HS PF

MODULE HANDBOOK

ENGINEERING AND MANAGEMENT/ INNOVATION AND DESIGN

HS PF Engineering

Study program director:
Prof. Dr. -Ing. Henning Hinderer

Examination regulations no. 2020
Applicable as from winter semester 2020/21

Last updated on May 9th, 2022

TABLE OF CONTENTS

I. Compulsory Modules / Section 1 of study program 4
1. Fundamentals of Mechanical Engineering 4
2. Fundamentals of Engineering 6
3. Mathematics 8
4. Computer Science 9
5. Business Administration I 11
6. English 13
7. Economics 15
8. Manufacturing Technology 1 17
9. Physics 18
10. Quantitative Methods I 19
11. Programming Project 21
12. Business Administration II 23

II. Section 2 of study program 25
1. Manufacturing Technology II 25
2. Design & Cross Cultural Management 27
3. Quantitative Methods II 29
4. Business Information Systems 31
5. Logistics and Management Accounting 33
6. Law 35
7. Production 36
8. Product & Service Innovation 38
9. Operations Management 41
10. International Technical Sales 43
11. Management Elective 45
12. Academic Education and Methods 46
13. Project Methods and Creativity 48
14. Interdisciplinary Projects 50
15. Engineering Elective 51
16. Innovation & Design Major Elective 52
17. Major Elective 2 53
18. Specialisations 54
19. Internship 55
20. Scientific colloquium 57
21. Bachelor Thesis 58

III. Specialisations 59
A Innovation and Design 59
B Operations Management 62
C International Technical Sales 64

This is a translation of an original document written in German.
The original document is the binding version.

The courses are aimed at the following group sizes:

Lecture: 70-80 students
Seminars: 35 students
Language courses: 25-30 students

Note on the modules:

The duration of the modules is usually one semester. The field "semester" indicates the respective semester. If a module extends over two consecutive semesters, the two relevant semesters are shown in this field. All modules of the program are usually offered every semester. An exception may be electives and specialisations. These can be cancelled if the statutory minimum number of participants has not been reached. Examinations are generally graded on the basis of a grading scale from 1 ("very good") to 5 ("fail"). The exceptions are the courses specified in the Special Section of the Study and Examination Regulations - and in this module handbook – as "Ungraded examination requirement" (UPL). These are evaluated as "pass" or "fail", cf. § 24 (1, 2) SPO.

LIST OF ABBREVIATIONS

CR	Credit according to the ECTS system (1 CR corresponds to 25-30 working hours. The workload shown in this document has been calculated on the basis of the maximum required. It can also be lower.)
ECTS	European Credit Transfer and Accumulation Systems
PLH	Examination requirement: assignment
PLK	Examination requirement: examination
PLL	Examination requirement: laboratory work
PLM	Examination requirement: oral examination
PLP	Examination requirement: project work
PLR	Examination requirement: presentation
PLS	Examination requirement: seminar paper
PLT	Examination requirement: thesis
PVL	Pre-examination requirement
PVL-BVP	Pre-examination requirement for preliminary bachelor qualification
PVL-BP	Pre-examination requirement for bachelor qualification
PVL-MP	Pre-examination requirement for master qualification
PVL-PLT	Pre-examination requirement for thesis
STA1	Section 1 of study program
STA2	Section 2 of study program
SWS	Contact hours per week
UPL	Ungraded examination requirement

I. Compulsory Modules / Section 1 of study program

1. Fundamentals of Mechanical Engineering

"Fundamentals of Mechanical Engineering"	
Code	MEN1140
Semester	1
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	MEN1141 Technical Mechanics MEN1142 Introduction to Mechanical Design
Recommended prerequisites	High school level in mathematics
Type and duration of examination (only in case of PLK/PLM)	PLK (90 minutes) module examination
Language	German
Module coordinator	Prof. Dr. Oßwald
Lecturer	Technical Mechanics: Dr. Frank Introduction to Mechanical Design: TBA (lecturer from the mechanical engineering program)
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 1st semester
Teaching methodology	Lectures with practical work
Objectives / intended learning outcomes	Students acquire knowledge of the fundamentals of these disciplines. They are able to correctly apply this knowledge when developing and optimizing products, and when creating and optimizing production facilities. **Technical Mechanics:** The students have a good understanding of the basic concepts and methods of Technical Mechanics and are familiar with the applications of the statics and strength theory as well as their specific methods. **Introduction to Mechanical Design:** The participants learn to find design solutions based on simple tasks. They are also able to read complex technical drawings and can apply the constructional principles of material components.
Content	**Technical Mechanics:** • Introduction • Physical basics of mechanics • Statics • Introduction to strength theory **Introduction to Mechanical Design:** • Basics of technical drawing, standards, technical designs as information medium • Component tolerances and fits • Material component connections • Methods for finding creative solutions
Reading list	. **Technical Mechanics:**

	Gabbert, U. / Raecke, I. (2013): Technische Mechanik für Wirtschaftsingenieure. Hanser: München. **Introduction to Mechanical Design:** • Hoischen, H. (2007): Technisches Zeichnen. Cornelsen: Berlin. • Böttcher, P. / Forberg, R. (1998): Technisches Zeichnen. Teubner: Stuttgart u.a. • VDI-Richtlinie 2222: Konstruktionsmethodik (1997). Beuth: Berlin. • Wittel, H. / Muhs, D. (2013): Maschinenelemente: Normung, Berechnung, Gestaltung. Wiesbaden: Springer Vieweg: Wiesbaden.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Slides, blackboard, data projector, simulations, audience response techniques, educational videos, e-learning platform of the university (Moodle)

2. Fundamentals of Engineering

"Fundamentals of Engineering"	
Code	MEN1310
Semester	1
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	MEN1311 Materials Science MNS1311 Introduction to Physics
Recommended prerequisites	High school level in mathematics
Type and duration of examination (only in case of PLK/PLM)	Materials Science: PLK (45 minutes) Introduction to Physics: UPL
Language	German
Module coordinator	Prof. Dr. Lindenlauf
Lecturer	Materials Science: TBA (lecturer from the mechanical engineering program) Introduction to Physics: Prof. Dr. Lindenlauf, Dr. Frank
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 1st semester
Teaching methodology	Materials Science: Lectures with practical work Introduction to Physics: Lectures, workshops
Objectives / intended learning outcomes	**Materials Science**: Students learn concepts, methods and technical capabilities of modern material technology as a key discipline in the global field of the engineering sciences. Basic skills for understanding metallic materials and their practical applications are taught. The objective of this course is to enable the students to competently answer simple questions regarding materials, for instance, in the areas of material structure, material testing, designations, thermal treatment of materials and their effects on the material structure. **Introduction to Physics:** The students recognize and understand basic physical correlations and are able to analyze simple electrotechnical tasks and solve them mathematically.
Content	**Materials Science:** Introduction to materials science, lecture (introduction - atom - structure - microstructure - component) **Introduction to Physics:** Quantities and units, technical calculation, electrical components, simple physical systems, electrotechnical networks and their modelling
Reading list	**Materials Science:** • Bargel, H., Schulze, G. (2012): Werkstoffkunde (VDI-Buch). 9th edition., Springer: Dordrecht. • Hornbogen, E., Jost, N. (2005): Fragen, Antworten, Begriffe zu Werkstoffe. 5th edition., Springer: Dordrecht. **Introduction to Physics:** • Hagmann, G. (2017): *Grundlagen der Elektrotechnik.* Aula: Wiebelsheim

	• University of Colorado (Boulder): Interactive Simulations – PhET (Physics Education Technology). http://phet.colorado.edu/de/
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Blackboard, data projector, simulations, experiments, peer instruction, audience response techniques

3. Mathematics

"Mathematics"	
Code	MNS1090
Semester	1
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	MNS1091 Mathematics 1
Type and duration of examination (only in case of PLK/PLM)	PLK (90 minutes) module examination
Recommended prerequisites	High school level in mathematics
Language	German
Module coordinator	Prof. Dr. Bulander
Lecturer	Mathematics 1: Dr. Heinemeyer
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 1st semester
Teaching methodology	Lecture with practical work
Objectives / intended learning outcomes	**Contribution to the qualification goals of the study program** The students learn mathematical basic principles that are consistently applied in economics, technical and all scientific disciplines, i.e. linear algebra and differential and integral calculus for single or multiple variables. They are able to use the appropriate mathematical methods and, therefore, possess the prerequisites for further studies. **Learning Objectives:** The students • are acquainted with vector calculus and matrix calculus, • are able to differentiate the functions of one variable and, thus, solve extremum problems, • are able to calculate the limits of functions, and • understand the concepts of integral calculus and know its important applications.
Content	Vector, matrices and determinant calculations. Differential and integral calculus of functions with a variable.
Reading list	• Gohout, W. (2011): *Mathematik für Wirtschaft und Technik*. 2nd edition, Oldenbourg: München. • Gohout, W., Reimer, D. (2016): *Formelsammlung Mathematik und Statistik: für Wirtschaft und Technik*. 1st edition, Europa-Lehrmittel: Haan-Gruiten • Reimer, D., Gohout, W. (2009): *Aufgabensammlung Mathematik für Wirtschaft und Technik*. 1st edition, Europa-Lehrmittel: Haan-Gruiten
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, tutorials, preparation for and completion of examination: 90 hrs
Media employed	Slides, blackboard, e-learning platform, tutorials

4. Computer Science

"Computer Science "	
Code	BAE1130
Semester	1
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	BAE1131 Introduction to Computer Science BAE1132 Programming Laboratory
Recommended prerequisites	High school level in Mathematics and/or supplementary Mathematics courses
Type and duration of examination (only in case of PLK/PLM)	PLK (90 minutes) module examination UPL
Language	German
Module coordinator	Prof. Dr. Volz
Lecturer	Prof. Dr. Volz
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 1st semester
Teaching methodology	Lecture with discussions, laboratory tutorials
Objectives / intended learning outcomes	The students • are able to play an active and responsible role in shaping the information society, • are able to manage information effectively, • understand basic structural characteristics of data, • understand structural characteristics of software systems, • work with modern hard- and software systems, • understand principles of presentation, processing and interpretation of information, and • possess knowledge and skills in computer modelling.
Content	**Introduction to Computer Science**: • Example of programming with table-based application • Data types • Functions • Programming language logic • Objects and states • Algorithms and programs • State modelling • Classes and generalisations • (Recursive) data structures (lists, trees, graphs) • Formal languages and finite automata • Functions of a computer • Limits of predictability **Programming Laboratory:** • Basic tools of software engineering • Description languages (HTML and CSS) • Programming languages (JavaScript and TypeScript) • Use of software libraries • Simple distributed systems

Reading list	• Volz, R. (2019): Skript zur Vorlesung - *Einführung in die Informatik*, Pforzheim University e-learning platform • Hubwieser, P. et al. (2007): *Informatik 2, Lehrwerk für Gymnasien.* Ernst Klett: Stuttgart • Hubwieser, P. et al. (2008): *Informatik 3, Lehrwerk für Gymnasien.* Ernst Klett: Stuttgart • Hubwieser, P. et al. (2009): *Informatik 4, Lehrwerk für Gymnasien.* Ernst Klett: Stuttgart • Hubwieser, P. et al. (2010): *Informatik 5, Lehrwerk für Gymnasien.* Ernst Klett: Stuttgart
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, exercises, independent practice in laboratory, preparation for and completion of examination: 120 hrs
Media employed	Lecture with slides (PowerPoint, data projector), computer-based programming in laboratory, e-learning and videos for laboratory preparation, computer-based assessments in laboratory, supplementary material available on the university's e-learning platform (Moodle)

5. Business Administration I

"Business Administration I"	
Code	BAE1120
Semester	1
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	BAE1121 Fundamentals of Business Administration
Recommended prerequisites	None
Type and duration of examination (only in case of PLK/PLM)	Module examination: PLK (60 mins)
Language	German
Module coordinator	Prof. Dr. Martin
Lecturer	Prof. Dr. Martin
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 1st semester
Teaching methodology	Lecture, seminar-style course
Objectives / intended learning outcomes	The Business Administration I module provides students with the basics of economic theory and practice. Initially, the students receive a general overview of the importance, objectives, tasks and procedures of external and internal accounting. They can address the typical issues in these areas and use methods of costing and performance calculation as well as bookkeeping and accounting to tackle them. They can recognise and explain the structure and contents of a balance sheet and a profit and a loss statement, are in a position to analyse them and use them in making management decisions. They are acquainted with the terminology, systems and methods of cost and revenue accounting (including full cost accounting, marginal costing and cost deviation analysis). They, therefore, are able to independently do calculations and systematically analyze costs in a company.
Content	• Cost-type accounting • Cost-centre accounting • Unit-of-output costing (calculation) and cost unit-period accounting (financial statement) • Balance and profit and loss statement • Annual financial statement-analysis with indicators • Basics of double-entry bookkeeping • Routine and annual accounting transactions
Reading list	• Joos-Sachse, T. (2014): *Controlling, Kostenrechnung und Kostenmanagement*. 5th edition, Wiesbaden: Gabler. • Olfert, K. (2008): *Kostenrechnung*. 15th edition, Kiehl: Ludwigshafen. • Zschenderlein, O. (2007): *Kompakttraining Buchführung*. 4th edition, Keihl: Ludwigshafen • Weber, M., Paa, K.U. (2014): *Bilanzen*, Haufe: Freiburg.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs

Media employed	Slides, blackboard, papers, case studies and practical work

6. English

"English"	
Code	LAN1510
Semester	1st/2nd Semester
Level	Preliminary level
Credits/ECTS	5
Contact hours per week	4
Related courses	LAN1603 Advanced Business English LAN1604 Advanced English for Engineers
Recommended prerequisites	B2/C1 English (CEFR) – no previous content knowledge required
Type and duration of examination (only in case of PLK/PLM)	Advanced Business English: PLH/ PLL/PLK/PLP/PLR (60 Minutes) Advanced English for Engineers: PLH/PLL/PLK/PLR (60 Minutes)
Language	English
Module coordinator	Prof. Dr. Kilian-Yasin
Lecturer	Advanced Business English: G. Loveday, R. Correa Advanced English for Engineers: R. Correa, Prof. Dr. Kilian-Yasin,
Relation to curriculum	WI, WI International Management, WI Innovation und Design – Compulsory subject in 1st & 2nd Semester
Teaching methodology	Lecture, seminar style course
Objectives/intended learning outcomes	**Advanced Business English:** Students deepen their language skills in the English language. This course aims to facilitate both oral and written communication within a business context. Students are provided with ample opportunity to practice all four language skills – listening, reading, speaking and writing. They will also address the challenges of conducting business with partners from different cultural backgrounds and areas of operation. **Advanced English for Engineers:** Students consolidate the skills they learned in Advanced Business English and extend their knowledge of topics relating to engineering processes. Students know how to give a presentation on a technical issue in English and how to guide a class discussion. Students know how to research and write short academic assignments about engineering topics in English.
Content	**Advanced Business English:** • Company structures • Types of business organizations and entrepreneurship • Corporate culture • Mergers & acquisitions • Project management • Corporate strategies – corporate social responsibility • Team working • New business • Marketing • Brands • Investment and finance **Advanced English for Engineers:**

	• Product development/innovation/engineering/design • Production and manufacturing processes • Current technological developments • Sustainable technologies • Methods for innovation and innovation processes • Entrepreneurship • Climate change and the greenhouse effect • Mobility solutions
Reading list	**Advanced Business English:** • Trappe, T., Tullis, G. (2008): *Intelligent Business.* Pearson: Harlow. • Allison J., Appleby R., De Chazal, E. (2013): *The Business.* Macmillan: Oxford. • MacKenzie, I. (2010): *English for Business Studies.* Cambridge University Press. **Advanced English for Engineers:** • Trappe, T., Tullis, G. (2008): *Intelligent Business.* Pearson: Harlow. • Brieger, N., Pohl, A. (2008): *Technical English. Vocabulary and Grammar.* Langenscheidt: München. • Ibbotson, M. (2008): *Cambridge English For Engineering.* Cambridge University Press. • Ibbotson, M. (2009): *Professional English in Use: Engineering.* Cambridge University Press.
Workload	Workload: 5 ECTS x 30 hrs.. = 150 Std. Class attendance: 4 SWS x 15 weeks = 60 hrs. Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Slides, blackboard, exercises, videos & audios, presentations

7. Economics

"Economics"	
Code	ECO1400
Semester	1st/2nd Semester
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	ECO1303 Economics 1 ECO1401 Economics 2
Recommended prerequisites	Economics 1: only previous knowledge in mathematics required Economics 2: knowledge of Economics 1 required
Type and duration of examination (only in case of PLK/PLM)	Economics 1: PLK (60 mins), Economics 2: PLK (60 mins)
Language	German
Module coordinator	Prof. Dr. Wolf
Lecturer	Economics 1: Prof. Dr. Wolf Economics 2: Prof. Dr. Wolf
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 1st + 2nd semester
Teaching methodology	Lecture with discussion, lecture with case study
Objectives / intendes learning outcomes	• The students are able think abstractly and structure complex problems – based on use of models • They can identify the key elements that determine the success of an economic system and the competitiveness of a location. • They are in a position to assess economic policy decisions focussing on the impact on micro and macro-economics. • They learn how to use micro-economic analysis techniques in order to understand the mode of operation of various markets and government interventions. • Macro-economic analysis will give the students an understanding of the main macro-economic environmental factors of operational activity: unemployment, inflation, economic growth, structural change and economic fluctuations. They will be able to explain these phenomena, and can, therefore, evaluate economic policy options for correcting macro-economic imbalances and their impact on business decisions. • The students can independently assess the macro-economic framework conditions of corporate activities and draw appropriate conclusions for investment and pricing decisions from them.
Content	• Aspects, basic concepts and methods of economics • Economic systems: planned economy and social market economy • Demand and supply in goods markets, elasticities; consumer and producer surplus • Pricing: perfect and imperfect competition, monopolistic pricing, oligopoly markets • State intervention in market pricing: highest prices, lowest prices, taxes, internalisation of externalities • Competition policy • Macro-economic goals: inflation, unemployment, growth, economic fluctuation

	• Macro-economic policy: Keynesianism versus supply policy • Monetary theory and monetary policy, interest rates and causes of inflation • Structural change: causes and effects
Reading list	**Economics 1:** • Beck, H. (2013): *Volkswirtschaftslehre*. Oldenbourg: München. • Mankiw, N. und Taylor, M. (2018): *Grundzüge der Volkswirtschaftslehre*. 7. Aufl., Schäffer-Poeschel: Stuttgart. • Pindyck, R. und Rubinfeld, D. (2018): *Mikroökonomie.*, 9. Aufl., Pearson: München. **Economics 2:** • Beck, H. (2013): *Volkswirtschaftslehre*. Oldenbourg: München. • Blanchard, O., Illing, G. (2017): *Makroökonomie*. 7. Aufl., Pearson: München. • Mankiw, N. und Taylor, M. (2018): *Grundzüge der Volkswirtschaftslehre*. 7. Aufl., Schäffer-Poeschel: Stuttgart.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Blackboard, slides, video projector, audience-response-techniques/interactive app., university e-learning platform (Moodle), instructional videos, alfaview (if necessary)

8. Manufacturing Technology 1

"Manufacturing Technology 1"	
Code	MEN1340
Semester	2nd Semester
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	MEN1341 Manufacturing Technology 1 MEN1272 Manufacturing Technology 1 Laboratory
Recommended prerequisites	High school level in mathematics Materials Science Mechanical Design High school level in electrical engineering and physics
Type and duration of examination (only in case of PLK/PLM)	Manufacturing Technology 1: PLK (60 mins) Manufacturing Technology 1 Laboratory: UPL
Language	German
Module coordinator	Prof. Dr. Oßwald
Lecturer	Manufacturing Technology 1: Prof. Dr. Oßwald Manufacturing Technology 1 Laboratory: Prof. Dr. Eberhardt (department of mechanical engineering), Prof. Dr. Oßwald
Relation to curriculum	WI, WI International Management, WI Innovation and Design Compulsory subject in 2nd semester
Teaching methodology	Lectures with practical work, laboratory tutorial
Objectives / intended learning outcomes	The students • are familiar with the technological properties and processes in the current production processes for metals in the following fields: cutting, joining and coating • comprehend the implementation options and limits of these production processes • are able to implement cost-optimized production processes to achieve functional products • are familiar with construction and technology of production machines and devices
Content	Content: Manufacturing technology of metals: Operation, performance characteristics, application areas of each of the following manufacturing processes: • Cutting • Joining • Coating
Reading list	• Schulze, G. (2015): *Fertigungstechnik*. VDI: Düsseldorf. • Schmid, D. et al. (2019): *Industrielle Fertigung.* Europa-Lehrmittel: Haan. • Awiszus, B. (2016): *Grundlagen der Fertigungstechnik*; Hanser: Freiburg.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Slides, blackboard, data projector, simulations, audience response techniques, educational videos, e-Learning platform of the university (Moodle) Laboratory tutorials

9. Physics

"Physics"	
Code	MNS1180
Semester	2nd Semester
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	MNS1181 Physics
Recommended prerequisites	Entrance-level qualification in mathematics for a university of applied sciences
Type and duration of examination (only in case of PLK/PLM)	Physics: PLK (60 mins) module examination
Language	German
Module coordinator	Prof. Dr. Lindenlauf
Lecturer	Prof. Dr. Lindenlauf, Dr. Frank
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 2nd semester
Teaching methodology	Lecture with integrated exercises and tutorials
Objectives / intended learning outcomes	The students • recognize and understand basic physical relationships • are able to analyze simple physical tasks and solve them mathematically
Content	Basics of translational and rotational dynamics, oscillations, energy, momentum, angular momentum, thermal energy, selected topics of modern physics.
Reading list	• Rybach, J.(2013): *Physik für Bachelors.* Hanser:München. • Hering, E. / Martin, R. / Stohrer, M.(2017): *Physik für Ingenieure*. Springer: Berlin. • University of Colorado (Boulder): *Interactive Simulations – PhET* (Physics Education Technology). http://phet.colorado.edu/de/
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Blackboard, data projector, simulations, peer instruction, audience response techniques, problem-based learning

10. Quantitative Methods I

"Quantitative Methods I"	
Code	BAE1090
Semester	2
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	BAE1091 Statistics 1 MNS1092 Mathematics 2
Recommended prerequisites	University entry qualification level in mathematics; Mathematics I lecture
Type and duration of examination (only in case of PLK/PLM)	PLK (90 mins) module examination
Language	German
Module coordinator	Prof. Dr. Bulander
Lecturer	Statistics 1: Prof. Dr. Bulander Mathematics 2: Prof. Dr. Galler
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 2nd semester
Teaching methodology	Lecture with practical work
Objectives / intended learning outcomes	**Contribution to the qualification objectives of the study program:** The students are familiar with the fundamentals of mathematics, which are required across the board in economic, technical and all scientific disciplines, i.e. differential and integral calculus for several variables. They are able to apply the corresponding procedures and are thus mathematically able to successfully pursue their studies. Students also become proficient in descriptive statistical concepts and procedures. They are able to apply the corresponding concepts and procedures confidently and are thus able to meet the quantitative requirements of their further studies. **Learning Objectives:** The students • can differentiate functions from several variables and thus solve extreme value tasks, • are able to calculate sequences and series, • understand complex numbers and their arithmetic operations, • are proficient in the integral calculation of functions with several variables and know their most important applications, • are able to recognise descriptive statistics concepts and procedures and apply them.
Content	**Statistics 1:** • Introduction to statistics • Basic knowledge of descriptive statistics • Basics of evaluating univariate records: situation, scattering and kurtosis parameters • Evaluation of bivariate data records: correlation and regression calculation

	Mathematics 2: • Differential and integral calculation of functions of several variables • Fundamentals of complex numbers • Sequences and series • Trigonometric and related functions
Reading list	**Statistics 1:** • Specht, K. / Bulander, R. / Gohout, W. (2014): *Statistik für Technik und Wirtschaft*. 2nd updated and expanded edition, De Gruyter Oldenbourg: München. **Mathematics 2:** • Gohout, W. (2011): *Mathematik für Wirtschaft und Technik.* 2nd edition, expanded edition, De Gruyter Oldenbourg: München.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Slides, data projector, e-learning platform of the university (Moodle)

11. Programming Project

"Programming Project"	
Code	BAE1140
Semester	2
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	ISS1141 Project Management BAE1141 Project Programming Seminar
Recommended prerequisites	Basic knowledge in programming, as taught in the 1st semester computer science course.
Type and duration of examination (only in case of PLK/PLM)	Project Management: PLK (60 mins) Project Programming Seminar: PLH/PLL/PLK/PLP/PLR (60 mins.)
Language	German
Module coordinator	Prof. Schätter
Lecturer	Project Management: Prof. Dr. Fournier, Prof. Dr. Kühn Programming Project Seminar: Prof. Dittmann, Dr. Heinemeyer, Prof. Schätter
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 2nd semester
Teaching methodology	Lecture, seminar, laboratory, exercises
Objectives / intended learning outcomes	The students • know the basics of project management, • know the relevant standards, especially IPMA (Deutsche Gesellschaft für Projektmanagement e. V.) and PMI (Project Management Institute), • know methods and techniques that are used in project management, but also in other areas, such as risk and quality management, • know methods and tools to generate and visually implement creative ideas, • are able to explain the basics of these techniques and apply concepts, methods and technical implementations to practical case studies, • are able to independently familiarize themselves with a new subject area within the framework of a real project and work on the project in a team, • are able to present team results in a target-oriented and appropriate manner. • develop social competency • acquire their first practical experience in organising and implementing projects, • know the basic procedure for the development of IT projects • know the fundamental importance of internet applications for companies as well as the basics of content management systems, • are able to design a website for a company and implement it with a content management system.
Content	**Project Management** • General introduction to project management on the basis of the project management standard of the German Association for Project Management (Deutsche Ge-sellschaft für

	Projektmanagement e.V. / Project Manage-ment Institute (Pennsylvania, USA) / ASAP Roadmap (Ac-celerated SAP). • Students learn a wide range of instruments of modern project management, which is also used beyond project management in various areas, especially in IT projects. • Practical communication of project management contents within the framework of case studies/exercises. **Project Programming Seminar:** Project seminar in which an Internet presence is implemented in several milestones with accompanying presentations and weekly project meetings: • Application of project management tools for the implementation of IT projects. • Carrying out research and analyses to determine the requirements for an Internet presence. • Design and conception of a website. • Implementation of a website with the Content Management System (CMS) Joomla! incl. administration, design adaptation on the template, content management, maintenance of multimedia content, installation of modules and components.
Reading list	**Projektmanagement:** • Kompetenzbasiertes Projektmanagement (PM4) (2019): *Handbuch für Praxis und Weiterbildung im Projektmanagement;* GPM Gesellschaft für Projektmanagement e. V.: Nürnberg • Schulz, M. (2019): *Projektmanagement: Zielgerichtet. Effizient. Klar*. UVK • PMBOK Guide (2016): *Project Management Body of Language*, 6th Edition, Newtown Square, Pennsylvania • ASAP Roadmap (verfügbar über sap.com) **Projektseminar Programmierung:** • Hoffmann, M. (2012): *Modernes Webdesign. Gestaltungsprinzipien, Webstandards, Praxis*. Galileo Press: Bonn. • Hahn, M. (2017): *Webdesign: Das Handbuch zur Webgestaltung,* Rheinwerk Design: Bonn. • Schürmann, T. (2016): *Praxiswissen Joomla! 3.x komplett.* O'Reilly: Heidelberg. Schmitz-Buchholz, D. (2018): *Joomla 3.9 logisch!* Books on Demand.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, project implementation, preparation for and completion of the examination: 90 hrs
Media employed	Slide presentations, project work, instructional videos presentations, interactive tasks, group work and discussions.

12. Business Administration II

"Business Administration II"	
Code	BAE1110
Semester	2
Level	Preliminary level
Credits / ECTS	5
Contact hours per week	4
Related courses	BAE1111 Financing and Investment BAE1113 Business Management
Recommended prerequisites	B2/C1 level English (CEFR) Attendance of the Business Administration I module
Type and duration of examination (only in case of PLK/PLM)	PLK (60 mins.) module examination
Language	German and English
Module coordinator	Prof. Dr.-Ing. Hinderer
Lecturer	Financing and Investment: Prof. Dr. Wupperfeld Business Management: Prof. Dr.-Ing. Hinderer
Relation to curriculum	WI International Management, WI Innovation and Design – compulsory subject in 2nd semester
Teaching methodology	Lecture, seminar
Objectives / intended learning outcomes	Students have a sound knowledge of modern methods of financing, investment and strategic management. They recognize the importance of the financing and investment process as well as the strategic orientation of a company in the market and which models of strategic management can be used.
Content	**Financing and Investment:** Addressing basics of financial instruments and financial planning as well as investment calculation. Special forms of financing such as financial participation as well as innovations in corporate financing and start-up financing are also explained. **Business Management:** The fundamentals of strategic corporate management are dealt with. The derivation of a strategic objective for a company in the market is explained based on an analysis of the competitive environment. In particular, the strategic implications in the management areas of "operational and organizational structure", "business models", "leadership" as well as goal-oriented corporate management are addressed.
Reading list	**Financing and Investment:** • Olfert, K. (2015): *Investitionen*. 13th edition, Kiehl: Ludwigshafen. • Olfert, K. (2017): *Finanzierung*. 17th edition. Kiehl: Ludwigshafen. **Business Management:** • Wheelen,T. L., Hunger J. D. et al. (2015): *Strategic Management and Business Policy.* 14th Global Edition, Upper Saddle River: New Jersey. • Dillerup, R., Stoi, R. (2012): *Strategische Unternehmensführung* 3rd edition, Vahlen: München. • Porter, M. (2009): *Wettbewerbsstrategie. Methoden zur Analyse von Branchen und Konkurrenten.* 10th edition, Campus: Frankfurt.

Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Slides, blackboard, case studies and practical work

II. Section 2 of study program

1. Manufacturing Technology II

"Manufacturing Technology II"	
Code	MEN2360
Semester	3
Level	Advanced level
Credits / ECTS	5
Contact hours per week	4
Related courses	MEN2361 Manufacturing Technology 2 MEN2172 Manufacturing Technology 2 Laboratory
Recommended prerequisites	Advanced level in Mathematics Material Sciences Mechanical Design High School level in Electrotechnology and Physics Manufacturing Technology 1
Type and duration of examination (only in case of PLK/PLM)	Manufacturing Technology2: PLK (60 mins) Manufacturing 2 laboratory: UPL
Language	German
Module coordinator	Prof. Dr. Oßwald
Lecturer	Manufacturing Technology 2: Prof. Dr. Frey, Prof. Dr. Eberhardt (both from the mechanical engineering study program) Manufacturing Technology 2 Laboratory: Prof Dr Frey (mechanical engineering study program)
Relation to curriculum	WI, WI International Management, WI Innovation and Design – compulsory subject in 3rd semester
Teaching methodology	Lecture, laboratory, practical work
Objectives / intended learning outcomes	The students • are familiar with the technological properties and processes of current manufacturing processes for metals (in the fields of: forming, shaping and modification of material properties) and plastics, • understand the implementation options and limits of these manufacturing processes, • are able to determine the manufacturing processes for functional products at optimum cost, • are familiar with the assembly and technology of production machines and devices.
Content	The topic of production technology for metals: In each case functionality, performance characteristics, application areas of the following manufacturing processes: • forming • shaping • modification of material properties Manufacturing process for plastics: Properties of polymeric materials, areas of application and potentials, plastics processing technologies, machines and tools, design suitable for production and materials
Reading list	• Schulze, G.: *Fertigungstechnik.* VDI: Düsseldorf. • Schmid, D. et al. (2019): *Industrielle Fertigung*. Europa-Lehrmittel: Haan.

	• Awiszus, B. (2006): *Grundlagen der Fertigungstechnik*, Hanser Fachbuchverlag: München. • Michaeli, W. (2010): *Einführung in die Kunststoffverarbeitung.* Hanser: München. • Saechtling, H. (2013): *Kunststoff Taschenbuch.* Hanser: München.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work and examination, preparation: 90 hrs
Media employed	Slides, blackboard, laboratory tasks, demonstrations

2. Design & Cross Cultural Management

"Design & Cross Cultural Management	
Reference number	ART2010
Semester of study	3rd semester
Level	Advanced level
Credits	5
SWS	4
Related courses	ART2011 Design Basics BAE2473 Cross Cultural Management 1 (CCM1)
Recommended prerequisites	None
Type and duration of examination (only in case of PLK)	Design Basics: PLP CCM1: PLH/PLL/PLK/PLP/PLR (60 minutes)
Language	German and English
Module coordinator	Prof. Dr Mahadevan
Lecturer	Design Basics: Prof. Thomas Gerlach / N. N. (Faculty of Design) CCM1: Prof. Dr Mahadevan
Relation to curriculum	WI Innovation and Design - compulsory subject 3rd semester
Teaching methodology	Lecture, seminar, exercises, project
Objectives / intended learning outcomes	**Design basics:** The students • have an overview of the most important basics of design theory and methodology, • know Design Thinking, • are able to visualise and develop simple ideas/drafts. **Cross Cultural Management 1:** The students • are familiar with the concept of culture, • know basic ethnographic methods and test their application, • know basic intercultural management theories, concepts and models and test their application.
Content	**Design basics:** Students learn the step-by-step sequence of a design process using individual tasks that increase in complexity over the course of the semester. All the short projects follow a basic structure and methods. Students gain experience in presenting their own ideas/designs and in the basic approach to solving design tasks. **Cross Cultural Management 1:** • Concept of culture • Introduction to ethnographic methods • Introduction to intercultural management and intercultural communication • Culture shock and intercultural competence
Reading list	**Design basics:** • Bürdek, B. E. (2015): *Design - Geschichte, Theorie und Praxis der Produktgestaltung.* Birkhäuser. • Heufler, G. (2012): *Design Basics - Von der Idee zum Produkt.* niggli-Verlag.

	Cross Cultural Management 1: Mahadevan, J. (2017): *A Very Short, Fairly Interesting and Reasonably Cheap Book about Cross-Cultural Management.* London: Sage. (selected chapters)
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs. Class attendance: 4 SWS x 15 weeks = 60 hrs. Preparation and follow-up, practical work and examination, : 90 hrs.
Media employed	**Design basics:** Seminar-based, interactive teaching, possibly with lecture elements and practical design tasks. **Cross Cultural Management 1:** Seminar-based, interactive teaching, possibly with lecture elements (for PLK examination form: lecture). The course is based on the e-learning platform of the Hochschule (Moodle) .

3. Quantitative Methods II

"Quantitative Methods II"	
Code	BAE2080
Semester	3
Level	Advanced level
Credits / ECTS	5
Contact hours per week	4
Related courses	BAE2025 Statistics 2 BAE2024 Operations Research
Recommended prerequisites	Mathematics 1 Mathematics 2 Quantitative Methods I
Type and duration of examination (only in case of PLK/PLM)	PLK (90 mins) module examination
Language	German
Module coordinator	Prof. Dr. Bulander
Lecturer	Statistics 2: Prof.Dr. Galler Operations Research: Prof. Dr. Galler
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 3rd semester
Teaching methodology	Lecture with practical work
Objectives / intended learning outcomes	**Contribution to the qualification objectives of the study program**: Students master probability theory, estimation theory and test theory as well as linear optimization and its applications. They are able to apply the corresponding concepts and procedures with confidence and are thus in a position to meet the quantitative requirements of their further studies. The students • are familiar with probability calculation • know the quality criteria for estimators and are able to use them • are able to conduct statistic tests • are able to recognize and solve the problems of linear optimization • are acquainted with the most important procedures of network plan technology
Content	**Statistics 2:** Probability theory, theory of estimation, test theory **Operations Research:** Classification and development of OR, basic model of linear optimization, graphical solution of an LP problem, simplex algorithm and special cases, duality, transport problems, classification problem, network plan technology.
Reading list	**Statistics 2:**. • Rinne, H. (2008): *Taschenbuch der Statistik*. Harri German: Thun, Frankfurt a. M. • Specht, K. ,Bulander, R. ,Gohout, W. (2014): *Statistik für Technik und Wirtschaft.* 2nd expanded edition, De Gruyter Oldenbourg: München. **Operations Research:**

	• Gohout, W. (2009): *Operations Research*. 4th expanded edition, De Gruyter Oldenbourg: München.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Slides, blackboard, practical work

4. Business Information Systems

"Business Information Systems"	
Code	BAE2490
Semester	3
Level	Advanced level
Credits / ECTS	5
Contact hours per week	4
Related courses	BAE2491 Business Information Systems BAE2492 Business Information Systems Laboratory
Recommended prerequisites	Participation in the Fundamentals of Business Administration and Introduction to Computer Science lecture English module
Type and duration of examination (only in case of PLK/PLM)	IT Applications: PLK (60 mins) module examination including questions on the laboratory IT Applications laboratory: UPL evaluation through a laboratory report and online assessment test
Language	German and English
Module coordinator	Prof. Dr.-Ing. Thimm
Lecturer	Business Information Systems: Prof. Dr.-Ing. Thimm Business Information Systems laboratory: Prof. Dr.-Ing. Thimm,
Relation to curriculum	WI International Management, WI Innovation and Design – Compulsory subject in 3rd semester
Teaching methodology	Lecture with exercises/laboratory tasks on computer (case studies) and self-reflection on the subject matter covered in preparation for the assessment test and laboratory report,
Objectives / intended learning outcomes	The students • get acquainted with the different types of business application systems, their basic functions, features and areas of application • are familiar with the key success factors for the use of business application systems • are able to explain the different architectures and basic information technology approaches and concepts of business application systems • are able to explain the correlation between business processes and business application systems • understand the basic principles of ERP systems • possess practical basic knowledge of ERP systems • know current trends in business application systems.
Content	**Business Information Systems:** Business Application Systems - general principles, management of the digital enterprise, central business computing tasks, IT-business alignment, information as a competitive factor, classification of business processes, differences between standard software and customized software, characteristics and architecture of ERP systems **Business Information Systems Laboratory:** Case study for IT-based management of the procedural sequence of an order (from receipt to delivery) with the help of an ERP system, creation of master data in materials management, input of all values of an order and order monitoring, use of the integrated reporting system
Reading list	**Business Information Systems:**

	• Laudon, K., Laudon, J. (2019): *Management Information Systems: Managing the Digital Firm.* Edition 16e, Prentice Hall: Boston. • Valacich, J., Schneider, C. (2017): *Information Systems Today: Managing the Digital World.* Global Edition, 8th Edition, Pearson. • Pearlson, K. E., Saunders, C. S., Galletta, D. F. (2016): *Managing and Using Information Systems: A Strategic Approach.* 6th Edition, Wiley. **Business Information Systems Laboratory:** • Masutta, M., Cordts, S. (2016): *SAP ERP für Anfänger.* 1. Aufl., Verlag mana Buch: Heide. • Frick, D., Gadatsch, A., Schäffler-Külz (2008): *Grundkurs SAP ERP, Geschäftsprozess-orientierte Einführung mit durchgehendem Fallbeispiel.* 1st edition., Vieweg & Sohn: Wiesbaden
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Digital slides, blackboard, videos providing examples of systems. Worksheets on case studies, e-learning content and videos for self-study, supplementary material available on the university's e-learning platform (Moodle)

5. Logistics and Management Accounting

"Logistics & Management Accounting"	
Code	BAE2510
Semester	3
Level	Advanced level
Credits / ECTS	5
Contact hours per week	4
Related courses	BAE2511 Logistics BAE2512 Management Accounting
Recommended prerequisites	None
Type and duration of examination (only in case of PLK/PLM)	PLK (60 mins) module examination
Language	German and English
Module coordinator	Prof. Dr. Peter
Lecturer	Logistics: Prof. Dr.-Ing. Weyer & Prof. Dr. Peter Management Accounting: Prof. Schnell
Relation to curriculum	WI International Management, WI Innovation and Design – Compulsory subject in 3rd semester
Teaching methodology	Lecture with case studies and exercises
Objectives / intended learning outcomes	**Logistics** The students have a good grasp of the fundamental concepts of logistics in the areas of macro and micro logistics. In each case, the basics of these areas are explained and concepts, methods and technical implementations are developed using practical case studies. In addition, the students will be able to design processes and strategies along the entire value chain. The participants become acquainted with the whole of the logistics business processes. **Management Accounting** Students learn how to think and act as a management accountant. They know the methods and procedures used by a management accountant in a company and are able to assess the benefits and limitations of the instruments.
Content	**Logistics:** The course addresses logistics definitions as well as logistic ways of thinking and deals in particular with the significance and perspectives of procurement and production logistics. Conflicting objectives of logistics as well as logistical levers for increasing company value are discussed. The course focuses on two areas of logistics - along the value chain - and deals with their interactions. • International procurement logistics, e.g.: process organization in purchasing, sourcing strategies, supplier management, supplier selection and evaluation, supplier control • Production logistics, e.g.: area of activity, processes, structure, production management, inbound logistics (IBL), production material control (PMC), outbound logistics (OBL), warehouse logistics (WHL) In addition, the course provides an introduction to distribution and transport logistics as well as macrologistics. **Management Accounting:**

	The course demonstrates clearly over the course of the whole semester how a management accountant thinks and acts using the case study of “Robert Bike & E-Wheelchair Ltd” After a short introduction to the concept and general tasks of a management accountant, the course begins with an analysis of a company’s strengths, weaknesses, opportunities and threats (SWOT). Based on this, the entire process of corporate planning and budgeting is explained. In addition to the planning process and organisation, typical planning instruments are explained and, in particular, the content, purpose and connection of partial financial plans are explained. After that the use of further important tools of the management accountant, such as contribution margin accounting, breakeven point analysis, target costing and finally the creation of accounting reports and cockpit charts including indicator systems (e.g. DuPont, Balanced Scorecard) will be imparted.
Reading list	**Logistics:** • Heizer, J.; Render, B. (2016): *Operations Management*, Global Edition, 11th edition, Pearson, London • Van Weele, A.J. (2014): *Purchasing and Supply Chain Management*, 6th edition, Cengage Learning, London **Management Accounting:** • Weygandt, J., Kimmel, P., Kieso, D. (2018*): Managerial Accounting*. 8th Edition, Wiley: Hoboken, N.J. • Weber, J., Schäffer, U. (2016): *Einführung in das Controlling*. 15h edition, Schäffer-Poeschel: Stuttgart. The participants are asked to register on the e-learning platform (Moodle) for both courses and to download the current version of the lecture notes and case studies as a PDF file.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Lecture with case studies and exercises.

6. Law

"Law"	
Code	LAW1300
Semester	3
Level	Advanced level
Credits / ECTS	5
Contact hours per week	4
Related courses	LAW1301 Contract Management LAW1302 Corporate Law
Recommended prerequisites	None
Form and duration of examination (only in case of PLK/PLM)	PLK (60 mins) module examination
Language	German
Module coordinator	Prof. Dr. Eisenberg (by proxy: Prof. Dr. Schmitt)
Lecturer	Contract Management and Corporate Law: Prof. Dr. Eisenberg
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 3rd semester
Teaching methodology	Lecture
Objectives / intended learning outcomes	Students comprehend the legal basics of contract law and law of obligations including product liability. This is one of the prerequisites for solving economic, legal and business problems, and is one of the professional duties of an industrial engineer.
Content	• Civil law - general section Contract law, terms and conditions, proxy etc. • Civil law - law of obligations Breach of contract, consumer protection, law of torts, product liability
Reading list	Civil Code (BGB) and Commercial Code (HGB) publications, e.g. Deutscher Taschenbuch Verlag: München. • Gildeggen, R. et al. (2016): *Wirtschaftsprivatrecht. Kompaktwissen für Betriebswirte*. Oldenbourg: München. • Müssig, P. (2018): *Wirtschaftsprivatrecht. Rechtliche Grundlagen wirtschaftlichen Handelns*. Müller: Heidelberg et al. • Frenz, W. (2016*): Recht für Ingenieure. Zivilrecht, Öffentliches Recht, Europarecht*. Springer: Berlin, Heidelberg.. (most recent edition in each case)
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Blackboard, worksheets, interactive teaching methods

7. Production

“Production” / “Production Engineering & Manufacturing”	
Code	BAE2520
Semester	4
Level	Advanced level
Credits / ECTS	6
Contact hours per week	4
Related courses	BAE2421 Production 1 BAE2115 Production 1 Laboratory BAE2521 Production 2
Recommended prerequisites	Completed pre-study internship Materials Science Physics Manufacturing Technology Technical Mechanics
Type and duration of examination (only in case of PLK/PLM)	PLK (60 mins) module examination Production 1 laboratory: UPL
Language	German and English
Module coordinator	Prof. Dr.-Ing. Saile
Lecturer	Production 1: Prof. Dr.-Ing. Saile Production 1 Laboratory: Prof. Dr.-Ing. Saile Production 2: Prof. Dr. Oßwald
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 4th semester
Teaching methodology	Lecture with discussions, laboratory
Objectives / intended learning outcomes	The students • have an overview of the plastics production technology for processing thermoplastic materials using injection moulding and extrusion as well as for further processing processes for semi-finished products (e.g. blow moulding), • are familiar with the basic design principles of product development with regard to automation-compatible assembly, • are able to identify different function groups of automated product assembly and select the appropriate automation components based on the task, • are familiar with modern forms of organization of production and factory operation, • understand the importance of a production system in relation to product characteristics and planning assumptions, • see the benefit of basic control circuits in both the technical and organisational context of a production plant.
Content	**Production 1:** • Lean Production • Error prevention and error correction • Process and machine capability • Human-robot collaboration • Control engineering • Continuous improvement **Production 2:** • Production machines • Machinery safety • Automation

	• Sensors in production machines • Machine vision and identification • Hydraulic technology • Pneumatic technology • Machine drives and actuators • Mechanical machine components
Reading list	**Production 1:** • Liker, J. (2014): *Der Toyota Weg*. FBV: München. **Production 1 Laboratory:** • Reinhold, C. (2012): *Mess-, Steuerungs- und Regelungstechnik.* Vogel: Würzberg.. **Production 2:** • Sands, N.P., Verhappen, I. (2018): *A Guide to the Automation Body of Knowledge*. 3rd edition. International Society of Automation 978-1-941546-91-8.
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up for the lecture, practical work and examination, preparation for the examination: 120 hrs
Media employed	Lecture with discussion, laboratory tasks on machines and experimental constructions

8. Product & Service Innovation

"Produkt- & Service-Innovation" / "Product & Service Innovation	
Reference number	BAE2680
Semester of study	Semester 4
Level	Advanced level
Credits	6
SWS	4
Related courses	BAE2584 Methods of Product Development BAE2585 Methods of Product Development Laboratory BAE2583 Innovation Management
Recommended prerequisites	None
Type and duration of examination (only for PLK/PLM)	PLK+PLH (60 minutes) Module examination
Language	German or English
Module coordinator	Prof. Dr.-Ing. Woidasky
Lecturer	Methods of Product Development: Prof. Dr.-Ing. Woidasky Methods of Product Development Lab: Prof. Dr.-Ing. Woidasky Innovation Management: Prof. Dr. Kölmel
Relation to curriculum	WI Innovation and Design - compulsory subject 4th semester
Teaching methodology	Lecture with discussion
Objectives / intended learning outcomes	**Methods of product development:** Students are able to, • structure the product development process, assign concrete activities to the individual steps and pursue design-to-X approaches, • Apply methods of product development and quality assurance (including creativity methods, FMEA, QFD, modelling, cost management), • Describe and evaluate products and processes under sustainability and cost aspects. **Innovation management:** • Understanding of innovation management as an entrepreneurial task and as a design mandate for a company-wide innovation system. • Ability to identify relevant management aspects to foster innovation initiatives, develop understanding of organisational initiative design and how this influences the company's innovation portfolio. • Be able to identify relevant parameters of innovation collaboration management, develop understanding of how collaboration can increase the relevant resource and capability base of the company and what benefits arise from partner management in networks. • Ability to explain the effect of increasing service intensity on innovation management. • Develop an understanding of the informal side of the entrepreneurial innovation organisation and be able to recognise its effect on innovation team activities. Be able to identify and shape relevant parameters to influence the innovation-oriented organisational culture. • Understand opportunities that may arise from new technologies (e.g. IoT, additive manufacturing, DLT) and be able to identify specific challenges to innovation management.

Content	**Methods of product development:** • Methods of PD: Munich Product Concretisation Model (MKM) or comparable approach, e.g. SPALTEN • Sustainable PD 3: Exemplary development of a product, preferably in cooperation with external partners. (Corporate) partners • Value-based PD: Cost management in product development; life cycle costs • Energy management: System approach: Energy and Energy Management; Energy transition in Germany; Energy efficient Production and use of goods • Lightweight design as a driver of innovation: improving energy efficiency and emissions of GHG • Innovative energy efficient techniques in production, transport or storage of energy • Material efficiency and Circular economy **Innovation management:** Competitive products form the basis for the economic success of companies. However, this can only be ensured in the long term if all product-related measures of a company, from the development of customer-oriented products to the optimal design of the product life cycle, are carried out effectively and efficiently through systematic innovation and product management. Based on a process-oriented structure, central aspects of innovation and product management are taught. • Basics of innovation and product management • Strategic planning in innovation and new product management • Generation and evaluation of product ideas • Product conception • Product development • Market testing • Lifecycle management • Organisation of innovation and product management
Reading list	**Methods of product development:** • Ulrich, K. T., Eppinger, S. D. (2012): *Product Design and Development.* McGraw-Hill: New York. • Pahl, G., Beitz, W. et al. (2007): *Konstruktionslehre - Grundlagen erfolgreicher Produktentwicklung. Methods and applications.* Springer: Berlin, Heidelberg. • Gausemaier, J. et al. (2011): *Produktinnovation - Strategische Planung und Entwicklung der Produkte von morgen.* Hanser: Munich. • Warnecke, H. J., Bullinger, H. J. (2003): *Wirtschaftlichkeitsrechnung für Ingenieure.* Hanser: Munich. **Innovation management:** • Gaubinger, K. , Werani, T. , Rabl, M. (2015): *Praxisorientiertes Innovations- und Produktmanagement Grundlagen und Fallstudien aus B-to-B-Märkten.* Gabler: Wiesbaden. • Gassmann, O., Sutter, P. (2008): *Praxiswissen Innovationsmanagement: Von der Idee zum Markterfolg.* Hanser: Munich. • Hauschildt, J., Salomo, S. (2007): *Innovationsmanagement.* Vahlen: Munich.
Workload	Workload: 6 ECTS x 30 hours = 180 hours Attendance time: 4 SWS x 15 weeks = 60 hours

	Preparation/review, exercises, preparation and execution of the examination: 120 hours.
Media employed	The module consists of three teaching and learning formats (lectures; speed research; case study) and takes an interactive approach, using slides, blackboard work, assignments for individual and group work, keynote speeches, group and panel discussions, individual and group presentations.

9. Operations Management

"Operations Management"	
Code	BAE2530
Semester	4
Level	Advanced level
Credits / ECTS	6
Contact hours per week	4
Related courses	BAE2531 Operations Management 1 BAE2332 Operations Management 1 Laboratory BAE2333 Operations Management 2
Recommended prerequisites	None
Type and duration of examination (only in case of PLK/PLM)	PLK (60 minutes) module examination Operations Management 1 Laboratory: UPL
Language	English
Module coordinator	Prof. Dr. Kühn
Lecturer	Operations Management 1: Prof. Dr. Kühn Operations Management 1 Laboratory: Prof. Dr. Kühn Operations Management 2: Prof. Dr. Kühn
Relation to curriculum	WI International Management, WI Innovation and Design – Compulsory subject in 4th semester
Teaching methodology	Lecture, practical work, laboratory
Objectives / intended learning outcomes	The students • are acquainted with the processes and methods in production planning and control and can apply them • know the importance of operational and strategic perspectives in operations management as well as their mutual dependencies • recognize the interdependences between production and logistics • know current trends in operations management and understand logistical, organizational, technical and economic implications for the entire organisation • know the basics of ergonomics and health and safety at work and are in a position to use them • are able to apply methods of time management - time tracking and predetermined time systems • are able to look at operations holistically, master essential techniques and are able to apply them to new (real) tasks.
Content	**Operations Management 1 and 2 – Lectures with parallel practical work and laboratory units:** Students understand methods and processes of operations management and production planning. They can apply them and are able to adopt the correct approach to solve problems. Students learn operational and strategic aspects of operations management and know their dependencies, as well as the interdependencies between product and service, and production and logistics.
Reading list	• Heizer, J. / Render, B. (2014): *Operations Management*. Pearson Education: New Jersey

	• Slack, N. et al. (2012): *Operations and Process Management - principles and practice for strategic impact.* Pearson Education: New Jersey • Thonemann, U. (2011*): Operations Management - Konzepte, Methoden und Anwendungen*. Pearson Studium: München.
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 120 hrs
Media employed	Lecture, laboratory work, seminar style course, project work

10. International Technical Sales

"International Technical Sales"	
Code	BAE2550
Semester	4
Level	Advanced level
Credits / ECTS	6
Contact hours per week	4
Related courses	BAE2551 International Technical Sales 1 BAE2552 International Technical Sales 2
Recommended prerequisites	B2/C1 English (CEFR) Successful attendance of the modules Business Administration I I and II
Type and duration of examination (only in case of PLK/PLM)	PLK (60 minutes) module examination
Language	German or English
Module coordinator	Prof. Dr. Hinderer
Lecturer	Prof. Dr. Hinderer
Relation to curriculum	WI International Management, WI Innovation and Design - Compulsory subject in 4th semester
Teaching methodology	Lecture with discussions
Objectives / intended learning outcomes	The students are familiar with the concepts and tools of marketing, and have an understanding of marketing as management concept in a company. They have an insight into the specific aspects of international marketing, industrial goods marketing and technical sales.
Content	• Introduction and basics: definition of "marketing", marketing concepts and sales especially for investment goods and technology companies • Differences in sales in B-to-B and B-to-C • The marketing mix: product policy, price policy, communications policy, distribution policy • Aspects of the technical sales regarding the different business types in industrial goods marketing • Development of communications strategies • Overview of customer relationship management
Reading list	**International Technical Sales 1:** • Backhaus, K. / Voeth, M. (2014): *Industriegütermarketing: Grundlagen des Business-to-Business Marketing*. 10th edition, Vahlen: München. • Doole, I., Lowe, R. (2019): *International Marketing Strategy*. 8th edition, Andover. • Backhaus, K., Voeth, M. (2010): *Internationales Marketing*. 10th edition, Schäffer-Poeschel: Stuttgart • Kotler, P., Keller, K. L. (2009): *Marketing Management*. 13th edition, Pearson: Upper Saddle River. **International Technical Sales 2:** • Blythe, Z., Zimmermann, A. (2017): *Business to Business Marketing Mangement.* Routledge. • Meffert, H. et al. (2007): *Marketing: Grundlagen marktorientierter Unternehmensführung*. Gabler: Wiesbaden. • Buttle, F. (2009): *Customer Relationship Management*. Elsevier: Amsterdam et al.

	• Hollensen, S. (2011): *Essentials of Global Marketing – A Decision-Oriented Approach.* Pearson: England.
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 120 hrs
Media employed	PowerPoint, blackboard, videos and print media for illustration

11. Management Elective

"Management Elective"	
Code	BAE2400
Semester	4
Level	Advanced
Credits / ECTS	6
Contact hours per week	4
Related courses	Depending on current semester course offering
Recommended prerequisites	Contents from preceding semesters; English level B2 if course held in English is selected
Type and duration of examination (only in case of PLK/PLM)	PLH/PLL/PLK/PLP/PLR (60 minutes) module examination
Language	German or English
Module coordinator	Study Program Director
Lecturer	TBA
Relation to curriculum	WI, Wi International Management, WI Innovation and Design – Compulsory subject in 4th semester
Teaching methodology	Seminar style course, lecture or project (depending on the course selected)
Objectives / intended learning outcomes	Students acquire in-depth knowledge in their own chosen special subjects in the field of management. Courses in this module contribute to the completion of the qualification framework for Industrial Engineering - Management part.
Content	The contents depend on the selected courses from the "Management Electives" electives list and are published in the respective syllabus of the course before the beginning of the lecture period.
Reading list	The literature depends on the courses selected from the electives list and is published in the respective syllabus of the course before the beginning of the lecture period.
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 120 hrs
Media employed	Depending on the selected course

1 A compilation of the Management Elective subjects will be posted. The list can also be obtained at the Program Director's assistant. One elective module consisting of 4 SWS with an award of 6 credits must be chosen from the " Management Elective" option list.

12. Academic Education and Methods

"Academic Education and Methods"	
Code	ISS3150
Semester	5
Level	Advanced level
Credits / ECTS	5
Contact hours per week	4
Related courses	ISS3151 Academic Seminar ISS3153 Academic Writing and Research
Recommended prerequisites	None
Type and duration of examination (only in case of PLK/PLM)	UPL
Language	German and English
Module coordinator	Prof. Dr. Mahadevan
Lecturer	Academic Seminar: Prof. Dr. Mahadevan Academic Writing and Research: Prof. Dr. Kilian-Yasin
Relation to curriculum	WI, WI International Management, WI Innovation and Design – compulsory subject in 5th semester
Teaching methodology	Workshops, e-learning, practice
Objectives / intended learning outcomes	**Academic Seminar:** The students work independently on general academic subject areas and use these to create their individual study profile. They demonstrate this through completion of corresponding assignments. **Academic Writing and Research:** The students are familiar with the requirements and criteria of academic writing and research. They are able to approach a problem scientifically, to examine it systematically and to produce a scientific paper independently, taking formal criteria into account.
Content	**Academic Seminar**: • Ability to work independently • Task-oriented work • Ability to summarize and communicate general academic content • Individual profile building **Academic Writing and Research**: • Identifying and formulating problems • Developing a research question • Characteristics and style of academic writing • Sources: research, evaluation, citing • Structure and formal requirements of academic writing • Tables and Figures • Planning and checking your own work
Reading list	**Academic Seminar:** Will be provided depending on the study profile selected **Academic Writing and Research:** • Theisen, M. R. (2011): *Wissenschaftliches Arbeiten. Technik – Methodik – Form.* 15th edition, Vahlen: München.

	Franck, N., Stary, J. (2011): *Die Technik wissenschaftlichen Arbeitens: Eine praktische Anleitung.* 16th edition, UTB/Schöningh: Paderborn et al.
Workload	Workload: 5 ECTS x 30 hrs = 150 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 90 hrs
Media employed	Presentations, e-learning, practical work

13. Project Methods and Creativity

"Project Methods and Creativity"	
Code	BAE3100
Semester	6
Level	Professionally-qualifying academic level
Credits / ECTS	6
Contact hours per week	4
Related courses	BAE3250 Project Methods and Creativity
Recommended prerequisites	All examinations of section 1 of the study program must have been passed.
Type and duration of examination (only in case of PLK/PLM)	PLH/PLL/PLP/PLR
Language	German
Module coordinator	Prof. Dittmann
Lecturer	Project Methods and Creativity: Prof. Dittmann, Dr. Heinemeyer, Prof. Schätter
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 6th semester
Teaching methodology	Seminar style course
Objectives / intended learning outcomes	The students • conduct a technical or interdisciplinary project in teams • learn roles within teams such as how to deal with budget and time limitations • develop competences in team analysis and team building, in achieving team objectives and for preventing and dealing with critical situations in a team • are able to present team results accurately to the appropriate addressee • are able to independently familiarize themselves with a complex topic and conduct the project with appropriate role allocation • are able to implement the technical and methodological knowledge they have previously acquired in a concrete task, thereby broadening their skills • have developed the ability to generate creative ideas and implement them
Content	Project management in which a complex task is accomplished in defined milestones (research/analysis, concept, prototype, implementation). Weekly project meetings to coordinate the contents, prepare the milestones and carry out four graded milestone presentations. Topics are, for example: • Technical product development • Robotics with Lego Mindstorms, Fischertechnik • Development of IT systems/apps • Modeling and visualization of technical operational sequences or processes • Creation of e-learning units • Visualization of information in the day to day operation of a company (internal and external)
Reading list	• Ries, E., Böhme, E., et al. (2018): *The Startup Way: Das Toolkit für das 21. Jahrhundert, mit dem jedes Unternehmen erfolgreich sein kann.* Vahlen: München.

	• Fox, D., Püttmann, T. et al. (2018): *Bauen, erleben, begreifen: fischertechnik-Modelle für Maker.* dpunkt: Heidelberg. • Stadler, A. (2016): *Mein LEGO-EV3-Buch: Eigene Roboter bauen und programmieren mit LEGO MINDSTORMS.* Hanser: München. • Böhringer, J., Bühler, P. et al. (2014): *Kompendium der Mediengestaltung: IV. Medienproduktion Digital (X.media.press).* Springer Vieweg: Berlin, Heidelberg.
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 120 hrs
Media employed	Project work, weekly alternation of graded milestone presentations and project meetings

14. Interdisciplinary Projects

"Interdisciplinary Projects"	
Code	BAE3200
Semester	6
Level	Professionally-qualifying academic level
Credits / ECTS	6
Contact hours per week	4
Related courses	Interdisciplinary Projects
Recommended prerequisites	All examinations of section 1 of the study program must have been passed. Specific lectures for each project topic. Successful completion of all examinations of section 2 of the study program, including the 5th semester, if possible
Type and duration of examination (only in case of PLK/PLM)	PLP
Language	German and English
Module coordinator	All professors of the Engineering and Management study program
Lecturer	All professors can be examiners
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 6th semester
Teaching methodology	Project
Objectives / intended learning outcomes	Students are able to work in a team of 2 to 5 members. They accomplish interdisciplinary tasks and solve problems related to industrial engineering in a systematic and scientific way. This includes, for example: • data collection and analysis • development and evaluation of solutions • implementation of solutions • documentation and ensuing presentation As part of the project work, students learn to compile results in a team and present them to the supervisor. In addition, they learn to deal with specific interdisciplinary issues and ways to solve them. This enables students to apply contents learned previously within a professional context, and to broaden their own communication and problem-solving abilities.
Content	Diverse interdisciplinary topics where students • apply their economic and technical knowledge, skills and competences • use standard tools for project management and data analysis • plan, organise and carry out projects within a given time frame • carry out independent research, data collection and analysis • document and present processes and results
Reading list	Literature is chosen by the students.
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance = 0 SWS; preparation, literature research, working on the project in teams: 180 hrs per student
Media employed	Current literature, presentations, intensive individual supervision, final presentation

15. Engineering Elective

"Engineering Elective"	
Code	BAE3300
Semester	6
Level	Professionally-qualifying academic level
Credits / ECTS	6
Contact hours per week	4
Related courses	Depending on current semester course offering
Recommended prerequisites	Contents from preceding semesters; English level B2
Type and duration of examination (only in case of PLK/PLM)	PLH/PLL/PLK/PLP/PLR (60 minutes) module examination
Language	German or English
Module coordinator	Study Program Director
Lecturer	TBA
Relation to curriculum	WI, Wi International Management, WI Innovation and Design – Compulsory subject in 6th semester
Teaching methodology	Seminar style course, lecture or project (depending on the course selected)
Objectives / intended learning outcomes	Students acquire in-depth knowledge in their selected subjects in the field of STEM/engineering. Courses in this module contribute to the completion of the qualification framework for Industrial Engineering – STEM/engineering component.
Content	The contents depend on the courses selected from the "Engineering Electives" subject list and are published in the respective syllabus of the course before the beginning of the lecture period.
Reading list	The literature depends on the courses selected from the electives list and is published in the respective syllabus of the course before the beginning of the lecture period.
Workload	Workload: 6 ECTS x 30 hrs = 180 hrs Class attendance: 4 SWS x 15 weeks = 60 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 120 hrs
Media employed	Depending on the selected class

2 *A compilation of the Engineering Elective subjects will be posted. The list can also be obtained at the Program Director's assistant. One elective module consisting of 4 SWS with an award of 6 credits must be chosen from the " Engineering Elective" option list.*

16. Innovation & Design Major Elective

Innovation and Design is a compulsory module (see III. “Specialisations”). In addition, a further industrial engineering major elective (B or C) (each awarded 12 credits) has to be selected from the “Specialisations” list (see also III.). The participation in the major electives can be limited by the study program.

17. Major Elective 2

See III. “Specialisations”. An Industrial Engineering Major Elective (B or C) (each awarded 12 credits) has to be selected from the “Specialisations” list (see also III.). The participation in the major electives can be limited by the study program.

18. Specialisations

See III. Specialisations

Four ECTS have to be selected from the courses listed in the electives catalog of the study program. These will be posted on the notice board. The modules/courses have to be selected in consultation with the study program director. Participation can be limited by the study program and, according to § 30 Abs. 5 Satz 1 LHG, by resolution of the School of Engineering.

19. Internship

"Internship"	
Code	INS3082
Semester	5
Level	Advanced level
Credits / ECTS	25
Contact hours per week	100 days of attendance in a company
Related courses	None
Recommended prerequisites	Courses from 1st to 3rd semester. All examinations of section 1 of the study program must have been passed.
Type and duration of examination (only in case of PLK/PLM)	UPL
Language	German or English
Module coordinator	The assignment of students' internship supervisors can be found on the Engineering and Management website, in the category 'internship'.
Lecturer	None
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 5th semester
Teaching methodology	Practice/training
Objectives / intended learning outcomes	Students have an opportunity to apply and deepen the knowledge acquired in their previous semesters in an industrial and economic setting. The activities and working methods of industrial engineers are experienced in everyday life and can be correlated with theoretical subject matters. Students enhance their experience with regard to methodological and social skills, learn technological, commercial and organizational contexts, and increase their understanding of business processes. They learn to work together with other employees on specific tasks and projects in a team and to integrate into the corporate hierarchy. Students are able to reflect on what they have learned in theory and in practice and thus get a clear picture of where they want to work in the future. They, therefore, have a stronger motivation to pursue their studies. In addition, the practical experience and feedback allow them to choose a suitable topic for their thesis and their subsequent career. They are able to recognise their individual preferences and align their studies to them. The internship, therefore, paves the way for a good start in their career.
Content	The internship should be aligned to the study program. It provides practical experience and knowledge, which supplement program courses. Students get an insight into the processes and structures of a company by performing both technical and economic tasks during the internship. Students may perform tasks related to either business and engineering, even though tasks that relate to both business and engineering would best serve the aim of this internship.

	Regular contact with the respective supervisor in the company ensures that students gain a satisfactory insight into the interconnection between the economic and technical operations through a qualified employee. The internship is an integrated part of the study program, therefore, the university regulates the internship and determines its contents. It should provide practical experience and knowledge that supplement courses on the program. The internship covers at least 20 weeks (100 attendance days) in a company or another institution where the students are able to gain work experience. Students are expected to write a detailed report about the internship showing that the required content and activities have in fact been completed in a company.
Reading list	Subject to the topic
Workload	25 ECTS x 30 hrs = 750 hrs = 100 days (7.5 hrs a day)
Media employed	Not applicable

20. Scientific colloquium

"Scientific Colloquium"	
Code	COL4999
Semester	7
Level	Professionally qualifying academic level
Credits / ECTS	2
Contact hours per week	2
Related courses	None
Requirements according to the examination regulations	In the 6th semester at the earliest. All examinations of the first four study semesters must have been passed.
Recommended prerequisites	Successful attendance of the course 'Research Methods and Academic Writing' in the 4th semester
Type and duration of examination (only in case of PLK/PLM)	UPL
Language	German or English
Module coordinator	All professors of the Engineering and Management study program
Lecturer	All full-time professors can be examiners
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 7th semester
Teaching methodology	Individual colloquia, preparation for the thesis
Objectives / intended learning outcomes	While writing their thesis, students will learn to solve complex and wide-ranging problems methodologically, independently, and accurately. The essential elements of how to perform scientific work learnt during their studies can be applied and explored. Individual weaknesses are recognized and resolved in consultation with the supervising professor. The ability to critically self-reflect is encouraged.
Content	Depending on individual students and the specific shortcomings that the student or his supervising professor recognize in the process of writing the thesis; addressing methodological issues.
Reading list	Subject to the planned topic of the thesis
Workload	Workload: 2 ECTS x 30 hrs = 60 hrs Class attendance: 2 SWS x 15 weeks = 30 hrs Preparation and follow-up: 30 hrs
Media employed	Not applicable

21. Bachelor Thesis

"Bachelor Thesis"	
Code	THE4999
Semester	7
Level	Professionally qualifying academic level
Credits / ECTS	12
Contact hours per week	0
Related courses	None
Requirements according to the examination regulations	Registration of the Bachelor Thesis is permitted in the 6th semester at the earliest, as long as all examinations of the first four study semesters have been passed.
Recommended prerequisites	Successful attendance of the 'Scientific Colloquium' seminar as well as the 'Research Methods and Academic Writing' seminar. All examinations of section 2 of the study program should have been passed.
Type and duration of examination (only in case of PLK/PLM)	PLT
Language	German or English
Module coordinator	All professors of the Engineering and Management study program
Lecturer	All professors and qualified lecturers can be primary examiners
Relation to curriculum	WI, WI International Management, WI Innovation and Design – Compulsory subject in 7th semester
Teaching methodology	None
Objectives / intended learning outcomes	The thesis shows that students are able to independently solve problems using scientific tools. They are able to apply and use methods and thought processes when solving mostly practical problems within a prescribed period. Holistic solutions can be achieved through complex thinking and factual analysis as well as the appropriate retrieval and use of information. Thus, relevant literature must be researched, filtered and evaluated. The topic is addressed systematically; Lines of argument need to be developed. Students choose scientific methods and procedures, use them and develop them further to solve the problem. The results are critically evaluated using the most recent research. The findings and results are clearly and scientifically documented by the student in written form.
Content	The Bachelor thesis is one of the first major scientific works for the students. The topic of the thesis is defined by the first supervisor in consultation with the students, and depends on both the chosen field and the specific problem. It must be broadly related to the field of industrial engineering, and the chosen course of study. It should cover specialised topics or current issues in these areas. A suggestion or proposal for a topic mostly comes from the company where the student intends to write the thesis.
Reading list	Topic-specific literature, chosen by the students
Workload	12 Credits x 30 hrs = 360 hrs
Media employed	Not applicable

III. Specialisations

Students are required to take Module A (12 credits). They must additionally choose a module with 12 credits (6th semester 6 credits and 7th semester 6 credits) from the compulsory electives modules B and C for Industrial Engineering (these can be found on the following pages) in consultation with their program director. A further 4 credits are required which must be selected from the courses offered in the compulsory elective catalogue of the study program.

.

A Innovation and Design

"Innovation und Design" / "Innovation and Design	
Reference number	ART3100
Semester of study	Semester 6 / 7
Level	Professional academic level
Credits	12
SWS	8
Related courses	BAE3090 Sustainable Product Development BAE 3091 Product Design BAE3092 or BAE3093 Innovation Project (consisting of two parts; for example, only one part can be taken if recognised from abroad)
Participation requirements according to the examination regulations	All examinations of section 1 of the study program must have been passed.
Recommended prerequisites	
Type and duration of examination (only for PLK/PLM)	PLH/PLL/PLK/PLP/PLR (60 minutes)
Planned group size	Max. 25 students
Language	German or English
Module coordinator	Prof. Dr Kölmel
Lecturers	Sustainable product development: Prof. Dr.-Ing. Woidasky Product Design: Prof. Thomas Gerlach / N. N. (Faculty of Design) Innovation project: Prof. Dr. Kölmel, Prof. Dr. Kühn; Prof. Dr. Wupperfeld, Prof. Dr.-Ing. Hinderer (two lecturers per semester)
Relationto curriculum	WI Innovation and Design - elective 6th/7th semester
Teaching methodology	Seminar-based teaching
Objectives / intended learning outcomes	**Sustainable product development:** The students know the basic procedure for the development of products. They know the sustainability concept and can apply it to industrial issues regarding products and processes. They are able to assess products and processes with regard to their environmental and sustainability impacts. They are able to independently create a test protocol. **Product design:** Students recognise the connections between form, function, usability and meaning. They understand different formal systems and are able to recognise the principles behind these systems and apply them practically in their own work. They are able to realise their personal ideas of form and grace, taking into account perceptual theory. They are able to establish criteria for their design and to reflect critically on them.

	Innovation project: Students are able to develop innovative ideas, evaluate them and formulate them as concepts. They understand that the selection of an idea depends on the prospects of success on the market. Concepts are implemented as visual, functional or interactive prototypes. Ideas and concepts are reflected upon in the group in order to adopt mutual perspectives, to recognise problem situations in dialogue with others and to redefine approaches to solutions.
Content	**Sustainable product development:** Basics and history of sustainability, sustainability concept, basics of product development, development methodologies such as Stage-Gate, VDI 2221; legal requirements in product development, definition of "quality", functions, function models, Quality Function Deployment, FMEA, Design for X, among others. Design for recycling, lightweight construction; securing raw materials, recycling rates, selected examples of recycling cycles; production and recycling of important materials (e.g. glass, PET, steel); life cycle analysis, environmental impact categories, simplified life cycle analysis, eco labels, environmental protection approaches; reliability and service life: basics, concepts, obsolescence; introduction to standardisation activities, creation of standards **Product design:** Development of a design project in selected work steps from the following catalogue: - Research and creation of the criteria - Team building and decision-making processes - Ideation and use of creativity and design techniques - Idea-sketch phase until selection of preferred design - Draft to Selection Keysketch - Detailed design - Preparation of the final representation describing the design - Short presentation and further steps **Innovation project:** The students develop an innovation project between technology and economy. In the course of the process, materials are created and the social, economic and ecological relevance is discussed. In addition, students make an initial assessment of the commercial viability of the innovation. The project prepares for an interdisciplinary working world in which it is no longer just a matter of technical expertise, but also about the question of what happens with this knowledge, which problems are taken into account and to which solution they contribute.
Reading list	**Sustainable product development:** • Wimmer, W. and Züst, R. (2001): ECODESIGN Pilot. Kluwer Academic Publishers: Dordrecht. • Pahl, G., Beitz, W. et al. (2013): Pahl/Beitz Konstruktionslehre. Springer: Berlin u. a.

	• Engeln, W. (2011): Methoden der Produktentwicklung. Oldenbourg Industrieverlag: Munich. • Pfeifer, W. and Schmitt, T. (2007): Masing - Handbuch Qualitätsmanagement. Hanser: Munich. • Ponn, J. and Lindemann, U. (2011): Konzeptentwicklung und Gestaltung technischer Produkte. Springer: Berlin. • Bertsche, B. and Lechner, G. (2009): Zuverlässigkeit im Fahrzeug- und Maschinenbau. Springer: Berlin. • Bertsche, B. (2008): Reliability in Automotive and Mechanical Engineering. Springer: Berlin. • Ehrlenspiel, K. (2009): Integrierte Produktentwicklung. Hanser: Munich **Product design:** • Bernhard E. Bürdek (2015): Design: History, Theory and Practice of Product Design, Birkhäuser, 2015 • Gerhard Heufler (2012) Design Basics, From the Idea to the Product, Niggli **Innovation project:** • Michael Lewrick & Patrick Link & Larry Leifer: The Design Thinking Playbook; Wiley (2018) • Sandrine Fernez-Walch: The Multiple Facets of Innovation Project Management; Wiley ISTE; (2017) • Großklaus, Rainer H. G.: Von der Produktidee zum Markterfolg. - 2nd ed. 2014. - Wiesbaden : Gabler Verlag, (2014). http://dx.doi.org/10.1007/978-3-8349-4594-5
Workload	Indication per course: Workload: 3 ECTS x 30 h = 90 h Attendance time: 2 SWS x 15 weeks = 30 h Preparation/review, exercises, preparation and execution of the examination: 60 h.
Media employed	Slides, graphic and digital drafts and descriptions, tasks for individual and group work, short talks, group and plenary discussions, actual prototypes

B Operations Management

"Operations Management"	
Code	BAE4710
Semester	6 or 7
Level	Professionally qualifying academic level
Credits / ECTS	12
Contact hours per week	8
Related courses	BAE4056 Supply Chain Management BAE4151 Quality and Improvement BAE4711 Production Design BAE4712 Future Oriented Production Concepts
Requirements according to the examination regulations	All examinations of section 1 of the study program must have been passed.
Recommended prerequisites	Extensive prior knowledge from previous courses within the modules Manufacturing Technology I and II, Operations Management and Logistics and Management Accounting.
Type and duration of examination (only in case of PLK/PLM)	Each PLH/PLL/PLK/PLP/PLR (60 mins)
Language	English
Module coordinator	Prof. Dr. Kühn
Lecturer	Supply Chain Management: Prof. Dr. Peter Quality and Improvement: Prof. Dr. Oßwald Production Design: Prof. Dr.-Ing. Weyer, Prof.Dr. Kühn Future Oriented Production Concepts : Prof. Dr. Kölmel
Relation to curriculum	WI International Management – Compulsory subject in 6th/7th semester
Teaching methodology	Seminar style course, laboratory sessions, project work
Objectives / intended learning outcomes	Students are able to • describe methods for analysis of logistics and production engineering processes as well as their characterizing parameters, • understand the specific features of different manufacturing principles, • optimize existing processes in production and logistics or plan them anew by systematically applying methods of quality management and continuous improvement systems, • describe the phases of factory planning, • independently implement a layout plan and a work place design in a case study taking ergonomic aspects into consideration, • comprehend relevant trends and new developments in terms of opportunities and risks, and their implications for operations management, and apply them accordingly.
Content	**Supply Chain Management:** Basics and definition of supply chain management, planning levels of supply chain management, supply chain strategy, supply chain planning, supply chain execution, coordination in supply chain, supply chain configuration in theory and practice. **Quality and Improvement:** Concepts and methods of quality management with special relevance for production and logistics processes including factory planning; concepts and methods of continuous improvement systems.

	Production Design: Design and optimisation of processes, workplaces and layouts in the production environment taking technical, economic and ergomatic aspects into consideration; phases of factory planning; familiarisation with and application of relevant methods in production design. **Future Oriented Production Concepts:** Current developments in operations management will be discussed in depth. The students deal intensively with the topics as project work, preferably involving external business partners: Possible topics include production systems, cyber physical systems, internet of things and product service systems:
Reading list	**Supply Chain Management:** • Chopra, S. (2018): *Supply Chain Management: Strategy, Planning and Operation.* 7th Edition, Pearson: London. • Heizer, J., Render, B. (2016): *Operations Management.* 11th Edition, Pearson: London. • Handfield, R. B., Monczka, R. M., Giunipero, L. C., Patterson, J. L. (2016): *Sourcing and Supply Chain Management.* 6th Edition, Cengage Learning: Florence (KY). Other recommended practitioner journals: • Inside Supply Management • Supply Chain Quarterly **Quality and Improvement:** Will be announced in the syllabus. **Production Design:** Will be announced in the syllabus. **Future Oriented Production Concepts:** • Petri Helo, Angappa Gunasekaran, Anna Rymaszewska (2017): *Designing and Managing Industrial Product-Service Systerms*. Springer: Switzerland. • Tisch, M., Abele, E., Metternich, J. (2019): *Competencies for Future Production – Concepts, Guidelines, Best-Practice Examples*. Springer: Switzerland.
Workload	Workload for each class: 3 ECTS x 30 hrs = 90 hrs Class attendance: 2 SWS x 15 weeks = 90 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 60 hrs
Media employed	Lecture, laboratory work, seminar style course, project work

C International Technical Sales

"International Technical Sales "	
Code	BAE4720
Semester	6 / 7
Level	Professionally qualifying academic level
Credits / ECTS	12
Contact hours per week	8
Related courses	BAE4025 International Marketing BAE4721 Business Plan and Business Models BAE4722 International Technical Sales 3 BAE4037 Marketing Simulations
Requirements according to the examination regulations	All examinations of section 1 of the study program must have been passed.
Recommended prerequisites	Successful attendance of: International Technical Sales 1 International Technical Sales 2
Type and duration of examination (only in case of PLK/PLM)	Each PLH/PLL/PLK/PLP/PLR (60 mins)
Language	German and English
Module coordinator	Prof. Dr. Wupperfeld
Lecturer	International Marketing: Prof. Dr. Wupperfeld Business Plan and Business Models: Prof. Dr. Wupperfeld International Technical Sales 3: Prof. Dr.-Ing. Hinderer Marketing Simulations: Prof. Dr.-Ing. Hinderer
Relation to curriculum	WI International Management, WI Innovation and Design – Compulsory subject in 6th/7th semester
Teaching methodology	Seminar style courses
Objectives / intended learning outcomes	The students know the fundamental concepts of marketing in the areas of international marketing, market research and technical sales. They learn the basics of this subject area which will then be consolidated. Concepts, methods and technical implementations will be developed using practical case studies. The students are able to apply the knowledge gained from environmental analysis and market research to proposals for the design of business models and successful market development. In addition, the participants work on selected practical projects to develop marketing-specific solutions.
Content	**International Marketing:** Cultural environment of global marketing, international business activities and multinational market groups, corporate context of marketing. **Business Plan and Business Models:** Students independently develop business models and business plans for concrete projects or business ideas. Aspects of product and service development, market research, marketing and corporate planning are all brought together. **International Technical Sales 3:** International capital goods and services marketing, analysis of international markets and derivation of market entry and market development strategies based on real case studies and sound market research. Preparation of international sales situations.

	Marketing Simulations: Simulations of realistic cases from the perspective of market-oriented corporate management. Designed as a business simulation in which the participants make their own marketing decisions. All marketing mix elements are applied in specific company situations in the context of a simulated market with competing companies. For example, communication campaigns should be designed to support a concrete sales situation. The participants have to justify and substantiate their marketing and sales specific decisions.
Reading list	**International Marketing:** • Usunier, J. (2000): *Marketing Across Cultures*. 4th edition, Prentice Hall: Harlow. • Backhaus, K. / Büschken, J. / Voeth, M. (2003): *Internationales Marketing*, Schäffer-Poeschel: Stuttgart. • Backhaus, K./ Büschken, J. / Voeth, M. (2005): *International Marketing*. Palgrave MacMillan: Basingstoke. • Usunier, J. (2004): *Marketing international: développement des marchés et management multiculturel*. 2nd edition, Vuibert: Paris. **Business Plan and Business Models:** • Nagl, A. (2018): *Der Businessplan - Geschäftspläne professionell erstellen.* Springer Gabler: Wiesbaden. • Wupperfeld, U. (1999): *Der Business-Plan für den erfolgreichen Start.* mvg-Verlag. Backhaus, K., Schneider, H. (2019): *Strategisches Marketing.* Schäffer-Pöschl: Stuttgart. **International Technical Sales 3:** • Backhaus, K., Voeth, M. (2010): *Internationales Marketing.* 10th edition., Schäffer-Poeschel: Stuttgart. • Kotler, P., Keller, K. L., Bliemel, F. (2007): *Marketing-Management - Strategien für wertschaffendes Handeln*. 12th edition., Pearson: München. • Meffert, H. et al. (2007): *Marketing - Grundlagen marktorientierter Unternehmensführung.* 10th edition., Gabler: Wiesbaden. **Marketing Simulations:** • Kotler, P. (2012): *Marketing Management*. 2nd Europ. Edition. Pearson: München. • Meffert, H. et al. (2015): *Marketing: Grundlagen marktorientierter Unternehmensführung*. 12th edition, Springer-Gabler: Wiesbaden. • Wöhe, G. (2011): *Einführung in die Betriebswirtschaftslehre*. 24th edition, Vahlen: München. • Backhaus, K. / Voeth, M. (2010): *Internationales Marketing*. 10th edition, Schäffer-Poeschel: Stuttgart.
Workload	For each class: Workload: 3 ECTS x 30 hrs = 90 hrs Class attendance: 2 SWS x 15 weeks = 30 hrs Preparation and follow-up, practical work, preparation for and completion of examination: 60 hrs
Media employed	Presentation, workshops, project reports and documentation