Module registration No.	4.13
Semester	3
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Grundlagen der Eletrotechnik - Vorlesung • Grundlagen der Eletrotechnik - Labor
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same frame-work and teaching the same level of competences.
Responsible profes-sor/ Module coordinator	Prof. Dr.-Ing. Albrecht Oehler
Total number of ECTS	6
Examination/ Type of assessment	Written exam (2hrs.)
Learning outcomes (module)	• Methods for analyzing and for synthesis of complex systems • Competence in the field of engineering These two learning outcomes are achieved by considering electric cir-cuits. Starting with Ohm's law and with resistors the electric and magnetic fields are introduced. After the lecture the students have the competence to consider complex systems. Either to analyze them by analytical meth-ods or to synthesize complex systems based on a structured considera-tion of the impact of each component.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.13.1 Course: Grundlagen der Eletrotechnik - Vorlesung

Type of course	Compulsory

Lecturers name; contact details see ESB-website	Prof. Dr.-Ing. Albrecht Oehler
Teaching language	German
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	3 SWS
Learning outcomes	• fundamental laws, e.g. Ohm's and Kirchhoff's laws • knowledge and usage of electronic parts • calculation of DC circuits using different methods of analyzing • determination of electric and magnetic fields • calculation of AC circuits • realization of electronic circuits • analysis of circuits
Course-specific contribution to AoL Competence Goals	• **Competence Goal 2.1: introduced** (Intercultural aspects are handled by introducing scientists and their cultural background, e.g. Bohr, Coulomb etc.) • **Competence Goal 3.1: introduced** (Critical and reflected handling of technical aspects are considered and reflect upon the potential ethical consequences of technical decisions) • **Competence Goal 4.1: reinforced** (Students build on their available domain knowledge and acquire advanced knowledge about methods by means of analyzing and sythesizing networks using electronic parts, taking the impact of electric and magnetic fields into account. Additionnally, measurement techniques are introduced to quantify and validate the theoretical achievements.) • **Competence Goal 5.1: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: introduced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• DC circuits • Kirchhoff’s laws • passive electronic parts and transistors • networks • electric and magnetic fields • Faraday’s and Ampere’s law • AC circuits with complex notation • filters
Teaching and learning methodology	Lecture with exercises

Miscellaneous	---
Indicative reading list	• Hagmann, Gert: Grundlagen der Elektrotechnik, AULA-Verlag, 17., durchges. u. korr. Aufl. 2017 • Moeller: Grundlagen der Elektrotechnik, Vieweg+Teubner-Verlag, 22. Auflage, 2008

4.13.2 Course: Grundlagen der Eletrotechnik - Labor

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr.-Ing. Albrecht Oehler/Sari
Teaching language	German
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	1 hour per week laboratory; supervision by Prof. Dr.-Ing. Albrecht Oehler and laboratory assistant
Learning outcomes	Target of the lab is the application of electrical engineering in the laboratory. Learning outcomes are • measurement techniques • synthesis of electronic circuits • analysis of circuits • validation of theoretically achieved results
Course-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students build on their available domain knowledge and acquire advanced knowledge about methodes by means of analyzing and sythesizing networks using electronic parts, taking the impact of electric and magnetic fields into account. Additionnally measurement techniques are introduced to quantify and validate the theoretical achievements.) • **Competence Goal 5.1: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: introduced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	Experiments: • Ohm’s and Kirchhoff's laws in DC circuits • Capacitors and inductors • Electric and magnetic fields • Oscilloscope • Filter

	• Amplifier
Teaching and learning methodology	Laboratory
Miscellaneous	---
Indicative reading list	• Descriptions of the experiments are provided

4.14 Module: Markenführung und Vertrieb

Module Registration No.	4.14
Semester	3
Duration of module	1 Semester
Type of module	Compulsory
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same frame-work and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Johanna Bath and Prof. Dr. Kristina Steinbiß
Lecturers name (contact details see ESB-website)	Prof. Dr. Johanna Bath and Prof. Dr. Kristina Steinbiß
Teaching language	German
Credits (ECTS)	5
Total work load	150 hours
Contact hours per week	4 SWS
Examination/ Type of assessment	Project
Weighting of Grade within overall programme	According to credits
Learning outcomes	• **Technical competencies:** Students will get in debths digital marketing and sales know how, get to know the drivers for new business models and how to convert strategy into business models as well as makreting and sales strategies while using state of the art tools and methods, like advanceds branding strategies or content marketing.

	• **Methodological competencies**: Students will get to know methods to build strategies for customer targeting, communication as well as branding and apply them to real live examples. They also get an introduction to important IT tools to implement the strategies into action (like mailing automization, social media automization, etc.). • **Social competencies**: Students will work in small groups in order to solve case studies and work on real live problems. They will use different presentations techniques and are guided to actively discuss their experiences and opinions in course. • **Personal competencies**: Students will learn to apply technical and theoretical know-how to real live applications and critically assess their own consumption of digital media.
Module-specific contribution to AoL Competence Goals	• **Competence Goal 2.1: reinforced** (Case studies as well as business models usually come from an international context.) • **Competence Goal 3.1: reinforced** (The criticality of using data for marketing purposes and the fine line between marketing and manipulation are one of the topics that are focused on, legal basis for data use is taught.) • **Competence Goal 4.1: reinforced** (Case studies are done throughout and case studies are also part of the exam) • **Competence Goal 6.1: introduced** (students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Introduction to digital busniess models and the connected challenges for sales and marketing functions in companies (platform business, sharing economy, etc.) • Connection of business strategy, sales strategy and marketing/communication strategy • (Digital) Customer targeting / Use of Algorithms • Introduction to content marketing strategy • Introduction to digital sales channels • Advanced Brand Management
Teaching and learning methology	Lectures, group collaboration and case studies
Miscellaneous	None
Indicative reading list	• Achatz, Andreas, et. Al.: Think growth, 2019, Herzberger Publishing, Frankfurt a. M. • Brad Stone: Die Sharing Economy, 2017, Plassen Verlag: Kulmbach • Hoffmann, Kerstin: Prinzip Kostenlos – Content Marketing für Dienstleister, Berater und Wissensträger, 2017, Wiley: Weinheim • Misof, Günther / Schwarz, Michael: Innovatives Brand Management: Wie Sie Marken in digitalen Zeiten organisieren, führen und optimieren, 2017 • Parker, Geoffrey, et. Al.: Platform Revoluation, How Networked markets are transforming the economy and how to make them work for you, 2016, Norton: New York

	• Sundararajan, Arun: The Sharing Economy, 2016, The MIT Press: Cambridge • Wala, Hermann: Meine Marke: Was Unternehmen authentisch, unverwechselbar und langfristig erfolgreich macht, 2018

4.15 Module: Operational Planning and Optimization

Module registration No.	4.15
Semester	3
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Operations Research • Operations Management Systems • Project Management
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Jürgen Hartung
Total number of ECTS	6
Examination/ Type of assessment	Written exam (3hrs.)
Learning outcomes (module)	• Knowledge of the structure, operation and optimization of planning systems • The ability to analyze, evaluate and optimize processes or process parameters, in particular by using mathematical methods • The ability to holistically manage projects based on different standards and techniques
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.15.1 Course: Operations Research

Type of course	Compulsory

Lecturers name; contact details see ESB-website	Prof. Dr. Volker Reichenberger
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	Students are able to build elementary mathematical models for optimization problems and to apply established solution methods to these problems. They can apply their knowledge for scientific research as well as for practical purposes in engineering applications. They are able to judge the qualitiy of mathematical models and of solutions provided by computer programs. They know about the possibilities of modelling as well as their shortcomings.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: introduced** (Students get familiar with English notions from operations research.) • **Competence Goal 4.1: introduced** (Students learn to solve complex practical optimization problems using mathematical methods.) • **Competence Goal 5.1: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: introduced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Linear problems and linear programming • Special linear problems (transportations problems etc.) • Graph-based problems • Simulation methods
Teaching and learning methodology	Lecture with exercises
Miscellaneous	---
Indicative reading list	• Hillier, Liebermann: Introduction to Operations Research. McGrawHill 2020

4.15.2 Course: Operations Management Systems

Type of course	Compulsory

Lecturers name; contact details see ESB-website	Prof. Dr. Jochen Hartung
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	Upon successful completion, students will have developed the following competencies • **Technical competencies**: Students get to know Information Technology in Operations and apply their knowledge in a hands-on project (e.g. process automation, process mining, business intelligence, GUI building etc.). • **Methodological competencies**: Students learn to understand and classify different operations management approaches following by procedures and methods for the ideation, analysis, implementation and operation of IT application systems. • **Social competencies**: Students work in small groups on application-related tasks with state-of-the-art real-life applications in various roles. • **Personal competencies**: Students learn to work on operational tasks with real-life applications and to critically evaluate the use of these systems in terms of technology, economic benefit, and user acceptance.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (The language of the lecture is English, thus improving the language skills of the student.) • **Competence Goal 4.1: introduced** (Students get to know different operational application systems and can courseify them concerning the different phases of selection, implementation, and operation) • **Competence Goal 6.1: reinforced** students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Operations Management • Information Systems • Technology Lifecycle • Operations Management • Business Process Management • Information Technology in Operations • Digital Transformation • Hands-on project (e.g. process automation, process mining, business intelligence, GUI building etc.) • Data Engineering • Core Business Applications

Teaching and learning methodology	Lecture, group collaboration and exercises
Miscellaneous	---
Indicative reading list	• Alpar, Paul, et al. Anwendungsorientierte Wirtschaftsinformatik: Strategische Planung, Entwicklung und Nutzung von Informationssystemen. Springer, 2019. • Hansen, Hans Robert, et. al. Wirtschaftsinformatik. Walter de Gruyter, 2019 • Gronau, Norbert. Enterprise resource planning: Architektur, Funktionen und Management von ERP-Systemen. Oldenbourg, 2010 • Laudon, Kenneth C., Laudon, Jane Management Information Systems: Managing the Digital Firm, 16th Edition. Pearson, 2020 • Gadatsch, A. Geschäftsprozesse analysieren und optimieren. Springer. 2015 • Heinzer, J., Render, B., Munson, C. Operations Management. Pearson. 2020. • Langmann, C, Turi, D. Robotic Process Automation. Springer. 2020 • Kenneth L., Laudon, J. Management Information Systems: Managing the Digital Firm. Pearson. 2021

4.15.3 Course: Project Management

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Arun Fletcher
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	Upon successful completion, students will have developed the following competencies: • Subject-specific competencies: Students have developed the basic competencies in project management such as project definition and evaluation; planning and scheduling; resource selection, communication and feedback issues and cultural considerations. • Methodological competencies: Students have the ability to analyse project processes and use methods and systems to plan, schedule and monitor projects. • Specialised and practical competencies, skills and abilities: Students deepen their practical skills in the field of project management by applying all subject specific competencies in a project example in small teams in the lecture.

	• Social competencies: Students perform effectively as a team member while having also developed basic project leadership skills within a project team. • Normative competencies: Students increase personal and work effectiveness in communication and interaction in teams as well as become aware of complexity of working within a project team.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students get familiar with specific terms from the field of project management. They are constantly able to practice their written and oral language skills in English). • **Competence Goal 2.1: reinforced** (Students get familiar with specific aspects of international project management to understand different management approaches and team developing strategies.) • **Competence Goal 3.1: introduced** (Students learn that project management also means to discuss ethical issues depending on the project subject. In addition they learn that the management of projects is influenced by ethical conventions of the company and the project environment.) • **Competence Goal 4.1: reinforced** (Students get the ability to analyse processes, methods and systems used to plan, schedule and monitor projects. They will have developed the basic competencies in project management such as project definition and evaluation, planning and scheduling, resource selection and communication.)
Contents/ Indicative syllabus	• Introduction to Project Management • Project Selection • Project Life Cycle and Organisation • Project Goals and the Project Manager • Develop Project Charter and A3 • Project Integration Management • Project Scope Management • Project Time Management • Project Cost Management • Project Quality Management • Project Human Resource Management • Project Communication Management • Project Procurement Management • Project Executing • Project Monitoring & Controlling • Project Closing
Teaching and learning methodology	Lecture with interactive workshops
Miscellaneous	---
Indicative reading list	Basics: • Project Management Institute (Hrsg.) (2017): A guide to the project management body of knowledge: PMBOK® guide. Newtown Square, PA: PMI, 6. ed., 2017. ISBN 978-1-935589-67-9

	• DIN 69900 Netzplantechnik (critical path method) • DIN 69901-1 Grundlagen (basics) • DIN 69901-2 Prozesse, Prozessmodell (processes, process model) • DIN 69901-3 Methoden (methods) • DIN 69901-4 Daten, Datenmodell (data, data model) • DIN 69901-5 Begriffe (terms) • DIN-Fachbericht ISO 10006 Leitfaden für Qualitätsmanagement in Projekten • Köster, Kathrin (2009): International Project Management. London: Sage Publications. ISBN 978-1412946216 Further readings: • Bruno, Jenny (2016): Projektmanagement, Zürich: vdf Hochschulverlag, 5. Auflage. • Braehmer, Uwe (2009): Projektmanagement für kleine und mittlere Unternehmen: Das Praxisbuch für den Mittelstand. München: Hanser Verlag, 2. Auflage. ISBN 978-3-446-42160-8, eBook • Drees, Joachim / Conny Lang / Marita Schöps (2014): Tipps, Tools und Tricks aus der Praxis für die Praxis. München: Hanser. ISBN 978-3-446-44225-2, eBook • Drews, Günter (2014): Praxishandbuch Projektmanagement. Freiburg; München: Haufe-Lexware. ISBN 978-3-648-05090-3 • Jakoby, Walter (2010): Projektmanagement für Ingenieure: Gestaltung technischer Innovationen als systemische Problemlösung in strukturierten Projekten. Wiesbaden: Vieweg + Teubner. ISBN 978-3-8348-0918-6, eBook • Meredith, Jack R. / Samual A. Mantel (2015): Project Management: A Managerial Approach. Hoboken, NJ: Wiley, 10th edition. ISBN 978-0470533024 • Rad, Parviz F. / Ginger Levine (2006): Metrics for project management: formalized approaches. Vienna, VA: Management Concepts. ISBN 1-56726-166-3 • Wanner, Roland (2007): Earned Value Management: so machen Sie Ihr Projektcontrolling noch effektiver. Norderstedt: Books on demand. ISBN 978-3-8370-0657-5

4.16 Module: Projekt Unternehmen

Module registration No.	4.16
Semester	3
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Prozessmanagement • Unternehmensprojekt
How frequently is the module offered	Every semester

Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any Industrial Engineering programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. techn. Daniel Palm
Total number of ECTS	5
Examination/ Type of assessment	Written exam (1hrs.) & Project Work
Learning outcomes (module)	This module familiarizes students with the analysis and optimization of business processes in the business environment. They know the concept of process management and its methods, and can model, analyse and improve processes. They understand the social implications of process changes and can apply process management in projects in the business environment. They are able to develop solutions in teams and communicate and represent these solutions to company representatives. Students are able to accept and process external criticism constructively.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.16.1 Course: Prozessmanagement

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. techn. Daniel Palm
Teaching language	German
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	**Professional competencies:** • Understanding the concept and methods of process management. • Creating process maps, modelling, analysing and optimising processes. **Methodological competencies:** • Understanding, selecting and applying methods for the analysis and improvement of processes.

	• Modeling processes **Interdisciplinary competencies, professional qualifications:** • Understanding of complex interrelationships and process and organizational structures in the company **Practical competencies/skills/abilities:** • Creation of process maps • Process analysis • Application of the 4-step method for process optimization • Process optimization in the business game • Create process key figures, KPI
Course-specific contribution to AoL Competence Goals	• **Competence Goal 3.1: introduced** (Students learns how business decisions in process management impacts the working environment and the wellbeing of the employees.) • **Competence Goal 4.1: introduced** (Student familiarizes with the analysis and optimization of business processes in production and logistics networks.) • **Competence Goal 6.1: introduced** students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Customer orientation • Process orientation • Benefits of process management • Process map, flowchart • Process life cycle • Process management 4-step method • Process key figures
Teaching and learning methodology	Lecture, business game, group work, project work
Miscellaneous	Linked with lecture enterprise project
Indicative reading list	• Karl W. Wagner, Gerold Patzak: Performance Excellence - Der Praxisleitfaden zum effektiven Prozessmanagement. 2. Auflage. Carl Hanser Verlag München, 2015. ISBN 978-3-446-40575-2 • Eva-Maria Kern (Hrsg.): Prozessmanagement individuell umgesetzt. Springer, Berlin, 2012.

4.16.2 Course: Unternehmensprojekt

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. techn. Daniel Palm/Braun/Bitsch
Teaching language	German

Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	The aim of the course is that the students develop a solution for a problem from the business environment in a team with the help of problem-based, practice-oriented learning. After the course the students must be able: • To divide the project task into sub-projects and to distribute tasks in the team. • To build up their working environment and to use the necessary infrastructure. • To Coordinate the team and lead sub-projects, manage conflicts and get involved in the team. • To use knowledge and techniques from different management disciplines, especially from the Process Management lecture, to find solutions. • To coordinate solution concepts with company representatives and to make qualified and comprehensible decisions. • To recognize, evaluate and accept mistakes and to introduce necessary corrections. • To acquire application-oriented knowledge from literature and in personal interviews. **Professional competencies:** The aim of the course is to enable the students to take up processes, to recognize problems or weak points and, with the help of project and process management methods and in a team, to find an organizational, technical and economic solution to these problems. **Methodological competencies:** Students know the essential methods, techniques and tools of process and project management and can implement them in concrete company projects. **Professional/practical competencies/skills/abilities:** Within the scope of the project in the company, the students take up concrete tasks from business practice, analyse them, evaluate different possible solutions and assign the most promising variants to concrete solutions. They learn how to obtain information and missing knowledge and to absorb it in a structured way. **Interdisciplinary competences, social skills:** The project work promotes the ability to work in a team, to deal with and accept different knowledge and cultures, to solve conflicts and communication problems. The fulfilment of expectations on the entrepreneurial side is trained practically. **Normative competencies**: Students recognize that project work a high degree of tolerance and discipline in the project team and towards external stakeholders.

Course-specific contribution to AoL Competence Goals	• **Competence Goal 2.1: reinforced** (In the course of the project, students are confronted with the challenge of working in an interdisciplinary and intercultural environment. The skills required for this are taught in the module "Managing Global Teams".) • **Competence Goal 3.1: reinforced** (During the course of the project, students have to make decisions that should include ethical aspects in addition to the professional criteria. The basics for this are taught in the Process Management course.) • **Competence Goal 4.1: reinforced** (Student familiarizes with the analysis and optimization of business processes in production and logistics networks.) • **Competence Goal 6.1: introduced** students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	Working on a task from business practice in a group of students. The group size is usually about 10 to 15 students, but may vary depending on project availability and the total number of enrolled students. Here, concrete business processes are to be included and improved. In order to be able to handle the project task efficiently and responsibly, competences from the courses Project Management and Process Management must be applied.
Teaching and learning methodology	Group work, project work
Miscellaneous	Linked with lecture Prozessmanagement
Indicative reading list	• Will be communicated to the students at the beginning of the project. • Karl W. Wagner, Gerold Patzak: Performance Excellence - Der Praxisleitfaden zum effektiven Prozessmanagement. 2. Auflage. Carl Hanser Verlag München, 2015. ISBN 978-3-446-40575-2 • Eva-Maria Kern (Hrsg.): Prozessmanagement individuell umgesetzt. Springer, Berlin, 2012.

4.17 Module: Industrial Practice

Module registration No.	4.17
Semester	3 and 4
Duration of module	2 Semesters
Type of module	Compulsory
Courses included in the module	• Problem Solving Skills and Academic Writing • Business Simulation
How frequently is the module offered	Every semester
Admission requirements	None

Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any Industrial Engineering programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Jürgen Hartung
Total number of ECTS	7
Examination/ Type of assessment	Project work & Continuous Assessment (CA)
Learning outcomes (module)	The integrative work typical for industrial engineering requires not only technical and methodological competence but also a distinctive social competence (soft skills). This includes, above all, the ability to communicate technological and economic content both inside and outside the company in an interdisciplinary manner. This module familiarizes students with the international world of Business and its linked nature. They know skills to solve problems in a practical and systematic way used also in scientific practice. They understand the internal and external network of different departments, suppliers and customers and the interconnection between the different stakeholders. They understand that decisions at one point in the network have an impact on other stakeholders.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.17.1 Course: Problem Solving Skills and Academic Writing

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Kristina Steinbiß
Teaching language	English
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	The module fosters students‘ personal competencies in effectively preparing and presenting arguments, lines of reasoning and research results. Students learn to conduct scientific research, write academic texts, and give clear and convincing presentations to a public audience.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students get familiar with the requirements for writing a scientific paper in English.)

	• **Competence Goal 4.1: reinforced** (Students know which method they have to apply to different scientific problems in order to find a solution. They are able to identify rules, principles, or relationships that explain facts, data, or other information. They analyze information and makes correct inferences or draws accurate conclusions.)
Contents/ Indicative syllabus	• Methods and scientific approaches • Requirements for scientic works • Standards • Types of scientific works • Academic writing • Presentation of scientific results • Problems from practical applications
Teaching and learning methodology	Seminar
Miscellaneous	---
Indicative reading list	• Kornmeier, M.: Wissenschaftlich schreiben leicht gemacht, 8. Auflage 2018 • Esselbron-Krumbiegel, H.: Richtig wissenschaftlich Schreiben: Wissneschaftssprache in Regeln und Übungen, 5. Auflage 2017

4.17.2 Course: Business Simulation

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. techn. Daniel Palm (Dozent: M. Guldin)
Teaching language	English
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	In a business simulation, students learn cross functional alignment between departments, between strategy and execution and the alignment between partners in the supply chain network. The round-based simulation game allows students to apply theoretical knowledge to real-life scenarios and experience the impact individual decisions have on the overall supply chain. The game is played online in groups of 2 to 4 students. **Professional competencies:** • Understanding that company success is not only the responsibility of one function or manager, it is teamwork. • Coordinated decision making is critical. • A strategy is necessary to have a common direction. • How to translate strategy into action.

	• The right management information is very important. • Internal and external collaboration is key to success. **Interdisciplinary competencies, social skills:** • Communication and decision making • Alignment of goals in teams and consistency of decisions • In- and external collaboration • Working online in teams
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: introduced** (Students get familiar with the relevant English business vocabulary.) • **Competence Goal 2.1: introduced** (Students learn how business decisions impacts different partners in the supply network.) • **Competence Goal 4.1: introduced** (Student familiarizes with the strategic fit in networks.) • **Competence Goal 6.1: introduced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	Round based online business simulation of a company with four roles: • Sales management • Purchasing management • Supply chain management • Operations management
Teaching and learning methodology	Lecture, online business game, group work
Miscellaneous	---
Indicative reading list	• Ed Weenk: Mastering the Supply Chain. Principles, Practice and Real-Life Applications. KoganPage, 2019.

4.18 Module: Industrial Internship

Module registration No.	4.18
Semester	3-5
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Internship • Intercultural Competencies and Preparation for Internship • Colloquium and Scientific Work on Internship
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate

Transferability of the module to other programmes	The module is transferable to other business engineering programmes requiring students to gain work experience.
Responsible professor/ Module coordinator	Prof. Dr. Jürgen Hartung
Total number of ECTS	27
Examination/ Type of assessment	Continuous assessment (CA) & Individual Assignment (Scientific Work on internship) & Project Work
Learning outcomes (module)	This module encompasses the industrial internship (in Germany or abroad) as well as its preparation and its wrap-up (preparing and presenting a scientific report about the internship). As a preparation or the internship, the module familiarizes students with the international world of Business and its linked nature. know how to address companies internationally in communication and in job applications. They gain intercultural competencies and are aware of cultural differences. During the Industrial Internship, students deepen practical experiences and skills from the field of work of industrial engineers in a business environment. Students have the option of choosing whether to complete their internship in Germany or abroad. They take responsibility for tasks with a limited complexity and deal with language and cultural differences in their day-to-day business. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: • Professional competencies: - apply advanced skills and knowledge learned through study to the more complex interdisciplinary problems faced in practice • Methodological competencies: - work in an independent and responsible manner on practical tasks with a limited degree of complexity - reflect course contents learned in the first three semesters of study • Social competencies: - co-operatively solve problems and tasks - adapt to a new work culture in an industrial environment • Personal competencies: - reflect on the practical experience they have gained to help them more consciously make their decision on the personal future career path - develop independent critical thinking and first-hand insights into the varied consequences of technical, business and social decisions - (optional) language and communication skills at an expert level in the language of internship

	After their return from the Industrial Internship, students present their report to the course lecturer. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: • Professional competencies: - Master presentation software (e.g. MS PowerPoint, Prezi) • Methodological competencies: - prepare and give a clear and concise presentation in English language • Social competencies: - Critical reflection of the own learning action • Personal competencies: - reflect on the practical experience gained, identify own strong and weak points, determine personal needs for further improvement
Graded/ungraded	Graded
Weighting of grade within overall programme	3/156

4.18.1 Course: Intercultural Competencies and Preparation for Internship

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Jürgen Hartung
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2
Learning outcomes	After the successful completion of this course the students should have gained the following knowledge and developed the following competencies: • Understanding of the recruitment process and how to prepare a professional job application including how to manage a successful interview. • Understanding of the importance of networking and how to manage one's individual digital presence • Awareness of how to manage assessment centres and what personality testing is • Intercultural effectiveness – self-awareness, exploration, world orientation, relationship development, positive regard, emotional resilience

Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students get further knowledge of specific terms from the field of culture in an international context. They learn how to write effective job applications and gain knowledge of relevant terminology for the interview process.) • **Competence Goal 2.1: reinforced** (Students evaluate the influence of intercultural differences in international business relationships and adapt their behaviour according to these differences. They prepare themselves appropriately in advance for new intercultural situations. • **Competence Goal 3.1: reinforced** (Students get an awareness of the own cultural profile, ethical behaviour, the individual strengths and weaknesses in intercultural business situations. They seek advice, integrate suggestion and reflect what they are doing. The learn how to cope with conflict situations.)
Contents/ Indicative syllabus	• The recruitment and application process • CVs, resumés and cover letters • Interviews • Assessment centres • Networking • Digital presence • Accepting and rejecting job offers --- • Learning more effectively about other cultures • Learning how to initiate, maintain and manage positive relations to others • Learning how to manage oneself in challenging situations
Teaching and learning methodology	Seminar (blended learning, informative texts, self-tests, exercises and videos)
Miscellaneous	---
Indicative reading list	The reading is all available via the websites

4.18.2 Course: Internship

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Jürgen Hartung
Teaching language	German/English
Credits (ECTS)	22
Total work load	660 hours
Contact hours per week	n/a
Learning outcomes	During the Industrial Internship, students deepen practical experiences and skills from the field of work of industrial engineers in a (foreign) busi-

	ness environment. They take responsibility for tasks with a limited complexity and deal with language and cultural differences in their day-to-day business. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: • Professional competencies: - apply advanced skills and knowledge learned through study to the more complex interdisciplinary problems faced in practice • Methodological competencies: - work in an independent and responsible manner on practical tasks with a limited degree of complexity - writing a scientific work in connection with a field of activity during te internship - reflect course contents learned in the first five semesters of study • Social competencies: - co-operatively solve problems and tasks - (optional) adapt to a foreign work culture • Personal competencies: - reflect on the practical experience they have gained to help them - more consciously make their decision on the personal future career path - develop independent critical thinking and first-hand insights into the varied consequences of technical, business and social decisions - (optional) language and communication skills at an expert level in the language of internship
Course-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students work in an independent and responsible manner on practical tasks with a certain degree of complexity. Students are able to write a scientific paper in English. They reflect and critically apply course contents learned in the first three semesters of study.) Priority if the internship is completed abroad. • **Competence Goal 1.1: reinforced** (Students learn advanced communication skills in the language of the host country; advanced intercultural communication skills, sensitivity for cultural differences and importance of culture in business practice.) • **Competence Goal 2.1: reinforced** (Students learn advanced communication skills in the language of the host country; advanced intercultural communication skills, sensitivity for cultural differences and importance of culture in business practice.)
Contents/ Indicative syllabus	Knowledge of work procedures in a business environment; independent execution of typical business tasks. Contents vary depending on the organisation providing the internship.
Teaching and learning methodology	Individual Assignment and Colloquium (Support / guidance by the internship company's direct supervisor / team. Continuous support & feedback by faculty members)

Miscellaneous	---
Indicative reading list	Depending on topic

4.18.3 Course: Colloquium and Scientific Work on Internship

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Jürgen Hartung
Teaching language	English
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	After the return from the Industrial Internship, students present their report to the course lecturer. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: • Professional competencies: - master presentation software (e.g. MS PowerPoint, Prezi) • Methodological competencies: - prepare and give a clear and concise presentation on own experiences • Social competencies: - reflect on feedback from course participants • Personal competencies: - reflect on the practical experience gained, identify own strong and weak points, determine personal needs for further improvement - presentation of the scientific work in English language
Graded/ungraded	Graded
Weighting of grade within overall programme	3/156
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: assessed** (Students have acquired advanced communication skills in the language of the host country; they are able to present the scientific paper in English language.) • **Competence Goal 2.1: assessed** (Students have acquired advanced communication skills in the language of the host country; they are able to present the scientific paper in English language.) • **Competence Goal 6.1: introduced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)

Contents/ Indicative syllabus	The contents vary depending on the topic of the scientific work
Teaching and learning methodology	Individual Assignment and Colloquium
Miscellaneous	---
Indicative reading list	Depending on the topic of the scientific work

4.19 Module: Study Abroad Semester

Module Registration No.	4.19
Semester	5
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	Depending on programme of partner university
How frequently is the module offered	Every semester
Admission requirements	66 ECTS credits in the first three semesters of the curriculum
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme requiring students to spend a semester at a partner university abroad.
Responsible professor/ Module coordinator	Prof. Dr. Dirk Schieborn
Lecturers name (contact details see ESB-website)	Various lecturers of host institution
Teaching language	English
Credits (ECTS)	30
Total work load	900 hours
Contact hours per week	ESB: 0 SWS; partner university: depending on host institution curriculum
Examination/ Type of assessment	Depending on partner university
Weighting of Grade within overall programme	n/a

Learning outcomes	After the successful completion of this module the students should have developed the following competencies: • **Professional competencies**: advanced knowledge in the various fields of international business and engineering (depending on courses chosen); understanding of different university systems. • **Methodological competencies**: advanced methodological competencies in the various fields of international business and engineering (depending on courses chosen). • **Social competencies**: advanced communication skills in the language of the host country; advanced intercultural communication skills, sensitivity for cultural differences and importance of culture in business practice. • **Personal competencies**: development of own personality and personal profile through study abroad experience; reflection and learning from own international experience, reflection on envisaged own professional career path.
Module-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students learn advanced communication skills in the language of the host country; advanced intercultural communication skills, sensitivity for cultural differences and importance of culture in business practice.) • **Competence Goal 2.1: reinforced** (Students learn advanced communication skills in the language of the host country; advanced intercultural communication skills, sensitivity for cultural differences and importance of culture in business practice.) • **Competence Goal 3.1: reinforced** (Students gain first-hand experience in how other cultures deal with conflicting interests and develop an understanding for different concepts of “right” and “wrong”.) • **Competence Goal 4.1: reinforced** (Students learn advanced methodological competencies in the various fields of international business and engineering (depending on courses chosen). • **Competence Goal 5.1: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	Depending on partner university
Teaching and learning methodology	Depending on partner university
Miscellaneous	--
Indicative reading list	n/a

4.20 Module: Information and Communication Networks

Module registration No.	4.20
Semester	6
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Information and Communication Networks - Lecture • Information and Communication Networks - Laboratory
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr.-Ing. Albrecht Oehler
Total number of ECTS	6
Examination/ Type of assessment	Written Examination (2hrs.)
Learning outcomes (module)	• Reinforce methods for analyzing and for synthesis of complex systems • Reinforce competence in the field of engineering • Competence in Digital Techniques with focus on digital communication networks These learning outcomes are achieved by considering digital networks. After the lecture the students have the knowledge of digitalization and its benefits and drawbacks. They have expertise in the area of digital local area networks and wide area networks. They are enabled to understand and to evaluate complex networks.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.20.1 Course: Information and Communication Networks - Lecture

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr.-Ing. Albrecht Oehler

Teaching language	English
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	3 SWS
Learning outcomes	• understanding of digizalization • Information Theory to evaluate maximum data rates • knowledge of transmission characteristics of four-poles, e. g. of communication lines • knowledge of radio networks, e. g. wire-less local area networks • planning of communication networks • routing algorithms
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (The language of the lecture and the laboratory is English thus enforcing the language skills of the students.) • **Competence Goal 2.1: reinforced** (Intercultural aspects are handled by handling aspects of international standardization.) • **Competence Goal 3.1: introduced** (Critical and reflected handling of technical aspects are considered and reflect upon the potential ethical consequences of communication networks.) • **Competence Goal 4.1: reinforced** (Students build on their available domain knowledge and acquire advanced knowledge about methodes by means of analyzing and sythesizing communication networks. Additionnally, measurement techniques are introduced. • **Competence Goal 5.1.: introduced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• communication networks • signals and systems • information and services • data transmission and protocols • modulation and demodulation • international standardization
Teaching and learning methodology	Lecture with exercises
Miscellaneous	---
Indicative reading list	• Hagmann, Gert: Grundlagen der Elektrotechnik, AULA-Verlag, 17., durchges. u. korr. Aufl. 2017 • Werner, Martin: Nachrichtentechnik, Springer-Vieweg-Verlag, 2010

	• Rupprecht, W.: Einführung in die Theorie der kognitiven Kommunikation. Springer-Verlag, 2014 • Engels, Y.; Hüdepohl, K.; Oehler, A.; Schmidt, R.; Wilhelm, D.: Anwendungsneutrale Kommunikationskabelanlagen nach EN 50173 und EN 50174 - Büro, Industrie, Rechenzentren, Gebäudeautomation und Wohnungen, VDE-Verlag, 2019.

4.20.2 Course: Information and Communication Networks - Laboratory

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr.-Ing. Albrecht Oehler
Teaching language	German
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	1 hour per week laboratory; supervision by Prof. Dr.-Ing. Albrecht Oehler and laboratory assistant
Learning outcomes	• application of engenieering methods in the laboratory environment • measurement techniques • synthesis of electronic circuits • analysis of circuits • validation of theoretically achieved results
Course-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students build on their available domain knowledge and acquire advanced knowledge about methodes by means of analyzing and sythesizing communication networks. Additionnally, measurement techniques are introduced to quantify and validate the theoretical achievements.) • **Competence Goal 5.1: introduced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• realisation of electronic networks, e.g. oscillator or band-pass filter • realisation of a radio receiver • digitalization of analogue signals and digital transmission • measurement of wide areas radio networks • measurement and optimization of local area wire-less networks
Teaching and learning methodology	Laboratory
Miscellaneous	---

Indicative reading list	• Descriptions of the experiments are provided

4.21 Module: Advanced Methods in Production and Logistics Technology

Module registration No.	4.21
Semester	6
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Advanced Production Technology • Advanced Logistics Technology and Automation • Technical Warehouse Planning
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Dominik Lucke
Total number of ECTS	8
Examination/ Type of assessment	Written Exam (2hrs.) & Project work/presentation
Learning outcomes (module)	• Knowledge of the advanced production technologies, logistics equipment and automated systems, robotics and handling technologies. • Knowledge of process models, methods and design options for the new construction, and expansion planning of warehouses in an international context.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.21.1 Course: Advanced Production Technology

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Dominik Lucke

Teaching language	English
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	**Professional competencies:** • Knowledge of the advanced production technologies • Knowledge of operation and maintenance principles of machines and equipment **Interdisciplinary competences:** • Assessment of production technology and the corresponding processes and their basic functionalities **Social competences, key competences:** • Assessment of the areas of application of production technologies according to sustainability and health hazards aspects **Personal Competences:** • Holistic assessment of different production technologies and knowledge of maintenance principles
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students build on their available terminology from the field of business engineering and complement it with specific terms from the field of Production Technology. They are constantly able to practice their written and oral language skills in English.) • **Competence Goal 4.1: reinforced** (Students get familiar with different advanced production technologies and learn to adapt them to practical planning problems.) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Advanced production technologies and current trends (e.g. additive manufacturing 3D printing, laser processing, production of fiber reinforced plastics components, bonding • Operation and maintenance of machines
Teaching and learning methodology	Lecture
Miscellaneous	---
Indicative reading list	• Fritz, A. Herbert [Hrsg.]: Fertigungstechnik, 12.Auflage, Springer Vieweg Berlin, Heidelberg 2018, ISBN 978-3-662-56535-3 • Westkämper, Engelbert, Warnecke, Hans-Jürgen: Einführung in die Fertigungstechnik Vieweg+Teubner, Wiesbaden, 2010.

4.21.2 Course: Advanced Logistics Technology and Automation

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Wolfgang Echelmeyer
Teaching language	English
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	Target of the lecture is a basic understanding of material handling in production and logistics processes. Starting with handling of parts in production lines, and with storing and shipping in warehouses or distribution centers. Students are able to understand and analyze basics and advanced state of the art technical logistics systems. Learning outcome: • Knowledge about logistics equipment and automated systems, ro-botics and handling technologies. • Mapping and analysis of material and information flow • Knowledge about different transport systems including Automated Guided Vehicles (AGV)
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students build on their available terminology from the field of business engineering and complement it with specific terms from the field of Automation and Materials Handling. They are constantly able to practice their written and oral language skills in English since the course is entirely conducted in English.) • **Competence Goal 4.1: reinforced** (Students build on their available domain knowledge and acquire advanced knowledge about logistics equipment and auto-mated systems, robotics and handling technologies, mapping and analysis of material and information flow, AGV and how to adapt them in real business life.) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Robot systems • Handling technologies • Automated Guided Vehicle (AGV) • Sorting technologies and distribution centers • Autonomous material handling systems
Teaching and learning methodology	Lecture
Miscellaneous	---

Indicative reading list	• Nof, Shimon Y.: Material Handling Automation in Production and Ware-house Systems in: Springer Handbook of Automation; Springer; ISBN: 978-3-540-78831-7 • Furmans, Kai: Material Handling and Production Systems Modelling - based on Queuing Models; Springer, Dec. 2014

4.21.3 Course: Technical Warehouse Planning

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr.-Ing. Harald Augustin
Teaching language	English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	**Lecture**: Students are familiar with process models, methods and design options for the new construction, and expansion planning of factories and ware-houses in the international context. **Laboratory**: Students are familiar with two VR (Virtual Reality) systems for factory planning (visTable) and warehouse planning (taraVRbuilder) and specialised in there use in the context of the lecture topics. After this course, the students have the following skills: **Subject-specific knowledge and skills**: Acquisition of theoretical foundations for factory and warehouse planning, including important calculation methods and algorithms as well as the legal frameworks. Acquistion and application of practical knowledge in VR systems for factory and warehouse planning. **Methodological competencies**: Acquisition of analytical and synergistic expertise based on structured approaches and algorithms for analysis and synthesis of complex factory and warehouse systems.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students build on their available terminology from the field of business engineering and complement it with specific terms from the field of location and warehouse planning.) • **Competence Goal 2.1: introduced** (Intercultural aspects are introduced by handling aspects of international standardization.) • **Competence Goal 3.1: introduced (**Critical and reflected handling of technical aspects are considered and reflect upon the potential ethical consequences of communication networks.) • **Competence Goal 4.1: reinforced** (Students build on their knowledge gained in previous semesters. After successfully attending the mod-

	ule, students know and understand process models, methods and design options for the new con-struction, and expansion planning of factories and warehouses in the international context.) • **Competence Goal 5.1: reinforced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	**Lecture** Location planning: • Qualitative and quantitative parameters for locations • Analysis and evaluation of international location sites Warehouse planning: • Warehouse planning approaches based on standards as norms and guidelines • Warehouse types and structures • Detailed technical warehouse planning for the areas of incoming goods, racking systems, picking, packaging and dispatch with focus on processes planning and design and calculation of automation technologies • Technical and static design of automated racking systems in accordance with relevant standards and guidelines, such as DIN, VDI, FEM, etc. • IT in warehouses: material flow control and warehouse management systems • Evaluation of planning alternatives
Teaching and learning methodology	Lecture and project based learning
Miscellaneous	---
Indicative reading list	Basics: • Grundig, Claus-Gerold (2018): Fabrikplanung: Planungssystematik, Methoden, Anwendungen. 5. Aufl., München u.a.: Hanser. • Helbing, Kurt (2009): Handbuch Fabrikprojektierung. Berlin: Springer. • Kinkel, Steffen (2004): Erfolgsfaktor Standortplanung. In- und ausländische Standorte richtig bewerten. Berlin: Springer. • Martin, Heinrich (2011): Transport- und Lagerlogistik. 8. Aufl., Wiesbaden: Vieweg. • Mallon, Jürgen / Sebastian Dannenberger (2011): Produktionsaufbau in China. Handlungsempfehlungen als Ergebnis einer empirischen Analyse. Heidelberg: Springer.

	• Schenk, Michael / Siegfried Wirth (2013): Fabrikplanung und Fabrikbetrieb: Methoden für die wandlungsfähige und vernetzte Fabrik. Berlin u.a.: Springer. • Ten Hompel, Michael et al. (2007): Materialflusssysteme: Förder- und Lagertechnik. 3. Aufl., Berlin: Springer. • Ten Hompel, Michael / Volker Sadowsky / Maria Beck. (2011): Materialflusssysteme 2: Planung und Berechnung der Kommissionierung in der Logistik. Berlin: Springer. • Ten Hompel, Michael / Hubert Büchter / Ulrich Franzke (2008): Identifikationssysteme und Automatisierung. Berlin: Springer. • Ten Hompel, Michael / Thorsten Schmidt (2007): Warehouse Management: Organisation und Steuerung von Lager- und Kommissioniersystemen. 3. Aufl., Berlin: Springer, • Wiendahl, Hans-Peter / Jürgen Reichardt / Peter Nyhuis (2014): Handbuch Fabrikplanung: Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktion. 2. Auflg. München: Hanser.

4.22 Module: Business Economics

Module registration No.	4.22
Semester	6
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Controlling and Corporate Governance • Legal Aspects of International Business Transactions
How frequently is the module offered	Every semester
Admission requirements	None
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Andreas Taschner
Total number of ECTS	6
Examination/Type of Assessement	Written Exam (1hr.) & Project Work
Learning outcomes (module)	The module familiarizes students with the basic principles of doing business in an international environment. Students will understand the principles of Controlling and Corporate Governance in an international business environment as well as legal problems arising in the area of international business.

Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.22.1 Course: Controlling and Corporate Governance

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Andreas Taschner
Teaching language	English
Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	The course familiarizes students with the basic concepts and tools of management accounting and focuses on their use in an international manufacturing environment. Special emphasis is put on the influence of different governance models on business management and management accounting. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: **Professional competencies:** • understand basic management accounting concepts and apply them in real-life examples • understand relevance of different governance models in business life and discuss their impact on management and management accounting **Methodological competencies:** • transfer theoretical management accounting concepts to real-life applications • reflect strengths and weaknesses of different management accounting approaches and their applicability in business practice **Social competencies:** • co-operatively solve problems in small teams **Personal competencies:** • critically analyse conflicts between commercially attractive op-tions and ethical behaviour
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Course is taught in English, By completion of the course, students will be able to understand and articulate the most relevant terms used in practice and academia in the field of management reporting, budgeting, performance measurement and strategic management control in English)

	• **Competence Goal 3.1: reinforced** (Students understand the ethical implications of different governance models and can identify potential ethical problems in specific governance settings) • **Competence Goal 4.1: reinforced** (Students transfer theoretical costing concepts to real-life applications. They reflect strengths and weaknesses of different management accounting approaches and their applicability in business practice) • **Competence Goal 5.1: introduced** (Students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering)
Contents/ Indicative syllabus	Business organization and corporate governance • Main dimensions of organizing a business entity and its relations with different stakeholder groups • Different prespectives of governance, typical governance mechanisms • Governance and its impact on management and management accounting Management Accounting & Control (MAC) • Goals of MAC • The typical MAC system Budgeting and planning • Traditional budgeting • Alternative budgeting approaches Cost management • Cost accounting versus cost management • Modern cost management tools Performance management • Financial statements • Key performance indicators • Performance management systems
Teaching and learning methodology	Lecture, company project
Miscellaneous	---
Indicative reading list	• Charifzadeh, Michel / Taschner, Andreas: Management Accounting and Control, Weinheim: Wiley-VCH 2017 • Horváth, Péter / Gleich, Ronald / Seiter, Mischa: Controlling, 14. Aufl., München: Vahlen, 2020 Further material (script) will be provided in course.

4.22.2 Course: Legal Aspects of International Business Transactions

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Prof. Dr. Joachim Gschwinder
Teaching language	English

Credits (ECTS)	3
Total work load	90 hours
Contact hours per week	2 SWS
Learning outcomes	On successful completion of this course, students will be able to: • reflect on the different approaches by different legal systems and attain an appreciation of how these differenet legal systems regulate international business transactions; • analyse some key principles of international law to gain an understandinmg of how it impacts on international business across a variety of legal jurisdictions; • analyse some public international law issues as they affect international business transactions; • apply private international law to specific issues affecting international business such as in identifying the choice of law applicable to international sales contracts, the formation and terms of international sales contracts.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: introduced** (Students get familiar with specific terms from the field of international law.) • **Competence Goal 2.1: introduced** (Students will understand the legal and cultural environment of international business as well as legal problems arising in the area of business in an international, culturally diverse environment.) • **Competence Goal 3.1: introduced** (Students will understand the conflicts of law and learn to settle disputes.) • **Competence Goal 4.1: introduced** (It aims to give students an understanding as well as practical knowledge of legal problems arising in the area of international business and to equip them with the skills needed to prevent and handle these problems. They are able to identify legal requirements in doing international business.)
Contents/ Indicative syllabus	• Legal systems in the world • World Trade law • European Union law • International Sales • International Dispute Resolution
Teaching and learning methodology	Lecture, case studies
Miscellaneous	---
Indicative reading list	• August, Ray, Mayer, Don, Bixby, Michael B., International Business Law, International ed of 6th revised ed, Pearson Education Limited, New Jersey 2012. Further material (script) will be provided in course.

4.23 Elective Business Administration: Human Resources

Module Registration No.	4.23
Semester	6
Duration of module	1 Semester
Type of module	Compulsory Elective
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Hazel Grünewald
Lecturers name (contact details see ESB-website)	Ms. Ursula Wiehl-Schlenker Dr. Roy Mouawad
Teaching language	English
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	2 SWS
Examination/ Type of assessment	Continuous assessment and term paper
Weighting of Grade within overall programme	According to credits
Learning outcomes	• **Professional competencies:** Understanding of key concepts, models, and practices within the field of HR such as workforce planning, recruiting, selection, performance management and development, and cultural impact. Understanding of how theories can be used in practical applications. • **Methodological competencies:** Competence to develop and answer a specific research question, to prepare a paper and a presentation according to scientific standards. The ability to stand back and view complex situations in perspective and to think critically about organizations and what happens in them. • **Social competencies:** Presentation and teamwork skills (through group work and group presentations).

	• **Personal competencies:** Awareness of the necessary skills to realize an academic project; competence to evaluate other student's academic projects and presentations.
Module-specific contribution to AoL Competence Goals	• **Competence Goal 1.1:** reinforced (Since the course is entirely taught in English and contains several interactive components, students can further develop their language skills.) • **Competence Goal 2.1:** reinforced (Group presentations and teamwork in international teams as well as case studies raise awareness of cultural issues and differences in the working environment.) • **Competence Goal 3.1:** reinforced (Students are encouraged to critically reflect on a company's HR practice.)
Contents/ Indicative syllabus	The purpose of this course is to learn how to manage people in organizations. Understanding human resource management (HRM) is key to being an effective manager. This course uses an integrative approach to help students understand, predict, and influence how individuals behave at work. In addition, students will be provided with the tools to attract, select, and retain the right employees, while recognizing the role of the organization's culture and strategy and the impact of external forces.. Real-world examples will be used to provide a relevant and rich learning experience.
Teaching and learning methodology	Lectures with case studies, videos, group work, exercises, student presentations, and discussions
Miscellaneous	None
Indicative reading list	**Human Resource Management:** • Armstrong, Michael. (2017). Armstrong's Handbook of Human Resource Management Practice. 14th edition. London: KoganPage • Boon, C., Den Hartog, D. N., & Lepak, D. P. (2019). A systematic review of human resource management systems and their measurement. Journal of management, 45(6), 2498-2537. • Bratton, J., Gold, J., Bratton, A., & Steele, L. (2021). Human resource management. Bloomsbury Publishing. • Chams, N., & García-Blandón, J. (2019). On the importance of sustainable human resource management for the adoption of sustainable development goals. Resources, Conservation and Recycling, 141, 109-122. • Sima, V., Gheorghe, I. G., Subić, J., & Nancu, D. (2020). Influences of the industry 4.0 revolution on the human capital development and consumer behavior: A systematic review. Sustainability, 12(10), 4035. • Stewart, G. L., & Brown, K. G. (2019). Human resource management. John Wiley & Sons. • Stone, R. J., Cox, A., & Gavin, M. (2020). Human resource management. John Wiley & Sons.

4.24 Elective Business Administration: Supply Chain Management, Logistics and Sourcing

Module Registration No.	4.24
Semester	6
Duration of module	1 Semester
Type of module	Compulsory Elective
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same frame-work and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. techn. Daniel Palm / Prof. Dr.-Ing. Vera Hummel
Lecturers name (contact details see ESB-website)	Prof. Dr. techn. Daniel Palm / Prof. Dr.-Ing. Vera Hummel
Teaching language	English
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	2 SWS
Examination/ Type of assessment	Written exam (1hr.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	The course familiarizes students with the basic principles of Supply Chain Management, Logistics and Sourcing. After successful completion of this course the students should have gained the following knowledge and developed the following competencies: **Professional competencies:** • Understand basic concepts and methods of Sourcing, Logistics and Supply Chain Management • Understand the role of Supply Chain Management in the Company and the interdependencies between marketing, engineering, production, logistics and sourcing. **Methodological competencies:**

	• Understand and apply methods to plan, control and optimize logistics functions **Personal competencies:** • develop the ability to think and act holistic and integrating
Module-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students get familiar with the English terminology from the fields of Supply Chain Management, Logistics and Sourcing.) • **Competence Goal 2.1: reinforced** (Students learn how business decisions impacts different partners in the supply network.) • **Competence Goal 3.1: reinforced** (Students learn sustainability aspects in international sourcing and how to balance social, economical and ecological decisions.) • **Competence Goal 4.1: reinforced** (Students are familiar with the strategic fit in networks.)
Contents/ Indicative syllabus	• Introduction to Supply Chain Management • Push and Pull Supply Chains • Global logistic structures and value chains • Integrated logistics, procurement, materials management and production • Sourcing Stategies • Supplier Assessment and Cooperation • Transport carriers, traffic infrastructure and its systems; targets and target conflicts of transport logistics • Tracking and Tracing
Teaching and learning methodology	Lecture
Miscellaneous	None
Indicative reading list	• Chopra, Sunil/Meindl, Peter: Supply Chain Management. Strategy, Planning, and Operation. 6th Edition, Pearson, 2016.

4.25 Wahlpflichtmodul ING: Automatisierung und Mechatronik

Module Registration No.	4.25
Semester	6
Duration of module	1 Semester
Type of module	Compulsory elective
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate

Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Wolfgang Echelmeyer
Lecturers name (contact details see ESB-website)	Prof. Dr. Wolfgang Echelmeyer
Teaching language	German
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	2 SWS
Examination/ Type of assessment	Written exam (1hr.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	Target of the lecture is a basic knowledge about planning of material handling in production and logistics processes. Starting with handling of parts in production lines, and with storing and shipping in warehouses or distribution centers. Students are able to understand how to use a 3D- simulation software and to plan with state of the art technology logistics systems. Learning outcome: • Knowledge about logistics equipment and automated systems, robotics and handling technologies. • Knowledge about how to program robots and conveyor technology
Module-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students build on their available domain knowledge and acquire advanced knowledge about logistics equipment and automated systems, robotics and handling technologies. Students are able to analyse performance and efficiency of automated logistics systems.) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Robot systems • Handling technologies • Automated Guided Vehicle (AGV) • Sorting technologies and distribution centers • Autonomous material handling systems • Programming plc and robots
Teaching and learning methodology	Lecture

Miscellaneous	None
Indicative reading list	• M. R. Endsley and E. O. Kiris, “The Out-of-the-Loop Performance Problem and Level of Control in Automation,” Hum. Factors J. Hum. Factors Ergon. Soc., vol. 37, no. 2, pp. 381–394, 1995. • T. B. Sheridan, Modeling Human-System Interaction: Philosophical and Methodological Considerations, with Examples. John Wiley & Sons, 2017. • J. Adams, “Human-Robot Interaction Design: Understanding User Needs and Requirements,” Proc. Hum. Factors Ergon. Soc. 49th Annu. Meet. {O}rlando, {FL}, {USA}, no. 3, pp. 447–451, 2005. • P. Marsden and M. Kirby, “Allocation of functions,” Handb. Hum. Factors Ergon. methods, pp. 31–34, 2005. • M. Bonini and W. Echelmeyer, “A Method for the Design of lean Human-Robot Interaction,” in 11th International Conference on Human System Interaction (HSI), 2018, pp. 457–464. • M. Bonini, A. Urru, and W. Echelmeyer, “The Quality Interaction Function Deployment for lean Human-Robot Interaction,” in Proceedings of the 24th International Conference on Methods and Models in Automation and Robotics (MMAR 2019), 2019, pp. 145–151. • M. Bonini, A. Urru, and W. Echelmeyer, “Lean Human-Robot Interaction Design for the Material Supply Process,” in Proceedings of the 16th International Conference on Informatics in Control, Automation and Robotics - Volume 2: ICINCO, 2019, pp. 523–529. • Nof, Shimon Y.: Material Handling Automation in Production and Warehouse Systems in: Springer Handbook of Automation; Springer; ISBN: 978-3-540-78831-7 • Furmans, Kai: Material Handling and Production Systems Modelling - based on Queuing Models; Springer, Dec. 2014

4.26 Wahlpflichtmodul ING: Digitales Engineering und Tools

Module Registration No.	4.26
Semester	6
Duration of module	1 Semester
Type of module	Elective
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.

Responsible professor/ Module coordinator	Prof. Dr.-Ing. Vera Hummel
Lecturers name (contact details see ESB-website)	Prof. Dr.-Ing. Vera Hummel
Teaching language	German
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	2 SWS
Examination/ Type of assessment	Written exam (1hr.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	Intelligent products, high customization of products, flexible production, highly qualified professionals formed wide, demographically-sensitive job design and individualization of customer requirements are tags of Industry 4.0. Nowadays the customization of workflows regarding Industry 4.0 principles has already been started within integrated holistic engineering platform e.g 3D experience. The student will get an overview of complex engineering system from the from the product idea to the design, the parts list, the process engineering and factory planning up to the ergonomics consideration and the work instructions for the individual workplace. Students know and are able to: • communicate the possibilities and limitations of a digital engineering platform • apply the principles of seamless engineering processes and platforms • know the pre-conditions of a digital factory • apply specific digital and virtual tools • execute collaborative engineering activities
Module-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: reinforced** (Students are able to apply knowledge about digital engineering and their tools in order to design and improve the product creation and production process. They are able to apply collaboration aspects into complex engineering networks.) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	Digital and Virtual Engineering: Tools and Technologies • Tools • Product development • Process engineering, time management, ergonomics

	• Factory layout • Materials flow simulation • Robotics, machining • Machine learning, AI in context of production and logistics • Technologies • Seamless digital Engineering (in general) • Cloud Computing Digital, intelligent Factory: Pre-condition and Realization • Pre-condition • Data Model • Information Model • Intelligent Production • Pre-conditions • Possible steps towards a digital, intelligent factory
Teaching and learning methodology	Lecture
Miscellaneous	None
Indicative reading list	• Digitale Fabrik: Methoden und Praxisbeispiele (VDI-Buch); Uwe Bracht (Autor), Dieter Geckler (Autor), Sigrid Wenzel (Autor); Springer Vieweg; Auflage: 2., aktualisierte und erweiterte Aufl. 2018; ISBN-10: 3662557827; ISBN-13: 978-3662557822; 2018 • Digitale Fabrik; Springer; Engelbert Westkämper, Dieter Spath, Carmen Constantinescu, Joachim LentesAuflage: 2013 (11. Dezember 2013), ISBN-10: 9783642202582, ISBN-13: 978-3642202582; Springer Verlag, 2013 • Collaboration Engineering: IT-gestützte Zusammenarbeitsprozesse systematisch entwickeln und durchführen; Jan Marco Leimeister; Springer Gabler; Auflage: 2014 (30. April 2014); ISBN-10: 3642208908; ISBN-13: 978-3642208904

4.27 Elective Integration: Process Optimization

Module Registration No.	4.27
Semester	6
Duration of module	1 Semester
Type of module	Compulsory elective
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate

Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr. Günter Bitsch
Lecturers name (contact details see ESB-website)	Prof. Dr. Günter Bitsch
Teaching language	English
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	2 SWS
Examination/ Type of assessment	Written exam (1hr.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	• **Methodological competencies:** Students learn qualitative and quantitative methods for process optimization. • **Technical competencies**: Students learn about available tools and how to use them. • **Social competencies:** Through interaction within working groups, students gain experience in team collaboration. • **Personal competencies:** Students learn to optimize processes under various aspects to optimize and critically evaluate optimization.
Module-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (The language of the lecture is English, thus improving the language skills of the student.) • **Competence Goal 3.1: reinforced** (Students learn that process optimization always has an impact on the person involved. Process optimization thus accompanies a critical reflection on the effects, especially concerning social and ethical issues as well as the legal framework (e.g., General Data Protection Regulation).) • **Competence Goal 4.1: introduced** (Students learn to analyze, evaluate, and optimize existing processes.)
Contents/ Indicative syllabus	• Process Management Fundamentals • Business Process Modeling • Process Monitoring • Qualitative Process Analysis • Quantitative Process Analysis • Process Redesign
Teaching and learning methodology	Lecture

Miscellaneous	None
Indicative reading list	• Dumas, Marlon, et al. Fundamentals of business process management. Springer, 2018. • Scheer, August-Wilhelm. Unternehmung 4.0: Vom disruptiven Geschäftsmodell zur Automatisierung der Geschäftsprozesse. Third Edition. Springer, 2018. • Van der Aalst, Wil. Process Mining: Data Science in Action. Second Edition. Springer, 2016.

4.28 Elective Integration: Circular Economy

Module Registration No.	4.28
Semester	6
Duration of module	1 Semester
Type of module	Compulsory elective
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate
Transferability of the module to other programmes	The module is transferable to any other programme requiring students to prove the ability to apply sustainable economic and ecological thinking over the entire product life cycle in complex value-added systems.
Responsible professor/ Module coordinator	Prof. Dr. Anja Braun & Bahnmüller
Lecturers name (contact details see ESB-website)	Prof. Dr. Anja Braun
Teaching language	English
Credits (ECTS)	4
Total work load	120 hours
Contact hours per week	2 SWS
Examination/ Type of assessment	Written exam (1hr.)
Weighting of Grade within overall programme	According to credits
Learning outcomes	After successful completion of the module students have acquired the following competencies: **Professional competencies:**

	• Apply theories to enable the shift from a linear model to a circular economy • Adopt and innovate new technical solutions to develop the environmental sector. **Methodologicial competencies:** • Transfer circular economy business concepts to real-life applications • Assess the technical possibilities of industrial, service, community, and primary production processes and systems to minimise environmental impacts **Social competencies:** • Co-operatively solve interdisciplinary challenges of circular economy value-added systems in small teams **Personal competencies:** • Understand the necessity of a circular economy • Critically reflect upon the circular economy concept
Module-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students get familiar with the English terminology from the field of Circular Economy.) • **Competence Goal 4.1: reinforced** (Students are able to transfer their knowledge of circular economy concepts to real value added systems. They are able to transform linear value creation systems into circular structures.)
Contents/ Indicative syllabus	Based on the competences learned in semesters 1 to 6, students will generate an understanding of the the paradigm: decoupling economic growth from resource consumption. This includes the contents: • Understand the guiding principles of the circular economy and relate it to neighboring concepts • Investigate what it takes to create products that are easy to repair, refurbish, remanufacture, repurpose, recycle or recover • Explain drivers and barriers for businesses to cooperate towards a circular economy • Gauge the macro-systemic effects of the transition towards a circular economy • Critically reflect upon the circular economy concept
Teaching and learning methodology	Lectures, group work, presentations
Miscellaneous	None
Indicative reading list	• Sillanpää, M.; Ncibi, C. (2019): The Circular Economy – Case Studies about the Transition from the Linear Economy, LUT University, Finland; Academoc Press, Elsevier. ISBN: 978-0128152676

4.29 Module: Technical Planning Project

Module Registration No.	4.29
Semester	7

Duration of module	1 Semester
Type of module	Compulsory
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same frame-work and teaching the same level of competences.
Responsible professor/ Module coordinator	Prof. Dr.-Ing. Harald Augustin
Lecturers name (contact details see ESB-website)	Prof. Dr.-Ing. Harald Augustin
Teaching language	English
Credits (ECTS)	6
Total work load	180 hours
Contact hours per week	4 SWS
Examination/ Type of assessment	Projekt work
Weighting of Grade within overall programme	According to credits
Learning outcomes	Students apply their knowledge from the complete study time in a real data-based planning project of a warehouse within virtual teams. Upon successful completion, students will have developed the following competencies: • **Subject-specific competencies**: Application of planning procedures, methods and tools for warehouse planning and their application in real case-based planning tasks settings. • **Methodological competencies**: Deepening of analytical and synergistic expertise on hand structured solution models for the analysis and de-sign of complex warehouse systems. • **Specialised and practical competencies, skills and abilities**: Students will deepen practical skills in the field of technical warehouse planning in virtual teams with the following content: Planning of a warehouse with detailed technical planning of warehouse systems with all relevant trades and their integrative character in terms of a holistic approach due to the planning constraints. • **Social competencies**: The social competence is developed in the con-text of the ongoing teamwork with a focus on the handling and solution of communication and social conflicts that arise in virtual teams.

	• **Normative competencies**: Students recognize the importance of the observance of human and cultural differences in the context of virtual planning. They recognize the importance of compliance with government rules and design guidelines for human-centred and sustainable forms of work systems in warehouses.
Module-specific contribution to AoL Competence Goals	• **Competence Goal 1.1: reinforced** (Students deepen their language proficiency in the field of logistics and warehouse planning. They are constantly able to practice their written and oral language skills in English.) • **Competence Goal 2.1: reinforced** (Students get familiar with different cultures of a team and their planning approaches and interpersonal communication as far as foreign students participate.) • **Competence Goal 3.1: assessed** (Students get to know, that warehouse planning also means to discuss ethical issues in exploiting landscape and integrate people work force in the warehouse processes. The student also must reflect the integration of handicapped people in the warehouse workforce due to the real case-based planning scenario they are working in.) • **Competence Goal 4.1: reinforced** (Students know how to apply their knowledge in a real data-based planning of a warehouse in a virtual planning team. Students deepen and apply their ability to analyse processes, methods and systems used to design and calculate warehouse systems with a technical, economic and social focus. They have developed the competencies to run a complete warehouse planning process from the first idea to a final technical implementation planning of the warehouse.) • **Competence Goal 5.1: reinforced**(students are familiar with advanced mathematical and statistical concepts and are able to apply them to problems in economics and engineering) • **Competence Goal 6.1: reinforced** (Students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Project planning • Data analysis and interpretation • VSAW (Value Stream Analysis Warehouse) with KPI definition and evaluation • VSDW (Value Stream Design Warehouse) and system segmentation • General Development Planning • Building Design with detailed trade construction, e.g. baseplate, racks etc. • Planning of all warehouse areas as incoming goods, storage, picking, packing, dispatch and outside logistics • Design and technical planning of automation concepts in all warehouse areas • Economic evaluation with detailed process cost analysis
Teaching and learning methodology	Planning project in teams with supervision by professor
Miscellaneous	None

Indicative reading list	• Arbeitsgemeinschaft Industriebau e.V. (Hrsg.) (2004): Grundlagen der Standortentwicklung im Industriebau: ein Leitfaden für Architekten, Ingenieure und Unternehmen. München: Callwey. • Bielefeld, Bert / Mathias (2010): Entwicklung und Durchführung von Bauprojekten im Bestand: Analyse, Planung, Durchführung. Wiesbaden: Vieweg + Teubner. • Jodin, Dirk / Michael Ten Hompel (2012): Sortier- und Verteilsysteme: Grundlagen, Aufbau, Berechnung und Realisierung. 2. Auflage, Berlin: Springer. • Kinkel, Steffen (2004): Erfolgsfaktor Standortplanung. In- und ausländische Standorte richtig bewerten. Berlin: Springer. • Martin, Heinrich (2011): Transport- und Lagerlogistik. 8. Aufl., Wiesbaden: Vieweg. • Martin, Heinrich (2012): Praxiswissen Intralogistikplanung: reale Projekte mit Ist-Situation, Zielsetzung, Planungen und Wirtschaftlichkeitsbetrachtungen. Wiesbaden: Springer Vieweg. • Ten Hompel, Michael et al. (2007): Materialflusssysteme: Förder- und Lagertechnik. 3. Aufl., Berlin: Springer. • Ten Hompel, Michael / Volker Sadowsky / Maria Beck. (2011): Materialflusssysteme 2: Planung und Berechnung der Kommissionierung in der Logistik. Berlin: Springer. • Ten Hompel, Michael / Hubert Büchter / Ulrich Franzke (2008): Identifikationssysteme und Automatisierung. Berlin: Springer. • Ten Hompel, Michael / Thorsten Schmidt (2007): Warehouse Management: Organisation und Steuerung von Lager- und Kommissioniersystemen. 3. Aufl., Berlin: Springer. • Wiendahl, Hans-Peter. / Jürgen Reichardt /Peter Nyhuis (2014): Handbuch Fabrikplanung: Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktion. 2. Auflage, München: Hanser.

4.30 Module: Interdisciplinary Project

Module Registration No.	4.30
Semester	7
Duration of module	1 Semester
Type of module	Compulsory
How frequently is the module offered	Every semester
Admission requirements	none
Level	Undergraduate
Transferability of the module to other programmes	This module is transferable to any programme following the same framework and teaching the same level of competences.

Responsible professor/ Module coordinator	Prof. Dr. Vera Hummel, Prof Dr. Daniel Palm
Lecturers name (contact details see ESB-website)	Prof. Dr. Vera Hummel, Prof Dr. Daniel Palm
Teaching language	English
Credits (ECTS)	8
Total work load	240 hours
Contact hours per week	6 SWS
Examination/ Type of assessment	Projekt work
Weighting of Grade within overall programme	According to credits
Learning outcomes	Students apply their know-how from different business disciplines in a simulated business environment. After successful completion of the module students have acquired the following competencies: **Professional competencies:** • Apply know-how from various business disciplines to a complex simulated business environment **Methodological competencies**: • transfer theoretical business concepts to real-life applications **Social competencies**: • co-operatively solve problems in small teams • work under time pressure and in a competitive environment **Personal competencies:** • critically analyse conflicts between commercially attractive options and ethical behaviour
Module-specific contribution to AoL Competence Goals	• **Competence Goal 4.1: assessed** (Students know how to apply their knowledge in a complex simulated business environment and how to transfer theoretical business, logistics and production concepts to real-life applications.) • **Competence Goal 6.1: assessed** (students are able to apply advanced digital tools for collaboration, analysis and communication and/or are able to apply knowledge regarding digital aspects of economics and engineering)
Contents/ Indicative syllabus	• Based on the competences learned in semesters 1 to 6, students will generate and design a new product with potential for smart components and produce prototypes in the Werk150. The factory exemplifies a production operation with all assembly- and logistics-side process steps of a variant-rich small batch and single piece production be tween product and process development as well as all incoming and outgoing goods with the entire value-added process.

	• The assembly and logistics system infrastructure includes i.a. flexible, mobile storage systems, ten manual assembly stations, driverless transport systems and a modular, self-controlled roller conveyor system. Furthermore, various collaborative robot systems (Rethink Robotics type Baxter and Sawyer, Universal Robots UR10 (CB2 - old), UR5 (CB3), UR3 (CB3), KUKA IIWA) for the realization of MRK applications, a Wibond pick-by-light System for employee assistance and an industrial IO-Link communication system with various sensors and programmable logic controllers for solving automation tasks. • The Werk150 also has an app and cloud-based collaborative engineering, planning and simulation platform (Dassault Systemès 3DExperience) and a constantly evolving Manufacturing Self-Execution System (MSES) specifically designed for transformable scenarios in the context of Industry 4.0 was developed and implemented. In addition, marketing, procurement, quality management, sales, cost accounting and controlling will be part of the task. At the beginning of the project, pre-define
Teaching and learning methodology	Group work, presentations, lectures, hand-on training in the Werk150 – the factory of the ESB Business School on campus
Miscellaneous	None
Indicative reading list	All study materials from semester 1 until semester 6

4.31 Module: Bachelor Thesis und Kolloquium

Module registration No.	4.31
Semester	7
Duration of module	1 Semester
Type of module	Compulsory
Courses included in the module	• Bachelor Thesis • Kolloquium zur Thesis
How frequently is the module offered	Every semester
Admission requirements	Admission can only be applied for if at least 165 ECTS credits have been collected altogether.
Level	Undergraduate
Transferability of the module to other programmes	The module is transferable to any programme requiring students to write a final thesis at the end of the study programme.
Responsible professor/ Module coordinator	Prof. Dr. Dirk Schieborn
Total number of ECTS	14

Examination/Types of Assessment	Bachelor Thesis/Presentation (RE)
Learning outcomes (module)	After successful completion of the module students can develop clear research goals and derive an appropriate research method, develop an effective solution for the defined problem using methods and instruments from the subject areas covered in the study programme and can prepare a concise and clear presentation of their work.
Graded/ungraded	Graded
Weighting of grade within overall programme	According to credits

4.31.1 Bachelor Thesis

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Several individual thesis evaluators
Teaching language	German/English
Credits (ECTS)	12
Total work load	360 hours
Contact hours per week	0 SWS
Learning outcomes	The thesis shows that the student is able to independently work on a problem from the subject areas of the programme using academic methods. It should deal in a self-contained manner with a practical problem based on empirical data and/or theory. The problem should be systematically presented and developed and solutions proposed. • **Professional competence**: develop clear research goal and define appropriate research method, critically reflect available theory when working on a given research question. • **Methodological competences**: understand the most important concepts and techniques in business research methodology, select appropriate theories, methodologies and sources, apply the principles of academic writing and empirical research. • **Social competence**: liaise with supervisor and discuss research problems in a structured way, communicate with third parties for data and advice • **Personal competences**: organize own work in an adequate way to achieve the planned output within given time and resource constraints, critically reflect own achievements.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 3.1: reinforced** (Students identify possible conflicts of interest embedded in the developed solution and reflect ways to deal with them.) • **Competence Goal 4.1: reinforced** (Students can develop clear research goals and derive an appropriate research method, develop an

	effective solution for the defined problem using methods and instruments from the subject areas covered in the study programme and can prepare a concise and clear presentation of their work.)
Contents/ Indicative syllabus	Depending on selected topic
Teaching and learning methodology	Individual mentoring by supervisors, self-study
Miscellaneous	---
Indicative reading list	Depending on selected thesis topic

4.31.2 Kolloquium zur Thesis

Type of course	Compulsory
Lecturers name; contact details see ESB-website	Several individual thesis evaluators
Teaching language	German/English
Credits (ECTS)	2
Total work load	60 hours
Contact hours per week	2 SWS
Learning outcomes	• **Professional competence**: prepare concise and clear presenta-tion of research goal, method applied and achieved work results. • **Social competence**: liaise with supervisor and discuss research problems in a structured way, conduct a topic-centered scientific conversation. • **Personal competences**: organize preparatory work in an ade-quate way to achieve the planned output at a defined deadline, crit-ically reflect own achievements, present own achievements in a concise and clear manner to others.
Course-specific contribution to AoL Competence Goals	• **Competence Goal 3.1: reinforced** (Students identify possible conflicts of interest embedded in the developed solution and reflect ways to deal with them.) • **Competence Goal 4.1: reinforced** (Students can develop clear research goals and derive an appropriate research method, develop an effective solution for the defined problem using methods and instruments from the subject areas covered in the study programme and can prepare a concise and clear presentation of their work.)
Contents/ Indicative syllabus	Depending on selected topic
Teaching and learning methodology	Individual mentoring by supervisors, self-study
Miscellaneous	---

Indicative reading list	Depending on individual topic