HOCHSCHULE ANSBACH

Module Guide

Engineering and Management

- Bachelor -

Study Examination Regulations (SPO) 2019

Faculty Technology

Date: 2020-01-14

Content

1 Introduction to the course of studies

Engineering and Management			
Short form:	WIG	**SPO-Nr.:**	HSAN-20152
Program Director:	Prof. Dr.-Ing. Yvonne Leipnitz-Ponto		
Study Counseling:	Prof. Dr.-Ing. Yvonne Leipnitz-Ponto		
ECTS:	210 Points		
Normal period:	7 Semester		
Prerequisite for participation:	University entrance qualification (general or subject-specific), Fachhochschulreife, university entrance for (particularly) qualified professionals		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

The aim of the course is to provide the future engineer and manager with the specialist, methodological and social skills necessary for the independent application of scientific knowledge and procedures and for supervisor action in business and society.
Furthermore, the course should create the prerequisites for students to think and act entrepreneurially, actively shape innovations and to meet the permanent challenges of an internationalized world. A further aim of the course is to prepare students for a Technology-driven world economy by means of the modules listed starting with module number 5000. Thus the industrial engineer is professionally positioned between business administration and Technology, and
This means an interface that requires interdisciplinary thinking and action as well as the ability to work as a team and coordinate specialised operational staff, as well as their orientation towards common goals.
In addition to the targeted acquisition of specialist knowledge, the course is designed to train the ability to grasp overarching contexts, to react flexibly and to lead people. The ability to make decisions, to communicate and to cooperate should be developed and promoted.

Content:

The standard period of study is 7 semesters with a total volume of 210 ECTS credits.

The practical semester should be the fifth semester.

The programme is divided into the following module groups:

- General compulsory modules
- Specialist compulsory modules
- elective modules
- Optional compulsory bridge modules
- specialization modules
- Practical study semester
- bachelor thesis

From the third semester onwards, the following study areas are offered in accordance with the curriculum:

Engineering Sciences:
- Energy Technology
- plastics Technology
- medical Technology

- systems Engineering Economics and General Sciences: - International Management - Product Management
Graduation / Academic degree:
Bachelor of Engineering, Short form: „B.Eng.“

2 Module descriptions

2.1 General compulsory modules

Mathematics I		
Abbreviation:	WIG-Mathematics I	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	1
Module supervisor:	Prof. Dr. rer. nat. Schmidt, Torsten	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only winter semester	
Courses of the module:	Mathematics I (WIG-Mathematics I)	
Teaching forms of the module:	WIG-Mathematics I: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or study plan	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

The students develop the most important terms, concepts and laws of mathematics for an industrial Engineering course. They understand the prerequisites, the functionality and the applicability of mathematical methods.

Competence to act:

The students master the mathematical calculations and are able to transfer their knowledge to the fields of technical sciences practically and to draw conclusions from the results.

Social competence:

The students organize themselves in learning groups in such a way that mathematically strong and rather weaker pupils come together to work together on the subject of the lecture. In this way, both sides benefit from each other and an optimal learning outcome is achieved in the overall picture.

Content:

- Equations and inequalities
- Complex numbers (representation forms, basic arithmetic operations)
- Vector algebra and matrix calculation
- Functions and curves
- Differential Calculus and Integral Calculus
- Linear Algebra and Analytical Geometry
- Statistics

Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the award of credit points is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Papula Mathematik, Bände 1-6 Papula Formelsammlung Mathematik für Fachhochschule, Walz Mathematik leicht gemacht, Kreul

Mathematics II		
Abbreviation:	WIG-Mathematics II	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	2
Module supervisor:	Prof. Dr. rer. nat. Schmidt, Torsten	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Mathematics II (WIG-Mathematics II)	
Teaching forms of the module:	WIG-Mathematics II: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

The students develop the most important terms, concepts and laws of mathematics for an industrial Engineering course. They understand the prerequisites, the functionality and the applicability of mathematical methods.

Competence to act:

The students are proficient in mathematical calculations and are able to transfer their knowledge practically to the fields of technical sciences and to draw conclusions from the results.

Social competence:

The students organize themselves in learning groups in such a way that mathematically strong and rather weaker pupils come together to work together on the subject of the lecture. In this way, both sides benefit from each other and an optimal learning outcome is achieved in the overall picture.

Content:

- Series developments (power, Taylor and Fourier series)
- Fourier and Laplace transformations
- Ordinary differential equations
- Ordinary DGL. systems
- Multidimensional functions
- Extreme value calculation and error calculation
- Area and volume calculations

Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Papula Mathematics, Bände 1-6 Papula Formelsammlung Mathematics für Fachhochschule, Walz Mathematics leicht gemacht, Kreul

Physics		
Abbreviation:	WIG-Physics	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	1
Module supervisor:	Prof. Dr. rer. nat. Schmidt, Torsten	
Language:	German	
Credits / SWS:	7.5 ECTS / 6 SWS	
Workload:	Contact hours:	65 h
	Self-study:	160 h
	Total expenditure:	225 h
Module duration:	2 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Physics (WIG-Physics)	
Teaching forms of the module:	WIG-Physics: SU/Ü/Pr - seminaristic Classes/Exercise/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	School knowledge physics	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

The students develop the most important terms, concepts and laws of physics for an industrial Engineering course. They become acquainted with the physical knowledge method (modelling, calculation and measurement) and its implementation in Technology. In practical training, the systematic preparation, implementation and evaluation of simple physics experiments is practiced.

Competence to act:

The students master the description and calculation of physical-technical interrelationships and can quickly penetrate new technical fields on this basis. The students are able to set up their own physical measurement setups, carry out measurements and evaluate the results within the framework of measurement uncertainty.

Social competence:

The practical training is conducted in small groups. Preparation and implementation must be coordinated within the group and the elaboration carried out jointly in the team and represented in relation to the practical training supervisors.

Content:

The module consists of the seminaristic classes, the exercises and the practical training with the following topics:

- Basics of mechanics and conservation laws of physics
- Fundamentals of vibration and wave theory

- Elementary Fluid Mechanics
- Introduction to thermodynamics
- Basics of electrodynamics
- Radiation and wave optics
- Introduction to quantum physics.

In the practical training six experiments of 1.5 h each are carried out on the above subjects.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Gerthsen-Physik
Feynmans Physikalische Vorlesungen
Tipler/Orear Physik
Hering Physik
Giancoli-Physik
Eichlers Neues Physikalisches Grundpraktikum
Lindner, Physik für Ingenieure

Electrical Engineering

Abbreviation:	WIG- electrical Engineering	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	2
Module supervisor:	Prof. M. Sc. Weiherer, Stefan	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	electrical Engineering (WIG- electrical Engineering)	
Teaching forms of the module:	WIG- electrical Engineering: S/Pr - Seminars/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Mathematics I (Differential/Integral, systems of equations with matrices, vectors, etc. of 1st order, complex calculation)	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

The students get to know the essential electrical quantities and gain an overview of physical and technical effects and interrelationships in electrical Engineering. They understand application-oriented basic functions of important devices and installations in electrical Engineering and electronics. The understanding is strengthened by exercise tasks integrated into material transfer, some of which can be solved independently.

Competence to act:

Students acquire basic methodological skills for Engineering approaches and problem solving, i.e. they learn to assign electrical effects to specific applications and to calculate simple electrical arrangements.

Social competence:

The understanding of the acquired knowledge and its application are deepened in practical training by the students, working together in groups on problems and learning - first with help, then independently - how to clearly document procedures and results in reports.

Content:

- Charge and current (current density, applications)
- electric field (potential, power, work, efficiency)
- DC networks
- Storage of electrical charges (capacitor, capacity)
- Magnetism and magnetic materials

- Magnetic Induction (generator, electrical machines, applications)
- Alternating current Technology (complex voltages, currents and power)
- Alternating current networks with impedances
- Three-phase current (mains with balanced load, protective functions)
- Applications in electronics (semiconductor, diode, MOS transistor, memory, integration, OP amplifier)

The seminar includes exercises as well as practical training

- (four lessons of 1.5 h each).

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or study plan.

Literature:

- Moeller: Grundlagen der Elektrotechnik, Wiebaden, Vieweg+Teubner, 2008
- Hagmann, Gert: Grundlagen der Elektrotechnik, Wiebelsheim, Aula-Verlag, 2008
- Hagmann, Gert: Aufgabensammlung zu den Grundlagen der Elektrotechnik, Wiebelsheim, Aula-Verlag 2006
- own help sheets

Design Engineering		
Abbreviation:	WIG- Design Engineering	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	1
Module supervisor:	Prof. Dr.-Ing. Emmerich, Ulf	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Design Engineering (WIG- Design Engineering)	
Teaching forms of the module:	WIG- Design Engineering: SU/Ü/Pr - seminaristic Classes/Exercise/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Successful participation in CAD exercises, successful participation in technical drawing.	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

Students are able to create simple drawings and CAD constructions.

Competence to act:

Students are able to acquire knowledge about the design of machine elements.

Social competence:

none

Content:

Introduction to methodical design, calculation of machine elements, application of technical rules and standards, technical drawing, CAD.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Roloff-Matek: Maschinenelemente
Labisch, Weber: Technisches Zeichnen
CAD: Online Lehrbücher SolidWorks

Material Science and Engineering			
Abbreviation:	WIG- Material Science and Engineering		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	2	
Module supervisor:	Prof. Dr.-Ing. Sover, Alexandru		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	only Summer semester		
Courses of the module:	Material Science and Engineering (WIG- Material Science and Engineering)		
Teaching forms of the module:	WIG- Material Science and Engineering: SU/Ü/Pr - seminaristic Classes/Exercise/Practical training		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

Description of the primary types of materials (metals, ceramics, polymers) and composites; production, processing and their application. The relationships that exist between the structural elements of materials and their properties are presented. Material characterization and testing technologies are presented with different practical exercises.

Competence to act:

Knowledge of important materials as a basis for decisions on their technical use

Social competence:

Ability to work in a team/communicate through work in practical training groups

Content:

The module consists of seminaristic classes and laboratory practical training.

Seminaristic Classes:

- Material basics knowledge (structure, types, importance, etc.)
- Extraction, production and processing
- Physical and chemical material properties
- Characteristic applications of different materials as metals, plastics, ceramics, glasses and composites.
- Materials testing

Practical training (six attempts of 0.75 h each):

Materials testing with static and dynamic tests, non-destructive testing, magnetic properties, rheology.
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Kirchhöfer, H. and Sover, A.: lecture notes • Shackelford, J.: »Indroduction to Materials Science for Engineers«, Pearson Education, Prentice Hall, München • Bergmann, W.: »Werkstofftechnik«, Bd. 1 und Bd. 2, C. Hanser, München • Kalpakjian, S., Schmid, St.: »Manufacturing Processes for Engineering Materials«, Pearson Education, Prentice Hall, München Practical training: • Macherauch, E., Zoch, H.-W.: »Praktikum in Werkstoffkunde«, Springer Vieweg, Wiesbaden • Dohmke, WW.: »Werkstoffkunde und Werkstofforüfung«; Cornelsen, Berlin

Engineering Mechanics

Abbreviation:	WIG- Engineering Mechanics	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	1
Module supervisor:	Prof. Dr.-Ing. Emmerich, Ulf	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Engineering Mechanics (WIG- Engineering Mechanics)	
Teaching forms of the module:	WIG- Engineering Mechanics: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical and methodological competence:

The students are able to calculate the force and moment effect inside components and the resulting deformation.

Competence to act:

The S. are able to apply statics and strength theory. The students gain a basic understanding of the interaction of forces and moments in components.

Social competence:

none

Content:

The course will be accompanied by exercises.

The main topics of this module include:

- Basics of Statics of Rigid Bodies
- Balance on the rigid body
- Circulation calculations
- Cutting reactions on the beam
- timber frameworks
- Friction between solid bodies

- Fundamentals of strength mechanics - stresses in the component - Substance Laws and State of Distortion - Bending of the beam and bending line - transverse shear stresses - Torsion of cylindrical beam - comparative stress hypotheses - Stability and buckling
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Gabbert, Raecke: Technische Mechanik für Wirtschaftsingenieure

Business administration		
Abbreviation:	WIG- Business administration	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	1
Module supervisor:	Prof. Dr. rer. pol. Götz, Burkhard	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Business administration (WIG- Business administration)	
Teaching forms of the module:	WIG- Business administration: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional / methodical competence:

The students

- are familiar with the instruments, functions and laws of operational production
- understand the relevant relationships between companies and the environment as the result of constitutive decisions within the framework of corporate Management
- get an overview of the different types of businesses

Competence to act:

The students

- can solve operational and strategic Management tasks
- master an interdisciplinary approach to the analysis of existing problem areas

Social competence:

none

Content:

- Objectives of companies (material and formal objectives)
- Economic factors of production
- Performance functions (research and development, procurement, service provision, sales Management, logistics, waste disposal)
- Corporate finance (investment, financing, payment transactions)

- Operational Management (planning, organisation, controls, controlling) - Operational accounting (financial accounting, operational accounting, consideration of the environment in accounting) - Life cycle of the business (start-up, restructuring, crisis). The module consists of seminaristic classes and case studies.
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Beschorner, Dieter; Peemöller, Volker: Allgemeine Betriebswirtschaftslehre, 2. Aufl., Herne 2005

Accounting and balancing		
Abbreviation:	WIG- Bookkeeping and Accounting	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Industrial Engineering and Management - Bachelor	1
Module supervisor:	Prof. Dr. sc. pol. Konle, Matthias	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Bookkeeping and Accounting (WIG- Bookkeeping and Accounting)	
Teaching forms of the module:	WIG- Bookkeeping and Accounting: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Industrial Engineering and Management	

Learning outcomes:

Technical and methodological competence:

The students

- know the different areas of accounting and their different tasks,
- are familiar with the technique of double-entry bookkeeping and know the commercial law regulations of individual financial statement,
- know the fundamental differences between accounting according to German and international law.

Competence to act:

The students

- are able to participate in the preparation of an annual financial statement,
- are able to analyse and evaluate annual financial statements,
- develop the ability to better assess and judge the economic consequences of entrepreneurial action.

Social competence:

none

Content:

- Differentiation between financial reporting and cost accounting and their subareas
- Double-entry accounting system and technique, with general accepted accounting principles and legal rules
- Organization of accounting (chart of accounts and accounts code)
- Posting of intra-year business transactions in commercial and industrial enterprises

- Preparation of an annual financial statement - Fundamentals of balance sheet analysis, creation and interpretation of key figures - Main features of balance sheet policy (design options) - Comparison of accounting according to HGB and international regulations (IFRS, US-GAAP).
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Döring, Ulrich und Rainer Buchholz: Buchhaltung und Jahresabschluss. 15. Auflage, Berlin 2018

Informatics

Abbreviation:	WIG-Informatics	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	2
Module supervisor:	Prof. Dr. rer. pol. Pidun, Tim	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Computer science (WIG-Computer science)	
Teaching forms of the module:	WIG-Computer science: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

The students are familiar with the basics of object-oriented programming with Java.

They understand the role of variables, methods and parameters and are familiar with the use of the most important control structures. They also have detailed knowledge in the programming of graphical user interfaces.

The students are able to solve and evaluate smaller software development tasks with an economic or Engineering problem background and to independently adapt them to restrictions. Students are also able to assess software tools in terms of their performance and capabilities as well as their extensibility. The learning of further programming languages such as VBA, C or Matlab is greatly facilitated.

Social competence:

Students learn to work together in small groups constructively during exercises. By presenting selected exercises, they expand their presentation skills and are able to articulate themselves comprehensibly in the domain specific (programming) language.

The module or course consists of seminaristic classes and exercises.

Content:

Introduction to Java, graphics introduction, variables and calculations, methods and parameters, event-driven programming, decisions - if, repetitions - loops, objects and classes, user interfaces, one- and multidimensional arrays, strings, acoustic and visual elements

Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• D.Bell, M.Parr: Java für Studenten – Grundlagen der Programmierung, 3. Auflage, Prentice Hall 2003 • D. Louis, P. Müller: Jetzt lerne ich Java 5, Markt+Technik 2005 • G. Krüger: Handbuch der Java-Programmierung, 5. Auflage, Addison-Wesley 2008 (www.javabuch.de) • D. Flannagan: Java in a Nutshell, germane Ausgabe, 4. Auflage 2003, O'Reilly Verlag

Technical English		
Abbreviation:	WIG-TechnEnglish	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	1
Module supervisor:	Dr. Zürn, Martina	
Language:	English	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Technical English (WIG- TechnEnglish)	
Teaching forms of the module:	WIG- TechnEnglish: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Englisch in Wort und Schrift, Niveau Fachabitur	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

Ability to use the English language in word and writing in a professional and technical way.

Competence to act:

Application of the above-mentioned competence in a real environment.

Social competence:

Development of a technical vocabulary through close interaction with the relevant subjects. Understanding and adequate presentation

Content:

Use of the language in professional and private situations, taking into account country-specific peculiarities.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Documents on topics of the lecture

Basic internship			
Abbreviation:	WIG- Basic internship		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	1	
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne		
Language:	German		
Credits / SWS:	3 ECTS / 0 SWS		
Workload:	Contact hours:		0 h
	Self-study:		0 h
	Total expenditure:		90 h
Module duration:	4 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Basic internship (WIG-Basic internship)		
Teaching forms of the module:	WIG-Basic internship: practical activity		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	none		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

Students should gain insights into the professional field of an engineer and manager.

Action competence:

Students should get to know the first processes in companies and apply them in a real environment.

Social competence:

Students experience working in a team.

Content:

In the first two years of study, students must complete a basic practical training course of eight weeks full-time. The basic practical training is to be carried out in a contiguous manner or in any number of sections with a relevant practical activity corresponding to the course of studies in a company or other institution of professional practice outside the university.

Studies- / Examination performance:

proof of employment

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Documents provided by the companies

Automation Technology		
Abbreviation:	WIG-Automation Technology	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr. Göhringer, Jürgen	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Automation Technology (WIG-Automation Technology)	
Teaching forms of the module:	WIG-Automation Technology: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Mathematics, Electrical Engineering, Applied Physics and Computer Science	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students gain a deeper understanding of the language, goals, potentials, working methods and technical realizations of automation Technology. In addition, methodological competencies and system-oriented thinking are strengthened.

Students have knowledge and understanding of the Technology in automation from some of the typical application examples dealt with.

Competence to act:

The students learn to classify important terms of automation Technology as well as to distinguish goals and tasks of automation. They also can explain examples.

Social competence:

The understanding of the acquired knowledge and its application are deepened in practical training, in which the students work together in groups on problems and clearly document procedures and results in independently conceived reports.

Content:

The following contents are taught in the Automation Technology module:

- Automation systems and structures
- Input and output systems as process peripherals (sensors)
- Electrical drive systems for production equipment

- communications systems
- Programmable logic controllers (PLC)
- NC machines and Controls (CNC)
- Robots and Controls (RC)
- SCADA systems
- MES systems

The module consists of seminaristic classes with practical example projects as well as practical training (seven attempts of 1.5 h each).

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Lecture script
- Lauber, R; Göhner, P. Prozessautomatisierung 1 und 2 4. Aufl. Berlin, Heidelberg, New York: Springer Verlag 2013
- Heimbold, T.: Einführung in die Automatisierungstechnik Carl Hanser Verlag, München, 2014
- Langmann, R., Taschenbuch der Automatisierung, Carl Hanser Verlag, 2010

Energy Management		
Abbreviation:	WIG- Energy Management	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr.-Ing. Dehs, Rainer	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	Wintersemester	
Courses of the module:	Energy Management (WIG- Energy Management)	
Teaching forms of the module:	WIG- Energy Management: SU - seminaristic teaching	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students have an insight into the history of energy Technology. They know about conventional energy sources as well as about the limitations of resources.

They can understand the main features of both, conventional and regenerative energy conversion processes. They have an overview of the interaction of the currently used technologies for energy supply, as well as their economic and political aspects.

Competence to act:

Students are able to classify the various energy conversion processes. For wind and hydropower plants, they are able to make basic calculations on energy yield and economic efficiency. In the field of electrical energy, they are able to carry out the entire describe the process chain from the deposit of primary energy to the consumer.

Social competence:

In occasional discussions on current topics during the lecture, they further develop their discussion culture.

Content:

- Introduction and History
- Energy sources and energy needs
- Energy conversion; thermal processes
- Energy conversion; renewable energy sources
- Energy transport, storage and interconnected operation

• The course consists of seminaristic teaching and exercises.
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Lecture skript • Strauß, Karl: Kraftwerkstechnik zur Nutzung fossiler, regenerativer und nuklearer Energiequellen; Springer-Verlag, 7. Auflage, 2016

Process Engineering and Environmental Technologies

Abbreviation:	WIG- Process Engineering and Environmental Technologies	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Process Engineering and Environmental Technologies (WIG- Process Engineering and Environmental Technologies)	
Teaching forms of the module:	WIG- Process Engineering and Environmental Technologies: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Previous Physics, Mathematics, Materials Engineering knowledge	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

Students have knowledge of selected basic operations in process and environmental Engineering. They understand the implementation of material conversion processes in apparatuses and machines, their functional principle and their integration into complete plants.

Competence to act:

The students possess the ability to basic-engineer as a basis for the comparative evaluation of different plant concepts with the aim of a profitability analysis for investment decisions.

Social competence:

The students organise themselves in small groups and carry out practical training experiments. Subsequently, they work together to draw up a protocol of results in due time. This trains team and communication skills. Exercises during the lecture can also be worked on in small groups.

Content:

In the module "VUT" physics and chemistry basics are repeated and based on that Engineering basics and knowledge are imparted.

The module consists of seminaristic classes, exercises, practical examples, practical training (two attempts of 2 h each) and an excursion.

Content 1 Basics: Material Data, Trigonometric Functions, Ideal Gas Law, Reaction Equations

and stoichiometry, linear systems of equations

Content 2 Process Engineering: Particle measurement Technology (characterisation of bulk solids, handling of bulk solids) with practical training (classification, distribution laws, adsorption, balancing); drinking water and waste water treatment, waste gas purification (conversion of concentrations, balancing of material flows)
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Grundlagen der Verfahrenstechnik für Ingenieure (Bockhardt, Güntzschel, Poetschukat) Verfahrenstechnik für Ingenieure (W. Hemming)

Manufacturing Technology			
Abbreviation:	WIG-Manufacturing Technology		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	3	
Module supervisor:	Prof. Dr. rer. pol. Pidun, Tim		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	45 h	
	Self-study:	105 h	
	Total expenditure:	150 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Production Engineering (WIG-Production Engineering)		
Teaching forms of the module:	WIG-Production Engineering: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Materials Engineering, Technical mechanics		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical method competence:

Knowledge of important manufacturing processes and their task of forming workpieces from specified material according to specified geometric conditions and assembling them into functional products.

Competence to act:

The Students develop the ability to assess these processes in terms of quality, economy, flexibility and resource savings.

Social competence:

Goal-oriented, group-oriented development of problem solutions

Content:

Manufacturing processes with shaping, forming, separating and joining. Production systems with machinery and tools, workpieces and tool clamping, workpiece handling and CNC Technology.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:
Koether, Rau: Automatisierungstechnik für Wirtschaftsingenieure

Economics		
Abbreviation:	WIG- Economics	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	4
Module supervisor:	Prof. Dr. rer. pol. Götz, Burkhard	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Economics (WIG- Economics)	
Teaching forms of the module:	WIG- Economics: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional / methodical competence:
The students
- know the basic economic interrelationships
- understand the impact of pricing policy decisions on business success
- have an overview of the importance of the environmental economy

Competence to act:
The students
- master an interdisciplinary approach to the analysis of existing problem areas
- acquire the ability to analyse the current economic policy problems in Germanland and their solutions

Social competence:
none

Content:

- Object and history of the VWL
- Basic concepts of economic activity
- economic systems
- demand theory
- offer theory

- Price formation on markets - Macroeconomic paradigms - Economic policy The module consists of seminaristic classes and case studies.
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Bofinger, Peter, Grundzüge der Volkswirtschaftslehre, München 2003

Cost accounting			
Abbreviation:	WIG- Cost accounting		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Prof. Dr. rer. pol. Götz, Burkhard		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Cost accounting (WIG- Cost accounting)		
Teaching forms of the module:	WIG- Cost accounting: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Basic knowledge of business administration		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional / methodical competence:

The students

- know the importance and tasks of internal accounting as an information system in the company
- understand the reasons for the increased importance of cost and performance accounting for companies, especially in the current market environment

Competence to act:

The students

- can apply the building blocks as well as the various systems of cost and performance accounting according to the situation and assess them from an economic point of view
- can use cost Management tools to identify and exploit cost reduction potentials in the company
- master an interdisciplinary approach to the analysis of existing problem areas

Social competence:

none

Content:

- Basics and basic concepts of cost accounting
- Cost element, cost center and cost unit accounting
- Internal activity allocation
- Cost allocation systems on full and partial cost basis

- Target/actual comparison with deviation analysis - process cost calculation - Cost Management with target costing, life cycle costing and cost structure analysis. The module consists of seminaristic classes and case studies.
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Jorasz, William, Kosten- und Leistungsrechnung, 3. Aufl., Stuttgart 2003 • Olfert, Klaus, Kostenrechnung, 13. Aufl., Ludwigshafen 2003 • Steger, Johann, Kosten- und Leistungsrechnung, 3. Aufl., München 2001

Basics of information Management			
Abbreviation:	WIG- Basics of information Management		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	3	
Module supervisor:	Prof. Dr. Göhringer, Jürgen		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	Basics of information Management (WIG- Basics of information Management)		
Teaching forms of the module:	WIG- Basics of information Management: SU/Ü - seminaristic Classes/Exercise		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

Students have an insight into various operational information systems. They master the technical basics in the areas of Internet, databases, communication and architecture. In addition, methodological competencies and system-oriented thinking are strengthened. They have knowledge and understanding of the Technology in the information Technology from some treated typical application examples.

Competence to act:

The students learn to classify important terms of information Technology as well as to distinguish goals and tasks of the individual technologies and to define those using examples.

Social competence:

The understanding of the acquired knowledge and its application are deepened in practical training, in which the students work together in groups on problems and clearly document procedures and results in independently conceived reports.

Content:

The following contents are taught in the Internet and Databases module:

Operational information systems (ERP, PLM, MES, CRM, SCM)

- Application software and operating systems
- Internet Basics Technology

- HTML, CSS
- IT security and cryptography
- Relational database systems
- Entity Relationship Models and Normal Forms
- Database queries with SQL
- Architecture and licensing models

The module consists of seminaristic classes with practical example projects

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Lecture script
- Dembrowski, Klaus: Computernetzwerke. Addision-Wesley Verlag; 2012
- Schwenk, Jörg: Sicherheit und Kryptographie im Internet, Springer Vieweg Verlag, 2014
- Münz, Stefan, Clemens Güll: HTML5. Franzis Verlag, 9. Auflage, 2014
- Steyer, Ralph, Joomla! Einführung in das populäre CMS. Springer Vieweg Verlag, 2015

Marketing		
Abbreviation:	WIG-Marketing	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. rer. nat. Schnurpfeil, Roland	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Marketing (WIG-Marketing)	
Teaching forms of the module:	WIG-Marketing: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Business fundamentals	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/Methodological competence:

The students

- understand marketing as a customer-oriented company-wide way of thinking in the sense of a corporate philosophy
- know the basic instruments of strategic and operative marketing

Competence to act:

- Ability to implement the learned content in a problem-solving manner in all areas of marketing fundamentals
- Understanding and applicability of the learned theory on the basis of the decision-oriented approach
- Marketing-oriented competence / understanding

Social competence:

- Ability to work in a team / negotiation skills through exercises
- Presentation skills through short presentations on numerous individual topics (additional promotion of the ability to develop unknown content in a short period).

Content:

Strategic Marketing Overview (Strategic Analysis Process - Goals - Strategies - Actions - Control)

Overview of operative marketing and its instruments (marketing mix: 4 P (product, price, distribution and communication policy) and 4 C [Costs to the customer , Customer needs , Convenience and Communication])

Consideration of the following individual aspects:

- Marketing as part of the corporate philosophy
- Marketing as a critical success factor
- Methods and applications of market research and segmentation
- Observation and analysis of Technology and market developments
- Determinants of competitive advantage
- Competition analysis and analysis of your own competitive position
- Product positioning / brand Management
- Corporate Identity and Corporate Behavior
- Tasks and limits of product Management

Studies- / Examination performance:

written examination, 60 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Freter, Hermann: Marketing, Die Einführung mit Übungen, München 2004

Bruhn, Manfred: Marketing. Grundlagen für Studium und Praxis. 10. Auflage. Wiesbaden: Gabler Verlag, 2010

Kotler, Philipp, Armstron, Gary, Grundlagen des Marketing, Pearson,
2012

Technical sales and distribution

Abbreviation:	WIG- Technical sales and distribution	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Technical sales and distribution (WIG- Technical sales and distribution)	
Teaching forms of the module:	WIG- Technical sales and distribution: SU/case st. - seminaristic Classes/case studies	
Prerequisite for participation:	Laut SPO und Studiesplan	
Recommended requirements:	Basic knowledge of marketing	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students gain a deeper understanding of technical sales as an interface to customers in industry or capital goods marketing. They learn the special features

We know and recognize the need for a combination of technical expertise and communication skills for the distribution of technical products.

Competence to act:

Students learn technical sales concepts in industry and capital goods marketing as well as in business-to-business marketing. They will be able to develop customer-oriented sales strategies and sales concepts and design sales forms accordingly and will be familiar with sales instruments in technical sales.

Social competence:

Methods and theoretical knowledge in teamwork deepened, so that by practical case studies in Tea-mexerciseen and Workshops straight also the “soft” leading authority important for the selling such as communication, conflict treatment, co-ordination (role distribution) and consensus finding are component of the learning process.

Content:

- Explanatory approaches to intercompany transactions
- Special features and differentiation of technical sales (industrial / capital goods marketing, business-to-business marketing)
- Different sales concepts and forms

- Customer-oriented strategy development - Overview of sales instruments in technical sales - Instruments of sales Management / sales controlling - Trends in business-to-business business (Key Account Management...)
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Preußners, D., Mehr Erfolg im Technischen Vertrieb: 15 Schritte, die Sie voranbringen, Springer/Gabler Verlag, 2014.

Finance and investment Management		
Abbreviation:	WIG- Finance and investment Management	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	4
Module supervisor:	Prof. Dr. rer. pol. Götz, Burkhard	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Finance and investment Management (WIG- Finance and investment Management)	
Teaching forms of the module:	WIG- Finance and investment Management: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Basic knowledge of business administration	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional / methodical competence:

The students

- are familiar with the importance and tasks of corporate finance
- know the reasons for the increased importance of corporate financing, in particular in relation to the current market environment
- get an overview of the different types of businesses

Competence to act:

The students

- are proficient in the most important instruments of corporate financing
- can apply the building blocks as well as the various systems of investment calculation in a situation-related manner and assess them from an economic point of view
- can hedge market price risks with the aid of derivatives
- master an interdisciplinary approach to the analysis of existing problem areas

Social competence:

none

Content:

- investment planning

- Static investment calculation methods
- Dynamic investment calculation procedures
- Overview of financing transactions
- equity financing
- credit financing
- internal financing
- Instruments to limit interest rate and currency risks
- payment transactions
- Financial planning.

The module consists of seminaristic classes and case studies.

Studies- / Examination performance:

written exam, 60 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Perridon, L., Steiner, M., Finanzwirtschaft der Unternehmung, 10. Auflage, München 1999
- Zantow, R., Finanzierung, München 2004

Human Resource Management and Employment Law		
Abbreviation:	WIG- PuAR	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. iur. von Blumenthal, Astrid	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Summer semester	
Courses of the module:	Human Resource Management; Employment Law	
Teaching forms of the module:	SC - Seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Private Business Law	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Labour law:

Technical/methodological competence:

- Students are familiar with the legal foundations of human resources;

- They have a basic knowledge of the rights and obligations of the parties to the employment contract, the regulations on occupational health and safety, the consequences of breaches of duty in the employment relationship and the possibilities of termination.

Competence to act:

- Students are aware of possible sources of error in the establishment and performance of employment relationships.

- They are able to analyse and solve labour law problems.

Social competence:

- The students can ask questions in a target-oriented way and work out possible solutions in a team.

Personnel Management:

Technical/methodological competence:

- The students have knowledge of the importance of personnel Management and personnel Management in the company.

- They know psycho-social methods of personnel Management

Competence to act:

- The students are able to assess and select applicants based on the knowledge they have acquired, to support them in the selection process and to lead personnel independently and goal-orientedly.

Social competence:

- The students develop a pronounced ability for cooperation and communication.
- They are able to cope with typical crisis situations - even in a group

Content:

- Basic knowledge of the rights and obligations of the parties to the employment contract, the regulations of occupational health and safety, the consequences of breaches of duty in the employment relationship and the possibilities of termination is imparted. The effects of collective agreements, the works constitution and industrial disputes on the employment relationship are presented. In addition, the economic, psychological and sociological concepts of personnel Management and their application, the basics of teamwork and group dynamic processes are dealt with. Leadership styles and models as well as models of motivation, communication and conversation are developed.
- Teaching method: Lecture, Exercise, Seminaristic Classes

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Wörlen, Rainer u. Kokemoor, Axel, Arbeitsrecht, jeweils aktuellste Auflage
Steckler, Brunhilde u. Schmidt, Christa, Arbeitsrecht und Sozialversicherung, jeweils aktuellste Auflage
Teschke-Bährle, Ute, Arbeitsrecht - schnell erfasst, jeweils aktuellste Auflage
Jung, Hans, Personalwirtschaft, 9. aktual. u. verb. Auflage 2010
Krieg, Hans-Jürgen u. Ehrlich, Harald, Personal, 1998

Quality Management			
Abbreviation:	WIG-Quality Management		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Prof. Dr. rer. nat. Schnurpfeil, Roland		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	Winter Semester		
Courses of the module:	Quality Management (WIG-Quality Management)		
Teaching forms of the module:	WIG-Quality Management: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Basic knowledge of business administration		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional / methodical competence:

The students

- understand integrated Management systems as a strategic instrument of corporate Management
- are familiar with the special features of cross-sectional functions and tasks as well as their design in business practice.
- know the essential standards of quality, environmental protection and occupational health and safety (safety) Management.
- know the basic processes of implementation and evaluation of Management systems.

Competence to act:

Students will be able to assess and apply selected instruments of cross-departmental Management approaches. They know their areas of application.

Social competence:

The ability to work in a team is strengthened by team tasks. Students will be familiarized with the specific problems and difficulties that arise in cross-departmental tasks.

Presentations strengthen the ability to communicate in and in front of larger teams.

Content:

- Integrated Management Systems - Philosophy, Objectives, Structure, Documentation

- Quality Management systems (QMS) according to DIN EN ISO 9001:2000, extension by QS 9000, VDA 6-1, VDA-4;
- Environmental Management systems (EMS) according to the 14000 series of standards and EWG 1836/93 regulation (EC Eco-Audit)
- Occupational health and safety and safety Management systems (AMS) according to country guides, OHRIS, SCC, OHSAS 18001, ASCA model
- possible extensions to e.g. personnel Management, information and documentation Management, logistics Management
- Documentation of integrated systems according to VDI 4060 BI1
- Tasks and limits of integrated Management systems.

The course consists of seminaristic classes, case studies, group work and short presentations.

Studies- / Examination performance:

written exam, 60 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Welge, Al Laha, Strategisches Management; Gabler 4. Aufl. 2003
- Binner, H.F., Integriertes Organisations- und ProzessManagement, Hanser 1997
- Leonhard, K.W., Naum, P., Managementsysteme, DGQ-Band 11-04
- Becker, P., Prozessorientiertes Managementsystem, expert Verlag 2001
- Schmayer, B. Leitfaden ArbeitsschutzManagementsysteme, Hanser 1997
- Quality Management für Ingenieure; Gerhard Linß; Carl Hanser Verlag GmbH & Co. KG; Auflage: 3. aktualisierte und erweiterte Auflage (7. Juli 2011)

Production planning and logistics			
Abbreviation:	WIG-Production planning and logistics		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Industrial Engineering and Management - Bachelor	6	
Module supervisor:	Prof. Dr. sc. pol. Konle, Matthias		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Production planning and logistics (WIG-Production planning and logistics)		
Teaching forms of the module:	WIG-Production planning and logistics: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Basic knowledge of business administration		
Usability:	Bachelor Industrial Engineering and Management		

Learning outcomes:

Technical/methodological competence:

The students

- understand industry-independent and cross-functional tasks and instruments of production Management
- have an overview of the approaches of holistic production systems (Toyota production systems etc.) and know the associated methods and instruments.
- are familiar with different production types and their particularities.
- are familiar with organizational and process design methods.
- know the requirements and problems of internal and external logistics.

Competence to act:

The students

- can use selected production Management tools (SMED, KANBAN, VSA...)
- can analyse and evaluate production and production systems

Social competence:

- Ability to work in a team through group work
- Presentation skills through short presentations on numerous individual topics
- Promotion of the ability to develop unknown content in a short period of time

Content:
- Overview of the production and its different operational characteristics (manufacturing principles, etc.) - Decision fields of production planning (program, potential and process planning) - Quality orientation as a success factor in production - Trends in production planning / approaches and instruments of modern, integrated production systems (e.g. Toyota production system, BPS, TPM...) - Functions of PPS systems. - Fundamentals of internal and inter-company logistics The course consists of seminaristic classes, case studies and exercises.
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Günther, Hans-Otto und Horst Tempelmeier: Produktion und Logistik. Berlin u.a., 12. Auflage, 2016

Private business law

Abbreviation:	WIG-WPR	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr. iur. von Blumenthal, Astrid	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Private Business Law (WIG-Private business law)	
Teaching forms of the module:	SC - Seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

- Students have an overview of the most important areas that make up the broad field of Private Business Law.
- They are familiar with the application and interpretation of statutory laws, especially of the German Civil Code (BGB) and the German Commercial Code (HGB).

Competence to act:

- Students are able to recognise and analyse legal problems in business life.
- The students have the ability to analyse the facts of the case quickly and to implement the contents learned in smaller cases of professional practice in a problem-solving manner.

Social competence:

- Students are able to communicate with legal professionals without difficulty.
- They have the ability to articulate themselves precisely, comprehensibly and coherently.
- -

Content:

- Overview of the Germanic legal system and the most important areas that make up the broad field of Private Business Law;
- Introduction to the system and basic norms of private business law; overview of civil jurisdiction and enforcement. The following topics are dealt with: Legal business theory, general teaching of the law of obligations, especially the law of default;

- Sales law, law of general terms and conditions, basic principles of commercial and company law, product liability, civil jurisdiction and execution.

The module consists of Seminaristic Classes and Exercise.

Studies- / Examination performance:

Written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Ullrich, Norbert, Wirtschaftsrecht für Betriebswirte, jeweils aktuellste Auflage
- Kallwass, Wolfgang, Privatrecht, jeweils aktuellste Auflage
- Dieselben, Schuldrecht BT, jeweils aktuellste Auflage
- Führich, Ernst, Wirtschaftsprvatrecht, jeweils aktuellste Auflage
- Steckler, Brunhilde, Wirtschaftsrecht, jeweils aktuellste Auflage

Practical internship		
Abbreviation:	WIG- Practical internship	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	5
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert	
Language:	German	
Credits / SWS:	10 ECTS / 0 SWS	
Workload:	Contact hours:	0 h
	Self-study:	300 h
	Total expenditure:	300 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Practical internship (WIG- Practical internship)	
Teaching forms of the module:	WIG- Practical internship: Practical activity	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

The students develop the project subject and method competence for typical tasks of an industrial engineer in the operational practice.

Action competence:

During project processing, students are able to reliably achieve the economic, technical and scheduling goals of the project on the basis of an Engineering appropriate task at the Technology/economy interface. They are able to document the results of their work in the form of a scientific report. They are able to put into practice the technical and methodological competence acquired during their studies.

Social competence:

They integrate themselves into a hitherto unknown social environment and learn how to deal with problems as an element of the company hierarchy.

Content:

18-week operational project processing on the basis of an Engineering adequate task at the interface Technology/economy under the guidance of two mentors (professor, company). Intermediate and graduation presentation. Depending on the project, several of the following activities: Task analysis, concept design, costing, scheduling, obtaining and evaluating quotations for goods and services, project structuring, cost and deadline tracking, preparation of project documentation and handover, commissioning, review.

Training on the job

Studies- / Examination performance:
report The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
none

Research report			
Abbreviation:	WIG-Research report		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	5	
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert		
Language:	German		
Credits / SWS:	10 ECTS / 0 SWS		
Workload:	Contact hours:	0 h	
	Self-study:	300 h	
	Total expenditure:	300 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Research report (WIG-Research report)		
Teaching forms of the module:	WIG-Research report: project work		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

The students develop the project subject and method competence for typical tasks of an industrial engineer in the operational practice.

Action competence:

During project processing, students are able to reliably achieve the economic, technical and scheduling goals of the project on the basis of an Engineering appropriate task at the Technology/economy interface. They are able to document the results of their work in the form of a scientific report. They are able to put into practice the technical and methodological competence acquired during their studies.

Social competence:

They integrate themselves into a hitherto unknown social environment and learn how to deal with problems as an element of the company hierarchy.

Content:

Depending on the project, several of the following activities: Task analysis, concept design, costing, scheduling, obtaining and evaluating quotes for goods and services, project structuring, cost and deadline tracking, project documentation and delivery, commissioning, review.

Preparation of a research report in one or more of the above topics.

Studies- / Examination performance:

report

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
none

Working techniques I			
Abbreviation:	WIG-Working techniques I		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	5	
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert		
Language:	German		
Credits / SWS:	2.5 ECTS / 3 SWS		
Workload:	Contact hours:		35 h
	Self-study:		40 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Working techniques I (WIG-Working techniques I)		
Teaching forms of the module:	WIG-Working techniques I: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

Ideally, students should have access to the entire range of specialist and methodological skills they have acquired during their studies and should be able to consolidate and deepen their knowledge.

Competence to act:

They are proficient in structuring and organising a task with regard to the division of labour. They are also familiar with formulating, adhering to and communicating goals in terms of deadlines and content. Students are able to make use of the technical and methodological competence acquired during their studies for the respective task.

Social competence:

They recognise group-dynamic processes and know how to steer them in a goal-oriented manner. They recognize disturbances in the group and understand how to deal with them. They have initial knowledge of moderation. The students have an insight into group dynamic processes and know the basics of communication and work organisation.

Content:

The main topics of this event include:

- Basics of working techniques and working methods
- project organisation
- Goals, concepts and planning

- Strategic and tactical operational planning and design - knowledge Management - time Management - effectiveness - Company and corporate culture - Tasks and methods of personnel Management - Increasing the efficiency of an organization - Basics of labour law The module consists of Seminaristic Classes and Exercise.
Studies- / Examination performance:
Participation in the event The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
none

Working techniques II			
Abbreviation:	WIG-Working techniques II		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	5	
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert		
Language:	German		
Credits / SWS:	2.5 ECTS / 3 SWS		
Workload:	Contact hours:	35 h	
	Self-study:	40 h	
	Total expenditure:	75 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Working techniques II (WIG-Working techniques II)		
Teaching forms of the module:	WIG-Working techniques II: SU/Präs - seminaristic Classes/Präsentation		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

Ideally, students should have access to the entire range of specialist and methodological skills they have acquired during their studies and should be able to consolidate and deepen their knowledge.

Competence to act:

The students are able to present work results in an appealing way to a larger group. They learn to structure and design a lecture and to present it with a suitable time Management.

Social competence:

They know the basics of communication and develop their personality further during the independent presentation.

Content:

The main topics of this event include:

- Basics of working techniques and working methods
- Goals, concepts and planning
- Strategic and tactical operational planning and design
- time Management

The module consists of Seminaristic Classes and Exercise.

Studies- / Examination performance:
presentation The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
none

Team-oriented project thesis

Abbreviation:	WIG- Team-oriented project thesis	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	5
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne	
Language:	German	
Credits / SWS:	5 ECTS / 0 SWS	
Workload:	Contact hours:	10 h
	Self-study:	140 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Team-oriented project thesis (WIG- Team-oriented project thesis)	
Teaching forms of the module:	WIG- Team-oriented project thesis: project thesis	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

- The students have specialist knowledge from the general and subject-specific compulsory modules as well as from the core modules.
- They understand the structure and functional principle of technical plants and plant components in production Engineering in the field of plastics, energy and environment.
- You are familiar with the basics of accounting, cost and performance accounting, finance and investment Management and know the elements of marketing.
- The students also master the most important modern information and communication technologies.

Competence to act:

- They are able to analyse practical problems and develop proposals for solutions from a technical and economic point of view.

Social competence:

- - The students are able to organise themselves jointly in a team and work on a task in a structured way.

Content:

- Issue of a "task" by the supervising professor to the team with approx. 2 to 4 participants,
- Development of a concept proposal and coordination with the supervising professor,
- Independent processing of the task
- Graduation meeting with the supervising professor

- Completion of the project work (considering the information if necessary).
Studies- / Examination performance:
report The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
none

Bachelor thesis			
Abbreviation:	WIG-Bachelor thesis		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	7	
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne		
Language:	German		
Credits / SWS:	12 ECTS / 0 SWS		
Workload:	Contact hours:	0 h	
	Self-study:	360 h	
	Total expenditure:	360 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Bachelor thesis (WIG-Bachelor thesis)		
Teaching forms of the module:	WIG-Bachelor thesis: BAr - Bachelor thesis		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Successful completion of the practical semester		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

The students are familiar with the methods of project Management. They know how to structure a task and how to combine the partial results into a meaningful whole.

Competence to act:

The students are able to make use of the technical and methodological competence acquired during their studies to solve a problem at the interface Technology/economy at the Engineering level. They are familiar with the application of scientific methods as well as the more appropriate documentation of the results in the form of a written paper with a scientific claim. They know how to adhere to cost and deadline specifications as well as specifications for the execution of the target product.

Social competence:

The students integrate themselves into the social and hierarchical structure of a previously unknown company.

Content:

Working on a task from the operational practice under guidance of a mentor in the enterprise and a professor of the FH-Ansbach.

In detail the following steps result:

- Analysis/structuring of the task
- Classification of the individual structural elements in the respective scientific context

- Developing/evaluating/comparing approaches to solutions taking into account technical and economic aspects - Synthesis of the solution concept - Implementation/demonstration of the solution concept - Documentation/presentation/discussion of the results - Create the Bachelor thesis (report). Training on the job.
Studies- / Examination performance:
Bachelor thesis The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
none

2.2 Elective module

Computer aided development and manufacturing			
Abbreviation:	WIG- Computer aided development and manufacturing		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Prof. Dr.-Ing. Emmerich, Ulf		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:	22,5 h	
	Self-study:	52,5 h	
	Total expenditure:	75 h	
Module duration:	1 Semester		
Frequency:	only Summer semester		
Courses of the module:	Computer aided development and manufacturing (WIG- Computer aided development and manufacturing)		
Teaching forms of the module:	WIG- Computer aided development and manufacturing: SU/Pr - seminaristic Classes/Practical training		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		
Learning outcomes:			
Technical/methodological competence: The students master the basics of current CNC Technology, CAD/CAM problems and develop an understanding of the current topics of simultaneous Engineering. Action competence: The students are able to assess, plan and - to a certain extent - solve CAD/CAM-related tasks independently. Social competence: Development of CNC-related tasks			
Content:			
Students develop and construct in higher education. We use the 3D software Solid Works with the corresponding mold module, SolidCAM and MasterCAM. - Creation of drawings and 3D models for CNC machining - Transfer of 3D data sets from other systems (ProE, Catia) via data interface (IGES, VDAFS, Step,...) - Integration of standard parts from online catalogs			
Studies- / Examination performance:			
Student research project and oral exam, 20 minutes			

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
- Lehrbuch Spritzgießwerkzeuge mit SolidWorks effektiv konstruieren (Download über den OPAC der Bibliothek) - Spritzgießwerkzeuge mit SolidWorks Plastics effektiv auslegen - Spritzgießwerkzeuge mit SolidWorks effektiv konstruieren, Übungen der Hochschule Ansbach

Corporate Performance Management

Abbreviation:	CorpPerfManagement	**Modul-Nr.:**	
Assignment to the curriculum:	**Course of studies u. -richtung**	**Semester**	
	Engineering and Management - Bachelor	5	
Module supervisor:	Prof. Dr. rer. pol. Pidun, Tim		
Language:	English		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	45 h	
	Self-study:	105 h	
	Total expenditure:	150 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Corporate Performance Management (CorpPerfManagement)		
Teaching forms of the module:	CorpPerfManagement: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Moreover, a good command of the English language is required, basics of economics or economics related studies and acquaintance with MS Word and Excel are highly preferable. Theoretical knowledge of Performance Management and the concept of the Balanced Scorecard is preferable as well, but can alternatively be obtained by pre-reading sessions.		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Knowledge:
Students learn to design a BSC for a virtual enterprise. They train their ability to defend and align their particular objectives and views to the entire business and performance model. Learning assets consist of self-reading and lecture parts, role-play and self-conducted problem focussed workshops in student peer groups. The models are built using standard software, i.e. MS Word and Excel

Professional Skills:
The students are enabled to perceive Performance Measurement Systems (PMS) and in particular the Balanced Scorecard (BSC) as neutral and universal Management and controlling instruments, to understand and appraise the heterogeneity of the topic and its application, to systematically derive BSC perspective related strategies, objectives and measures from superordinate enterprise units, to choose, develop and explain well-defined indicators and targets to discuss and solve trade-offs between constructed model and real-life business function as well as to assess the goodness-of-fit of their model in their particular business ecosystem. As the session is conducted in English, students train their ability to communicate using the English terminology. Workshop results will be presented and discussed regularly in plenary sessions. Thus the students' ability to give presentations will be improved
Finally, the student's ability to debate and defend their functional views in a competitive company environment will be trained

Social Skills:
All parts of the session are conducted in small groups of German and international students. Thus the following skills are trained:
Team work, problem solving approaches in formal, functional peer groups, Intercultural communication and cooperation despite language drawbacks, diversity as an opportunity to use different, but synergetic approaches, recognizing and understanding different cultural mindsets that drive decisions and an appropriate discussion and debating culture, esp. in conflict situations

Content:

Interculturel part:
Theoretical fundamentals of the concept of culture and various models, practical exercises for the reflection of the home culture and development of cultural differences, culture simulation with the participants, guided discussion on the topic, preparation of an adventure diary, acquisition of intercultural social competence, using English language to communicate with peers, visit of each year newly defined scientific/cultural meaningful places, museums and events, making use of learnt methods during the entire course.
Subject specific part:
Building knowledge on PMS and the different generations of the BSC model and the concepts of visions, strategies, objectives, goals, measures, indicators, and targets and their cybernetic models. Seeing the business world from a BSC's perspective but as well as from a departmental view. Building a Strategy Map to back up and ensure the coherence of the specific views to the entire enterprise strategy, designing and choosing of indicators that explain enterprise performance in the given environment. Considering various attributes and properties of indicators to ensure their comprehensiveness. Adaption of strategies and alternative indicators for collective problem views, declaration of the goodness-of-fit for the chosen model and set of indicators and formulation of recommended actions for the enterprise according to the findings. A technical site visit introducing the students to further practical aspects of Corporate Performance Management sums up the workshop

Studies- / Examination performance:

Präsentation

Requirements for the award of credit points are the passing of the respective module examination according to the study and examination regulations and the study plan.

Literature:

- Bertelsmann-Stiftung (2008): Intercultural Competence - The key competence in the 21 century? https://www.ngobg.info/bg/document/49/726bertelsmanninterculturalcompetences.pdf
- Franco-Santos, M., Kennerley, M., Micheli, P., Martinez, V., Mason, S., Marr, B. (2007). Towards a definition of a business performance measurement system. International Journal of Operations & Production Management, 27(8), p. 784–801
- Heini, O. (2007): Performance Measurements - Designing a Generic Measure and Performance Indicator Model. Master Thesis. Université de Genève., p. 63
- Jakobsen, M., Norreklit, H. und Mitchell, F. (2010). Internal Performance Measurement Systems: Problems and Solutions, Journal of Asia-Pacific Business 11 (4), Taylor & Francis, New York, p. 258–277
- Kaplan, R., & Norton, D. (1992). The Balanced Scorecard - Measures That Drive Performance. Harvard Business Review, (January-February 1992), p. 71-79
- Kaplan, R., & Norton, D. (2008). Mastering the Management System. Harvard Business Review, (January 2008), p. 1–17
- Kellen, V. (2003). Business Performance Measurement. At the Crossroads of Strategy, Decision- Making, Learning and Information Visualization (White Paper). Chicago, DePaul University
- Marchand, M. und Raymond, L. (2008). Researching performance measurement systems: An information systems perspective, IJOPM 28 (7), Emerald, Bingley, p. 663–686
- Nudurupati, S., Bititci, U., Kumar, V., & Chan, F. (2011). State of the art literaturee review on performance measurement. Computers & Engineering and Management, 60(2), 279–290. doi:10.1016/j.cie.2010.11.010

- Pidun T. (2014): Determinants for the Goodness of Performance Measurement Systems: The Visibility of performance. In: Vijayan Sugumaran (Ed.): Recent Advances in Intelligent Technologies and Information Systems, p. 162-185
- Popova, V. und Sharpanskykh, A. (2010). Modeling organizational performance indicators, Information Systems 35 (4), Elsevier, Amsterdam, p. 505–527
- Strecker, S., Frank, U., Heise, D. und Kattenstroth, H. (2012). MetricM (...), Information Systems and E-Business Management 10 (2), Springer, Berlin, p. 241–276
- Thomas A., Kammhuber S., Schroll-Machl, S. (Eds.; 2009): Handbuch Interkulturelle Kommunikation und Kooperation. Band 1 - Grundlagen und Praxisfelder; dto, Band 2 Länder, Kulturen und interkulturelle Berufstätigkeit. Vandenhoeck Ruprecht, Göttingen

Digitalisation in industry (Industry 4.0)			
Abbreviation:	WIG- Digitalisation in Industry		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Prof. Dr.-Ing. Göhringer, Jürgen		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Digitalisatin in Industry (WIG- Digitisation in industry)		
Teaching forms of the module:	WIG- Digitisation in industry: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

The students master the basic specialist knowledge, the essential scientific concepts, the basic development directions as well as application-oriented solutions in the field of digitisation in industry.

In detail, the most important concepts of industry 4.0 (Internet of Things, Cyberphysical System etc.), the associated paradigm shifts (e.g. IT architectures, business models) and the new technologies (e.g. cloud-based services, app structure, big data, artificial intelligence) are mastered by the students in the basics.

Students will also develop an understanding for the integration of the new concepts of Industry 4.0 into existing industrial structures and their further development towards digitisation.

Competence to act:

The students learn to classify important terms of industrial digitisation, are able to competently assess relevant questions and simply develop concepts.

Social competence:

The students have the ability to structure, solve tasks independently, and train their team and communication skills.

Content:

In the module Digitalisation in Industry the following contents are taught:

- Fundamentals, terms, meaning and objectives of digitisation
- Paradigm shift and new technologies

- Digitization concepts and strategies of companies
- Digital enterprise technologies, software systems and architectures for vertical PLM and horizontal ERP integration
- Manufacturing Intelligence, Manufacturing Execution and Manufacturing Operation Management, ShopFloor Integration
- Scheduling strategies and systems
- Reporting Methods and KPIs, Smart Data
- Diagnostics and Remote Service
- Cloud- and app-based systems
- Various real examples of first digitisation projects

The module consists of seminaristic classes with practical example projects.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Lecture script
- Bauernhansel, u.a. Industrie 4.0 in Produktion, Automatisierung und Logistik, Springer Vieweg Verlag, Wiesbaden, 2014
- Armin Roth u.a.: Einführung und Umsetzung von Industrie 4.0, Springer Gabler Verlag, Berlin, 2016
- Dais, Kagermann, Wittenstein, Russwurm, Fischer, Derenbach u.a. Umsetzungsempfehlungen für das Zukunftsprojekt Industrie 4.0, acatech, Berlin, 2013
- Internetportale zum Thema Industrie 4.0/IT/InternetofThings diverser Unternehmen, z.B. Bosch, Siemens, GE, Dassault Systemes

Law of Energy Systems			
Abbreviation:	WIG-Law of Energy Systems		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Prof. Dr. jur. von Blumenthal, Astrid		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	Law of Energy Systems (AIW-Law of Energy Systems)		
Teaching forms of the module:	WIG-Law of Energy Systems: SU/Ü/Ex - seminaristic Classes/Exercise/Exkursion		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

The students are familiar with the requirements of public law, in particular environmental law, for the construction and operation of energy plants. They are familiar with the instruments of administrative law, in particular public environmental law and supplementary energy law regulations. They are familiar with the most important licensing procedures.

Competence to act:

Students are able to assess which legal norms must be observed in practice in the planning, construction and operation of energy plants in individual cases. They can assess the chances of success of approval procedures and independently develop solutions for minor problems in public environmental and energy law.

Social competence:

The students can work together in small groups and develop group-related problem solutions under time pressure. They can articulate themselves and ask questions in a target-oriented manner. They are able to write well structured case solutions.

Content:

The following materials are taught:

- Public building law
- immission control law
- water protection law

- nature conservation law

With references to the corresponding approval procedures. The relationships with superordinate international and European law are shown. The following is introduced in

- environmental liability law

- as well as the right of environmental impact assessment

The module consists of seminaristic classes.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Frenz, Walter, Recht für Ingenieure, 2017
- Leidinger, Tobias, Energieanlagenrecht, 2007
- Erbguth, Wilfried; Schlacke, Sabine, Umweltrecht, 2016

Energy conversion processes and technologies			
Abbreviation:	WIG- Energy conversion processes and technologies		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	3	
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	Energy conversion processes and technologies (WIG- Energy conversion processes and technologies)		
Teaching forms of the module:	WIG- Energy conversion processes and technologies: SU/Ü/Pr/Ex/Fallbsp. - seminaristic Classes/Exercise/Practical training/Exkursion/study cases		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

The students have knowledge of selected basic operations of thermal process Engineering. They understand the chemical conversion of fuels into thermal energy. They are familiar with the essential state-of-the-art combustion systems, their functional principles and their integration into complete plants.

Competence to act:

The students possess the ability to basic-engineer as a basis for the comparative evaluation of different plant concepts with the aim of an economic efficiency analysis as a basis for investment decisions.

Social competence:

Ability to work in a team, as the exercises and practical examples can be worked on in small groups.

Content:

In the module physics and chemistry basics are repeated and based on that Engineering basics and knowledge are imparted.

The module consists of seminar classes, exercises, practical examples and excursions.

Content 1 Fundamentals: Material data, ideal gas law, reaction equations and stoichiometry, calorific value and calorific value, efficiencies

Content 2 Combustion processes: Fundamentals of combustion calculation (air volume, combustion gas volume, combustion gas composition, gas dew point, emissions) as design basis for combustion systems

Content 3 Plant design and operation: power plants with solid fuels, e.g. coal-fired CHP, waste-to-energy, biomass CHP, power plants with fuel gases, e.g. natural gas, biogas CHP; technologies of the modern gas industry ("power to gas", "green hydrogen")
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
lecture script; VDI-Wärmeatlas

LabVIEW Basics 1			
Abbreviation:	LabVIEW Basics 1		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	3	
Module supervisor:	Prof. Dr. rer. nat. Uhl, Christian		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	LabVIEW Basics 1 (LabVIEW Basics 1)		
Teaching forms of the module:	LabVIEW Basics 1: SU/Pr - seminaristic Classes/Practical training		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

Students will master the LabVIEW environment, flow programming, and common LabVIEW architectures in a convenient format. They will learn how to develop LabVIEW applications for measurement and test applications, instrument control, data logging, and measurement analysis.

Competence to act:

Using simple design templates and architectures, students will be able to develop applications that capture, process, display, and store data.

Social Competence:

The students learn to work constructively together in small groups by means of exercises. In the presentation of selected exercises, they expand their presentation skills and are able to articulate themselves comprehensibly in their own programming language.

Content:

- Function of front panels, block diagrams, icons and connector panels
- Creating user interfaces with diagrams, graphs and buttons
- Dealing with the programming structures and data types included in LabVIEW
- Various editing and troubleshooting methods
- Create and save VIs for use as SubVIs
- Displaying and saving data
- Creating applications using data collection devices

- Create applications using devices with serial or GPIB ports - Using the state machine design pattern in applications
Studies- / Examination performance:
written examination, 45 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Exercises and templates for the course

LabVIEW Basics 2			
Abbreviation:	LabVIEW Basics 2		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	3	
Module supervisor:	Prof. Dr. rer. nat. Uhl, Christian		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	LabVIEW Basics 2 (LabVIEW Basics 2)		
Teaching forms of the module:	LabVIEW Basics 2: SU/Pr - seminaristic Classes/Practical training		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

Students learn how to create complete stand-alone applications using the NI LabVIEW graphical development environment. Students will be able to apply the VI development process and the most common VI architectures.

Action Competence:

Students develop, implement, and distribute stand-alone applications with LabVIEW. They will be able to select LabVIEW features according to individual requirements, enabling rapid and productive application development.

Social Competence:

Students learn how to work constructively in small groups through exercises. In the presentation of selected exercises, they expand their presentation skills and are able to articulate themselves comprehensibly in their own programming language.

Content:

Course content includes event-driven programming, programmatic control of the user interface, optimized reuse of existing program codes, and use of file I/O functions. In addition, tools for creating installation programs and stand-alone applications will be presented.

Studies- / Examination performance:

written examination, 45 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Exercises and templates for the course

Manufacturing Execution System			
Abbreviation:	AIW-ManufactExecutSystem		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Prof. Dr.-Ing. Göhringer, Jürgen		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	45 h	
	Self-study:	105 h	
	Total expenditure:	150 h	
Module duration:	1 Semester		
Frequency:	only Summer semester		
Courses of the module:	Manufacturing Execution System (AIW-ManufactExecutSystem-KT)		
Teaching forms of the module:	AIW-ManufactExecutSystem-KT: SU/PR/PA - seminaristic Classes/Practical training/Project work		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Wirtschaftsingenierwesen		

Learning outcomes:

Professional and methodical competence:

The students master the basic specialized knowledge, the substantial scientific concepts as well as the application-oriented solutions for the IT-supported Production control with Manufacturing Execution Systems (MES-Systems).

The most important concepts and functions of these software systems for IT-supported planning and control of production machines and production plants are developed in detail. The essentially functions are scheduling, order Management, material Management, resources Management, tracking & tracing, data collection and KPIs. In addition, the vertical integration of the MES level with the ERP level and the shop floor as well as the horizontal integration with Product Life-Cycle Management (PLM) systems are dealt with. This applies in particular to the connection between virtual planning and real production control with MES systems. Students will also gain an understanding of the technical and process-oriented integration of MES systems into the existing IT systems of companies.

Competence to act:

The students master the decisive topics of production-oriented MES systems with regard to architecture, networking and functionality. They will also be able to analyse MES relevant topics and develop well-founded concepts. The student can discuss the topic MES systems from both sides, the software vendors and the software users (end customer).

Social competence:

The students have the ability to structure, solve tasks independently and train their team and communication skills.

Content:

In the Manufacturing Execution Systems module, the following contents are taught (based on VDI standard 5600):

- Fundamentals, terms, objectives and architectures of MES systems
- Definition of the systems: Manufacturing Intelligence, Manufacturing Execution and Manufacturing Operation Management
- Methods of production planning and control (work plan, operation, parts lists, requirements planning)
- Advanced Planning and Scheduling (strategies e.g. capacity and schedule planning)
- Order Management and control
- Material Management in production (inventory Management and monitoring)
- Product traceability (Trace&Tracking)
- Resource Management (tools, CNC programs, etc.)
- Automatic data acquisition (e.g. PLC, CNC, RFID) and manual data acquisition (e.g. screen dialogs, barcodes, mobile devices)
- Connection of production machines (BDE/MDE)
- Production reporting via KPIs (OEE, availability, productivity, energy Management), Smart Data/BigData
- Personnel Management (access control, shift models, factory calendar, working time models, etc.)
- Outlook on cloud- and app-based systems
- Market analysis (market sizes, players and trends)
- Real project example from the automotive, aerospace, electronics, food and beverage, pharmaceutical, etc. industries.
- Industry Lectures

Studies- / Examination performance:

written exam, 90 minutes and project work

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Lecture script
- VDI Norm 5600 Manufacturing Execution Systems, Beuth Verlag Berlin, Blatt 1–6
- Schuh, Stich (Hrsg.): Produktionsplanung und –steuerung, Springer Vieweg Verlag, Berlin, 2012,
- ANSI/ISA 95 Norm, Enterprise Control System Integration Part1- Part3
- Louis, P: Manufacturing Execution Systems Grundlagen und Auswahl,
- Kletti. J.: Manufacturing Execution Systems, 2. Auflage, Springer Vieweg Verlag Berlin, 2015

Surface Engineering		
Abbreviation:	WIG-Surface Engineering	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	7
Module supervisor:	Prof. Dr. Hans-Achim Reimann	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Surface Engineering (WIG-Surface Engineering)	
Teaching forms of the module:	WIG-Surface Engineering: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Materials Engineering	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

Essential coating techniques for a wide variety of materials, as well as special variants of surface design (dyeing, embossing, ...).

Competence to act:

Students acquire knowledge through theory and demonstrations (exercises) of surface Engineering.

Social competence:

none

Content:

- Physics of the user interface
- Preparation, cleaning, activation
- PVD, CVD, PECVD, DLC
- Printing, varnishing
- electroplating
- powder
- laser technologies
- as well as special variants of plastic-specific surface design (through-dyeing, prototyping, thermoforming, embossing,...)
- post-treatment

- decoating
- Testing techniques for the characterization of surfaces

The focus is on thermoplastic materials. Metals, ceramics, glasses, etc. play only a minor role.

Practical works/Exerciseen

- pad printing
- laser structuring
- plasma technologies
- deposition welding
- case-hardening

Studies- / Examination performance:

written exam, 60 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Hofmann, H-G.; Spindler, J.: Verfahren in der Beschichtungs- und Oberflächentechnik, C. Hanser, München
- Müller, K-P.: Praktische Oberflächentechnik, JOT-Fachbuch, Vieweg Verlag, Springer, Heidelberg

Project and process Management		
Abbreviation:	WIG- Project and process Management	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Project and process Management (WIG- Project and process Management)	
Teaching forms of the module:	WIG- Project and process Management: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students get a deeper understanding of how to organize projects with the help of project structure plans, plan project resources with software support, and evaluate and control projects with key figures. They learn to define (business) processes in the company, to visualize them with the help of process maps, to evaluate processes and to create a comprehensive process model for an organization to work out.

Competence to act:

The students get to know project concepts, project definitions and project success factors and receive the methodical tools, project organisation forms and structure plans to plan project resources and evaluate projects with key figures. You know how to define processes and analyze them with key figures, as well as how to visualize process maps.

Social competence:

Theoretically acquired knowledge is deepened by group work in workshops, so that the terms project culture and climate are reflected in projects by working in teams. Besides the factual level, the relationship level with important elements such as communication, conflict Management, coordination (distribution of roles) and consensus building becomes part of the learning process.

Content:

The module consists of seminaristic classes, workshops and exercises.

- Project Terms, Project Definitions, Project Success Factors
- Project organization forms and structure plans, resource planning

- Tools and key figures for project evaluation and controlling - Process definition, business processes, process models - Process maps, visualization of processes - Key figures for controlling and process improvement
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Madauss, B., ProjektManagement - Theorie und Praxis aus einer Hand, Springer 2018. Schmelzer/Sesselmann, GeschäftsprozessManagement in der Praxis, Hanser Verlag 2013

Process simulation			
Abbreviation:	WIG-Process simulation		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	3	
Module supervisor:	Prof. Dr. phil. nat. Schlüter, Wolfgang		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	45 h	
	Self-study:	105 h	
	Total expenditure:	150 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Process simulation (WIG-Process simulation)		
Teaching forms of the module:	WIG-Process simulation: SU/Ü/PA - seminaristic Classes/Exercise/Project work		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

Students get an overview of the function of simulation programs. They get to know physics motivated and general modelling approaches and detailed knowledge about elementary dynamic systems. They obtain an insight into the theory of dynamic systems: the concept of phase space, global behaviour, parameter sensitivity and the characterization of equilibrium points.

Competence to act:

The students learn to solve complex simulation models with the software program Matlab/Simulink. They understand modelling approaches using differential equations and can evaluate them. They can classify and evaluate the results of dynamic simulations. They can apply the theoretical access on heat transfer processes.

Social competence:

In the lecture-accompanying exercises, the students learn to solve simulation problems autonomiously. In the case of problems, they can ask fellow students or the lecturer for help to achieve their goals.

Content:

1. Basics

1.1 Introduction

1.2 Simulink - Basics

2. Differential equation systems

2.1 Ordinary differential equations
2.2 Solving differential equations with Simulink
2.3 Higher order differential equations and DGL systems
2.4 Solving higher order differential equations with Simulink
3. Modelling and simulation of dynamic systems
3.1 Basic Definition
3.2 Elementary dynamic systems
3.3 Input functions
3.4 General modelling approach
3.5 Physical Modeling Approaches
3.6 Simulink Blocks for More Complex Simulations
4. investigation of dynamic systems
4.1 Introduction to Matlab
4.2 Parameter sensitivity
4.3 The phase space
4.4 Global behaviour
4.5 Behaviour of linear systems
4.6 Behaviour of nonlinear systems
5. heat transfer
5.1 Fundamentals
5.2 Spatial approach
6. Application examples
6.1 Heat exchanger
6.2 CO2 dynamics

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Simulationstechnik:

H. Bossel: Modellbildung und Simulation - Konzepte, Verfahren und Modelle zum Verhalten dynamischer Systeme, 2. Auflage Vieweg Verlag 1994

P. Junglas: Praxis der Simulationstechnik, Europa Lehrmittel 2014

U. Kramer, M Neculau: Simulationstechnik, Hanser Verlag 1998

D. Acheson: Vom Calculus zum Chaos, Oldenbourg 1999

H.E. Scherf: Modellbildung und Simulation dynamischer Systeme, Oldenbourg 2007

H.J. Bungartz, S. Zimmer, M. Buchholz, D. Pflüger: Modellbildung und Simulation, Springer 2009

F. Haußer, Y. Luchko, Mathematische Modellierung mit MATLAB, Spektrum Verlag 2011

Matlab/Simulink:

J. Hoffmann, U. Brunner: Matlab & Tools - für die Simulation dynamischer Systeme,

Addison-Welsley 2002

O. Beucher: Matlab und Simulink lernen - Grundlegende Einführung, Adisson Wesley 2007

A. Angermann/M. Beuschel/M. Rau/U. Wohlfarth: Matlab - Simulink - Stateflow, Oldenbourg 2002

W. Pietruszka: MATLAB und Simulink in der Ingenieurpraxis, Teubner 2006
H.Bode: MATLAB-Simulink, Analyse und Simulation dynamischer Systeme, Teubner 2006
U.Stein: Einstieg in das Programmieren mit Matlab, Hanser 2009
Wärmeübertragung:
W. Polifke, J. Kopitz: Wärmeübertragung, Pearson Studium 2005
R. Marek, K. Nitsche: Praxis der Wärmeübertragung, Fachbuchverlag Leipzig 2012

Process control and feedback control systems		
Abbreviation:	WIG- Process control and feedback control systems	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr.-Ing. Dehs, Rainer	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Process control and feedback control systems (WIG- Process control and feedback control systems)	
Teaching forms of the module:	WIG- Process control and feedback control systems: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Mathematics 1 und Mathematics 2	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students have an insight into the description of technical systems using mathematical methods. Especially for linear and time-invariant systems, you know their exact description using differential equations as well as Laplace transformation. You are aware of the special importance of stability in the context of control loops. The technical/economic aspects of solving a task as control or regulation are well known. The students understand the structuring and parameterization of a PID controller, as well as the programming of a PLC on the basis of a requirement specification.

Competence to act:

The students master the decomposition of systems into simple modules such as integrator, proportional element etc. They are able to carry out a controller design on the basis of specifications. The students master troubleshooting in control programs as well as their elimination. They can safely convert a textual specification into a control program.

Social competence:

In practical training, students learn to analyse technical problems in small groups and to develop and formulate solutions together. They develop the ability to organise, structure and divide the solution process.

Content:

- control Engineering

o System description in time and image area; H

o Frequently occurring transmission elements and their interconnection;
o Stability
o Control design.
- Control Technology
o System structure and function,
o Programming interfaces
o Application examples.
Practical training on the above topics.

Studies- / Examination performance:

schriftliche Prüfung, 90 Minuten

Voraussetzungen für die Vergabe von Credits, ist das Bestehen der jeweiligen Modulprüfung gem. SPO bzw. Studienplan.

Literature:

- Lecture script
- Föllinger, Otto: Regelungstechnik, Einführung in die Methoden und ihre Anwendung, VDE-Verlag 2016, 12. Auflage

Simulation in bioTechnology			
Abbreviation:	WIG-Simulation in bioTechnology		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	2	
Module supervisor:	Prof. Dr. phil. nat. Schlüter, Wolfgang		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	only Summer semester		
Courses of the module:	Simulation in bioTechnology (WIG-Simulation in bioTechnology)		
Teaching forms of the module:	AIW-SimulationBiotechnologie: SU/Ü - seminaristic Classes/Exercise		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Kenntnisse in Matlab		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

Students learn how to use modelling and simulation methods using various biotechnological case studies.

They will learn about the advantages and applicability of various methods and apply them independently.

Competence to act:

By the end of the course, students should have understood the basic concepts of modelling and simulation and be able to solve a specific modelling problem in Matlab independently and assess the knowledge gained.

Social competence:

Since the research work is carried out in groups, the ability to work in a team is promoted.

Content:

The module explains the basics of modeling and simulation. In addition, detailed knowledge of simulation analysis is imparted. The module consists of seminaristic classes and practical work on PCs.

- Modeling / Simulation Basics
- parameter
- sensitivities
- Experimental Design
- Derivation of differential equations
- Analytical vs. numerical solutions

- model reduction
Studies- / Examination performance:
Project work, presentation The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Programmieren mit Matlab, Ulrich Stein

Simulation Technology

Abbreviation:	WIG- Simulation Technology	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. phil. nat. Schlüter, Wolfgang	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Simulation Technology (WIG- Simulation Technology)	
Teaching forms of the module:	WIG- Simulation Technology: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students get to know the basics of event-oriented simulation and get an overview of its field of application. They are focused on the development of event-oriented programming of a statechart in the Stateflow program. They get to know the structure and the operation mode of a fuzzy controller and can estimate the advantages and disadvantages of fuzzy control compared to classical control Engineering.

Competence to act:

Students are able to develop event-driven systems and are able to implement them in a suitable software tool. They can develop a fuzzy control system in a goal-oriented manner and assess its area of application.

Social competence:

The students develop an understanding of the problems involved in the development of an event-oriented or fuzzy control system In practical simulation exercises and learn in a target-oriented way to

to inquire.

The students get to know different currently applied simulation methods, their field of application and learn the implementation in suitable simulation software.

Content:

I. Discrete-event systems

1. introduction

2. discrete signals and systems

3. autonomous deterministic automata
4. standard machines
5. deterministic I/O machines
6. machine networks
7. non-deterministic machines
8. Petri nets
9. markov chains and stochastic automats
10. time-valued vending machines
11. waiting systems

II. Fuzzy systems

12. introduction
13. fuzzy quantities
14. construction of a fuzzy system

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Lunze: Ereignisdiskrete Systeme, Oldenbourg 2006
- Kiencke: Ereignisdiskete Systeme, Oldenbourg 1997
- Angermann, Beuschel: Matlab-Simulink-Stateflow Oldenbourg 2002
- Hoffmann, Brunner: Matlab & Tools - für die Simulation dynamischer Systeme, Addisson-Wesley 2002
- Kahlert, Frank: Fuzzy-Logik und Fuzzy Control, vieweg 2. Auflage 1994
- Kiendl: Fuzzy Control methodenorientiert, Oldenbourg 1997
- Börcsök: Fuzzy Control - Theorie und Industrieeinsatz, Verlag Technik 2000

Spanish 2 (for advanced)

Abbreviation:	Spanish 2	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	
Module supervisor:	Dr. Zürn, Martina	
Language:	Spanish	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Spanish 2 (für Fortgeschrittene) (Spanish 2)	
Teaching forms of the module:	Spanish 2: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Spanish 1 for beginners or proof of comparable language skills	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

- Further development of a practical language foundation for students with previous knowledge (Spanish 1 / A1) and activation of transfer knowledge for students with previous knowledge / sound knowledge of other Romance Languages

Competence to act:

- Enabling students in a Spanish-speaking country to complete practical training or a semester.
- Preparation for the Business Spanish Modules

Social competence:

- Development of intercultural competence

Content:

The four basic skills will be developed and written expression will be practised (opinions on texts, pros and cons, first letters will be prepared).

In addition to general topics, special attention is paid to the use of regional materials.

At least grammatical phenomena will be taken through:

- Indefinido (regular and irregular)
- Imperfecto (regular and irregular)
- Potencial (introductory, possibly in business Spanish)
- Futuro (introductory, possibly in business Spanish)

- Use of direct and indirect objects (deepening) - Imperative (deepening) Personal, demonstrative, possessive and relative pronouns (in-depth)
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Eñe A2 . Hueber. Kursbuch + Arbeitsbuch + 2 Audio-CDs: 978-3-19-004220-3 • Current link list and additional material in ILIAS

Computational Fluid Dynamics

Abbreviation:	WIG-Computational Fluid Dynamics	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. phil. nat. Schlüter, Wolfgang	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Computational Fluid Dynamics (WIG-Computational Fluid Dynamics)	
Teaching forms of the module:	WIG-Computational Fluid Dynamics: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students get to know the basics of event-oriented simulation and get an overview of its field of application. They are familiar with the development of event-oriented programming of a statechart in the Stateflow program. They are familiar with the structure and the mode of operation of a fuzzy controller and can estimate the advantages and disadvantages of fuzzy control compared to classical control Technology.

Competence to act:

Students are able to develop selected event-driven systems and program them in a suitable software tool. They can develop a fuzzy control system in a goal-oriented manner and assess its area of application.

Social competence:

In practical training simulation techniques, students develop an understanding of the problems involved in the development of an event-oriented or fuzzy control system and learn to ask questions in a goal-oriented manner.

The students should learn various currently applied simulation methods, know their field of application and fields of application and learn the technical programming implementation by means of suitable simulation software.

Content:

1. introduction
2. Computational Fluid Dynamics Procedure
3. continuity and energy equation

4. nozzle and diffuser
5. postprocessing: plans, streamlines and reports
6. networking: network types and Prism Layer
7. changes of direction and pipe branches
8. geometry generation
9. 2D simulations
10th Navier-Stokes equations
11. tutorials
12. flow around bodies
13. compressible currents
14. discretization
15. turbulence
16. transient simulations
17. heat conduction and convection
18. outlook networking
19. automation
20. application potential

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

S. Lechner: Numerische Strömungsberechnung, vieweg + teubner 2009

E. Laurien, H. Oertel jr.: Numerische Strömungsmechanik, 3. Auflage, vieweg+teubner 2009

H. Oertel jr., E. Laurien: Numerische Strömungsmechanik, 2. Auflage, vieweg 2003

J. Ferziger, M. Peric: Numerische Computational Fluid Dynamics, Springer 2008

J. Strybny: Ohne Panik Strömungsmechanik!, 3. Auflage, vieweg 2007

W. Bohl, W. Elmendorf: Technische Strömungslehre, 13. Auflage, Vogel Fachbuch Kamprath-Reihe 2005

H Kuhlmann: Strömungsmechanik, 2. Auflage, Pearson 2014

F. Durst: Grundlagen der Strömungsmechanik, Springer 2006

Distribution of medical Technology goods - case studies		
Abbreviation:	WIG- Distribution of medical Technology goods - case studies	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr. rer. nat. Schnurpfeil, Roland	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Distribution of medical Technology goods - case studies (WIG- Distribution of medical Technology goods - case studies)	
Teaching forms of the module:	WIG-Distribution of medical Technology goods - case studies: Ü - Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

The students

- are familiar with the tasks, activities and tools of a sales representative in the operational function of sales in the medical Technology industry
- in various situations as sales representatives of a medical Technology company.
- Gain an overview of the activities of a manager in the operational function of Sales and Distribution

Competence to act:

The students

- can prepare, carry out and follow up a sales discussion
- have an interdisciplinary approach to the analysis and solution of existing problem areas in the distribution of medical devices within the framework of the entrepreneurial environment

Social competence:

no focus in the module

Content:

1) The sales pict / product presentation

- Structure/ Design
- Five sentence/ statement

2) Customer benefit argumentation 3) Handling of objections - Objections / Concerns - Forewalls/Excuses 4) Selected case study on the distribution of medical devices
Studies- / Examination performance:
Case studies and presentations The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Own materiel, selected case studies

Wirtschaftsenglish - Advanced Writing and Cultural Studies		
Abbreviation:	Wirtschaftsenglish - Advanced	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	
Module supervisor:	Dr. Zürn, Martina	
Language:	English	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Wirtschaftsenglish - Advanced Writing and Cultural Studies (Wirtschaftsenglish - Advanced)	
Teaching forms of the module:	Wirtschaftsenglish - Advanced: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	successfully completed English compulsory courses	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competences:

- Acquisition of the ability to work in an international/ English-speaking company by consolidating technical terminology
- Deepening written and oral communication skills in the foreign language
- Ability to integrate into international companies by acquiring in-depth language skills and knowledge of intercultural aspects

Content:

- Analysis and discussion of selected texts on economic and cultural topics
- Writing documents relevant to business life (formal requirements for memos, notices, reports and articles)
- Style elements in free text production with special attention to sentence structure and punctuation
- Content and formal structure of an essay
- Expansion of writing skills (essays on current topics)

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:
- Scripts in the Ilias or in the in-house Copy Shop - Supplementary materials distributed via overhead projector or as handouts - Use of online, visual and auditory materials in the language laboratory

Business Spanish - Written communication in a professional environment			
Abbreviation:	WIG- Business Spanish - Written communication in a professional environment		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor		
Module supervisor:	Dr. Gebhard, Christian		
Language:	Spanish		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	45 h	
	Self-study:	105 h	
	Total expenditure:	150 h	
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	Business Spanish - Written communication in a professional environment (WIG- Business Spanish - Written communication in a professional environment)		
Teaching forms of the module:	Business Spanish - Written communication in a professional environment: SU/Ü - seminaristic Classes/Exercise		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Successful participation in the module "Spanish 2 for Advanced". or proof of comparable knowledge of Spanish recommended		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

- Acquisition of the ability to interact in writing in a business environment using business terminology
- Ability to use the Spanish language in written form in a professional and professional way.
- Deeper development of intercultural competence

Content:

- Writing business letters
- Practice of various strategies for the comprehension, in-depth understanding and editing of specialist texts from textbooks, trade journals, the business section of newspapers or business-relevant publications by government bodies or associations.
- Reviewing and deepening the grammar introduced in the Spanish courses (especially pasts, pronouns) and acquiring more complex structures (especially subjunctive, conditional sentences, verbal periphrases).
- Taking up topics from the folk/business economics also with regard to their particularity for a Spanish-speaking country (e.g. economic policy and structure, labour market, international cooperation etc.)

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Martínez, lola / Sabater, María Luísa (2008): Colegas 2 . Difusión/ Klett. • Ebenfalls empfohlen: • Abegg, Birgit / Martínez Cestero, Antonio (2006): Comunicación empresarial. • Hueber. • Kursbuch: 978-3-19-004030-8 • Audio-CD: 978-3-19-034030-9 • Tano, Marcelo (2009): Expertos. Curso avanzado de español • orientado al mundo del trabajo . Difusión/Klett. • Libro del alumno + Audio-CD + DVD: 978-3-12-515595-4 (3-12-22. Juli 2015 515595-9) • Cuaderno de ejercicios + Audio-CD: 978-3-12-515596-1 • Ergänzendes Material in ILIAS (z.B. aktuelle Texte aus Fachbüchern und Zeitungen) • Belgeitend empfohlen: Rosario Alonso Raya u.a. (2012): Gramática básica del estudiante de español. Überarbeitete und erweiterte Ausgabe: 978-3-12-535515-6

2.3 Compulsory elective bridge modules

"Energy Engineering"

Fundamentals of fluid and thermodynamics

Abbreviation:	WIG- Fundamentals of fluid and thermodynamics	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr.-Ing. Kapischke, Jörg	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Fundamentals of fluid and thermodynamics (WIG- Fundamentals of fluid and thermodynamics)	
Teaching forms of the module:	WIG- Fundamentals of fluid and thermodynamics: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Mathematics, Physics	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

fluid dynamics

Technical/methodological competence:

The students master the basics for the calculation of flow machines, resistances in pipelines, inflow and outflow processes and resistances of flowed bodies. In this course the students get knowledge about technical approaches for the calculation of turbomachines, pressure losses in pipes and piping elements, flowed around bodies and the flow of compressible fluids. The law of conservation of mass, the law of conservation of momentum, the law of conservation of energy and the law of twist teach students how and to what extent different forms of energy are converted and which forces result from changes in momentum.

Competence to act:

After graduation of the module, students are able to formulate, work on and solve fluid dynamic Engineering tasks.

Social competence:

Group-oriented elaborations of practical tasks within the framework of exercises and internships lead to the ability to carry out work sharing and coordination in an optimized way.

Thermodynamics

Technical/methodological competence:

The students are able to balance, calculate and evaluate machines and plants for energy conversion and transmission. In this course the students acquire knowledge about the heat transfer, changes of state of ideal gases and of steam in machines and plants as well as the limited conversion of energy. Students gain a

basic understanding of the apparatus and machines for energy conversion and energy transfer. The thermal behaviour of gases and liquids in the aggregates can be predicted.

Competence to act:

After completing the module, students can formulate, work on and solve the most important thermodynamic Engineering tasks.

Social competence:

Group-oriented development of problem solutions within the framework of exercises and internships lead to improved communication skills and content coordination of tasks.

Content:

fluid dynamics

The main topics of this course include:

- Material properties of liquids and gases
- hydrostatics
- Incompressible flows
- equation of continuity
- law of conservation of energy
- principle of linear momentum
- principle of angular momentum
- Similarity laws and key figures
- flow forms
- pipe flows
- exhaust processes
- bodily flow
- Compressible flows
- basics
- pipe flows
- exhaust processes
- bodily flow
- Flow of gas-liquid mixtures
- Introduction to numerical solution methods
- Flow measurement Technology.

The course consists of seminaristic classes, exercises, practical training and excursions.

Thermodynamics

- The main topics of this course include:
- heat transfer
- Fundamentals of Thermodynamics
- Changes of state of the ideal gas
- Heat pump and chiller
- Irreversible processes and state variables for their assessment
- gas turbine plants
- Stirling engine
- combustion engines
- piston compressor
- Steam in machines and plants

- Combined gas/steam power plant (GUD process)
- Organic Rankine Processes (ORC)
- Mixtures of ideal gases
- Humid air

The course consists of seminaristic classes, exercises, practical training and excursions.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Fluid dynamics
Böswirth, L.: Technische Strömungslehre, 7. Auflage, Vieweg+Teubner Verlag, Wiesbaden, 2007.
Bohl, W.: Technische Strömungslehre, Kamprath-Reihe, 14. Auflage, Vogel Verlag, Würzburg, 2008.

Thermodynamics
Cerbe, G.; Wilhelms, G.: Technische Thermodynamik, 5. Auflage, Carl Hanser Verlag, München, 2008.

Energy conversion processes and technologies			
Abbreviation:	WIG- Energy conversion processes and technologies		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	3	
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	Energy conversion processes and technologies (WIG- Energy conversion processes and technologies)		
Teaching forms of the module:	WIG- Energy conversion processes and technologies: SU/Ü/Pr/Ex/Fallbsp. - seminaristic Classes/Exercise/Practical training/Exkursion/study cases		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	None		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

The students have knowledge of selected basic operations of thermal process Engineering. They understand the chemical conversion of fuels into thermal energy. They are familiar with the essential state-of-the-art combustion systems, their functional principles and their integration into complete plants.

Competence to act:

The students possess the ability to basic-engineer as a basis for the comparative evaluation of different plant concepts with the aim of an economic efficiency analysis as a basis for investment decisions.

Social competence:

Ability to work in a team, as the exercises and practical examples can be worked on in small groups.

Content:

In the module physics and chemistry basics are repeated and based on that Engineering basics and knowledge are imparted.

The module consists of seminar classes, exercises, practical examples and excursions.

Content 1 Fundamentals: Material data, ideal gas law, reaction equations and stoichiometry, calorific value and calorific value, efficiencies

Content 2 Combustion processes: Fundamentals of combustion calculation (air volume, combustion gas volume, combustion gas composition, gas dew point, emissions) as design basis for combustion systems

Content 3 Plant design and operation: power plants with solid fuels, e.g. coal-fired CHP, waste-to-energy, biomass CHP, power plants with fuel gases, e.g. natural gas, biogas CHP; technologies of the modern gas industry ("power to gas", "green hydrogen")
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
lecture script; VDI-Wärmeatlas

Energy process Engineering			
Abbreviation:	WIG-Energy process Engineering		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	only Summer semester		
Courses of the module:	Energy process Engineering (WIG-Energy process Engineering)		
Teaching forms of the module:	WIG-Energy process Engineering: SU/Ü/Ex - seminaristic Classes/Exercise/Exkursion		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	General compulsory modules, Thermodynamik und Fluiddynamik		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

The students have knowledge of selected basic operations of thermal process Engineering. They understand the thermodynamics of air and water vapour. They know the essential apparatuses for heat transfer according to the state of the art and their functional principle as well as their integration into complete power Engineering plants.

Competence to act:

The students possess the ability to basic-engineer as a basis for the comparative evaluation of different plant concepts with the aim of an economic efficiency analysis as a basis for investment decisions.

Social competence:

Ability to work in a team, as the exercises can be carried out in small groups.

Content:

In the module "EVT" basics of thermodynamics are repeated and based on that Engineering basics and knowledge are imparted.

The module consists of seminar classes, exercises, practical examples and excursions.

Content 1 Fundamentals: Material data, ideal gas law, changes of state in h, x - diagram / T, s - diagram as design basis for plant systems, heat flows

Content 2 Heat transfer processes: Heat flows (conduction, convection, passage), heat balances, heat loss determination in buildings and heat networks, heat exchangers, water and steam boilers, Clausius-Rankine

process as design basis for power plants, mass transfer processes as design basis for air-conditioning systems Content 3 Plant design and operation: Power plants with Clausius Rankine process, e.g. waste-to-energy plant, solar power plant; district and local heating networks
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Script with task and formula collection; VDI-Wärmeatlas

"Plastics Engineering"

Plastics Engineering		
Abbreviation:	WIG-Plastics Engineering	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr.-Ing. Sover, Alexandru	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Plastics Engineering (WIG-Plastics Engineering)	
Teaching forms of the module:	WIG-Plastics Engineering: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

The students learn the basics of plastics, their production, properties and processing as well as their economic importance in order to understand fundamental differences between the different materials and the respective application possibilities.

Competence to act:

The students make decisions for the selection of plastics for different applications.

Social competence:

Communication skills by solving tasks in small groups, self-reflection.

Content:

- Introduction to plastics (structure, monomers, polymers)
- Development and economic importance of polymer materials
- Classification of plastics
- Thermoplastics, thermosets and elastomers (description, structure and properties)
- Properties of plastics
- Applications with examples
- Basis Processing methods
- Plastics recycling

Studies- / Examination performance:
written exam, 90 minutes and student research project The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
- Understanding Polymer Processing, Tim A. Osswald, 2nd Edition, 2018 - Polymer Processing- Principles and Modeling, Jean-Francois Agassant, Pierre Avenas, Pierre J. Carreau, Bruno Vergnes, Michel Vincent, 2nd Edition, 2017 - Kunststofftechnik, Einführung und Grundlagen, Christian Bonte, Carl Hanser Verlag, München 2014 - Kunststoffchemie für Ingenieure, Wolfgang Kaiser, 3. Auflage, 2011 - Saechtling Kunststoff Taschenbuch, E. Baur, S. Brinkmann, T.A. Osswald, E. Schmachtenberg, 31. Ausgabe, 2013

Polymer production & compounding

Abbreviation:	WIG – Polymer production & compounding	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Industrial Engineering - Bachelor	3
Module supervisor:	Prof. Dr. rer. nat. (USA) Wilisch, Christian	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	60 h
	Independent study:	90 h
	Total workload:	150 h
Module duration:	1 Semester	
Frequency:	Winter semester	
Courses of the module:	WIG – Polymer production & compounding	
Teaching forms of the module:	SU/Pr – seminars, lectures, laboratory	
Prerequisites:	According to SPO or curriculum	
Recommended prior courses:	Materials Engineering	
Usability:	Bachelor Industrial Engineering	

Learning outcomes:

Professional and methodical skills:

Basic knowledge of the chemistry of relevant methods to synthesize polymers and the use of additives to control polymer properties;

Practical skills:

The students are able to assess, plan and work on tasks in polymer production independently and in small groups.

Social skills:

Not applicable in this module.

Content:

- Chemistry of monomers: basics of chemical bonding theory, saturated and unsaturated hydrocarbon compounds, kinetic and thermodynamic reactivity, functional groups and elementary reactions, step growth and chain growth polymer synthesis.
- Chemistry of polymers: polymer modification, cross-linking reactions, additives
- Manufacturing methods of important thermoplastics and thermosets
- Practical training: Generation of different polymers and their characterization (e.g. solvent resistance, UV/VIS- and IR-spectroscopy, surface properties)

Studies- / Examination performance:

written exam, 90 minutes, or written paper (12-15 pages) to be presented in class

The prerequisite for the award of credits is a passing grade in the respective module examination according to the SPO or curriculum.

Literature:	
• C.E. Mortimer:	Chemie; Thieme (2005) oder neuere Ausgabe
• W. Kaiser:	Kunststoffchemie für Ingenieure; Hanser (2006) oder neuere Ausgabe
• W. Keim:	Kunststoffe – Synthese, Herstellungsverfahren, Apparaturen; Wiley-VCH (2006)
• O. Schwarz:	Kunststoffkunde; Vogel (2000) oder neuere Auflage
• A. Ravve:	Principles of Polymer Chemistry; Plenum Press (1995)
• J.M.G. Cowie:	Chemie und Physik der synthetischen Polymeren; Vieweg (1997)
• B. Tieke:	Makromolekulare Chemie; VCH (1997)

"Systems Engineering"

Process simulation

Abbreviation:	WIG-Process simulation	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr. phil. nat. Schlüter, Wolfgang	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Process simulation (WIG-Process simulation)	
Teaching forms of the module:	WIG-Process simulation: SU/Ü/PA - seminaristic Classes/Exercise/Project work	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students get an overview of the function of simulation programs. They get to know physics motivated and general modelling approaches and detailed knowledge about elementary dynamic systems. They obtain an insight into the theory of dynamic systems: the concept of phase space, global behaviour, parameter sensitivity and the characterization of equilibrium points.

Competence to act:

The students learn to solve complex simulation models with the software program Matlab/Simulink. They understand modelling approaches using differential equations and can evaluate them. They can classify and evaluate the results of dynamic simulations. They can apply the theoretical access on heat transfer processes.

Social competence:

In the lecture-accompanying exercises, the students learn to solve simulation problems autonomiously. In the case of problems, they can ask fellow students or the lecturer for help to achieve their goals.

Content:

1. Basics

1.1 Introduction

1.2 Simulink - Basics

2. Differential equation systems

2.1 Ordinary differential equations
2.2 Solving differential equations with Simulink
2.3 Higher order differential equations and DGL systems
2.4 Solving higher order differential equations with Simulink
3. Modelling and simulation of dynamic systems
3.1 Basic Definition
3.2 Elementary dynamic systems
3.3 Input functions
3.4 General modelling approach
3.5 Physical Modeling Approaches
3.6 Simulink Blocks for More Complex Simulations
4. investigation of dynamic systems
4.1 Introduction to Matlab
4.2 Parameter sensitivity
4.3 The phase space
4.4 Global behaviour
4.5 Behaviour of linear systems
4.6 Behaviour of nonlinear systems
5. heat transfer
5.1 Fundamentals
5.2 Spatial approach
6. Application examples
6.1 Heat exchanger
6.2 CO2 dynamics

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Simulationstechnik:

H. Bossel: Modellbildung und Simulation - Konzepte, Verfahren und Modelle zum Verhalten dynamischer Systeme, 2. Auflage Vieweg Verlag 1994

P. Junglas: Praxis der Simulationstechnik, Europa Lehrmittel 2014

U. Kramer, M Neculau: Simulationstechnik, Hanser Verlag 1998

D. Acheson: Vom Calculus zum Chaos, Oldenbourg 1999

H.E. Scherf: Modellbildung und Simulation dynamischer Systeme, Oldenbourg 2007

H.J. Bungartz, S. Zimmer, M. Buchholz, D. Pflüger: Modellbildung und Simulation, Springer 2009

F. Haußer, Y. Luchko, Mathematische Modellierung mit MATLAB, Spektrum Verlag 2011

Matlab/Simulink:

J. Hoffmann, U. Brunner: Matlab & Tools - für die Simulation dynamischer Systeme,

Addison-Welsley 2002

O. Beucher: Matlab und Simulink lernen - Grundlegende Einführung, Adisson Wesley 2007

A. Angermann/M. Beuschel/M. Rau/U. Wohlfarth: Matlab - Simulink - Stateflow, Oldenbourg 2002

W. Pietruszka: MATLAB und Simulink in der Ingenieurpraxis, Teubner 2006
H.Bode: MATLAB-Simulink, Analyse und Simulation dynamischer Systeme, Teubner 2006
U.Stein: Einstieg in das Programmieren mit Matlab, Hanser 2009
Wärmeübertragung:
W. Polifke, J. Kopitz: Wärmeübertragung, Pearson Studium 2005
R. Marek, K. Nitsche: Praxis der Wärmeübertragung, Fachbuchverlag Leipzig 2012

Process control and feedback control systems		
Abbreviation:	WIG- Process control and feedback control systems	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	3
Module supervisor:	Prof. Dr.-Ing. Dehs, Rainer	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Process control and feedback control systems (WIG- Process control and feedback control systems)	
Teaching forms of the module:	WIG- Process control and feedback control systems: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Mathematics 1 und Mathematics 2	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students have an insight into the description of technical systems using mathematical methods. Especially for linear and time-invariant systems, you know their exact description using differential equations as well as Laplace transformation. You are aware of the special importance of stability in the context of control loops. The technical/economic aspects of solving a task as control or regulation are well known. The students understand the structuring and parameterization of a PID controller, as well as the programming of a PLC on the basis of a requirement specification.

Competence to act:

The students master the decomposition of systems into simple modules such as integrator, proportional element etc. They are able to carry out a controller design on the basis of specifications. The students master troubleshooting in control programs as well as their elimination. They can safely convert a textual specification into a control program.

Social competence:

In practical training, students learn to analyse technical problems in small groups and to develop and formulate solutions together. They develop the ability to organise, structure and divide the solution process.

Content:

- control Engineering

o System description in time and image area; H

o Frequently occurring transmission elements and their interconnection;
o Stability
o Control design.
- Control Technology
o System structure and function,
o Programming interfaces
o Application examples.
Practical training on the above topics.

Studies- / Examination performance:

schriftliche Prüfung, 90 Minuten

Voraussetzungen für die Vergabe von Credits, ist das Bestehen der jeweiligen Modulprüfung gem. SPO bzw. Studienplan.

Literature:

- Lecture script
- Föllinger, Otto: Regelungstechnik, Einführung in die Methoden und ihre Anwendung, VDE-Verlag 2016, 12. Auflage

2.4 Key study fields

"Energy Engineering"

Local energy systems

Abbreviation:	WIG- Local energy systems	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr.-Ing. Rosenbauer, Georg	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Local energy systems (WIG- Local energy systems)	
Teaching forms of the module:	WIG- Local energy systems: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional competence:

The focus of the event is on the (often coupled) provision of heat and power in small systems. The event focuses on photovoltaics.

Methodological competence:

The Technology-independent concept of marginal utility and its significance for technical and economic optimisation will be practiced using several examples.

Competence to act:

The students will be able to design PV systems and make a yield prognosis. They can adapt inverters to optimise module interconnections accordingly. They can qualitatively describe the influence of various design measures for battery storage on the proportion of own consumption and the degree of self-sufficiency.

Social competence:

none

Content:

The module consists primarily of 2 SWS seminaristic classes. First examples of exercises will be discussed there. The event is complemented by an extensive collection of tasks with detailed solutions for self-study.

Content focus:

Solar irradiation:

Solar constant, air mass, spectral distribution, three component model, radiation power on the horizontal and inclined surface. Radiant energy.

Focus - Photovoltaics:

From pn-junction to photodiode, loss mechanisms in the real PV cell, equivalent circuit diagrams and characteristic curve, cell and module concepts, cell and module interconnection (shading problems). Inverter adaptation, design of complete systems, performance ratio, operation. Battery storage: integration concepts, influence on own consumption share and degree of self-sufficiency.

Solar thermal energy:

Function, construction and design of absorbers, collectors, storage tanks, system dimensioning, yield and profitability.

Outlook - Prosumer:

System integration of PV, battery storage, heat pumps and demand side Management. Goals of the sector coupling. Optimisation of own consumption vs. network operation.

Studies- / Examination performance:

written exam, 60 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Mertens, K.: Photovoltaik, 2. Auflage, Hanser Verlag, München, 2013 oder Folgeauflagen.
- Hadamovsky, H.-F., Jonas, D.: Solarstrom, Solarthermie, 2. Auflage, Vogel Verlag, Würzburg, 2007 oder Folgeauflagen.

Electrical transmission and distribution

Abbreviation:	WIG- Elektrische Übertragung und Verteilung	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	7
Module supervisor:	Prof. M. Sc. Weiherer, Stefan	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Electrical transmission and distribution (WIG- Elektrische Übertragung und Verteilung)	
Teaching forms of the module:	WIG- Elektrische Übertragung und Verteilung: S/E/Pr - Seminars/Exercisees/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students learn the basics of electrical energy supply. The emphasis is placed on the basics of mathematical treatment and from that on the basic calculation methods in electrical networks. After graduation of the course, the students will know the structure and the basic operating methods of the electrical networks. Knowledge of protective measures in low-voltage networks rounds off the competences.

Competence to act:

They are able to carry out basic investigations of electrical networks with the aid of short-circuit current and load flow calculations.

Social competence:

During the entire course, the students learn to analyse technical problems in small groups, among other things, and to develop and formulate solutions together. They develop the ability to organise, structure and divide the solution process.

Content:

- Construction of electrical power supply networks
- Mathematical treatment of three-phase systems
- short-circuit current calculation
- load flow calculation
- Protective measures in low-voltage networks

Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Hütte, 29. Auflage, Elektrische Energietechnik, Band 3 Netze, Springer Verlag 1988. • Oeding, D., Oswald, B.: Elektrische Kraftwerke und Netze, 6te Auflage, Springer-Verlag, Berlin Heidelberg, 2004. • Hosemann, G.; Boeck, W.: Grundlagen der elektrischen Energietechnik, 4te Auflage, Springer-Verlag 1991.

Energy supply Engineering			
Abbreviation:	WIG- Energy supply Engineering		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	6	
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:		22,5 h
	Self-study:		52,5 h
	Total expenditure:		75 h
Module duration:	1 Semester		
Frequency:	only Summer semester		
Courses of the module:	Energy supply Engineering (WIG- Energy supply Engineering)		
Teaching forms of the module:	WIG- Energy supply Engineering: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Previous knowledge of physics, mathematics, thermodynamics and fluid mechanics		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional and methodical competence:

The students have knowledge of essential systems for energy supply in buildings, and how they work. They are familiar with the energy-efficient circuit variants of cogeneration and cogeneration and their fields of application in practice.

Competence to act:

The students possess the ability to basic-engineer as a basis for the comparative evaluation of different plant concepts with the aim of an economic efficiency analysis as a basis for investment decisions.

Social competence:

Ability to work in a team, as the exercises can be carried out in small groups.

Content:

In the module "EVT" basics of thermodynamics are repeated and based on that Engineering basics and knowledge are imparted.

The module consists of seminar classes, exercises, practical examples and excursions.

Content 1 Basics: Material data, ideal gas law, heat balances, efficiencies, counterclockwise circular flow process, log p,h - diagrams, h, x - diagram, thermodynamics of air

Content 2 BHKW: design basics, annual duration characteristics, key figures, economic efficiency

Content 3 Refrigeration systems and heat pumps: Compression and absorption refrigeration systems, circulation processes, refrigerants, system components, heat exchangers for evaporators and condensers as well as recooling plants, dry and evaporative cooling, economic efficiency in accordance with VDI 2067
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Script with task and formula collection; VDI-Wärmeatlas, VDI 2067

Engineering of air conditioning systems

Abbreviation:	WIG- Engineering of air conditioning systems	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr.-Ing. Leipnitz-Ponto, Yvonne	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Engineering of air conditioning systems (WIG- Engineering of air conditioning systems)	
Teaching forms of the module:	WIG- Engineering of air conditioning systems: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Previous knowledge of physics, mathematics, thermodynamics and fluid mechanics	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

The students have knowledge of selected basic operations of thermal process Engineering. They understand the chemical conversion of fuels into thermal energy. They are familiar with the essential state-of-the-art combustion systems, their functional principles and their integration into complete plants.

Competence to act:

The students have the ability to basic-engineer as a basis for the comparative evaluation of different plant concepts with the aim of a profitability analysis as a basis for investment decisions.

Social competence:

Ability to work in a team, as the exercises can be carried out in small groups.

Content:

- Application h, x - Diagram showing the thermodynamic change of state of the air,
- Calculation of the required supply air volume flows (summer and winter operation),
- Components in the Engineering of air conditioning systems (heat exchangers such as heating and cooling coils, humidifiers, etc.),
- Duct network calculation
- Fan selection or design
- Plant examples

Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Script with task and formula collection

"Plastics Engineering"

Simulation		
Abbreviation:	WIG-Simulation	
Assignment to the curriculum:	**Course of studies**	**Semester**
	Engineering and Management - Bachelor	6

Module supervisor:	Prof. Dr.-Ing. Emmerich, Ulf	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Simulation (WIG-Simulation)	
Teaching forms of the module:	WIG-Simulation: SU - seminaristic Classes	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

- Professional and methodical competence:

Teaching procedures for the application of simulation techniques in plastics Engineering; FEM and flow simulation.

- Competence to act:

Application of the above mentioned techniques in a real development environment.

- Social competence:

none

Content:

The goal is the optimal component and tool design, the avoidance of reworking the tool, if necessary the saving of the auxiliary tool. You will quickly receive production-ready tools with little sampling effort, longer tool life, optimum component quality and ideal machine utilization.

Filling simulation, distributor balancing, molded part optimization and process parameter estimation

cooling system optimization

Shrinkage and warpage calculation

Studies- / Examination performance:

written examination, 90 minutes / oral examination / presentation

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:
Internal university scripts, online exercises

Manufacturing Execution System

Abbreviation:	AIW-ManufactExecutSystem	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	4
Module supervisor:	Prof. Dr.-Ing. Göhringer, Jürgen	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Manufacturing Execution System (AIW-ManufactExecutSystem-KT)	
Teaching forms of the module:	AIW-ManufactExecutSystem-KT: SU/PR/PA - seminaristic Classes/Practical training/Project work	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Wirtschaftsingenierwesen	

Learning outcomes:

Professional and methodical competence:

The students master the basic specialized knowledge, the substantial scientific concepts as well as the application-oriented solutions for the IT-supported Production control with Manufacturing Execution Systems (MES-Systems).

The most important concepts and functions of these software systems for IT-supported planning and control of production machines and production plants are developed in detail. The essentially functions are scheduling, order Management, material Management, resources Management, tracking & tracing, data collection and KPIs. In addition, the vertical integration of the MES level with the ERP level and the shop floor as well as the horizontal integration with Product Life-Cycle Management (PLM) systems are dealt with. This applies in particular to the connection between virtual planning and real production control with MES systems. Students will also gain an understanding of the technical and process-oriented integration of MES systems into the existing IT systems of companies.

Competence to act:

The students master the decisive topics of production-oriented MES systems with regard to architecture, networking and functionality. They will also be able to analyse MES relevant topics and develop well-founded concepts. The student can discuss the topic MES systems from both sides, the software vendors and the software users (end customer).

Social competence:

The students have the ability to structure, solve tasks independently and train their team and communication skills.

Content:

In the Manufacturing Execution Systems module, the following contents are taught (based on VDI standard 5600):

- Fundamentals, terms, objectives and architectures of MES systems
- Definition of the systems: Manufacturing Intelligence, Manufacturing Execution and Manufacturing Operation Management
- Methods of production planning and control (work plan, operation, parts lists, requirements planning)
- Advanced Planning and Scheduling (strategies e.g. capacity and schedule planning)
- Order Management and control
- Material Management in production (inventory Management and monitoring)
- Product traceability (Trace&Tracking)
- Resource Management (tools, CNC programs, etc.)
- Automatic data acquisition (e.g. PLC, CNC, RFID) and manual data acquisition (e.g. screen dialogs, barcodes, mobile devices)
- Connection of production machines (BDE/MDE)
- Production reporting via KPIs (OEE, availability, productivity, energy Management), Smart Data/BigData
- Personnel Management (access control, shift models, factory calendar, working time models, etc.)
- Outlook on cloud- and app-based systems
- Market analysis (market sizes, players and trends)
- Real project example from the automotive, aerospace, electronics, food and beverage, pharmaceutical, etc. industries.
- Industry Lectures

Studies- / Examination performance:

written exam, 90 minutes and project work

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Lecture script
- VDI Norm 5600 Manufacturing Execution Systems, Beuth Verlag Berlin, Blatt 1–6
- Schuh, Stich (Hrsg.): Produktionsplanung und –steuerung, Springer Vieweg Verlag, Berlin, 2012,
- ANSI/ISA 95 Norm, Enterprise Control System Integration Part1- Part3
- Louis, P: Manufacturing Execution Systems Grundlagen und Auswahl,
- Kletti. J.: Manufacturing Execution Systems, 2. Auflage, Springer Vieweg Verlag Berlin, 2015

Tool design		
Abbreviation:	WIG-Tool design	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	7
Module supervisor:	Prof. Dr.-Ing. Emmerich, Ulf	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Tool design (WIG-Tool design)	
Teaching forms of the module:	WIG-Tool design: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

Development of injection moulds; tool design, mould production, surface modelling, derivation of electrodes, preparation of drawings.

Competence to act:

Application of the above mentioned competence in a real development environment.

Social competence:

none

Content:

Data import; model preparation; mould nest, standards; assembly; cooling; increase of productivity; documentation; derivation of electrodes; working with surfaces

Studies- / Examination performance:

Project work, presentation

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Emmerich, Spritzgießwerkzeuge mit SolidWorks effektiv konstruieren, Online-Lehrbuch

"Systems Engineering"

Computational Fluid Dynamics

Abbreviation:	WIG-Computational Fluid Dynamics	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. phil. nat. Schlüter, Wolfgang	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Computational Fluid Dynamics (WIG-Computational Fluid Dynamics)	
Teaching forms of the module:	WIG-Computational Fluid Dynamics: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students get to know the basics of event-oriented simulation and get an overview of its field of application. They are familiar with the development of event-oriented programming of a statechart in the Stateflow program. They are familiar with the structure and the mode of operation of a fuzzy controller and can estimate the advantages and disadvantages of fuzzy control compared to classical control Technology.

Competence to act:

Students are able to develop selected event-driven systems and program them in a suitable software tool. They can develop a fuzzy control system in a goal-oriented manner and assess its area of application.

Social competence:

In practical training simulation techniques, students develop an understanding of the problems involved in the development of an event-oriented or fuzzy control system and learn to ask questions in a goal-oriented manner.

The students should learn various currently applied simulation methods, know their field of application and fields of application and learn the technical programming implementation by means of suitable simulation software.

Content:

1. introduction
2. Computational Fluid Dynamics Procedure
3. continuity and energy equation

4. nozzle and diffuser
5. postprocessing: plans, streamlines and reports
6. networking: network types and Prism Layer
7. changes of direction and pipe branches
8. geometry generation
9. 2D simulations
10th Navier-Stokes equations
11. tutorials
12. flow around bodies
13. compressible currents
14. discretization
15. turbulence
16. transient simulations
17. heat conduction and convection
18. outlook networking
19. automation
20. application potential

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

S. Lechner: Numerische Strömungsberechnung, vieweg + teubner 2009

E. Laurien, H. Oertel jr.: Numerische Strömungsmechanik, 3. Auflage, vieweg+teubner 2009

H. Oertel jr., E. Laurien: Numerische Strömungsmechanik, 2. Auflage, vieweg 2003

J. Ferziger, M. Peric: Numerische Computational Fluid Dynamics, Springer 2008

J. Strybny: Ohne Panik Strömungsmechanik!, 3. Auflage, vieweg 2007

W. Bohl, W. Elmendorf: Technische Strömungslehre, 13. Auflage, Vogel Fachbuch Kamprath-Reihe 2005

H Kuhlmann: Strömungsmechanik, 2. Auflage, Pearson 2014

F. Durst: Grundlagen der Strömungsmechanik, Springer 2006

Industrial communication Technology		
Abbreviation:	WIG- Industrial communication Technology	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	7
Module supervisor:	Prof. Dr. rer. nat. Uhl, Christian	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Industrial communication Technology (WIG- Industrial communication Technology)	
Teaching forms of the module:	WIG- Industrial communication Technology: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	basic education	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

The students master the basics of the use of computers in process Management and control from the interface between the technical process and the computer input and output via the communication of the participants in the network to the human-machine interface.

Competence to act:

The students are able to classify and implement techniques in the field of digital signal processing. Develop the ability to implement applications using LabVIEW.

Social competence:

Within the framework of project work in a team, students strengthen their communication skills, their ability to divide work and to coordinate the content of sub-tasks in the team.

Content:

- Sensors, actuators and signal processing
- Fundamentals of digital data transmission (information and communication, the ISO/OSI model)
- Bus systems (structures, coding methods, bus access methods, data backup)
- internet technologies
- Introduction to LabVIEW (basics, flow structures, arrays and clusters, visualization of data, file I/O, data acquisition and interfaces).

Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Olsson, G., Piani, G.: Steuern, Regeln, Automatisieren, Carl Hanser und Prentice-Hall, 1992 • Schnell G. (Hrsg.): Bussysteme in der Automation Engineering, 3. Auflage, Vieweg Verlag, 1999 • Reißenweber, B.: Feldbussysteme zur industriellen Kommunikation, Oldenbourg Verlag, 2002 • Jamal, R., Hagestedt, A.: LabVIEW, 4. Auflage, Addison-Wesley, 2004

Process control and automatisation

Abbreviation:	WIG- Process control and automatisation	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr.-Ing. Dehs, Rainer	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Process control and automatisation (WIG- Process control and automatisation)	
Teaching forms of the module:	WIG- Process control and automatisation: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Mathematics 1 und Mathematics 2	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional and methodical competence:

The students have an insight into the description of technical systems in the state space. Especially for linear and time-invariant systems, they know their exact description in the different normal forms, as well as different analysis procedures. You are able to work out the parameters for dynamics. In the case of multi-variable systems, they are also familiar with the methods of decoupling and pole specification.

Competence to act:

Students can model and analyze simple electromechanical systems in the state space. They are able to change the given dynamics of the systems according to specifications and, if necessary, decouple them in the case of multi-variable systems. They are able to convert the system description into the frequency domain as well as into the state space.

Social competence:

none

Content:

- Representation in the state space
- Equivalent Transformation
- controllability, observability
- normal forms
- pole specification

- decoupling - observer
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Lecture script • Föllinger, Otto: Regelungstechnik, Einführung in die Methoden und ihre Anwendung, VDE-Verlag 2016, 12. Auflage

"General Management"

Corporate Planning and Organisation

Abbreviation:	WIG-CorporatePlanngOrganisation	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	7
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert	
Language:	Englisch	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Corporate Planning and Organisation (WIG-CorporatePlanngOrganisation)	
Teaching forms of the module:	WIG-CorporatePlanngOrganisation: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Cost and investment calculation	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students gain an in-depth understanding of the identification of success factors for strategic corporate Management on the basis of the EFQM Excellence Model. You will get to know benchmarking, good practice methods and key figures for sustainable corporate planning and Management.

Competence to act:

Using examples and computer-aided methods (business games), students learn about the networked and holistic effects of Management decisions. By analyzing cause-and-effect chains, you will learn how companies and organizations can be successfully managed in the market and in competition.

Social competence:

Theoretically acquired knowledge is deepened by group work, so that beside the content level also the relationship level is part of the learning process. Thus, problems are worked on together in group work, solution strategies are developed, presented and, in particular, implemented in a time-lapse business game.

Content:

Selected methods and concepts from the areas of

- Leadership, strategic planning and strategic controlling,
- Cost and financial Management as well as company valuation,
- Organizational psychology, personnel and knowledge Management
- Innovation and Technology Management,

- Product, process and project Management.

The module consists of seminaristic classes, case studies, workshops, exercises and company simulation.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

Baum/Coenenberg, Strategisches Controlling, Schäffer/Pöschel, 2013
EFQM, EFQM Excellence Modell, www.efqm.org
Hahn/Taylor, Strategische Unternehmensplanung - Strategische Unternehmensführung, Springer Verlag, 2005;
Kralicek/Böhmdörfer, Kennzahlen für Geschäftsführer, mi, 2008;
Madauss, ProjektManagement - Theorie und Praxis aus einer Hand, Springer, 2018;
Pepels, ProduktManagement, Duncker & Humblot Verlag, 2016;
Specht/Beckmann/Amelingmeyer, F&E-Management, Schäffer/Pöschel, 2002;
Tata Interactive Systems; Teilnehmer Handbuch TOPSIM 'General Management';
Wagner/Patzak, Performance Excellence, Hanser, 2015

Business Controlling		
Abbreviation:	WIG-BusinessControlling	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Industrial Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. sc. pol. Konle, Matthias	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Business Controlling (WIG-BusinessControlling)	
Teaching forms of the module:	WIG-BusinessControlling: SU/Fallbsp. - seminaristic Classes/Fallbeispiele	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Basic knowledge of cost accounting	
Usability:	Bachelor Industrial Engineering and Management	

Learning outcomes:

Professional / methodical competence:

The students

- know the basics of decision-oriented Management
- have an overview of the basic concepts of Controlling
- know the tasks and functions of Controlling
- get an overview of important controlling instruments

Competence to act:

The students

- are able to analyze and evaluate business situations economically.
- can use selected controlling instruments.

Social competence:

The students

- learn how to deal with resistances and opponents
- know the problems of social interaction in controlling, e.g. you are aware of the behavioral effects of controls and control systems.

Content:

- Differentiation of controlling and various controlling concepts

- Coordination and provision of information as central tasks of Controlling (differentiation between system-designing and process-supporting characteristics of the tasks) - Controlling instruments (cost accounting as an information system, planning and budgeting, selected key figure systems, overhead value analysis, etc.) - Organization of controlling, implementation in different branches. The course consists of seminaristic classes, case studies and Exerciseen.
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
lecture script

Corporate Finance		
Abbreviation:	WIG-CorporateFinance	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. rer. pol. Götz, Burkhard	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Corporate Finance (WIG-CorporateFinance)	
Teaching forms of the module:	WIG-CorporateFinance: SU/Fallbsp. - seminaristic Classes/study cases	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Basic knowledge of business administration	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Professional / methodical competence:
The students
- know the common forms of valuation of central asset types
- are familiar with the different ways of raising funds

Competence to act:
The students
- can apply an interdisciplinary approach to the analysis of existing problem areas
- can assess and apply concepts to increase the enterprise value
- control instruments for hedging interest rate and default risks

Social competence:
none

Content:

- Investment risk and capital market theoretical approaches
- business valuation
- value enhancement concepts
- Valuation of shares
- bond rating

- Self-financing, dividend policy and share buybacks - capital markets - Risk Management and derivative instruments - Mergers & Acquisitions, IPOs, Privatizations. The course consists of seminaristic classes and exercises.
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Volkart, Rudolf, Corporate Finance, Zürich 2003

International Law		
Abbreviation:	WIG-PIL	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	7
Module supervisor:	Prof. Dr. iur. von Blumenthal, Astrid	
Language:	English	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	Winter semester	
Courses of the module:	International Law (WIG-InternationalLaw)	
Teaching forms of the module:	SU/Fallbsp. - seminaristic Classes/study cases	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	None	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

The students are aware of the legal problem arising from the internationality of economic relations. They are familiar with the functioning of the international private business law as distinct from national private business law and with the system and hierarchy of norms underlying international private business law as between international agreements, European and German law. Students are familiar with the possibilities of foresighted contract drafting in international trade.

Competence to act:

Students deepen their knowledge of English by communicating orally and in writing in English. They have the necessary flexibility to acquire quickly foreign vocabulary. They are familiar with the working techniques in international private business law and have the skills to analyse and independently solve practical cases of low to medium difficulty. They will be able to participate in drafting contracts in an international context and work constructively with lawyers to solve problems in international business practice.

Social competence:

Students can work together in small groups and develop group-related problem solutions under time pressure. They can articulate themselves and ask questions in a target-oriented manner. They are able to write case solutions well structured and understandable.

Content:

- Tasks and areas of application of the international private business law
- Hierarchy of norms

- Systematics and methodology in international private law, in particular differentiation of conflict of laws rules and substantive rules - Basic differences between Anglo-American and Continental European legal systems - "Ordre public" and "renvoi" - Overview of the EGBGB - International sales law (especially CISG) - European regulations for the harmonization of international private law, in particular o Rome I Regulation o Rome II Regulation - International trade customs and trade terms
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
lecture script

"Product Management"

Corporate planning and organization

Abbreviation:	WIG- Corporate planning and organization	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert	
Language:	German	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Summer semester	
Courses of the module:	Corporate planning and organization (WIG- Corporate planning and organization)	
Teaching forms of the module:	WIG-Corporate planning and organization: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Cost and investment calculation	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students gain an in-depth understanding of the identification of success factors for strategic corporate Management on the basis of the EFQM Excellence Model. You will get to know benchmarking, good practice methods and key figures for sustainable corporate planning and Management.

Competence to act:

Using examples and computer-aided methods (business games), students learn about the networked and holistic effects of Management decisions. Through the analysis of cause-and-effect chains, you will learn how companies and ornamentations can be successfully managed in the market and in competition.

Social competence:

Theoretically acquired knowledge is deepened by group work, so that beside the content level also the relationship level is part of the learning process. Thus in group work problems are worked on together, solution strategies are developed, presented and implemented in particular in the business game in the time-lapse principle.

Content:

Selected methods and concepts from the areas of

- Leadership, strategic planning and strategic controlling,
- Cost and financial Management as well as company valuation,
- Organizational psychology, personnel and knowledge Management

- Innovation and Technology Management, - Product, process and project Management.
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
EFQM, EFQM Excellence Modell, www.efqm.org, 2013; Hahn/Taylor, Strategische Unternehmensplanung, 1997; Baum/Coenenberg, Strategisches Controlling, 1999; Specht/Beckmann, F&E-Management, 2002; Pepels, W., ProduktManagement, 2002; Performance Excellence, Karl W. Wagner, 2007; Madauss, Handbuch ProjektManagement, 2000; Kralicek/Böhmdörfer, Kennzahlen für Geschäftsführer, 2008; Tata Interactive Systems GmbH: Handbuch 2015, V 11.0 TOPSIM General Management II.

Product planning and development			
Abbreviation:	WIG- Product planning and development		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Industrial Engineering and Management - Bachelor	6	
Module supervisor:	Prof. Dr. sc. pol. Konle, Matthias		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Product planning and development (WIG- Product planning and development)		
Teaching forms of the module:	WIG- Product planning and development: SU/Fallbsp. - seminaristic Classes/study cases		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Basic technical and business knowledge		
Usability:	Bachelor Industrial Engineering and Management		

Learning outcomes:

Technical and methodological competence:

The students

- recognize problems in the phase of product development up to product introduction and get to know interdisciplinary approaches to solutions

- know approaches of cost-oriented product Management

- recognise the need to combine technical and commercial expertise with communication skills.

- Ideally, specialist and methodological skills from the technical and business subjects (e.g. construction, cost accounting, financing, project Management) are already available and can deepened and combined here.

Competence to act:

The students are able to apply the knowledge from the technical and commercial areas and to integrate it into project Management. They are able to lead a Product idea about the technical development to a successful product. They learn at an early stage to consider not only the technical aspects of the solution but also the economic side.

Social competence:

The work in the project team over a complete semester strengthens the ability of the students to work in a team. Communication skills, conflict resolution and the ability to present are particularly encouraged.

Content:
basic content of the event: - Technical aspects of product development (methods, guidelines, etc.) - Approaches and methods of the development/construction-accompanying calculation - value analysis - Market-oriented product development (target costing / business plan) - Overall process-oriented examples / project Management In a project, the students carry out the development of a manageable product taking into account the technical and economic requirements. The course consists of seminaristic classes, case studies and exercises.
Studies- / Examination performance:
student research project The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
will be announced at the beginning of each semester (basic literature of the technical and commercial studies are assumed from the basic subjects)

Innovation and Technology Management			
Abbreviation:	WIG-Innovation and Technology Management		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	6	
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert		
Language:	German		
Credits / SWS:	2.5 ECTS / 2 SWS		
Workload:	Contact hours:	22,5 h	
	Self-study:	52,5 h	
	Total expenditure:	75 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Innovation and Technology Management (WIG-Innovation and Technology Management)		
Teaching forms of the module:	WIG-Innovation and Technology Management: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Marketing and cost accounting		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

The students gain an in-depth understanding of strategic planning, controlling and controlling of innovations, i.e. of the process from the idea to idea concepts and innovation projects to the market-oriented product. You will analyse success factors for systematic innovation Management and learn to draw up business plans for product Management.

Competence to act:

Using case studies and exercises, students learn methods for generating, evaluating and conceptually developing ideas for new products and services. In addition, they learn methods for core competence analysis and for systematic R&D and Technology Management.

Social competence:

Theoretically acquired knowledge is deepened through group work, so that through case studies, joint exercises and workshops, not only the factual level but also the relationship level with important elements such as communication, conflict Management, coordination (allocation of roles) and consensus finding is part of the learning process.

Content:

The course consists of seminaristic classes, workshops and exercises.

- Success factors for systematic innovation Management as well as R&D and Technology Management

- methods and concepts for good innovation culture, innovation strategy, innovation planning, innovation project and innovation process - Creativity techniques and methods for the systematic generation and evaluation of ideas
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Gerpott, Strategisches Technologie- und InnovationsManagement, Schäffer/Poeschel, 2005; Hausschildt/Salomo, InnovationsManagement, Verlag Vahlen, 6. Auflage, 2016; Lamprecht, Stephan, Innovationen entwickeln und zu Geschäftsfeldern machen, Schäffer/Poeschel, 2016. Vahs/Burmester, Innovationsmangement: Von der Produktidee zur erfolgreichen Vermarktung, Schäffer/Poeschel, 2005.

Project and Process Management

Abbreviation:	WIG- Project and Process Management	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	6
Module supervisor:	Prof. Dr. rer. nat. Kaiser, Norbert	
Language:	German	
Credits / SWS:	2.5 ECTS / 2 SWS	
Workload:	Contact hours:	22,5 h
	Self-study:	52,5 h
	Total expenditure:	75 h
Module duration:	1 Semester	
Frequency:	Winter- and Summer semester	
Courses of the module:	Project and Process Management (WIG- Project and Process Management)	
Teaching forms of the module:	WIG- Project and Process Management: SU/Pr - seminaristic Classes/Practical training	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Basic knowledge in investment and cost accounting	
Usability:	Bachelor Engineering and Management	

Learning outcomes:

Technical/methodological competence:

Students gain a deeper understanding of how to organize projects with the help of project structure plans, plan project resources with software support, and evaluate and control projects with key figures. They learn to define (business) processes in the company, to visualize them with the help of process maps, to evaluate processes and to create a comprehensive process model for an organization.

to work out.

Competence to act:

The students get to know project concepts, project definitions and project success factors and receive the methodical tools, project organisation forms and structure plans, to plan project resources and evaluate projects with key figures. You know how to define processes and analyze them with key figures, as well as how to visualize process maps.

Social competence:

Theoretically acquired knowledge is deepened by group work in workshops, so that the terms project culture and climate are reflected in projects by working in teams. Besides at the factual level, the relationship level with important elements such as communication, conflict Management, coordination (distribution of roles) and consensus building becomes part of the learning process.

Content:

The module consists of seminaristic classes, workshops and exercises.

- Project Terms, Project Definitions, Project Success Factors

- Project organization forms and structure plans, resource planning - Tools and key figures for project evaluation and controlling - Process definition, business processes, process models - Process maps, visualization of processes - Key figures for controlling and process improvement
Studies- / Examination performance:
written exam, 60 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
Madauss, B., ProjektManagement - Theorie und Praxis aus einer Hand, Springer 2018. Schmelzer/Sesselmann, GeschäftsprozessManagement in der Praxis, Hanser Verlag 2013

2.5 Elective compulsory key study field in energy Technology

Electrical machines and drives			
Abbreviation:	WIG- Electrical machines and drives		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	6	
Module supervisor:	Prof. M. Sc. Weiherer, Stefan		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		45 h
	Self-study:		105 h
	Total expenditure:		150 h
Module duration:	1 Semester		
Frequency:	only Summer semester		
Courses of the module:	Electrical machines and drives (WIG- Electrical machines and drives)		
Teaching forms of the module:	WIG- Electrical machines and drives: S/E/Pr - Seminars/Exercises/Practical training		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	electrical Engineering, Mathematics and Physics		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional competence:

The students get to know the essential characteristics of the most important electrical machines and drives (transformer, asynchronous machine, synchronous machine) and gain an overview of physical and technical effects and connections. They understand application-oriented basic functions of electrical machines and drives.

Methodological competence:

The focus is on the development of specific electrical equivalent circuit diagrams of the electrical machines and drives discussed and their mathematical treatment. The understanding is strengthened by exercises, which are integrated into the material transfer and have to be solved - partly independently.

Competence to act:

Students acquire basic methodological competence for Engineering approaches and problem solutions, i.e. they learn to assign electrical and magnetic effects to the electrical equivalent circuit diagrams of the respective electrical machines and drives and to calculate the components of the equivalent circuit diagrams with the aid of metrological data from basic test arrangements (no-load, short-circuit and/or load tests).

Social competence:

The understanding of the acquired knowledge and its application are deepened in an integrated practical training, in which the students work together in groups on problems and learn - first with assistance, then independently - how to clearly document procedures and results in reports.

Content:
The seminar includes exercises as well as practical training. A collection of exercises with solutions for self-study complement the course. Content focus: - Magnetic Circuits - transformer - asynchronous machine - synchronous machine - Power electronics - pulse width modulated power converters (frequency converters)
Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Fischer, Rolf: Elektrische Maschinen, Hanser-Verlag, 15. Auflage, 2011 oder Folgeauflagen • Merz, H..: Electrical machines and drives, VDE Verlag, 2001 oder Folgeauflagen • Oeding, D., Oswald, B.: Elektrische Kraftwerke und Netze, 6. Auflage, Springer-Verlag, Berlin Heidelberg, 2004 oder Folgeauflagen • Hosemann, G.; Boeck, W.: Grundlagen der elektrischen Energietechnik, 4. Auflage, Springer-Verlag 1991 oder Folgeauflagen

Renewable Energy Technologies			
Abbreviation:	WIG- Renewable Energy Technologies		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	7	
Module supervisor:	Prof. Dr.-Ing. Rosenbauer, Georg		
Language:	German		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	45 h	
	Self-study:	105 h	
	Total expenditure:	150 h	
Module duration:	1 Semester		
Frequency:	only Winter semester		
Courses of the module:	Renewable Energy Technologies (WIG- Renewable Energy Technologies)		
Teaching forms of the module:	WIG- Renewable Energy Technologies: SU/Ü - seminaristic Classes/Exercise		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	Electrical Engineering, Electrical machines and drives		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Professional competence:

In recent decades, the focus has been on central energy conversion, but this is now changing due to the increased use of renewable energies. The performance level of the plants is considerably reduced, whereas the number of the plants feeding into the grids. This module takes these changes into account. The students will learn the basics, potentials and limits of the important renewable energies such as wind and water. Furthermore, they deal with basic considerations for the grid integration of the producers.

Competence to act:

After graduation of the module, the students will know the most important decentralized energy converters and their possibilities as well as their limits for use in electrical energy supply. They will be able to assess grid integration and its limits, and they made some recommendations for action.

Social competence:

Within the framework of a project work on the topic of regenerative plant Technology, independent development and presentation of a technical question is practiced. The students work in small teams and thus learn to solve problems in small groups.

Presentation skills are trained as well as defending one's own work in front of an auditorium.

Content:

- windmills
- hydroelectric power stations
- controllability of different plant types

- Network integration of decentralised units.

The course consists of seminaristic classes, exercises and project work.

Studies- / Examination performance:

written exam, 90 minutes

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.

Literature:

- Gasch, R.: Windkraftanlagen, Grundlagen und Entwurf, 5. Auflage, Stuttgart, Teubner, 2007
- Heier, S.: Windkraftanlagen. 5. Auflage, Teubner Verlag, Stuttgart Leipzig Wiesbaden, 2009
- Kaltschmitt, M., Wiese, A., Streicher, W.: Erneuerbare Energien, 3te Auflage, Springer Verlag 2003, Berlin, Heidelberg, New York

2.6 Business language

Business Spanish - Written communication in a professional environment		
Abbreviation:	WIG- Business Spanish - Written communication in a professional environment	
Assignment to the curriculum:	**Course of studies:**	**Semester:**
	Engineering and Management - Bachelor	
Module supervisor:	Dr. Gebhard, Christian	
Language:	Spanish	
Credits / SWS:	5 ECTS / 4 SWS	
Workload:	Contact hours:	45 h
	Self-study:	105 h
	Total expenditure:	150 h
Module duration:	1 Semester	
Frequency:	only Winter semester	
Courses of the module:	Business Spanish - Written communication in a professional environment - (WIG-Business Spanish - Written communication in a professional environment)	
Teaching forms of the module:	Business Spanish - Written communication in a professional environment: SU/Ü - seminaristic Classes/Exercise	
Prerequisite for participation:	According to SPO or curriculum	
Recommended requirements:	Successful participation in the module "Spanish 2 for Advanced". or proof of comparable knowledge of Spanish recommended	
Usability:	Bachelor Engineering and Management	
Learning outcomes:		
Professional and methodical competence: - Acquisition of the ability to interact in writing in a business environment using business terminology - Ability to use the Spanish language in written form in a professional and professional way. - Deeper development of intercultural competence		
Content:		
- Writing business letters - Practice of various strategies for the comprehension, in-depth understanding and editing of specialist texts from textbooks, trade journals, the business section of newspapers or business-relevant publications by government bodies or associations. - Reviewing and deepening the grammar introduced in the Spanish courses (especially pasts, pronouns) and acquiring more complex structures (especially subjunctive, conditional sentences, verbal periphrases). - Taking up topics from the folk/business economics also with regard to their particularity for a Spanish-speaking country (e.g. economic policy and structure, labour market, international cooperation etc.)		
Studies- / Examination performance:		
written exam, 90 minutes		

The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
• Martínez, lola / Sabater, María Luísa (2008): Colegas 2 . Difusión/ Klett. • Ebenfalls empfohlen: • Abegg, Birgit / Martínez Cestero, Antonio (2006): Comunicación empresarial. • Hueber. • Kursbuch: 978-3-19-004030-8 • Audio-CD: 978-3-19-034030-9 • Tano, Marcelo (2009): Expertos. Curso avanzado de español • orientado al mundo del trabajo . Difusión/Klett. • Libro del alumno + Audio-CD + DVD: 978-3-12-515595-4 (3-12-22. Juli 2015 515595-9) • Cuaderno de ejercicios + Audio-CD: 978-3-12-515596-1 • Ergänzendes Material in ILIAS (z.B. aktuelle Texte aus Fachbüchern und Zeitungen) • Belgeitend empfohlen: Rosario Alonso Raya u.a. (2012): Gramática básica del estudiante de español. Überarbeitete und erweiterte Ausgabe: 978-3-12-535515-6

Business language English 2			
Abbreviation:	WIG-Business language English 2		
Assignment to the curriculum:	**Course of studies:**	**Semester:**	
	Engineering and Management - Bachelor	4	
Module supervisor:	Dr. Zürn, Martina		
Language:	English		
Credits / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	45 h	
	Self-study:	105 h	
	Total expenditure:	150 h	
Module duration:	1 Semester		
Frequency:	Winter- and Summer semester		
Courses of the module:	Business language English 2 (WIG- Business language English 2)		
Teaching forms of the module:	WIG- Business language English 2: SU - seminaristic Classes		
Prerequisite for participation:	According to SPO or curriculum		
Recommended requirements:	English spoken and written, level vocational baccalaureate Module Technically Oriented English		
Usability:	Bachelor Engineering and Management		

Learning outcomes:

Technical/methodological competence:

Acquisition of the ability for fluid social interaction

Competence to act:

Ability to use the English language orally in an international context in a professional and professional way.

Social competence:

Understanding of intercultural factors

Content:

- basic skills development
- Introduction to regional aspects of the English-speaking world with special consideration of intercultural factors and codes of conduct
- Ability to communicate fluently and appropriately in relation to business situations (face to face, socializing)
- Acquisition of a speaking ability that allows one to express one's opinion clearly and appropriately without effort (meeting).
- Ability not only to grasp difficult and more complex topics, but also to summarize them (commenting-written, discussion-oral)
- Exercise on text construction and creating a presentation
- Fertikgeit to apply business correspondence in word and writing

Studies- / Examination performance:
written exam, 90 minutes The prerequisite for the awarding of credits is the passing of the respective module examination according to the SPO or curriculum.
Literature:
- Documents on topics of the lecture - Supplementary materials are projected via the overhead projector or distributed as handouts