



Programme and Course Description

Master Engineering and Management

Master of Engineering (M. Eng.)

Study regulation: WS 2021/22
as per: 23.03.2023

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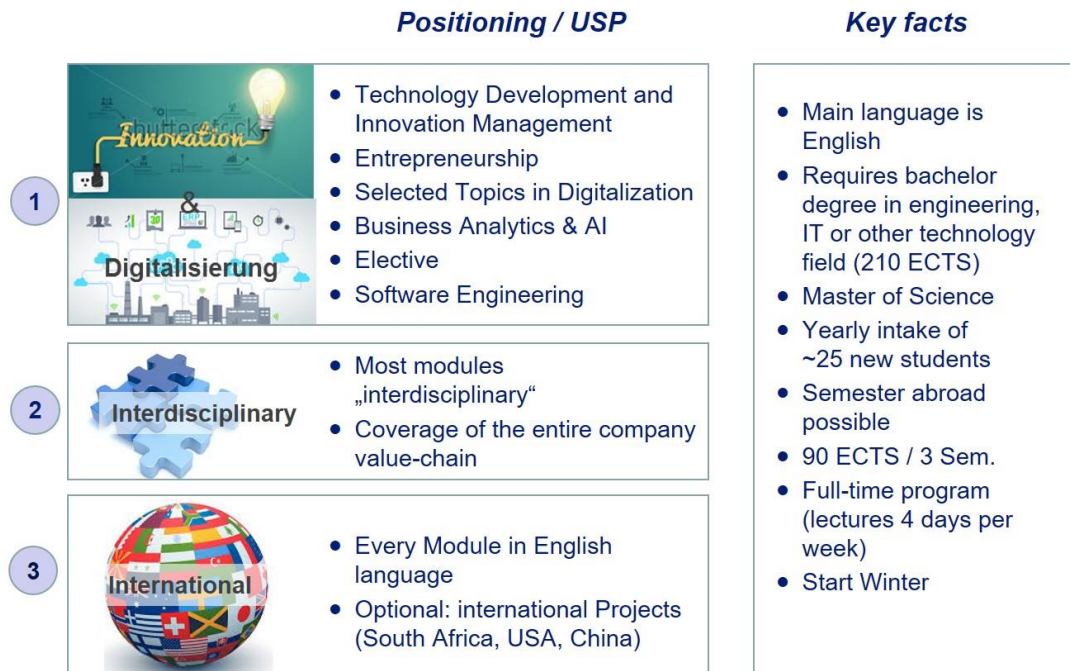
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1 Overview

Name of the programme	Engineering and Management
Study type & degree	Consecutive Master of Science (full time)
First start date	WS 21/22; Start only in winter semester
Standard period of study	3 semesters (90 ECTS, 48 SWS)
Study location	THI-Campus in Ingolstadt
Language of instruction	English
Cooperation	None
Admission requirement	Bachelor degree
Capacity	25 students p.a.
Programme director	Prof. Dr. Tobias Albrecht

2 Introduction

The Master programme “Engineering and Management” of Technische Hochschule Ingolstadt addresses students who intend to work for international companies in functions which require both, an engineering background as well as a thorough understanding of management practices. The programme focus on three main topics: INNOVATION, INTERDISCIPLINARY, INTERNATIONAL (I³). A short overview shows the following illustration:



The three main Topics of Innovation, Interdisciplinary and International will be taught on the basis of the entire value chain. The following illustration shows the different modules and their influence on the value chain.



2.1 Objectives

Based on their completed Bachelor's programme, graduates acquire and expand their knowledge, skills, and competencies to understand engineering and management in a digital and international environment. Especially an in-depth knowledge of using new technologies and management methods in a broad variety of industries. Furthermore, they can understand, develop, implement, and operate the general management tasks on the value chain. They will be in the position to recognise the interdependency of technical, strategic, managerial, and social topics in a digital influenced international business.

2.2 Admission requirements

- General regulations:
 - Studien- und Prüfungsordnung für den Masterstudiengang der Fakultät Wirtschaftsingenieurwesen M.Sc. Engineering and Management an der Technischen Hochschule Ingolstadt vom 16.11.2020
 - Rahmenprüfungsordnung (RaPO)
 - Allgemeine Prüfungsordnung (APO) der Technischen Hochschule Ingolstadt
 - Immatrikulationssatzung der Technischen Hochschule Ingolstadt

- Proof of bachelor's degree in engineering sciences, engineering and management, IT, natural sciences, or a degree in another related discipline at a German university with at least 210 ECTS credit points or an equivalent degree of a foreign university

- All foreign applicants must submit their bachelor's degree to uni-assist, which verifies their eligibility and converts their grades to the German grade system. Uni-Assist will issue a so-called preliminary inspection documentation (VPD) which you must upload to the application portal (similar to their other documents).

- Proof of English proficiency level B2 or higher

2.3 Target group

The master's programme is designed for students who:

- are interested in the field of engineering and management with a clear focus of international and digital aspects.
- graduates of bachelor programmes or young professionals with bachelor's degree in engineering sciences, engineering and management, IT, natural sciences, or a degree in another related discipline
- prospective students that prefer a master's programme fully taught in English, like to gain intercultural experience, and go for an international career at home and abroad

2.4 Structure of the programme

The programme has the following structure:

Curriculum

1. Semester

Software Engineering	International Management	Business Analytics & Artificial Intelligence
Digital Factory	Digital Marketing	Innovationmanagement & Entrepreneurship

2. Semester

Selected topics in digitalization	Management Accounting & International Taxation	Scientific Research Seminar
Advanced Manufacturing Technologies	Advanced Economics	Elective

3. Semester

Master's Thesis

2.5 Prerequisites for advancement

To get the title of master's thesis requires that at least 30 ECTS are achieved in the sequence of study (compare "Studien- und Prüfungsordnung" of 16/11/20).

3 Qualification profile

The programme is fully taught in English and welcomes both German and international students. It is designed as an interdisciplinary programme at the interface of technology and business with a strong focus on international and digital aspects.

Four clusters offer a maximum of interdisciplinarity:

- Cluster digitalization
- Cluster technology
- Cluster business
- Cluster integrative

The graduates can apply the mainly used management methods among the supply chain. They can manage innovation processes; apply new technology in both the production and business processes. Assess those changes for the environment and society and can form business models.

The graduates can compile complex tasks within cross-functional and international teams, speak English fluently, work target-oriented and are able to present results.

3.1 Mission statement

The master's programme integrates the mission statement in the following ways:

We prepare our students for the challenges of the future:

- The master's programme creates future competence.
- It creates a spirit of innovation and teaches entrepreneurial thinking.
- It is an interdisciplinary programme, which enables students to develop future-oriented solutions for interdisciplinary challenges.
- It qualifies students to help shape social changes such as the digital transformation and technological change. It sensitizes students to the sustainable use of the environment and resources, to socially responsible behavior and to social commitment.

We enable our students to develop solutions to problems based on scientific knowledge:

- The master's programme includes a lot of project work. This enables students to acquire applicable problem-solving skills.
- The lecturers transfer their practical experience and teach academic knowledge. They are professionally competent, are constantly developing in their areas of expertise and contribute their research experience to teaching.
- Students acquire professional, methodical, social, and self-competences.

We open outstanding regional and international perspectives for our students:

- The master's programme is fully taught in English, addresses international students, and creates intercultural competences.
- In this way, the programme contributes to a cosmopolitan, international campus.
- Our numerous cooperations with companies in the region enable our students to start their careers in the best possible way, both regionally and internationally.

We teach and learn through personal exchange:

- Because this is a master's programme, small groups and seminar-based forms of teaching are set to enable individual exchange with the students.
- The teaching concept offers digitalized courses (e.g. inverted classroom) in combination with many practical project studies to enhance the learning progress.
- The lecturers try out new ways of innovative and experimental teaching. For example, the first half of the semester concentrates on theoretical basics, the second half on practical application.

We help all students discover and realize their individual potential:

- The master's programme includes a lot of project work. In joint project work, our students gain social skills such as the ability to cooperate and deal with conflict, and leadership skills.
- The master's programme is international and intercultural. Hence, the programme promotes performance in an appreciative cooperation. We meet each other with tolerance and openness and understand diversity as an opportunity to learn from each other and develop further.

3.2 Study objectives

3.2.1 Subject-specific competences of the study program

Professional competences:

The graduates:

- can analyze and develop digitalization and how this will impact an existing or a future business with all the aspects among the supply chain.
- are familiar with modern technologies and can develop, evaluate, use and market modern technologies for specific applications
- can develop forward-looking business models and can use new technologies in different industries.
- can identify the opportunities and risks of operational and social transformation processes and know the success factors.

3.2.2 Interdisciplinary competences of the study program

Methodical competences:

The graduates are able

- to work scientifically
- to plan, compile and lead projects
- to apply new management and development methods in international and digital industries.
- to analyze interdisciplinary problems, to recognize comprehensive correlations, to transfer learned competences to new tasks and to evaluate the technical and social impact of compiled solutions

Social competences:

The graduates are able

- to compile complex tasks in cross-functional and international teams, to solve conflicts in teams and to lead teams
- to speak English fluently (incl. technical terms) and to react sensitively in intercultural affairs
- to communicate their competences and to communicate generally

- to convince and to become accepted

Personal competences:

The graduates

- are able to organize themselves and to manage their time
- have analytical and outcome-oriented intellectual power
- work target-oriented and autonomously
- are able to present results and themselves

3.2.3 Examination concept of the study programme

Module	Type of Exam
Digital Factory	SA mit Koll (term paper with colloquium)
Advanced Manufacturing Technologies	StA (student research project)
International Management	mdIP (oral examination)
Business Analytics & Artificial Intelligence	schrP (written examination)
Advanced Economics	schrP (written examination)
Management Accounting & International Taxation	schrP (written examination)
Entrepreneurship & Innovation Management	Proj (project thesis)
Selected Topics in Digitalization	StA (student research project)
Software Engineering	StA (student research project)
Digital Marketing	Proj (project thesis)
Elective	Depends on the Elective
Scientific Research Seminar	Proj (project thesis)
Master Thesis	MA (Master thesis)

3.2.4 Contribution of individual modules to the objectives of the programme

Module	Professional competence	Methodology	Social competence	Personal competence
Digital Factory	++	++		
Advanced Manufacturing Technologies	++	+		
International Management	++	++	+	
Business Analytics & Artificial Intelligence	++	+		
Advanced Economics	++	+		
Management Accounting & International Taxation	++	+		
Entrepreneurship & Innovation Management	+	+	++	+
Selected Topics in Digitalization	+	++	+	
Software-Engineering	++	+		
Digital Marketing	+	+	+	
Elective	+	++	+	++
Scientific Research Seminar	+	+	+	++
Master's Thesis	+	+	++	+

3.3 Possible professional fields

Graduates of this programme are in great demand. There is a wide field of application in specialist or management roles in national or international companies and organizations.

Graduates are especially well prepared to take on specialist and management roles in the following areas:

- Project Management
- Product and Technology Management
- Creativity and Innovation Management
- Business Development
- Entrepreneurship
- Sustainability

Graduates are also particularly well qualified for these tasks in an international context. Typical industries for the graduates of this program are:

- Mechanical and Electrical Engineering
- IT
- Mobility Industry
- Services
- Consultancy
- Education
- Cities and Communities

4 Description of Modules

4.1 Compulsory Modules

Digital Factory			
Module abbreviation:	DigFact_M-EGM	SPO-No.:	1
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	1
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Axmann, Bernhard		
Lecturers:	Axmann, Bernhard		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Digital Factory		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - seminar paper/presentation		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
none			
Recommended prerequisites:			
Interest in Software and Digital Tool			
Objectives:			
Students are able to:			
<ul style="list-style-type: none"> • develop knowledge to apply methods for scientific work to topics of the digital factory; • generate basic understanding of software applications for factory operation; • evaluate the tasks of the digitalisations of the factory, the resulting challenges and possible approaches to solutions in Industry 4.0; • develop an understanding of data quality and data management; • generate knowledge about the challenges of digitalisation; • determine specific problems around digitalisation using a systematic approach, evaluate them and identify alternative solutions. 			
Content:			
<ul style="list-style-type: none"> • Short recap: Scientific work • Short recap: Basics on Digital Factory / Industry 4.0 • Overview of the basics of AI and its application in industrial operations • Focus: Overview of software applications in industrial operations- predictive Maintenance <ul style="list-style-type: none"> ○ Logistic ○ Purchase ○ Sales ○ Production ○ Engineering 			

<ul style="list-style-type: none">○ Quality○ Personal● Basics of data and the importance of data quality● Challenges in the digitalization of an industrial company using the example of SMEs and corporations <p>Application in Thesis</p> <ul style="list-style-type: none">● Evaluation with 5D of software applications in the digital factory● or practical application of RPA or chatbot and evaluation with cost-benefit and break-even.
Literature:
<ul style="list-style-type: none">● BROY, M., Ch PREHOFER and H ENGESSER, 2016. Digitalisierung und die Rolle der Informatik in Anwendung und Forschung. In: Informatik-Spektrum, S. 436-443.● MERTENS, P. and D. BARBIAN, 2016. Digitalisierung und Industrie 4.0 – Trend mit modischer Überhöhung? In: Informatik Spektrum, S. 301-309.● SCHEER, A.-W., 2016. Nutzentreiber der Digitalisierung - Ein systematischer Ansatz zur Entwicklung disruptiver digitaler Geschäftsmodelle. In: Informatik Spektrum, S. 275-289● AXMANN, Bernhard, SCHULD, Tino, SOLIS, Lesly, 2021. Vergleich von Methoden zur Auswahl Digitaler Technologien für KMU. In: ZWF, p.735-739. ISSN ISSN zwf-2021-0148● AXMANN, Bernhard, HARMOKO, Harmoko, JANIESCH, Christian, HARMS, Lukas, 2021. A Framework of Cost Drivers for Robotic Process Automation Projects. In: Lecture Notes in Business Information Processing. In: Springer International Publishing, p.7-22. ISSN 10.1007/978-3-030-85867-4_2● AXMANN, Bernhard, HARMOKO, Harmoko, 2022. Process & Software Selection for Robotic Process Automation (RPA). In: Tehnički glasnik. ISSN 10.31803/tg-20220417182552
Additional remarks:
Exam: Seminar paper (8 -15 pages) with colloquium (15-20 pages)

Advanced Manufacturing Technologies			
Module abbreviation:	Adv_Man_Tech_M-EGM	SPO-No.:	2
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	1
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Bednarz, Martin		
Lecturers:	Bednarz, Martin		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:	47 h	
	Selbststudium:	78 h	
	Gesamtaufwand:	125 h	
Subjects of the module:	Advanced Manufacturing Technologies		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - StA+Coll. (student research project with colloquium), written 8-15 pages or presentation 15-20 pages; oral exam 10-15 min.		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>Students</p> <ul style="list-style-type: none"> • get to know advanced manufacturing technologies and their industrial applications; • can deduct advantages and disadvantages of different technologies; • are gathering process know-how and understand the physical principles of these technologies; • learn the latest trends in the industry; • practice how to work and communicate in teams; • know how modern manufacturing technologies may affect work processes and society. 			
Content:			
<p>Advanced Manufacturing Technologies e.g.:</p> <ul style="list-style-type: none"> • Additive Manufacturing; • Laser Technologies; • Technologies for Battery production; • Manufacturing Technologies of fibre reinforced plastics. 			
Literature:			
<ul style="list-style-type: none"> • GROOVER, Mikell P., 2013. <i>Fundamentals of modern manufacturing: materials, processes, and systems</i>. 5. edition. Hoboken, NJ: Wiley. ISBN 978-1-118-231463 			

- BRECHER, Christian, 2015. *Advances in production technology* [online]. Cham; Heidelberg; New York; Dordrecht; London: Springer Open PDF e-Book. ISBN 978-3-319-12304-2. Available via: <https://doi.org/10.1007/978-3-319-12304-2>.
- KALPAKJIAN, Serope and Steven R. SCHMID, 2014. *Manufacturing engineering and technology*. 5. edition. Singapore [u.a.]: Pearson. ISBN 978-0-13-312874-1, 978-981-06-9406-7

Additional remarks:

No remarks.

International Management			
Module abbreviation:	Int_Mgt_M-EGM	SPO-No.:	3
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	1
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Schneider, Yvonne		
Lecturers:	Schneider, Yvonne		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	International Management		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	mdIP - oral exam, 15 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>By actively participating in this course, students should be able to:</p> <ul style="list-style-type: none"> • understand key terms and challenges while conducting international business; • analyse how international firms are embedded in the global economy and contribute to international trade and foreign direct investment; • compare options firms have and how they can operate internationally; • determine the complexity of relationships between headquarters and subsidiaries; • differentiate between challenges of the environment that multinational enterprises face, incl. cultural differences, political influence, international trade agreements; • evaluate options for managing organisational structure and culture in an international environment; • explain the multi-dimensional nature of internationalization strategies; • assess how the international dimension of strategy can help to build a company's competitive advantage; • gain ability to critically reflect upon internationalization, its antecedents and consequences. <p>Cases and examples are integrated through the course to reinforce and clarify major topics.</p>			
Content:			
<p>This module provides a general overview on principles and challenges of International Management. Among others, the following aspects will be discussed:</p> <ul style="list-style-type: none"> • Introduction into globalization and international business • International business environment: culture, politics, economy • International trade and investment: government influence, cross-national cooperation 			

- Internationalization strategies (process, market entry modes, etc.)
- Internationalization and corporate social responsibility and business ethics
- Specifics of multinational companies, such as
 - Organizational structure of multinational companies
 - Leadership and human resource management in multinational companies
 - Strategic management of multinational corporations
 - Cultural differences and impact as cause for differences

Literature:

Will be specified at the beginning.

Additional remarks:

No remarks.

Business Analytics & Artificial Intelligence			
Module abbreviation:	BusAn_AI_M-EGM	SPO-No.:	4
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	2
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Meintrup, David		
Lecturers:	Bock, Jürgen; Radtke, Max		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Business Analytics & Artificial Intelligence		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
none			
Recommended prerequisites:			
none			
Objectives:			
<p>The students:</p> <ul style="list-style-type: none"> • develop general linear models; • interpret the results of statistical modelling in terms of goodness of fit and the significance of coefficients; • solve classification problems and evaluate the result; • develop knowledge and experience in the practical applications of machine learning and deep learning methods; • generate an understanding of procedures for formal knowledge modelling and knowledge interpretation. 			
Content:			
<ul style="list-style-type: none"> • Linear statistical models: multiple regression, multifactorial ANOVA • Unsupervised learning: clustering and PCA • Classifiers: Naive Bayes, logistic regression, CART • Definition of artificial intelligence and overview of sub-disciplines • Artificial neural networks • Graph-based knowledge representation and graph queries • Logic-based knowledge representation and automatic reasoning 			

Literature:

- JAMES, Gareth and others, 2021. *An introduction to statistical learning: with applications in R*. S. edition. New York, NY: Springer. ISBN 978-1-0716-1417-4, 1-0716-1417-7
- HASTIE, Trevor, Robert TIBSHIRANI and Jerome H. FRIEDMAN, 2017. *The elements of statistical learning: data mining, inference, and prediction*. Second edition, corrected at 12. edition. New York, NY: Springer. ISBN 978-0-387-84857-0, 0-387-84857-6

Additional remarks:

No remarks.

Advanced Economics			
Module abbreviation:	Adv_Econ_M-EGM	SPO-No.:	5
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	2
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Eisenberg, Andrea		
Lecturers:	Eisenberg, Andrea		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Advanced Economics		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students get to:</p> <ul style="list-style-type: none"> • understand the importance of global economic system and problems for strategic business decisions in globally active companies; • be able to evaluate challenges resulting from globalization and growing international business transactions; • understand global economic problems, international economic relations and economic policy; • understand how the international monetary system works; • achieve an in-depth understanding of micro- and macroeconomic interrelationships. 			
Content:			
<ul style="list-style-type: none"> • Advanced Microeconomic theory: supply and demand, economic actors • Advanced Macroeconomics: inflation, unemployment, economic growth • Institutional economics and international economic organizations • International trade and globalization • Interest rates, international monetary policy and currency systems 			
Literature:			
<ul style="list-style-type: none"> • MANKIW, Nicholas Gregory and Mark P. TAYLOR, 2020. <i>Economics</i>. 5. edition. Andover, Hampshire: Cengage. ISBN 9781473768628 • MCDOWELL, Moore, 2012. <i>Principles of economics</i>. 3. edition. London [u.a.]: McGraw-Hill Higher Education. ISBN 978-0-07-712169-3, 0-07-712169-4 			

<ul style="list-style-type: none">• TAYLOR, Timothy, 2022. <i>Principles of Economics</i>. PDF [online]. PDF e-Book.
Additional remarks:
No remarks.

Management Accounting & International Taxation			
Module abbreviation:	MgtAcc_IntTax_M-EGM	SPO-No.:	6
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	1
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Albrecht, Tobias		
Lecturers:	Albrecht, Tobias; Eisenberg, Andrea		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Management Accounting & International Taxation		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students get to:</p> <ul style="list-style-type: none"> • understand the importance of international taxation systems for strategic decision-making. • achieve sound understanding of the most important aspects of international company taxation; • understand the core concepts of cost and management accounting; • be able to use advanced management accounting concepts as a base for strategic management in global companies. 			
Content:			
<ul style="list-style-type: none"> • Economics of public sector, the tax systems • International taxation: taxation of global groups, Value added tax, withholding tax, transfer pricing • Principles of Cost Accounting • Advanced management accounting systems, • Budgeting and strategic planning as a base for strategic decisions making 			
Literature:			
<ul style="list-style-type: none"> • ATRILL, Peter and Eddie MCLANEY, 2021. <i>Management Accounting for Decision Makers</i>. 10. edition. ISBN 978-1292349459 • HERZFELD, Mindy, 2019. <i>International Taxation in a Nutshell</i>. 12. edition. ISBN 978-1684673469 			
Additional remarks:			
No remarks.			

Entrepreneurship & Innovation Management			
Module abbreviation:	ES_Inno_Mgt_M_EGM	SPO-No.:	7
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	2
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Schwandner, Gerd		
Lecturers:	Albrecht, Tobias		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Entrepreneurship & Innovation Management		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - project work		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
none			
Recommended prerequisites:			
none			
Objectives:			
<p>The students get to:</p> <ul style="list-style-type: none"> • understand the challenges and pitfalls of starting-up a company; • comprehend important aspects of innovations; • be able to apply innovation management tools; • know how to implement start-up specific management concepts; • be able to develop convincing business plans; • be able to effectively work as a team; • further improve their presentation skills; • understand the relevance of innovation and entrepreneurship for society. 			
Content:			
<p>Theory</p> <ul style="list-style-type: none"> • What is entrepreneurship? • Innovation: types, sources, how to find? • Innovation management and -strategy, • Start-ups: strategy agile product development, marketing, financing • Business plans • Other relevant topics: e.g. legal forms, intellectual property right <p>Start-up project:</p> <ul style="list-style-type: none"> • Creating of a business concept along 3 milestones, incl. pitch-presentations 			

<ul style="list-style-type: none">• Formulating a business plan as a team• Development of a prototype/mock-up ad a pitch-Videos
Literature:
<ul style="list-style-type: none">• KAWASAKI, Guy, 2015. <i>The art of the start 2.0 : the time-tested, battle-hardened guide for anyone starting anything</i>. London: Portfolio Penguin. ISBN 978-0-241-18726-5• RIES, Eric, 2019. <i>The lean startup: how constant innovation creates radically successful businesses</i>. London: Penguin Business. ISBN 978-0-670-92160-7
Additional remarks:
No remarks.

Selected Topics in Digitalization			
Module abbreviation:	SelTop_Digi_M-EGM	SPO-No.:	8
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	1
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Zehbold, Cornelia		
Lecturers:	Zehbold, Cornelia		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Selected Topics in Digitalization		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	Student research project without oral presentation 8-15 pages		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
Basics of Business Information Systems			
Objectives:			
Students:			
<ul style="list-style-type: none"> • get to know the drivers of digitalization as well as the typical phases, from digitizing existing processes to new digital business models and ecosystems; • gain insights into the possible effects of digitalization in society; • understand that it is no longer acceptable to just look at processes and data in isolation; • work with current software ; • practice digital collaboration in teams; • can analyse problems in the field of digitalization, using a systematic approach, and to present alternative solutions. 			
Content:			
<ul style="list-style-type: none"> • Disruptive technologies • Drivers of digitalization • Dimensions of digitalization briefly: business models, processes, products, integration and communication of products with the environment, human-machine interface • Digital business models and value networks • Digital business processes • Process mining and Robotic process automation (RPA) 			

Literature:

- MORABITO, Vincenzo, 2016. *The Future of Digital Business Innovation: Trends and Practices* [online]. Switzerland: Springer PDF E-Book. ISBN 978-3-319-26874-3, 978-3-319-26873-6. Available via: <https://doi.org/10.1007/978-3-319-26874-3>.

Additional remarks:

None

Software Engineering			
Module abbreviation:	SW_Eng_M-EGM	SPO-No.:	9
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	2
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Bock, Jürgen		
Lecturers:	Bock, Jürgen; Radtke, Max		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:	47 h	
	Selbststudium:	78 h	
	Gesamtaufwand:	125 h	
Subjects of the module:	Software Engineering		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	Student research project without oral presentation 8-15 pages		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
none			
Recommended prerequisites:			
none			
Objectives:			
<p>After participating in this module students can:</p> <ul style="list-style-type: none"> • explain the foundations of software engineering; • analyse and structure software requirements; • formally describe software components and interfaces; • develop, test and document simple software components in a high-level programming language; • use development tools (software engineering tool-chain) effectively; • cooperate in and across teams during the development of software applications. 			
Content:			
<ul style="list-style-type: none"> • Foundations of software engineering • Systematic analysis of software requirements • Modelling of requirements and components of a software product • Specification and documentation of software component interfaces • Development of software modules in teams including test and documentation • Consistent use of software engineering tools (IDE, sourcecode-, build-, artifact-management) 			
Literature:			
<ul style="list-style-type: none"> • THOMAS, David and Andrew HUNT, 2020. <i>The pragmatic programmer: your journey to mastery</i>. 20. edition. Boston: Addison-Wesley. ISBN 978-0-13-595705-9, 0-13-595705-2 • MILES, Russ and Kim HAMILTON, 2006. <i>Learning UML 2.0: [a pragmatic introduction to UML]</i>. 1. edition. Sebastopol, CA: O'Reilly & Associates. ISBN 0-596-00982-8 			

- GAMMA, Erich and others, 1994. *Design Patterns - Elements of Reusable Object-Oriented Software*. ISBN 0-201-63361-2

Additional remarks:

No remarks.

Digital Marketing			
Module abbreviation:	Digi_Mkt_M-EGM	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	2
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Albrecht, Tobias		
Lecturers:	Bilger, Rebecca		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Digital Marketing		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - project work		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
The student has the following abilities after finalizing this course:			
<ul style="list-style-type: none"> • the skill for Search Engine Optimization and Marketing; • how to handle with Big Data and Decision Making; • to know how to use social media management as well as SEO/SEM; • the skill to identify consumer behaviour. 			
Content:			
<ul style="list-style-type: none"> • Introduction of Big Data and Data-Analytics • How to use Tools like SEO/SEM • What are intellectual properties • How to use Web-Analytics • How to build and use a Brand 			
Literature:			
<ul style="list-style-type: none"> • KOTLER, Milton, CAO, Tiger, WANG, Sam, QIAO, Collen, ZHANG, Yuheng, 2020. <i>Marketing strategy in the digital age: applying Kotler's strategies to digital marketing</i> [online]. New Jersey: World Scientific PDF e-Book. ISBN 978-981-121-698-5, 978-981-121-699-2. Available via: https://doi.org/10.1142/11737. • KOTLER, Philip, Hermawan KARTAJAYA and Iwan SETIAWAN, 2021. <i>Marketing 5.0: technology for humanity</i>. Hoboken (New Jersey): Wiley. ISBN 978-1-119-66854-1, 978-1-119-66857-2 			

Additional remarks:
No remarks.

Scientific Research Seminar			
Module abbreviation:	Sc_Res_Sem_M-EGM	SPO-No.:	12
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	2
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Albrecht, Tobias		
Lecturers:	Albrecht, Tobias		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Scientific Reserach Seminar		
Lecture types:	S-Seminar		
Examinations:	LN - project work		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
none			
Recommended prerequisites:			
none			
Objectives:			
<p>The students:</p> <ul style="list-style-type: none"> • can successfully process a complex task within one semester; • are able to work independently into a new, challenging theme; • are able to document and present their project results; • have strong methodological and social competency in areas such as communication, project management and time management. 			
Content:			
<p>Processing of a semester-accompanying scientific question differ from semester to semester. Several topics are offered, from which one can be selected.</p> <p>The task is a scientific question and is handled by the student on his own responsibility.</p> <p>At the end of the semester, the results are summarized in the form of a report (approx. 10-15 pages) and a presentation (approx. 15-30 minutes).</p>			
Literature:			
<ul style="list-style-type: none"> • BUI, Yvonne, 2019. <i>How to Write a master's Thesis</i>. 3. edition. ISBN 978-1506336091 			
Additional remarks:			
No remarks.			

Master Thesis			
Module abbreviation:	Ma_Thes	SPO-No.:	13
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Compulsory Subject	3
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Albrecht, Tobias		
Lecturers:			
Credit points / SWS:	30 ECTS / 0 SWS		
Workload:	Kontaktstunden:	0 h	
	Selbststudium:	750 h	
	Gesamtaufwand:	750 h	
Subjects of the module:	Master Thesis		
Lecture types:	MA		
Examinations:	Master-Thesis		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
none			
Recommended prerequisites:			
none			
Objectives:			
<p>The students:</p> <ul style="list-style-type: none"> are able to carry out autonomously a complex problem in the area of engineering and management at the interface of technology, economy and sociology on a high scientific level; are able to apply the acquired skills and scientific methods; can integrate the results into a professional context and to present them in a scientific paper. 			
Content:			
<ul style="list-style-type: none"> Complex problems around foresight at the interface of technology, economy and sociology with integration of results into a professional context. Presentation in form of scientific paper. 			
Literature:			
<ul style="list-style-type: none"> SUBHASH CHANDRA, Parija and Kate VIKRAM, 2018. <i>Thesis Writing for master's and Ph.D. Program</i>. 1. edition. ISBN 978-9811308895 BUI, Yvonne N., 2019. <i>How to Write a master's Thesis</i>. 3. edition. ISBN 978-1506336091 			
Additional remarks:			
No remarks.			

4.2 Electives

Fallstudie Internet of Things			
Module abbreviation:	FallstudieIntThings_M-EGM	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Master Engineering and Management	Individual elective subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	Deutsch	1 Semester	Winter- und Sommersemester
Responsible for module:	Großmann, Daniel		
Lecturers:	Großmann, Daniel		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Fallstudie Internet of Things		
Lecture types:	SU/Ü-Seminaristischer Unterricht/Übung		
Examinations:	Projektarbeit mit mdl. Präsentation (15 min) und schriftlicher Ausarbeitung (5 - 25 Seiten)		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
Keine			
Recommended prerequisites:			
Keine			
Objectives:			
Die Studierenden			
<ul style="list-style-type: none"> • können die besonderen Eigenschaften des Internet of Things (IoT) und von IoT-Systemen erläutern • können die gesellschaftliche und wirtschaftliche Bedeutung des IoT einzuschätzen • kennen die wichtigsten Standards für die Kommunikation zwischen IoT-Geräten • kennen Techniken zur Speicherung und Verarbeitung von Daten in IoT-Systemen • kennen Architekturen und Technologien zur Strukturierung von IoT-Systemen und können diese auf eine eigene Fallstudie anwenden • kennen die Herausforderungen des Datenschutzes und der Datensicherheit in IoT-Systemen 			
Content:			
<ul style="list-style-type: none"> • Grundlagen des Internet of Things • Anwendungsbereiche • Gesellschaftliche und wirtschaftliche Bedeutung • Kommunikationsstandards und -technologien • Datenspeicherung und -verarbeitung • Design und Entwicklung 			
Literature:			
Wird zu Beginn bekannt gegeben.			

Additional remarks:

Keine Anmerkungen.

International negotiation training			
Module abbreviation:	WMod_InternNegoTrai_M-EGM	SPO-No.:	11
Curriculum:	Programme	Module type	Semester
	Master Engineering and Management	Elective Subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Eberl, Sabine		
Lecturers:	Eberl, Sabine; Hecht, Dirk; Schneider, Yvonne		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:	47 h	
	Selbststudium:	78 h	
	Gesamtaufwand:	125 h	
Subjects of the module:	International negotiation training		
Lecture types:	SU/Ü - lecture with integrated exercises		
Examinations:	LN - oral exam, 15 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>Students will</p> <ul style="list-style-type: none"> • understand the sensitivities of different cultures regarding the importance of negotiations in the purchasing environment • learn about common scientific approaches to successful negotiation management (Harvard, Schraner) • learn different methods of negotiation techniques • practice various negotiation situations in challenging environments (technology dependency, market monopolist, oligopolies, corporations) • can implement learned theories in negotiation strategies and deepen them in practical exercises 			
Content:			
<p>Structured into the topics culture - methods - technology</p> <ul style="list-style-type: none"> • Methods and theories of negotiation (e.g. Harvard) • International negotiation cultures • Negotiation strategies/techniques with monopolists • Communication techniques, moderation methods, • Crisis management, mediation • Technical aspects/support for rational negotiation management (e.g., video, on-site negotiation,) • Practical exercises (sales talks, etc.) 			

Literature:

- HEUSSEN, Benno and Jan CURSCHMANN, 2014. *Handbuch Vertragsverhandlung und Vertragsmanagement: Planung, Verhandlung, Design und Durchführung von Verträgen*. 4. edition. Köln: Schmidt. ISBN 978-3-504-06306-1
- RICHTER, Thorsten S., 2013. *Vertragsrecht: die Grundlagen des Wirtschaftsrechts*. 2. edition. München: Verlag Franz Vahlen. ISBN 978-3-8006-4673-9, 978-3-8006-4674-6
- FISHER, Roger and William URY, 2007. *Getting to yes: negotiating an agreement without giving in*. 2. edition. London [u.a.]: Random House. ISBN 1-8441-3146-7, 0-09-924842-5
- SCHRANNER, Matthias, 2019. *Teure Fehler: die 7 größten Fehler in schwierigen Verhandlungen*. 9. edition. Berlin: Econ. ISBN 978-3-430-20075-2

Additional remarks:

No remarks.

Strategic Foresight and Trend Analysis			
Module abbreviation:	StratFor_M-EGM	SPO-No.:	11
Curriculum:	Programme	Module type	Semester
	Master Engineering and Management	Elective Subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer-term
Responsible for module:	Schwarz, Jan Oliver		
Lecturers:	Schwarz, Jan Oliver		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Strategic Foresight and Trend Analysis		
Lecture types:	SU/Ü - lecture with integrated exercises		
Examinations:	mdIP - oral exam, 15 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
The students:			
<ul style="list-style-type: none"> • understand the most important foresight methods and can distinguish and explain them; • can apply the methods learned in case studies; • can methodically analyse trends and derive future developments. 			
Content:			
<ul style="list-style-type: none"> • Customer-, technology-, and competitor-foresight • Trend analysis and strategic early identification • Visioning • Strategic simulation methods • Prognostic crowdsourcing • Delphi method • Scenario technique • Trendreceiver method • Analysis of Science Fiction 			
Literature:			
<ul style="list-style-type: none"> • ELLER, E., HOFMANN, R., SCHWARZ, J.O., 2020. The Customer Foresight Territory. In: <i>Marketing Review St Gallen</i>. (3), p.888–895. 			

- HEIJDEN, Kees van der, 2009. *Scenarios: the art of strategic conversation*. 2. edition. Chichester [u.a.]: Wiley. ISBN 0-470-02368-6, 978-0-470-02368-6
- KRUPP, Steven, Paul J. SCHOEMAKER and David J. TEECE, 2014. *Winning the long game: how strategic leaders shape the future*. f. edition. New York: Public Affairs. ISBN 1-61039-447-X, 978-1-61039-447-5
- LIEBL, Franz, SCHWARZ, Jan Oliver, 2010. Normality of the Future: Trend Diagnosis for Strategic Foresight. In: *Futures*. (42 (4)), p.313-327.
- ORIESEK, Daniel F., SCHWARZ, Jan Oliver, 2021. *Winning the uncertainty game: turning strategic intent into results with wargaming* [online]. London; New York: Routledge PDF E-Book. ISBN 9781000289855, 9780367853594. Available via: <https://doi.org/10.4324/9780367853594>.
- ROHRBECK, René, MENES ETINGUE, Kum, 2018. Corporate Foresight and Its Impact on Firm Performance: A Longitudinal Analysis. In: *Technological Forecasting and Social Change*. **Volume 129**(April), p.105-116. ISSN <https://doi.org/10.1016/j.techfore.2017.12.013>
- ROHRBECK, René, BATTISTELLA, Cinzia , HUIZINGH, Eelko , 2015. Corporate Foresight: An Emerging Field with a Rich Tradition. In: *Technological Forecasting & Social Change*. **Volume 101**(December), p.1-9. ISSN <https://doi.org/10.1016/j.techfore.2015.11.002>
- ROHRBECK, René, SCHWARZ, Jan Oliver, 2013. The Value Contribution of Strategic Foresight: Insights from an Empirical Study of Large European Companies. In: *Technological Forecasting and Social Change*. **Volume 80**(8), p.1593–1606. ISSN <https://doi.org/http://dx.doi.org/10.1016/j.techfore.2013.01.004>
- SCHOEMAKER, Paul J. and Robert E. GUNTHER, May 2013. *Profiting from uncertainty: strategies for succeeding no matter what the future brings*. f. edition. New York: Atria Books. ISBN 978-1-5011-6175-9
- SCHWARZ, Jan Oliver, 2015. The ‘Narrative Turn’ in Developing Foresight: Assessing How Cultural Products Can Assist Organisations in Detecting Trends. In: *Technological Forecasting and Social Change*. (90 (Part B)), p.510–513. ISSN <https://doi.org/http://dx.doi.org/10.1016/j.techfore.2014.02.024>
- SCHWARZ, Jan Oliver, ROHRBECK, René, WACH, Bernhard, 2019. Corporate Foresight as a Microfoundation of Dynamic Capabilities. In: *FUTURES & FORESIGHT SCIENCE*. (e28) ISSN <https://doi.org/10.1002/ffo2.28>

Additional remarks:

No remarks.

Technology Design and Evaluation			
Module abbreviation:	TechDesEva_M-EGM	SPO-No.:	11
Curriculum:	Programme	Module type	Semester
	Engineering and Management (SPO WS 21/22)	Elective Subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Schönmann, Alexander		
Lecturers:	Schönmann, Alexander; Schropp, Theresa		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Technology Design and Evaluation		
Lecture types:	SU/Ü-Seminar with integrated exercises.		
Examinations:	LN - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>After attending the course, the students will have the following knowledge:</p> <ul style="list-style-type: none"> • know and apply important methods of technology management and can explain them; • can propose appropriate technology development process models based on use case and company size; • evaluate technological solutions in a team and represent advantages and disadvantages for this; • design the implementation of workshops for eliciting requirements for development process models; • know the tasks of technology development and know how to manage R&D processes. 			
Content:			
<ul style="list-style-type: none"> • Modern technologies and technology trends • Organisation and role of Technology Management • Technology Dynamics (Lifecycle models) • Technology Intelligence (Technology scanning, Technology monitoring, Technology scouting, Technology identification, search field description) • Technology information sources (formal, informal sources) • Technology evaluation (maturity, potential, economic efficiency, Technology portfolio analysis) • Technology planning (Roadmaps) • R&D Management • Technology development (Technology Stage Gate) • Application-specific selection of adequate technologies 			

- Linking Technology development and Product development processes
- New Product development: Development strategies and degree of newness; “Valley of death”
- Product Development processes: e.g. V-Model, Spiral model, Lean Start-up, Trends in process design
- Quality Function Deployment
- Product Architecture: functional and physical elements (differential design vs. integral design), Types of modularity
- Role of design in the development process (e.g. DFX)
- Digital Technologies #svhs#amp## Digital Ecosystems
- Biomimetics (learning from nature)
- Technology exploitation strategies
- Technology protection
- Case studies and Industry examples on latest trends and technologies

Literature:

- TROTT, Paul, 2021. *Innovation management and new product development*. S. edition. Harlow, England: Pearson. ISBN 978-1-292-25152-3
- SCHUH, Günther and Sascha KLAPPERT, 2011. *Technologiemanagement - Handbuch Produktion und Management*.
- KARAOMERLIOGLU, Dilek Cetindamar, Robert PHAAL and David PROBERT, 2016. *Technology management: activities and tools*. S. edition. New York, NY: Palgrave Macmillan. ISBN 978-1-137-43185-1
- SAVIOZ, Pascal, 2004. *Technology Intelligence - Concept Design and Implementation in Technology-based SMEs*.
- ULRICH, Karl T. and Steven D. EPPINGER, 2015. *Product Design and Development*.
- MARITAN, Davide, 2015. *Practical Manual of Quality Function Deployment* [online]. Cham [u.a.]: Springer International Publishing PDF e-Book. ISBN 978-3-319-08521-0, 978-3-319-08520-3. Available via: <https://doi.org/10.1007/978-3-319-08521-0>.
- EVERS, Natasha, James S. CUNNINGHAM, and Thomas HOHOLM, 2021. *Technology entrepreneurship: bringing innovation to the marketplace*. S. edition. London: Red Globe Press. ISBN 978-1-352-01117-3

Additional remarks:

A voluntary bonus system is offered:

In the course, topics on methods of technology management are offered for individual processing and presentation, which lead to bonus points for the examination performance for each qualitatively processed task. The creditability as well as maximum crediting of bonus points takes place according to the APO.

Lectures contain digital learning elements for self-study, such as learning videos or meetings via web conferences.

Introduction to AI and Neural Networks			
Module abbreviation:	WMod_IntroAIneuNet_M-EGM	SPO-No.:	11
Curriculum:	Programme	Module type	Semester
	Master Engineering and Management	Elective subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Schiendorfer, Alexander		
Lecturers:	Lodes, Lukas; Schiendorfer, Alexander		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Introduction to AI and Neural Networks		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>After successfully completing the module, the students have acquired solid foundations in artificial intelligence (AI) and neural networks. In particular, they are able:</p> <ul style="list-style-type: none"> • to analyze and evaluate state of the art AI systems in automotive production • to know the difference between artificial intelligence, machine learning and deep learning • to mathematically explain the training procedure in deep learning systems • to program basic machine learning algorithms in Python and NumPy • to describe necessary steps for continuous quality assurance of learning systems • to implement modern deep learning systems using state-of-the-art software frameworks such as TensorFlow, Keras or PyTorch 			
Content:			
<ul style="list-style-type: none"> • Distinction of (classical) artificial intelligence and machine learning • The role of AI in industrial applications (Industry 4.0/Industrial IoT, Smart Factory) • Categories of machine learning (supervised / unsupervised / reinforcement learning) • Linear regression, logistic regression • Artificial neural networks: Perceptrons, feedforward neural nets • Modern software frameworks and auto-differentiation: PyTorch, TensorFlow • Training (deep) neural networks: Initialization, numerical optimization, regularization 			

- Deep learning architectures: Convolutional neural nets for image processing, recurrent neural nets / LSTM for sequential data.

Literature:

- RUSSELL, Stuart J. and Peter NORVIG, 2021. *Artificial intelligence: a modern approach*. F. edition. Hoboken: Pearson. ISBN 978-0-13-461099-3
- 1. GÉRON, Aurélien, September 2019. *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: concepts, tools, and techniques to build intelligent systems*. S. edition. Beijing; Boston; Farnham; Sebastopol; Tokyo: O'Reilly. ISBN 978-1-492-03261-8
- DEISENROTH, Marc Peter, A. Aldo FAISAL and Cheng Soon ONG, 2020. *Mathematics for machine learning*. Cambridge: Cambridge University Press. ISBN 978-1-108-45514-5, 978-1-108-47004-9
- 2. GOODFELLOW, Ian, Yoshua BENGIO and Aaron COURVILLE, 2016. *Deep learning*. Cambridge, Massachusetts; London, England: The MIT Press. ISBN <http://www.deeplearningbook.org/>

Additional remarks:

Bonus points system:

In lecture, there may be tasks and quizzes, which will lead to bonus points for the exam in case of good execution. At most 10% of the final grade can be improved via bonus points.

Design and modelling with CATIA			
Module abbreviation:	WMod_DesModellCatia_M-EGM	SPO-No.:	11
Curriculum:	Programme	Module type	Semester
	Master Engineering and Management	Elective subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Basta, Georg		
Lecturers:	Basta, Georg		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Design and modelling with CATIA		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - project work		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
Students can			
<ul style="list-style-type: none"> • develop components in Part-Design and Generative Shape Design • create single part drawings and assembly drawings • organize themselves with several people in the design process 			
Content:			
<ul style="list-style-type: none"> • Working on a constructive student research project in a team • Learn working with CATIA and practice by modelling components • Part design • Assembly design • Drawings from single parts and assemblies 			
Literature:			
Will be specified at the beginning of the course.			
Additional remarks:			
No remarks.			

Entrepreneurial Finance & Growth Management			
Module abbreviation:	EDB_EF&M-EGM	SPO-No.:	11
Curriculum:	Programme	Module type	Semester
	Master Engineering and Management	Elective subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 Semester	winter and summer term
Responsible for module:	Marques, Thiago		
Lecturers:	Marques, Thiago; Theinert, Sarah		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Entrepreneurial Finance & Growth Management		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	LN - mündliche Prüfung, 15 Minuten		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>On completing the module, the students will have achieved the following learning outcomes based on scientific methods:</p> <ul style="list-style-type: none"> • Students gain in-depth theoretical and practical knowledge of entrepreneurial finance particularly start-up financing. • Students understand the entrepreneurial process and the sources of financing which are relevant in different development stages of emerging ventures. • Students know conventional and innovative financing instruments and can assess their advantages and disadvantages for new ventures and start-ups. • Students are familiar with start-up financing through support programs, networks, business angels, various forms of venture capital and crowdfunding, as well as loans and can classify and practically apply them. • Students gain a comprehensive understanding of the chances and risks resulting from different means of capital and fund raising. • In addition, students will be able to understand the business model of private equity and venture capital firms including their special refinancing and investment process. • Finally, students will gain the skill to apply and analyze valuation methods which are suitable for entrepreneurial companies. 			

- Students can apply use of different entrepreneurial financing instruments. They acquire the ability to prepare, resolve, and critically appraise alternatives for decisions regarding the sources and use of financing instruments considering risk and return aspects for new ventures. They can evaluate their impact and can translate their proposed solutions into business practice.
- Students acquire the ability to develop, analyze and critically appraise alternative courses of action through group work, case studies and discussion sessions. They benefit from debating and reasoning skills, can work in a team, and can present and defend results in front of an audience.
- Students can contribute theoretically sound and practicable ideas for entrepreneurial financing problems and decision-making process, and to critically discuss them. They are aware of the financial and capital consequences of their decisions and can incorporate them into their own value system.

Content:

- Sources and forms of financing and evaluation of start-ups from seed financing to exit, e.g., through buy-back, IPO and sale of the company or transition.
- Knowledge of the business model of private equity firms and refinancing: fundraising, investor relations and the return of funds.
- Knowledge of the investment process: sourcing, screening, contracting, venture management and exiting.
- Special forms of entrepreneurial activity (especially digital entrepreneurship, corporate and social entrepreneurship, and family entrepreneurship)
- Digital start-up financing and valuation, Crowdfunding, -investing as financing instruments

Literature:

- STAROŠOM, Heike. Corporate Finance Teil 2. Finanzierung in den Lebensphasen einer Unternehmung [online]. Verfügbar unter: <https://doi.org/10.1007/978-3-8349-4101-5>
- NIVEN, Paul R. und Ben LAMORTE, 2016. *Objectives and key results: driving focus, alignment, and engagement with OKRs*. Hoboken, New Jersey: Wiley. ISBN 978-1-119-25558-1, 978-1-119-25566-6
- ROSS, Aaron und Marylou TYLER, 2020. *Predictable revenue: turn your business into a sales machine with the \$ 100 million best practices of Salesforce.com*. West Hollywood, CA: Pebblestorm. ISBN 978-0-9843802-4-4
- BREALEY, Richard A., Stewart C. MYERS und Franklin ALLEN, 2020. Principles of corporate finance. T. Auflage. New York, NY: McGraw-Hill Education. ISBN 978-1-260-56555-3, 978-1-260-01390-0
- LYNN, Theo und andere, 2019. *Disrupting finance: Fintech and strategy in the 21st century*. Cham: Palgrave Macmillan. ISBN 978-3-030-02329-4, 3-030-02329-X
- WILSON, Jay D., 2017. *Creating Strategic Value Through Financial Technology*. Somerset: John Wiley & Sons, Incorporated. ISBN 978-1-119-24387-8
- VOLKMANN, Christine K., Kim Oliver TOKARSKI und Marc GRÜNHAGEN, 2010. *Entrepreneurship in a European perspective: concepts for the creation and growth of new ventures*. 1. Auflage. Wiesbaden: Gabler. ISBN 978-3-8349-2067-6
- TIMMONS, Jeffry A. und Stephen SPINELLI, 2016. *New venture creation: entrepreneurship for the 21st century*. T. Auflage. New York: McGraw-Hill. ISBN 978-0-07-786248-0
- GOMPERS, Paul A. und William A. SAHLMAN, 2002. *Entrepreneurial finance: a case book*. 1. Auflage. New York: Wiley. ISBN 0-471-45283-1
- SMITH, Richard L. und Janet Kiholm SMITH, 2004. *Entrepreneurial finance*. 2. Auflage. New York, NY: Wiley. ISBN 0-471-45221-1, 0-471-23072-3
- AMIS, David und Howard H. STEVENSON, 2001. *Winning angels: the seven fundamentals of early-stage investing; [sourcing, evaluating, valuing, structuring, negotiating, supporting, harvesting; featuring interviews with more than 50 well-known angels including the angels behind]*. 1. Auflage. London; Munich [u.a.]: Pearson Education. ISBN 0-273-64916-7
- ELLIS, Sean und Morgan BROWN, 2017. *Hacking growth: how today's fastest-growing companies drive breakout success*. New York: Currency. ISBN 978-0-451-49721-5
- KINGSNORTH, Simon, 2019. *Digital marketing strategy: an integrated approach to online marketing*. 2. Auflage. London; New York; New Delhi: Kogan Page. ISBN 978-0-7494-8422-4, 978-0-7494-9808-5
- KOTLER, Philip, Hermawan KARTAJAYA und Iwan SETIAWAN, 2021. *Marketing 5.0: technology for humanity*. Hoboken, New Jersey: Wiley. ISBN 978-1-119-66851-0

- CROLL, Alistair und Benjamin YOSKOVITZ, 2013. *Lean analytics: use data to build a better start-up faster*. 1. Auflage. Beijing [u.a.]: O'Reilly. ISBN 978-1-449-33567-0, 1-449-33567-5
- OSTERWALDER, Alexander und Yves PIGNEUR, 2010. *Business model generation: a handbook for visionaries, game changers, and challengers*. Hoboken, NJ: Wiley. ISBN 978-0-470-87641-1, 0-470-87641-7

Additional remarks:

No remarks.

Technology Commercialization & Intellectual Property Management			
Module abbreviation:	EDB_TC&IPM_M-EGM	SPO-No.:	11
Curriculum:	Programme	Module type	Semester
	Master Engineering and Management	Elective subject	
Modulattribute:	Language of instruction	Duration of module	Frequency of offer
	English	1 Semester	winter and summer term
Responsible for module:	Bader, Martin		
Lecturers:	Bader, Martin; Kleyn, Madelein		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Kontaktstunden:		47 h
	Selbststudium:		78 h
	Gesamtaufwand:		125 h
Subjects of the module:	Technology Commercialization & Intellectual Property Management		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	LN - Studienarbeit mit Präsentation		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>On completing the module, students will have achieved the following learning outcomes based on scientific methods:</p> <ul style="list-style-type: none"> • Understand the relevance of intellectual property (IP) and intellectual property rights (IPRs) in the context of business innovation and its role for the innovation economy, particularly for small and medium enterprises (SMEs) and start-ups. • Understand what role and impact have IPRs and patents in digital businesses. • Understand how digital business models can be protected. • Learn to understand and analyse contents and structures of complex practical challenges in the current innovation ecosystem. • Learn to filter, structure and process relevant information from experiences and opinions. • Learn to evaluate and reflect the IP/IPRs needs of startups and SMEs in applying IP in business; based on the scientific state of the art in innovation and intellectual property management research, practical relevance, and interdisciplinary demands of the different stakeholders. • Get briefly familiar with how to retrieve these intellectual property rights e.g., how to derive a patent publication of a company from the public patent databases, e.g., Espacenet. 			
Content:			
<p>In contrast to large companies, Startups as well as Small and Medium Enterprises (SMEs) across industries often have no differentiated processes, fewer research activities, and often no software tools to manage their intellectual property (IP). These often focus on clear cost/benefit aspects of a patent. Consequently, startup need to apply more stringent criteria. They usually have a widely networked but very lean internal</p>			

structure. Frequently, all IP management-related activities, e.g., the patent filing process, including file management and search activities, therefore usually involve a high degree of outsourcing to external patent law firms and consultants. In addition, the problem of IP enforceability may arise regarding available resources and high costs. E.g., in contrast to large companies, startups are often disadvantaged and therefore generally prefer to keep an invention confidential or save costs on IP management instead of building a case investing in IP as a value driver, especially regarding their envisioned growth or exit strategy, respectively.

The module will follow the outline:

- Fundamentals of intellectual property rights
- Patent protection strategies
- Evaluating and valuing patents
- Successful practices in commercializing patents
- Organizing patent management
- Patent management by Industry
- Patent management in new technology environments
- Generally useful information for start-ups when dealing with patents

Literature:

- GASSMANN, Oliver, Martin A. BADER und Mark THOMPSON, 2021. Patent management: protecting intellectual property and innovation. Cham, Switzerland: Springer. ISBN 978-3-030-59008-6
- BADER, Martin A. und Sevim SÜZEROĞLU-MELCHORS, 2023. *Intellectual Property Management for Start-ups - Enhancing Value and Leveraging the Potential*. Cham: Springer Nature. ISBN: 978-3-031-16992-2
- BADER, Martin A., 2006. Intellectual property management in R&D collaborations: the case of the service industry sector. Heidelberg [u.a.]: Physica-Verl. ISBN 3-7908-1702-3, 978-3-7908-1702-7
- BONAKDAR, Amir, FRANKENBERGER, Karolin, BADER, Martin A., GASSMAN, Oliver, 2017. *Capturing value from business models: the role of formal and informal protection strategies* [online]. International Journal of Technology Management, 2017 Vol.73 No.4, pp.151 - 175: International Journal of Technology Management, 20.03.2017. Verfügbar unter: 10.1504/IJTM.2017.083073
- *How to revolutionize your industry* [online]. Verfügbar unter: <https://www.youtube.com/watch?v=B4ZSGQW0UMI>

Additional remarks:

No remarks.

Design Culture Theory and Methods			
Modulkürzel:	DCT_M-EGM	Art des Moduls:	Elective subject
Zuordnung zum Curriculum:	Studiengang, -abkürzung, SPO-Nr.		
	Engineering and Management (M-EGM) - SPO-Nr.: 11		
Modulverantwortliche(r):	Rothbucher, Bernhard		
Dozent(in):	Rothbucher, Bernhard		
Sprache:	Englisch		
Leistungspunkte / SWS:	5 ECTS / 4 SWS		
Arbeitsaufwand:	Kontaktstunden:		47 h
	Selbststudium:		79 h
	Gesamtaufwand:		126 h
Lehrveranstaltungen des Moduls:	Design Culture Theory and Methods		
Lehrformen des Moduls:	SU/Ü-Lecture with integrated exercises		
Studien- / Prüfungsleistungen:			
Seminararbeit mit mündl. Prüfung (15 Min.), schriftliche Ausarbeitung (8-15 Seiten) und Präsentation (15-20 Seiten)			
Empfohlene Voraussetzungen:			
None			
Angestrebte Lernergebnisse:			
After attending the course, the students			
<ul style="list-style-type: none"> • can work on complex tasks in cross-functional and international teams, solve conflicts in the team and take over team leadership; • can organise themselves and manage their time as well as work in a goal-oriented and independent manner; • know the performance and limits of the methods learned and can name them; • apply frameworks for responsible innovation to ensure the ethical development and application of new technologies; • define and explain the concepts of business ethics and technology ethics. 			
Inhalt:			
<ul style="list-style-type: none"> • Cultural Probing • Intercultural Communication • Design Culture Excursion • Business Ethics • Sustainability and Social Responsiveness 			
Literatur:			
<ul style="list-style-type: none"> • MEYER, Erin, 2015. The culture map: decoding how people think, lead, and get things done across cultures. New York, NY: Public Affairs. ISBN 978-1-61039-276-1 • BOEIJEN, Annemiek van, Jaap DAALHUIZEN und Jelle ZIJLSTRA, 2020. <i>Delft design guide: perspectives, models, approaches, methods</i>. Amsterdam, The Netherlands: BIS Publishers. ISBN 978-90-6369-540-8, 90-6369-540-3 			

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| <ul style="list-style-type: none">• BOEIJEN, Annemiek van und Yvo ZIJLSTRA, 2020. <i>Culture sensitive design: a guide to culture in practice</i>. Amsterdam: BIS Publishers. ISBN 978-90-6369-561-3• SAGMEISTER, Simon und Joe Paul KROLL, 2018. <i>Business culture design: Develop Your Corporate Culture with the Culture Map</i>. Frankfurt; New York: Campus Verlag. ISBN 978-3-593-43815-3 |
| Weitere Anmerkungen: |
| No remarks. |

Design Leadership Methods			
Modulkürzel:	DLM_M-EGM	Art des Moduls:	Elective subject
Zuordnung zum Curriculum:	Studiengang, -abkürzung, SPO-Nr.		
	Engineering and Management (M-EGM) - SPO-Nr.: 11		
Modulverantwortliche(r):	Rothbucher, Bernhard		
Dozent(in):	Rothbucher, Bernhard		
Sprache:	Englisch		
Leistungspunkte / SWS:	5 ECTS / 4 SWS		
Arbeitsaufwand:	Kontaktstunden:		47 h
	Selbststudium:		79 h
	Gesamtaufwand:		126 h
Lehrveranstaltungen des Moduls:	Design Leadership Methods		
Lehrformen des Moduls:	SU/Ü-Lecture with integrated exercises		
Studien- / Prüfungsleistungen:			
StA mit Koll - Studienarbeit mit Kolloquium, schriftliche Ausarbeitung 8 - 15 Seiten, Präsentation 15 - 20 Seiten			
Empfohlene Voraussetzungen:			
None			
Angestrebte Lernergebnisse:			
<p>After attending the course, the students are able to</p> <ul style="list-style-type: none"> • define and explain the concept, principles, and process of design leadership methods; • compare and contrast different methods of design leadership methods and evaluate their suitability for different purposes; • apply methods of design leadership on projects in product and service design. 			
Inhalt:			
<ul style="list-style-type: none"> • Foundations of Design Leadership • Integration Tools • Innovation Project Simulation • Sociography • Visual Communication 			
Literatur:			
<ul style="list-style-type: none"> • PICCHI, Andrea, 2022. Design Management: Create, Develop, and Lead Effective Design Teams [online]. Berkeley, CA: Apress PDF E-Books. ISBN 978-1-4842-6954-1. Verfügbar unter: https://doi.org/10.1007/978-1-4842-6954-1. • COOPER, Rachel, 2013. <i>The handbook of design management</i>. London: Bloomsbury. ISBN 978-1-8478-8488-6, 978-1-84788-490-9 • ELKINGTON, Rob und andere, 2018. <i>Exceptional Leadership by Design: How Design in Great Organizations Produces Great Leadership</i>. Bingley: Emerald Publishing Limited. ISBN 978-1-78743-900-9 • CALABRETTA, Giulia, Gerda GEMSER und Ingo KARPEN, 2016. <i>Strategic design: eight essential practices every strategic designer must master</i>. Amsterdam: BIS publisher ISBN 90-6369-445-8, 978-90-6369-445-6 • QUAYLE, Moura, 2017. <i>Designed leadership</i>. New York; Chichester, West Sussex: Columbia Business School Publishing. ISBN 978-0-231-17312-4 			

Weitere Anmerkungen:
No remarks.