



HOCHSCHULE LANDSHUT

HOCHSCHULE FÜR ANGEWANDTE WISSENSCHAFTEN

Module Catalogue

for the

Bachelor's programme

Sustainable Industrial Operations and Business

(Full-time study)

at the

Faculty of Electrical Engineering and Industrial Engineering

at the

Hochschule Landshut

for

Summer semester 2024

Resolved in the Faculty Council on January, 9th 2024

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1. General notes

1.1 The most important documents for your studies

The three most important relevant documents for your studies are:

- **Study and Examination Regulations (SPO)** - here it is bindingly specified which compulsory and elective modules you must complete as part of your studies, as well as their semester hours per week and ECTS credits.
- Semester-actual **study and examination schedule** - here you can find out which courses are offered in the current semester. You can also find out the type of certificates and examinations for the respective module.
- **Module Catalogue** - it supplements the study and examination regulations and the study and examination plan. The module objectives and contents of all modules offered in the degree programme are described here. You will also find the recommended literature here. The module Catalogue may also list modules that are not currently offered.

Note on the formation of the overall examination result (often also referred to as "Bachelor degree"):

The module grades are included in the overall examination result with weights that are specified in the annex to the Study and Examination Regulations (Studien- und Prüfungsordnung; SPO).

The following diagram shows the course of studies according to the SPO of January 2023, which is valid from winter semester 2023/24.

Sem.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32					
7	Mobility Innovations [4/5]		Energy Infrastructure [4/5]		Seminar on Sustainable Development [2/4]		Bachelor's Thesis [12]																26														
6	Smart Manufacturing and Industry 4.0 [4/5]		Data Science and AI [4/5]		Supply Chain Management [4/5]		Enterprise Resource Planning [4/5]		Sustainable Development III: Transformations, Scenarios [4/5]		International Business and Cross-Cultural Communication [4/5]												30														
5	Internship [2/4]														Internship Seminar [2/2]		Seminar research studies (VHB) [2/3]								29												
4	Engineering and Design [4/5]		Introduction to Manufacturing Engineering [4/5]		Renewable Energy [4/5]		Sustainable Development II: Standards, Players, Interventions [4/5]		Project Management [4/5]		Studium Generale (Module in German language) [2/2]		Studium Generale (Module in German language) [2/2]		Studium Generale (Module in German language) [2/2]								31														
3	Automatic Control Engineering [4/5]		Network Communication / IoT [6/6]		Procurement, Manufacturing and Logistics [4/6]		Marketing and Sales [4/5]		Accounting [4/5]		German/Foreign Language* III [4/4]								31																		
2	Mathematics for Engineers II [8/10]				Applied Physics [6/7]		Electronics and Measurement Engineering [4/5]		Software Development and Coding [4/5]		German/Foreign Language* II [4/4]								31																		
1	Mathematics for Engineers I [6/6]		Principles of Electrical Engineering [4/5]		Fundamentals of Computer Science [4/5]		Principles of Business Administration and Economics [6/7]		Sustainable Development I: Principles [4/5]		German/Foreign Language* I [4/4]								32																		
ECTS credits		5		10		15		20		25		30																									
		Mathematics		Sustainability																												Total		210			
		Engineering and natural sciences		Languages and (inter)national culture																																	
		Information Technology and Data Science		Practical Modules and bachelor's thesis																																	
		Business administration		General Studies																																	
		[SWS / ECTS]																																			

* For non-German speakers: German as a foreign language
For German speakers: 2nd foreign language

Please note:

In the degree programme "Sustainable Industrial Operations and Business", students have the possibility to organise the workload and the course of studies relatively freely. Thus, not only the modules of the Studium Generale, but also the modules German I/II/III or modules 2nd foreign language I/II/III (see § 5, paragraph 1, sentence 1 of the SPO Sustainable Industrial Operations and Business) may be completed in each semester. The compulsory semester abroad can also be completed in the 5th, 6th or 7th semester. The above diagram shows only one possible example of the course of study. If you have any questions about the individual study programme, please contact the student advisory service.

A general studies programme is integrated into the degree programme. The Studium Generale comprises 6 ECTS points. The modules of the Studium Generale are offered in a separate catalogue throughout the university and can be taken in any semester. Details on the module catalogue "Studium Generale" can be found at <https://www.haw-landshut.de/hochschule/fakultaeten/interdisziplinaere-studien/studium-generale.html>.

1.2 Anticipated changes in the range of modules

not applicable

2. Module descriptions for the 1st to 4th semester

2.1 Compulsory modules in the 1st and 2nd semester

SIOB100 - Mathematics for Engineers I

Module number	SIOB100
Module designation according to SPO or SPP	Mathematics for Engineers I
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Dr. Christin David

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	6				
Workload (hours)	Total	Course		Self-study	
	180	90		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	6	4	2	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Working through the exercises
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	Endnotes
Proportion of the overall audit result	6/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <p>Thorough knowledge of the relevant subjects for industrial engineering Mathematical terms, laws and calculation methods</p> <p>Skills and competences:</p> <ul style="list-style-type: none"> - Ability to confidently apply this knowledge to tasks in different professional fields for industrial engineers - Training in practice-oriented mathematical ways of thinking and development of abstraction skills
Contents	<ul style="list-style-type: none"> - General basics (equations, inequalities, systems of equations, vector calculus) - Functions and curves (General function properties, Coordinate transformations, Integral rational functions, Broken rational functions, Algebraic functions, Trigonometric functions, Arc functions, Exponential functions, Logarithmic functions, Hyperbolic functions) - Complex numbers (definition and representation of a complex number, complex calculus, applications of complex calculus) - Differential calculus with one variable (derivative of a function, derivative rules, applications of differential calculus) - Taylor series
Media	Blackboard, overhead projector, tablet PC, calculator
Literature	The respective current edition of: Jeffrey, Alan: Mathematics for Engineers and Scientists. Chapman and Hall/CRC

SIOB110 - Principles of Electrical Engineering

Module number	SIOB110
Module designation according to SPO or SPP	Principles of Electrical Engineering
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Dr. Christin David

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project work
	4	3	1	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Basic knowledge of mathematics and physics
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	Endnotes
Proportion of the overall audit result	5/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Overview of the important topics in electrical engineering - Knowledge of the important terms and quantities of electrical engineering from the following four sub-areas: Direct current networks, electric fields, magnetic fields, alternating current networks - Knowledge of the important formulae that relate the electrical engineering quantities to each other (e.g. Ohm's law). <p>Skills:</p> <ul style="list-style-type: none"> - Ability to analyse basic electrotechnical facts and express them quantitatively with the help of appropriate formulae - Ability to check the plausibility of the calculation results with the help of qualitative estimation <p>Competences:</p> <ul style="list-style-type: none"> - In-depth understanding of the laws of electrical engineering - Possibility of critical evaluation of statements on electrotechnical facts - Possibility of further education and deepening in professional practice based on self-selected literature
Contents	<ul style="list-style-type: none"> - DC circuit - Electric field - Magnetic field - Equalisation processes in the RC and RL circuits. - AC circuit
Media	Tablet PC/beamer, blackboard, overhead projector
Literature	The respective current edition of: Warnes, Lionel: Electronic and Electrical Engineering: Principles and Practice. Bloomsbury Publishing

SIOB120 - Fundamentals of Computer Science

Module number	SIOB120
Module designation according to SPO or SPP	Fundamentals of Computer Science
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Dr. Christin David

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	120	60		60	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	3	-	1	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	-
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	5/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of basic computer science terms. - Understanding of the structure of computing systems and how they work. - Students know basic elements of an imperative programming language such as variable assignments, data types, if statements and loops. <p>Skills and competences:</p> <ul style="list-style-type: none"> - Students are able to calculate and deal with different number systems. - Design, analysis and graphical representation of programs in an imperative programming language
Contents	<p>Computer Engineering:</p> <ul style="list-style-type: none"> - Conversions from a number system; tracing arithmetic operations back to addition; negative and floating point numbers in binary representation. - Development of basic interrelationships for arithmetic and control units in CPUs as well as the structure of memory cells (SRAM/DRAM) - Modern computer architecture <p>Practical computer science:</p> <ul style="list-style-type: none"> - Basic elements of programming - Operating systems <p>Applied Computer Science:</p> <ul style="list-style-type: none"> - Economic, commercial applications using the example of MS-Office; - Technical-scientific applications: Simulators, emulators (using the example of virtual PCs), control systems
Media	Blackboard, overhead projector, beamer, computer examples
Literature	The respective current edition of: Pozdniakov, Sergei N.: Informatics in Schools. Fundamentals of Computer Science and Software Engineering. Springer International Publishing

SIOB130 - Principles of Business Administration and Economics

Module number	SIOB130
Module designation according to SPO or SPP	Principles of Business Administration and Economics
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr Reinhold Kohler

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	7				
Workload (hours)	Total	Course		Self-study	
	210	90		120	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	6	6	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	-
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	7/499

Module aims/learning outcomes/learning outcomes aimed at	<p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of basic terms of business administration and economics - Knowledge of the significance and tasks of the operational functional areas as well as the most important economic sectors in the economic cycle and their fundamental interrelationships <p>Skills:</p> <ul style="list-style-type: none"> - Mastery of elementary business and economic methods <p>Competences:</p> <ul style="list-style-type: none"> - Ability to assess the complexity of operational and economic processes - Ability to transfer the economic way of thinking to different business and economic situations
Contents	<p>Business administration:</p> <ul style="list-style-type: none"> - Goals, objectives and operational factors of production - Facility location, forms of business ownership, organisational structure and operational processes - Procurement, manufacturing, sales, investments and financing - Human resource management, leadership <p>Economics:</p> <ul style="list-style-type: none"> - Supply and demand and economic policy measures - Efficient markets and economic cycle and national income - Production and growth - Monetary and fiscal policy and the monetary system.
Media	Tablet PC, calculator, camera, blackboard/whiteboard, overhead projector
Literature	<p>The respective current edition of:</p> <ul style="list-style-type: none"> - Nickels, William G. / McHugh, James M. / McHugh, Susan M.: Understanding Business, International edition, McGraw-Hill/Irwin. - Mankiw, N. Gregory: Principles of Economics, South-Western.

SIOB140 - Sustainable Development I: Principles

Module number	SIOB140
Module designation according to SPO or SPP	Sustainable Development I: Principles
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	-
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	Endnotes
Proportion of the overall audit result	5/499

Module aims/learning outcomes/learning outcomes aimed at	<p>Knowledge:</p> <ul style="list-style-type: none"> - Concept, dimensions and elements of sustainable development - Examples of sustainable and non-sustainable development and their pre-conditions or obstacles - Role of industrial engineering for sustainable development <p>Skills:</p> <ul style="list-style-type: none"> - First techniques for the analysis and description of complex systems - Critically questioning norms, habits and opinions - Reflection on one's own values, views and actions <p>Competences:</p> <ul style="list-style-type: none"> - Recognise, explain and communicate the complexity of sustainable development - Place topics from business and technology in a frame of reference of sustainable development and problematise them with regard to sustainability requirements.
Contents	<ul style="list-style-type: none"> - Terms: Sustainability, sustainable development - Dimensions and elements of sustainable development: <ul style="list-style-type: none"> o Standards: Ecological compliance, Social equity, Economic Performance o Transformation fields: Energy, mobility, prosperity and consumption, industry, resources, food, cities and countryside o Actor groups: Civil society, politics, business, science, individual o Types of intervention: cultural (incl. values and norms), political-institutional, economic, technological o Reach: spatial, temporal - Examples of sustainable development - Obstacles and preconditions for sustainable development - Fundamentals of transformation theory

	<ul style="list-style-type: none"> – Climate change: a global challenge for sustainable development – Role of industrial engineering for sustainable development – Individual real experiment: self-experience and reflection
Media	Tablet PC with beamer, overhead projector, black and white board
Literature	<p>The respective current edition of:</p> <ul style="list-style-type: none"> – Costanza, Robert et al: An Introduction to Ecological Economics, CRC Press. – Göpel, Maja: The Great Mindshift - How a New Economic Paradigm and Sustainability Transformations go Hand in Hand, SpringerOpen. – Stuchtey, Martin R. / Enkvist, Per-Anders / Zumwinkel, Klaus: A Good Disruption - Redefining Growth in the Twenty-First Century, Bloomsbury.

SIOBF10 - German I

See Language Module Catalogue

SIOB150 - Mathematics for Engineers II

Module number	SIOB150
Module designation according to SPO or SPP	Mathematics for Engineers II
Language	Dr. Christin David
Lecturer	See semester-specific lecture schedule
Person responsible for the module	NN

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	10				
Workload (hours)	Total	Course		Self-study	
	300	120		180	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	8	6	2	-	-

Module-specific prerequisites according to SPO	-				
Recommended prerequisites	Mathematics for Engineers I (SIOB100)				
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	Endnotes				
Proportion of the overall audit result	10/499				

Module Objectives/Objectives Learning Outcomes	<p>Knowledge: Thorough knowledge of the mathematical terms, laws and calculation methods relevant to industrial engineering</p> <p>Skills and competences:</p> <ul style="list-style-type: none"> - Ability to confidently apply this knowledge to tasks in different professional fields for industrial engineers - Training in practice-oriented mathematical ways of thinking and development of abstraction skills
Contents	<p>Analysis and linear algebra:</p> <ul style="list-style-type: none"> - Integral calculus with one variable - Fourier series - Linear algebra - Fundamentals of linear optimisation - Differential and integral calculus for functions with several variables - Ordinary differential equations <p>Statistics:</p> <ul style="list-style-type: none"> - Descriptive statistics - Probability calculation - Probability distributions - Conclusive statistics, statistical test methods
Media	Tablet PC, calculator, camera, blackboard/whiteboard, overhead projector
Literature	The respective current edition of: Huw Fox, Bill Bolton: Mathematics for engineers and technologists. Butterworth-Heinemann

SIOB160 - Applied Physics

Module number	SIOB160
Module designation according to SPO or SPP	Applied Physics
Language	Dr. Christin David
Lecturer	See semester-specific lecture schedule
Person responsible for the module	NN

Study section	1st year of study
Module type	Compulsory module (basic modules)
Module group	-

ECTS points	7				
Workload (hours)	Total	Course		Self-study	
	210	90		120	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	6	5	1	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Modules "Mathematics for Engineers I" (SIOB100) and "Principles of Electrical Engineering" (SIOB110)
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	Endnotes
Proportion of the overall audit result	7/499

Module aims/learning outcomes/learning outcomes aimed at	<p>The students gain knowledge:</p> <ul style="list-style-type: none"> - of physical basics of mechanical, thermodynamic, optical and electrical phenomena, - in application of physical laws to the solution of real-world problems. <p>The students acquire the following skills and competences:</p> <ul style="list-style-type: none"> - ability to correctly identify and categorize the physics basics of technical applications, - Capability to understand dependences between different aspects of technical applications, - Capability to analyze and visualize physical equations, - Skills in carrying out simple physical calculations.
Contents	<ul style="list-style-type: none"> - Physics in moving reference frames: inertial forces, centrifugal force, Coriolis force. - Conservation laws in physics: mechanical work, forms of energy, conservation of energy, conservation of momentum, elastic and inelastic collisions, conservation of angular momentum, conservation of charge, conservation of mass. - The structure of matter: atom models, elementary particles, chemical elements, atomic bonds, molecules, crystals, states of matter, solids, metals, ceramics, amorphous solids, polymers, composite materials, liquids, hydrostatics and hydrodynamics, surface tension, capillary effect, gases, atmosphere, ideal gas. - Thermodynamics: temperature, temperature scales, kinetic-molecular theory, ideal-gas law, heat, the laws of thermodynamics, thermodynamic processes, cycle processes, heat engines. - Harmonic oscillations and waves: one-dimensional harmonic motion, damped and forced oscillations, wave equation, harmonic waves, reflection, standing waves, sound, perception of sound, sound level, Doppler effect, interference and diffraction.

	<ul style="list-style-type: none"> – Optics: spectrum of light, refraction, transmission and refraction at surfaces, polarization, total reflection, lenses, optical instruments, wave optics, interference, diffraction. <p>Exercises: appr. 30 problems with solutions and discussion during exercise units.</p>
Media	Tablet-PC and Projector, demonstration experiments
Literature	<p>The latest issue of:</p> <ul style="list-style-type: none"> – Cutnell, John D. / Johnson, Kenneth W.: Physics, John Wiley and Sons. – Serway, Raymond A. / Jewett, John W.: Physics for Scientists and Engineers, Brooks/Cole.

SIOB170 - Electronics and Measurement Engineering

Module number	SIOB170
Module designation according to SPO or SPP	Electronics and Measurement Engineering
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Dr. Christin David

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-		-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Successful completion of the modules "Principles of Electrical Engineering" (SIOB110), "Fundamentals of Computer Science" (SIOB120)
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	Endnotes
Proportion of the overall audit result	5/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Description of the manufacture of electronic devices - Description of electrical components by characteristic curves - Know important circuit symbols - Knowing important limit values - Description of the electrical function of important semiconductor components - Explain some basic circuits of electronics (rectifier, smoothing, MOSFET as switch/amplifier, basic OPV circuits). - Description of the conversion between analogue and digital signals - Knowing the basics and simple circuits of digital technology <p>Skills:</p> <ul style="list-style-type: none"> - Application of knowledge and laws about limit values to component selection - Analyse and draw simple circuits - Dealing with formulas, calculation methods and data sheets from engineering practice - Application of graphical solution methods based on characteristic curves - Evaluate a digitisation in terms of dynamics and sampling frequency - Optimising logic circuits with regard to the number of gates <p>Competences:</p> <p>The students are familiar with the concepts of electronics and measurement technology and can assess these independently in their later engineering practice in their professional field.</p>
Contents	Production of electronic circuits (development process, electronics design automation, PCB production, interconnection technologies, soldering processes, error probabilities).

	<p>Limit values (safe operating area, thermal resistance, handling of data sheets, dimensioning of heat sinks)</p> <p>Diode and its applications (Shockley equation, characteristic curve, limit values, data sheets, designs, half-wave rectifier, bridge rectifier, smoothing capacitor, light-emitting diode, photodiode, solar cell)</p> <p>MOSFET (function, characteristic curve, limit values, data sheets, designs, MOSFET as switch for resistive and inductive loads, MOSFET as amplifier)</p> <p>Operational amplifier (function of ideal/real OPV, principle of negative feedback, non-inverting/inverting amplifier, summer, integrator, differentiator. Cut-off frequency, slew rate)</p> <p>Analogue-to-digital converter/digital-to-analogue converter (mode of operation, quantisation error, sampling theorem)</p> <p>Digital technology (logic gates, CMOS technology, switching networks, switching units)</p>
Media	Visualisers, illustrative models, experimental demonstrations, simulations, videos, exercises, homework
Literature	Comprehensive lecture notes from Landshut University of Applied Sciences, selected data sheets (both will be made available via Moodle).

SIOB180 - Software Development and Coding

Module number	SIOB180
Module designation according to SPO or SPP	Software Development and Coding
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Dr. Christin David

Study section	1st year of study (foundation modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-		-

Module-specific prerequisites according to SPO	-				
Recommended prerequisites	Fundamentals of Computer Science (SIOB120)				
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	Endnotes				
Proportion of the overall audit result	5/499				

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of the structure, outputs and results of a compiled programming language - Understanding of the typical ways of thinking in software development. <p>Skills and competences:</p> <ul style="list-style-type: none"> - Ability to write simple and complex programs in the procedural language C/C++. - Ability to deal with a modern development environment
Contents	<p>Programming in C/C++:</p> <p>Expressions/instructions (evaluation sequence, blocks);</p> <ul style="list-style-type: none"> - Input/Output and Elementary - Operators and preprocessor - Control structures as well as arrays and pointers - Functions and parameter transfers - More complex data types and data structures; - Algorithms for advanced topics - Important functions of the standard and mathematical library; - File handling
Media	Blackboard, overhead projector, beamer, computer examples
Literature	The respective current edition of: Schmidt, Richard: Software engineering. architecture-driven software development. Elsevier.

SIOBF20 - German II

See Language Module Catalogue

2.2 Compulsory modules in the 3rd and 4th semester**SIOB190 - Automatic Control Engineering**

Module number	SIOB190
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Module designation according to SPO or SPP	Automatic Control Engineering				
Language	English				
Lecturer	See semester-specific lecture schedule				
Person responsible for the module	Prof. Dr. Martin Prasch				
Study section	2nd year of study (advanced modules)				
Module type	Mandatory module				
Module group	-				
ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-
Module-specific requirements according to SPO	-				
Recommended prerequisites	Principles of Electrical Engineering (SIOB110), Fundamentals of Computer Science (SIOB120) and Software Development and Coding (SIOB180)				
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	Endnotes				
Share of total audit result	20/499				
Module Objectives/Objectives Learning Outcomes	Knowledge: <ul style="list-style-type: none"> - Knowledge of basic automation technology terms and the importance of automation technology and its possible applications - Understanding of the structure of automation systems and their how it works and knowledge of the benefits of automating systems and the - Challenges in the implementation Skills: <ul style="list-style-type: none"> - The students apply their knowledge to make a rough planning of simple automation systems. - Their knowledge also enables them to design and implement simple PLC programs. Competences: <ul style="list-style-type: none"> - Students will be able to analyse technical processes and evaluate the feasibility of automation. - They are able to estimate the effort required for implementation. 				
Contents	<ul style="list-style-type: none"> - Importance of automation and automation objects - Design of automation systems and requirements for them - Functionality of automation computers - Interfaces of the automation computers to the process - Industrial communication technology - Structure and function of a PLC - Cyclic programme processing and response time - Addressing inputs and outputs and the memory - Basics of programming languages - Storing functions, edges and timers 				
Media	Blackboard, beamer, camera, hardware and software				
Literature	Kulczycki, Piotr: Automatic Control, Robotics, and Information Processing. Springer				

SIOB200 - Network communication / IoT

Module number	SIOB200
Module designation according to SPO or SPP	Network communication / IoT
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	6				
Workload (hours)	Total	Course		Self-study	
	180	75		105	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	6	4	2	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Fundamentals of Computer Science (SIOB120)
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	24/499

Module Objectives/Objectives Learning Outcomes	<p>The students gain knowledge in the field of networks for data and telecommunications with deeper focus on the tools and concepts of IoT and application areas</p> <p>The students acquire the following skills and competences:</p> <ul style="list-style-type: none"> - identify communication protocols - describe technologies used for data communication and mobile communication - understanding differences between technologies and protocols - describe technological basics of the Internet of Things (IoT) - describing the use of IoT and outline data communication
Contents	<ul style="list-style-type: none"> - Fundamentals of Standards on the Internet: History, organisation, committees, standards. - Basics of computer networks: ISO/OSI reference model, protocols of the TCP/IP stack, DNS, HTTP - Local area networks: Ethernet, WAN, WIFI - Telecommunication: DSL, Fiber and mobile communication (e.g. GSM, VoIP, LTE) - concepts and tools of IoT: The main current application areas; elements of networking; typical actuators and sensors; protocols (esp. MQTT) and interoperability Industry 4.0, etc) to be implemented.
Media	Tablet PC/projector, blackboard or whiteboard, flip chart, videos
Literature	<p>The latest issue of:</p> <ul style="list-style-type: none"> - Halsall, Fred: Computer Networking and the Internet, Addison-Wesley - McEwen, Adrian; Cassimally, Hakim: Designing the Internet of Things, John Wiley & Sons

SIOB210 - Procurement, Manufacturing and Logistics

Module number	SIOB210
Module designation according to SPO or SPP	Procurement, Manufacturing and Logistics
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	6				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	-
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	24/499

Module aims/learning outcomes/learning outcomes aimed at	Knowledge: <ul style="list-style-type: none"> - Overview of the operational processes of industrial production of goods. - Fundamentals of procurement and purchasing - Knowledge of the fundamentals of manufacturing, of different production types and of basic manufacturing strategies - Knowledge of production planning and control processes - Basic knowledge of logistics: from transport systems to internal and cross-company integrating supply chains Skills: <ul style="list-style-type: none"> - Performing ABC analysis, BoM explosion - Calculation of cost of purchasing and transportation costs - Calculation of optimal lot sizes and through put time Competences: <ul style="list-style-type: none"> - Solve basic problems of manufacturing optimization - Discuss adjustment decisions in practices
Contents	Procurement: Supplier management, make-or-buy decisions and sourcing strategies Manufacturing: <ul style="list-style-type: none"> - Types of production processes - Concepts of production planning and control - Production programme planning, material requirements planning, order scheduling and release and comparison of production control concepts Logistics: <ul style="list-style-type: none"> - Systems of transport, storage, handling and order-picking - Procurement, production and distribution logistics - Concepts of logistics: JIT, KANBAN, cross-docking etc.
Media	Tablet PC/projector, blackboard, flip chart
Literature	The latest issue of:

	<ul style="list-style-type: none">– Chopra, Sunil: Supply Chain Management. Global edition. Prentice Hall International.– Heizer, Jay; Render, Barry: Operations Management. Global edition. Pearson Education Limited.
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SIOB220 - Marketing and Sales

Module number	SIOB220
Module designation according to SPO or SPP	Marketing and Sales
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Reinhold Kohler

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Module "Principles of Business Administration and Economics" (SIOB130)
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module aims/learning outcomes/learning outcomes aimed at	Upon completion of the module, students know the basic concepts of marketing and are able to understand and analyse markets and customer behaviour in B2B markets. Based on this knowledge, they are able to educe recommendations regarding the marketing core tasks (4Ps) in a given context/for a given case. The students understand the structure, processes and the interdependencies within technical sales and are able to describe and evaluate specific sales tasks.
Contents	<ul style="list-style-type: none"> - Introduction: Definitions, classification B2C and B2B, core assignments in marketing - B2B marketing: characteristics and business types - Market - competition - own corporation: <ul style="list-style-type: none"> o Market research and market analysis o Market segmentation / target group analysis o Systematic competition analysis incl. 5forces analysis o Positioning and aspects of customer value / benefit o Market cycle: analysis and controlling o STEEP analysis, Strength/weakness analysis and SWOT analysis - Operational marketing tasks: 4Ps in B2B context <ul style="list-style-type: none"> o Product: structure, definition and life cycle o Price: pricing definition and strategies and their effect on the company's profitability and o Basic distribution concepts o Marketing communication: basic principles and options - Sales Management (focus on B2B markets) <ul style="list-style-type: none"> o Sales and distribution options o Structure of sales organizations incl. key account management o Structure of sales processes incl. after sales
Media	Tablet PC / beamer, e-learning (Moodle platform of the HS), blackboard, flip-chart
Literature	The latest issue of:

	<ul style="list-style-type: none">– Speh, Th.; Hutt, M.: Business Marketing Management: B2B; Cengage Learning EMEA.– Kotler, Ph.: Principles of Marketing, Pearson.– Kleinaltenkamp, M.: Fundamentals of Business-to-Business Marketing, Springer.– Hofmaier, R.: Marketing, Sales and Customer Management: An integrates overall B2B management approach, De Gruyter / Oldenbourg.
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SIOB230 - Accounting

Module number	SIOB230
Module designation according to SPO or SPP	Accounting
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr Reinhold Kohler

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	3	1	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Successful completion of the module "Principles of Business Administration and Economics" (SIOB130)
Exam	written exam - 60 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Understanding of internal accounting - Knowledge of cost allocation methods - Understanding decision-related costs - Understanding of the enterprise as a profit- and loss-generating organisation with capital and asset endowment - Knowledge of the interrelationships of inventory and flow variables in a business and the expenditure/income effects - Understanding how a company's profit for the period is generated <p>Skills:</p> <ul style="list-style-type: none"> - Understanding costing, budgeting and planning - Distinguish and differentiate between full cost and partial cost perspectives - Understanding of the booking technique and selected basic - Year-end closing <p>Competences:</p> <ul style="list-style-type: none"> - Carry out and interpret various profitability calculations - Ability to implement different approaches to cost management and discuss their advantages/disadvantages - Ability to analyse and interpret financial statements of individual companies and groups of companies
Contents	<ul style="list-style-type: none"> - Basics and basic terms as well as - Cost type accounting - Cost centre accounting and - Cost unit accounting - Full and partial cost accounting systems - Standard costing and - Activity-based costing - Target costing - Tasks and areas of industrial accounting - Introduction to industrial accounting

	– Annual financial statements and balance sheet analysis
Media	Tablet PC with beamer, overhead projector, blackboard
Literature	The current edition of: <ul style="list-style-type: none">– Schuster, Peter; Heinemann, Mareike; Cleary, Peter: Management Accounting. Springer International Publishing– Deitermann, Manfred; Schmolke, Siegfried; Rückwart, Wolf-Dieter: Industrielles Rechnungswesen - IKR, Winklers, Braunschweig. (German Language)

SIOBF30 - German III

See section 4.

SIOB240 - Engineering and Design

Module number	SIOB240
Module designation according to SPO or SPP	Engineering and Design
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	210	90		120	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	3	1	-	-

Module-specific prerequisites according to SPO	-				
Recommended prerequisites	Introduction to Manufacturing Engineering (SIOB250)				
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	Endnotes				
Proportion of the overall audit result	20/499				

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <p>Students have knowledge of</p> <ul style="list-style-type: none"> - to create and understand technical drawings, - about the application possibilities of CAD systems, - for the design of components, - about important machine elements, their function and application, - basic tasks, methods and procedures of product development. <p>Skills and competences:</p> <p>Students are able to,</p> <ul style="list-style-type: none"> - sketch components/assemblies and represent them in a technical drawing in accordance with standards, - Represent components/assemblies with the aid of a 3D CAD system and derive drawings and parts lists from them, - Select and design machine elements according to specifications, - to work out solutions for practice-oriented, constructive tasks under consideration of the rules of force-flow-appropriate, material-appropriate, production-appropriate and assembly-appropriate design.
Contents	<p>Lessons and exercises:</p> <ul style="list-style-type: none"> - Tasks of design and development as well as their integration into the company processes and organisation - Technical drawing: Standardised representation, dimensioning and labelling; dimensional, shape and positional tolerances; fits; surface finishes; types of drawing; two- and three-sheet projection; cuts and unwindings.

	<ul style="list-style-type: none"> – Machine elements: Structure and application guidelines of selected machine elements: Rolling bearings; Springs; Shafts/axles; Screws; Shaft-hub connections; Gears. – Design: Solution finding; economic efficiency calculation; standard series; design suitable for force flow, material, production and assembly; influence of surfaces and fits. – Design methodology and development process: Methodological procedures: V-model, simultaneous engineering, VDI 2221; tools for target-oriented solution search: list of requirements, functional/effective structures, morphological box.
Media	Computer/beamer, blackboard, overhead projector
Literature	The respective current edition of: Childs, Peter R. N.: Mechanical Design Engineering Handbook. Esevier

SIOB250 - Introduction to Manufacturing Engineering

Module number	SIOB250
Module designation according to SPO or SPP	Introduction to Manufacturing Engineering
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	-
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Classification of manufacturing processes, differentiation between production engineering and process engineering and energy technology - Means and methods by which discrete products are manufactured, in particular: <ul style="list-style-type: none"> o Manufacturing process <ul style="list-style-type: none"> ▪ Archetypes ▪ Forming ▪ Separate ▪ Fügen ▪ Coating ▪ Change substance properties ▪ Generative manufacturing processes o Handling and chaining - Knowledge of the cost drivers of the above-mentioned manufacturing processes - Knowledge of important boundary conditions and restrictions of the above-mentioned manufacturing processes - Knowledge of the possibilities for scaling the above-mentioned production processes with regard to output quantity and workpiece size as well as flexibility with regard to variants. - Basics of production system design: Definition of work systems, production type and process principle - Concept of product-determining data and selected specifications <p>Skills:</p> <ul style="list-style-type: none"> - Analysis of technical drawings with regard to essential product features determining the manufacturing process chain - Analysis of job data with regard to information relevant for work system design <p>Competences:</p>
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	<ul style="list-style-type: none"> - Ability to derive fundamentally suitable manufacturing methods and process chains for typical workpieces on the basis of important product-determining data and order data - Ability to determine the production type and process principle on the basis of essential order data and product structure features
<p>Contents</p>	<p>General basics:</p> <ul style="list-style-type: none"> - Definition and classification of production engineering and its distinction from process and energy engineering - Classification of manufacturing processes according to DIN 8580 - Marking of important product-determining data on technical drawings: Dimensional, form and positional tolerances, roughness, indication of treatment specifications <p>Manufacturing process:</p> <ul style="list-style-type: none"> - Casting process for metal: <ul style="list-style-type: none"> o Foundry basics, requirements for the design of moulds and products, overview of casting materials, advantages and disadvantages of the process group. o Mould structure o Mould making and casting processes and their classification o Sequence, process identifiers, scaling and example components of selected processes - Powder metallurgy: <ul style="list-style-type: none"> o Basics: powder production, shaping by pressing or MIM, sintering and post-processing o Requirements for the design of moulds and products, overview of the sintering classes, advantages and disadvantages of the process group, example components. - Primordial moulding of polymers: <ul style="list-style-type: none"> o Basics: Overview of polymer materials, foams and fibre composites o Overview of moulding processes in plastics processing o Important primary forming processes according to material groups: Sequence, process codes, scaling and example components - Generative manufacturing processes: <ul style="list-style-type: none"> o Basic principle and classification of the procedures, areas of application and procedure codes o Presentation of selected processes: Process principle, materials, process designations and areas of application - Forming manufacturing processes: <ul style="list-style-type: none"> o Basic principle of forming. Influence of forming degree and temperature on the process, classification of the processes, areas of application and process characteristics, comparison of forming with metal-cutting shaping, including environmental aspects. o Presentation of important processes in solid, sheet and wire forming o Tool design using the example of a shaft blank - Separating manufacturing processes: <ul style="list-style-type: none"> o Basic principles of cutting, chipping and removal o Sequence of the machining process, cutting materials, kinematics and cutting forces using the example of turning, machine straight line and tool life, economic significance of machining o Machining with geometrically defined and geometrically undefined cutting edge: important processes, their areas of application and process symbols, examples of workpieces and machine tools o Ablation by electrical discharge machining, laser and waterjet: areas of application and process characteristics, examples of workpieces and machine tools - Joining manufacturing processes: <ul style="list-style-type: none"> o Classification of joining processes o Important joining methods for non-positive, positive and material-fit connections: Fields of application and process codes, examples of workpieces and machine tools - Manufacturing processes Coating:

	<ul style="list-style-type: none"> ○ Classification and significance of the coating processes ○ Integration of coating into the manufacturing process chain ○ Environmental relevance: Degree of solid use and solvent content ○ Important processes: Fields of application and process codes, examples of workpieces and equipment <p>– Manufacturing processes change material properties:</p> <ul style="list-style-type: none"> ○ Metallurgical fundamentals using the example of the iron-carbon system ○ Heat treatment processes for steels: Classification of heat treatment processes (thermal, thermochemical, thermomechanical), heat treatment objectives, process sequence, equipment. <p>Manufacturing process chains</p> <ul style="list-style-type: none"> ○ Definition and process elements, boundary conditions of work planning in single-item and series production, basics of evaluation and selection of alternative manufacturing process chains ○ Manufacturing process chain planning methodology ○ Selected examples of manufacturing process chains: cast housing, smooth shafts, stepped shafts, splined shafts, machined flange <p>Handling and chaining:</p> <ul style="list-style-type: none"> ○ Handling and linking in assembly and manufacturing: Principles, sub-processes, facilities <p>Production systems:</p> <ul style="list-style-type: none"> ○ Work systems: Definition and design features Manufacturing type and process principle ○ Presentation of important manufacturing types and process principles: Characteristics, advantages and disadvantages, application according to quantities and component mass. ○ Flow production: Determination of customer cycle and line balancing, availability <p>Trends in modern production systems: Integration and coupling of subsystems, importance of buffers and bearings</p>
Media	PC/beamer, blackboard, videos
Literature	The respective current edition of: Nee, Andrew: Handbook of Manufacturing Engineering and Technology. Springer

SIOB260 - Renewable energy

Module number	SIOB260
Module designation according to SPO or SPP	Renewable energy
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	
Recommended prerequisites	Successful completion of the modules ...
Exam	written exam - 60 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module Objectives/Objectives Learning Outcomes	<p>The students know the basics of the technical-economic interrelationships of the energy industry, renewable energies as well as essential characteristics of each value creation stage.</p> <ul style="list-style-type: none"> - They are able to apply economic criteria in the procurement, transport and delivery of heat and electrical energy. Based on what they have learned, the students can work on case studies in a practical and interactive way. - Cognition of boundary conditions, structures and processes of today's and the future energy industry with a focus on the electricity industry.
Contents	<ul style="list-style-type: none"> - Fundamentals of the energy industry - Generation and transport of electricity, load curves, delivery to industrial and end customers - Structure and functioning of a liberalised electricity market, unbundling, regulation - Power trading, EEX power exchange, Derivatives Market, Spot Market - Contracts, pricing - Energy law framework conditions, laws and regulations in Germany and the EU - Promotion of renewable energies
Media	Tablet PC with beamer, overhead projector, blackboard
Literature	<p>The respective current edition of:</p> <ul style="list-style-type: none"> - Twidell, John, Renewable Energy Resources, London - Quaschnig, Volker, Understanding Renewable Energy Systems, London

SIOB270 - Sustainable development II: Standards, Players, Interventions

Module number	SIOB270
Module designation according to SPO or SPP	Sustainable development II: Standards, Players, Interventions
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Successful completion of the module: Sustainable Development I: Principles
Exam	written exam - 60 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module Goals / Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Standards, players and interventions as constitutive subsystems of sustainable development - Basic patterns of dynamics within these subsystems <p>Skills:</p> <ul style="list-style-type: none"> - Analysis, description and explanation of the dynamics within the subsystems - Identify and justify fundamental alternatives to traditional patterns of unsustainable development in technology, economics, politics and culture. <p>Competences:</p> <ul style="list-style-type: none"> - Outlining future concepts on the basis of the three subsystems - Recognise the need for inter- and transdisciplinary cooperation Development of procedures for initiating inter- and transdisciplinary work
Contents	<ul style="list-style-type: none"> - Standards: <ul style="list-style-type: none"> o Ecological carrying capacity: Earth history / Earth system / planetary, regional and local boundaries / tipping points / human species o Social equity: concepts of justice / operationalisation approaches / distributional issues on wealth, income and power o Economic performance: Performance concepts / Supply, welfare, provision and prosperity / Limits to growth o Interaction of the three standards - Groups of players: <ul style="list-style-type: none"> o Civil society: classification / emergence, organisation, development / significance o Policy: essence, forms, processes / sustainability initiatives o Science: tasks and limits / transformative science / sustainability science o Individual: responsibility / participation / psychology of sustainability o Companies: Types / sustainability strategies / sustainability-oriented business models

	<ul style="list-style-type: none"> ○ Interaction of the five groups of players – Types of intervention: <ul style="list-style-type: none"> ○ cultural: values, norms, meaning / creativity and art / education / routines ○ political-institutional: concept of institution / legal systems (especially of the EU and Germany) / environmental, social and economic law / corporate governance ○ economic (in the sense of macroeconomic): Ecological economics / circular economy, post-growth economy, degrowth, common good economy / entrepreneurial initiatives. ○ technological: terms and systematics / history and philosophy of technology / consequences of technology / key technologies of sustainable development ○ Interaction of the four types of intervention – Application examples Outlook: Transformations and future scenarios
Media	Tablet PC with beamer, overhead projector, black and white board
Literature	<p>The respective current edition of:</p> <ul style="list-style-type: none"> – Costanza, Robert et al: An Introduction to Ecological Economics, CRC Press. – Göpel, Maja: The Great Mindshift - How a New Economic Paradigm and Sustainability Transformations go Hand in Hand, SpringerOpen. – Ostrom, Elinor: Governing the Commons - the Evolution of Institutions for Collective Action. – Oliver, Parodi; Kaidi, Timm: Personal Sustainability - Exploring the Far Side of Sustainable Development, Routledge.

SIOB280 - Project Management

Module number	SIOB280
Module designation according to SPO or SPP	Project Management
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	3	1	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	-
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module aims/learning outcomes/learning outcomes aimed at	<p>Students understand the principles of projects and project management. They are able to effectively work in projects and to manage and lead simple or small projects on their own.</p> <p>Students learn:</p> <ul style="list-style-type: none"> - relevant terms and methods related to project management - characteristics of projects - basic leadership and management principles for project managers - how to use project management software <p>They can:</p> <ul style="list-style-type: none"> - define project scope and targets - plan project schedules, resources and cost - conduct and monitor stakeholder and risk management - conduct project controlling <p>Besides, students learn how to organize tasks by applying efficient time management and result-oriented way of working.</p> <p>Students will be enabled to successfully apply for the optional "Basiszertifikat Projektmanagement GPM" of the Deutsche Gesellschaft für Projektmanagement (GPM), which is the German chapter of the International Project Management Association (IPMA).</p>
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Contents	<p>In order to achieve the qualification targets, the following content is covered:</p> <ul style="list-style-type: none"> – introduction to project management – project definition and target specification – project organization – Stakeholder and risk management – planning of project phases, schedules, milestones, resources and cost – introduction to project controlling and earned value analysis – important processes of project management – introduction to leadership – project management software <p>The content follows the Individual Competence Baseline 4.0 of the International Project Management Association (IPMA).</p>
Media	<p>Tablet PC/projector, blackboard, flip chart, classroom response systems, moodle virtual classrooms</p>
Literature	<p>The latest issue of: Kerzner, Harold: Project management: a systems approach to planning, scheduling, and controlling. Wiley.</p>

3. Module descriptions for the 5th, 6th and 7th semester

3.1 Compulsory modules in the practical study semester

SIOB290 - Internship

Module number	SIOB290
Module designation according to SPO and SPP	Internship
Language	German or the working language of the internship company
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	Practical semester
Module type	Mandatory module
Module group	-

ECTS points	24				
Workload (working days)	Total	Course		Self-study	
	80	-		-	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	-	See semester-specific study and examination plan			

Module-specific prerequisites according to SPO	All exams of the first and second semester must be passed (exception English I).				
Recommended prerequisites	-				
Exam	-				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	not end-graded				
Proportion of the overall audit result	0/499				

Module Objectives/Objectives Learning Outcomes	<p>Introduction to the activity and working methodology of the engineer based on concrete tasks and projects in the field of sustainability.</p> <ul style="list-style-type: none"> - Extension and deepening of the knowledge, skills and competences acquired in the first semesters - Develop an understanding of the subject-specific professional environment <p>Special emphasis shall be placed on the use and development of the following <u>competences</u>:</p> <ul style="list-style-type: none"> - Ability to communicate and cooperate effectively in a horizontal and vertical direction as well as the ability to grasp, present and assess processes and problems independently - Ability to define, organise and carry out tasks/projects in a team and to evaluate and present the results
Contents	<p>The internship is to be completed in a manufacturing or service company. The company-dependent tasks are to be selected from engineering practice and - in order to ensure an appropriate technical depth - may originate from a maximum of three of the following areas:</p> <ul style="list-style-type: none"> - Research or development project - Participation in IT projects in as many project phases as possible - Operational processes in production, quality assurance and quality management as well as project work or project management - Product management, marketing and sales, service and maintenance - Customer service, procurement and materials management and logistics - Accounting, Controlling and Human Resources
Media	
Literature	

SIOB300 - Internship Seminar to SIOB290

Module number	SIOB300
Module designation according to SPO or SPP	Internship Seminar (can only be completed after the practical time in the company)
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	The practical seminar is usually held in the 6th semester.
Module type	Mandatory module
Module group	-

ECTS points	2				
Work effort (hours)	Total	Course		Self-study	
	60	30		30	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	2	2	-	-	-

Module-specific prerequisites according to SPO	All examinations of the first and second semester must be passed (exception: English I).
Recommended prerequisites	-
Exam	-
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	Not final grade, i.e. predicate "passed with success" or "passed without success".
Proportion of the overall audit result	0/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge: Understanding of the subject-specific professional environment</p> <p>Skills: Ability to present operational structures, operational processes and own work results</p> <p>Competences: Ability to expand, deepen and network theoretically acquired and practically experienced knowledge</p>
Contents	<ul style="list-style-type: none"> - Presentations and reports (in English) by the students about their activities in the companies during the practical study semester. - Linking practical training with the curriculum of the university
Media	Tablet PC with beamer, document camera, blackboard or whiteboard

3.2 Compulsory modules in the two theoretical semesters of the 5th, 6th and 7th semester s

SIOB310 - Seminar on Research Studies

Module number	SIOB310
Module designation according to SPO or SPP	Seminar Research Studies
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	Advanced studies
Module type	Mandatory module
Module group	-

ECTS points	3				
Workload (hours)	Total	Course		Self-study	
	90	30		60	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	2	2	-	-	-

Module-specific prerequisites according to SPO	All examinations of the first and second semester must be passed (exception: English I).				
Recommended prerequisites	-				
Exam	Course-related, final grade-forming certificate of achievement				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	endnotes				
Proportion of the overall audit result	16/499				

Module aims/learning outcomes/learning outcomes aimed at	<p>Knowledge:</p> <p>Know the process and methodology of science</p> <p>Skills:</p> <ul style="list-style-type: none"> - Conduct thorough literature research and use appropriate sources of professional information for job purposes - Speak and write in a scientifically correct way <p>Competences:</p> <ul style="list-style-type: none"> - Prepare and present results of academic articles, and document these results - Critically analyse subject-specific statements, discuss them and assess them regarding their practical relevance
Contents	Recognizing the criteria of a successful academic paper regarding content, structure, literature research, and citation. Introduction to the methodology of science by in-depth discussion of a selected topic of engineering and management
Media	Tablet PC/projector, blackboard or whiteboard, flip chart, videos
Literature	According to topic.

SIOB320 - Smart Manufacturing and Industry 4.0

Module number	SIOB320
Module designation according to SPO or SPP	Smart Manufacturing and Industry 4.0
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Principles of Electrical Engineering, Fundamentals of Computer Science, Software Development and Coding
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module aims/learning outcomes/learning outcomes aimed at	<p>Knowledge:</p> <ul style="list-style-type: none"> - Know the underlying technologies for industry 4.0 - Understand the principles of the technologies and their importance to industry 4.0 (Cloud Computing, Internet of Things, AI & Machine Learning, Edge Computing, Digital Twins) - Know the influence of industry 4.0 to lot size one production - Understand the difference between the IoT and the IIoT - Platform Ecosystems in the IIoT - Know the consequences and risks of Industry 4.0 <p>Skills:</p> <ul style="list-style-type: none"> - Analysis of existing production systems and potential improvements in terms of automation and digitalization - Description of the technologies for industry 4.0 - Description of business models and/or platform ecosystems of smart manufacturing enterprises <p>Competences:</p> <ul style="list-style-type: none"> - Be able to assess existing solutions - Be able to optimize existing (digital) production systems in the context of lot size one - Conduct basic modelling/description of platform ecosystems of Industry 4.0
Contents	<ul style="list-style-type: none"> - Importance of automation and automation objects - Design of automation systems and requirements for them - Components and systems of a smart factory - Structure and mode of operation of automation computers - Interfaces of the automation computers to the process - Technologies and interfaces of Industry 4.0 - Introduction to PLC programming <ul style="list-style-type: none"> o Cyclic programme processing and response time

	<ul style="list-style-type: none"> ○ Addressing inputs and outputs and the memory ○ Basics of the programming language LAD
Media	Tablet PC/projector, blackboard or whiteboard, flip chart, videos
Literature	<p>The latest issue of:</p> <ul style="list-style-type: none"> – Cioffi, R. and De Felice, F.: Digital Transformation in Smart Manufacturing. IntechOpen. – Nayyar, A. and Kumar, A.: A Roadmap to Industry 4.0: Smart Production, Sharp Business and Sustainable Development. Springer. – Bee L.: PLC and HMI Development with Siemens TIA Portal

SIOB330 - Data science and AI

Module number	SIOB330
Module designation according to SPO or SPP	Data Science and AI
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Fundamentals of Computer Science
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module aims/learning outcomes/learning outcomes aimed at	<p>Knowledge:</p> <ul style="list-style-type: none"> - The students are familiar with the activities of a data scientist and can explain them. They also know the individual process steps of data integration - Statistical methods to extract information from the data and also have basic knowledge of machine learning - The students are familiar with sub-areas of artificial intelligence and are able to explain them. - They know typical applications of artificial intelligence in industry. <p>Skills:</p> <ul style="list-style-type: none"> - Ability to analyse amounts of data with statistical methods. - Ability to formalize concrete problems in the context of AI. <p>Competences:</p> <ul style="list-style-type: none"> - As a platform for the documentation of the individual knowledge representations of the data Jupyter Notebooks is used - Deciding for which problems these methods are suitable and ability to explain some of the basic algorithms.
Contents	<ul style="list-style-type: none"> - Introduction: What is Data Science? - Characteristics of Data: Big Data vs. Data; structured / unstructured data; categorical / quantitative data - Descriptive statistics, causality and correlation. Exploratory data analysis - Machine learning (linear regression, k-nearest neighbours, k-means) - Model evaluation (performance metrics) Insights into the professional field of Data Science / Data Science in companies. - Definition and overview of artificial intelligence.AI History - Intelligent Agents - Problem solving by search - Logical agents - Short Introduction to machine learning and neural networks

	– AI in industry
Media	Tablet PC/projector, blackboard or whiteboard, flip chart, videos
Literature	<p>The latest issue of:</p> <ul style="list-style-type: none"> – Skiena, Steven S.: The Data Science Design Manual; Springer – O'Neil, Cathy; Schutt, Rachel: Doing Data Science; O'Reilly – Trevor Hastie, Tibshirani, Robert; Friedman, Jerome: The Elements of Statistical Learning: Data Mining, Inference and Prediction; Springer – Igal, Laura; Santi Segui: Introduction to Data Science; Springer – So, Anthony; Joseph, Thomas V.; Robert Thas John; Worsley, Andrew, Samuel Asare: The Data Science Workshop; Pack Publishing – Russel, S.; Norvig, P.: Artificial Intelligence: A Modern Approach; Pearson; – Poole, D.L.; Mackworth, A.K.: Artificial Intelligence: Foundations of Computational Agents; Cambridge University Press – Ertel, W.: Introduction to Artificial Intelligence; Springer – Goodfellow, Y. Bengio, Courville, A.: Deep Learning; MIT Press – Segaran, Toby: Programming Collective Intelligence

SIOB340 - Supply Chain Management

Module number	SIOB340
Module designation according to SPO or SPP	Supply Chain Management
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	Advanced studies
Module type	Compulsory elective module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	3	-	1	-

Module-specific prerequisites according to SPO	All examinations of the first and second semester must be passed (exception: English I).				
Recommended prerequisites	Procurement, Manufacturing and Logistics (SIOB210)				
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	endnotes				
Proportion of the overall audit result	20/499				

Module Objectives/Objectives Learning Outcomes	<p>Knowledge: The students have acquired basic knowledge of value and supply chains. They are able to classify, evaluate and process selected questions in the subject area independently or in teamwork and to work out proposals for solutions.</p> <p>Skills: Students master the most important basics and terms and the essential tasks and functions of supply chain management.</p> <p>Competences: You have gained an insight into international procurement and distribution logistics and are able to understand international transport flows. You are able to recognise and understand interrelationships and interdependencies, especially along the value and supply chains.</p>
Contents	<ul style="list-style-type: none"> - Basis Supply Chain Management - Globalisation - International SCM organisations - Transport logistics and intercontinental transports - Basis procurement strategies - Basis distribution logistics - Basics of the delivery concepts - Logistics service providers in SCM - OE vs. spare parts logistics
Media	Projector, blackboard
Literature	The respective current edition of: Christopher, Martin: Logistics & supply chain management. Pearson

SIOB350 - ERP systems

Module number	SIOB350
Module designation according to SPO or SPP	ERP systems
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	Advanced studies
Module type	Compulsory elective module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	2	-	2	-

Module-specific prerequisites according to SPO	All examinations of the first and second semester must be passed.				
Recommended prerequisites	Basic knowledge in business administration (SIOB130) and accounting (SIOB230)				
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	endnotes				
Proportion of the overall audit result	20/499				

Module Objectives/Objectives Learning Outcomes	<p>Knowledge: Students know the basic concepts of ERP systems.</p> <p>Skills: Students can handle a concrete ERP system in an overview-like manner.</p> <p>Competences:</p> <ul style="list-style-type: none"> - Ability to deal with basic terms from the field of ERP systems - Understanding of the interrelationship of functionalities in an ERP system - Ability to apply business management concepts in a concrete ERP system.
Contents	<ul style="list-style-type: none"> - Processes in the areas of purchasing, materials and inventory management, business partners, sales as well as human resources and accounting with an ERP system - The lecture provides a process-oriented insight into the functionality, architectural principles and technologies of ERP systems. - Basics of ERP systems (integration types, master data, transaction data) - Use of ERP systems in the areas of logistics, accounting and human resources - The core element of the lecture is the practical exercises on an ERP system.
Media	Blackboard, overhead projector, beamer
Literature	<p>The respective current edition of:</p> <ul style="list-style-type: none"> - Guerrero, S.: Custom Fiori Applications in SAP Hana. Springer - Kees, A.: Open Source Enterprise Software. Springer

SIOB360 - Sustainable development III: Transformations, scenarios

Module number	SIOB360
Module designation according to SPO or SPP	Sustainable development III: Transformations, scenarios
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Successful completion of the modules Sustainable Development I and II
Exam	written exam - 90 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Categories and elements of future scenarios - Fundamentals of transformation research - Principles for the management of sustainability-oriented transformations as well as future designs for selected transformation fields <p>Skills:</p> <ul style="list-style-type: none"> - Formation of scenarios and critical analysis of future designs - Application of methods for the evaluation of transformation <p>Competences:</p> <ul style="list-style-type: none"> - Recognise and describe inter- and transdisciplinary tasks and solutions - Multi-perspective assessment of transformative future scenarios - Derivation and operationalisation of transformation tasks
Contents	<ul style="list-style-type: none"> - Transformation fields: Overview - Scenario building: Approaches / Techniques / Examples - Transformation theory and models: transformation research / multi-level perspective / process models / narratives / tipping points - Great transformations: <ul style="list-style-type: none"> o Energy transition, mobility transition, prosperity and consumption transition, industrial transition and critical analysis of published concepts o Methods of alternative assessment and selection o Transformation tasks for industrial engineers at company and inter-company level <p>Principles for the management of sustainability-oriented transformations</p>
Media	Tablet PC with beamer, overhead projector, black and white board
Literature	<p>The respective current edition of:</p> <ul style="list-style-type: none"> - WCED: Our Common Future - Göpel, Maja: The Great Mindshift - How a New Economic Paradigm and Sustainability Transformations go Hand in Hand, SpringerOpen.

SIOB370 - International Business and Cross-Cultural Communication

Module number	SIOB370
Module designation according to SPO or SPP	International Business and Cross-Cultural Communication
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr Reinhold Kohler

Study section	3rd year of study
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	
Exam	Presentation (15 min.), term paper (15 pages)
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	20/499

Module aims/learning outcomes/learning outcomes aimed at	<p>Knowledge:</p> <ul style="list-style-type: none"> - Know the characteristics, advantages, and problems of economic internationalization - Understand the importance of international business and competition - Detailed knowledge of the key questions and planning steps for business internationalization - Know the typical operational issues caused by internationalization - Understand the concept of culture and its importance for business - Know the basic terms and theories of cross-cultural communication, such as diversity, stereotypes, cultural identity and perception. <p>Skills:</p> <ul style="list-style-type: none"> - Identify business issues caused by internationalization - Apply some selected methods for solving internationalization issues in business - Develop internationalization strategies - Describe cultures <p>Competences:</p> <ul style="list-style-type: none"> - Assess the complexity of challenges in international businesses - Assess one's own culture and its influence on behaviour - Communicate effectively in international teams
Contents	<p>International Business:</p> <ul style="list-style-type: none"> - Characteristics and drivers of economic internationalization - Internationalisation strategies - Operational specifics of running an international business - Case studies <p>Cross-cultural Communication:</p> <ul style="list-style-type: none"> - Models of national, organisational and occupational culture - Cultural impacts on international business and communication - Means of effective communication in the presence of cultural diversity

	<ul style="list-style-type: none"> – Case studies and practical exercises (e.g. role plays) on cultural differences between Germany and other countries
Media	Tablet PC/projector, blackboard or whiteboard, flip chart, videos
Literature	<p>The latest issue of:</p> <ul style="list-style-type: none"> – Kohler, R.: Optimization of Leadership Style. Springer. Wiesbaden – Wall, Stuart; Minocha, Sonal; Rees, Bronwen: International Business. Prentice Hall. – Meyer, Erin: Culture Map: Breaking Through the Invisible Boundaries of Global Business. PublicAffairs. – Christopher, Elizabeth: International Management: Explorations across cultures. Kogan Page. – Beniers, Cornelius J.M.; Hundt, Irina: International Business Communication for Industrial Engineers: Bridging the Cultural Gap. Hanser.

SIOB380 - Mobility innovations

Module number	SIOB380
Module designation according to SPO or SPP	Mobility innovations
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	Advanced studies
Module type	Compulsory elective module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	2		2	

Module-specific prerequisites according to SPO	All examinations of the first and second semester must be passed (exception: English I).				
Recommended prerequisites					
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	endnotes				
Proportion of the overall audit result	20/499				

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> - Know the phases of the diffusion innovation lifecycle - Know common use cases for (autonomous-vehicle) AV's and their underlying importance in future urban mobility - Understand the importance of users trust and criteria of acceptance - Know the contradiction and ethics of legal regulations - Understand the problem of mixed traffic - Know the CASE Logic - Understand the Business Model Management of shared mobility and shared-AV-providers <p>Skills:</p> <ul style="list-style-type: none"> - Describing and classifying mobility concepts and extending these - Application of selected methods to create business models for mobility providers. - Application of legal restrictions to the areas of road safety/mixed traffic <p>Competences:</p> <ul style="list-style-type: none"> - Assessing the complexity of the Future of Mobility - Be able to evaluate and complete existing solutions
Contents	<ul style="list-style-type: none"> - Phases of the diffusion innovation lifecycle - Technologies for the future of mobility: AVs - Mixed Traffic Problem - Four Element Model - CASE Logic - Users Trust - Legal regulations for AVs and Road Safety - Public Transport / Individual Transport / Goods Traffic - Micromobility solutions and last-mile-vehicles

	<ul style="list-style-type: none">– Business Model Management (Mobility of the Future: Mobility as a Service, Fleet Service Management, Car Sharing)
Media	Blackboard, overhead projector, beamer
Literature	The latest edition of: <ul style="list-style-type: none">– Economic Commission for Europe: A Handbook on Sustainable Urban Mobility and Spatial Planning– Proceedings of the International Conference on Vehicle Technology and Intelligent Transport Systems (VEHITS) and Proceedings of the International Conference on Smart Cities and Green ICT Systems (SMART-GREENS)

SIOB390 - Energy infrastructure

Module number	SIOB390
Module designation according to SPO or SPP	Energy infrastructure
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	Advanced studies
Module type	Compulsory elective module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	All examinations of the first and second semester must be passed.				
Recommended prerequisites	-				
Exam	written exam - 90 minutes				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	endnotes				
Proportion of the overall audit result	20/499				

Qualification goals	<p>Students are able to:</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Know the basics of the technical-economic interrelationships of the energy industry as well as the essential characteristics of each stage of the value chain. - Criteria and procedures for the rational use of energy. - Market changes in the liberalised electricity market <p>Skills:</p> <ul style="list-style-type: none"> - Cognition of boundary conditions, structures and procedures of today's and the future energy industry with a focus on the electricity industry. <p>Competences:</p> <ul style="list-style-type: none"> - They are able to apply technical criteria in the procurement, transport and supply of heat and electrical energy. - Derive analogies and comparison to the heat and gas market
Contents	<ul style="list-style-type: none"> - Energy resources and energy consumption <ul style="list-style-type: none"> o Primary energy resources, exhaustible resources, inexhaustible resources o Energy in Germany, Europe, World (Infrastructure) - Power stations <ul style="list-style-type: none"> o Thermodynamic basics o Gas power plants o Coal-fired power plants o Thermal power plants, conventional steam power plants o Hydropower plants, wind power plants, solar power plants o Nuclear fission, nuclear fusion, nuclear power plants o Fuel cells - Transmission and distribution of electrical energy <ul style="list-style-type: none"> o Fundamentals of high voltage technology o Apparent, reactive and active power

	<ul style="list-style-type: none"> ○ Transmission losses, transmission capacity, operating behaviour of long and short lines ○ Compensation systems <p>– Outlook on other disciplines of electrical power engineering: renewable energies, combined heat, power and cooling, energy industry law</p>
Media	Tablet PC/beamer, blackboard, overhead projector
Literature	<p>The respective current edition of:</p> <ul style="list-style-type: none"> – Laloui, Lyesse and Rotta Loria, Alessandro F., Analysis and Design of Energy Geostructures. Theoretical Essentials and Practical Application, London – Wei, Wie and Wand, Jianhui, Modeling and Optimization of Interdependent Energy Infrastructures

SIOB400 - Seminar on Sustainable Development

Module number	SIOB400
Module designation according to SPO or SPP	Seminar on Sustainable Development
Language	English
Lecturer	See semester-specific lecture schedule
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	2nd year of study (advanced modules)
Module type	Mandatory module
Module group	-

ECTS points	5				
Workload (hours)	Total	Course		Self-study	
	150	60		90	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	4	4	-	-	-

Module-specific prerequisites according to SPO	-
Recommended prerequisites	Successful completion of the modules Sustainable Development I-III
Exam	written exam - 60 minutes
Admission requirement for the examination	See semester-specific study and examination plan
Evaluation of the examination performance	endnotes
Proportion of the overall audit result	16/499

Module Objectives/Objectives Learning Outcomes	<p>Knowledge:</p> <ul style="list-style-type: none"> – Knowledge of the basics of scientific work in general and specifically in the field of sustainable development <p>Skills:</p> <ul style="list-style-type: none"> – Ability to conduct well-founded literature research and to use suitable specialised information sources for professional work – Ability to formulate scientifically adequately both orally and in writing <p>Competences:</p> <ul style="list-style-type: none"> – Ability to prepare results of professional articles, to present them concisely and to document them in writing. – Ability to critically question, discuss and evaluate subject-specific statements with regard to their practical relevance.
Contents	<p>Develop important criteria for a successful scientific paper with regard to content, structure and literature research with citation.</p> <p>Introduction to scientific work through in-depth treatment of a selected topic of sustainable development.</p>
Media	Tablet PC with beamer, overhead projector, blackboard
Literature	Literature will be announced in the course

SIOB410 - Bachelor's Thesis

Module number	SIOB410
Module designation according to SPO or SPP	Bachelor's Thesis
Language	English
Lecturer	-
Person responsible for the module	Prof. Dr. Martin Prasch

Study section	Advanced studies
Module type	Mandatory module
Module group	-

ECTS points	12				
Workload (hours)	Total	Course		Self-study	
	360	-		360	
Forms of teaching (semester hours per week)	Total	Seminarist. Lessons	Exercise	Internship	Project-work
	-	-	-	-	-

Module-specific prerequisites according to SPO	All examinations of the first and second semester have been passed and at least 90 ECTS points have already been acquired. Successful completion of the practical time in the company (exception: see SPO §11(3)).				
Recommended prerequisites	-				
Exam	-				
Admission requirement for the examination	See semester-specific study and examination plan				
Evaluation of the examination performance	Endnotes				
Proportion of the overall audit result	48/499				

Module aims/learning outcomes/learning outcomes aimed at	<p>Knowledge:</p> <ul style="list-style-type: none"> - Detailed and up-to-date knowledge on a topic of engineering and management <p>Skills:</p> <ul style="list-style-type: none"> - Apply fundamental scientific methods - Conduct literature research - Use appropriate sources of professional information for job purposes <p>Competences:</p> <ul style="list-style-type: none"> - Apply the knowledge, skills and competences acquired in the course of the bachelor's degree program to professional engineering and management assignments - Complete projects within a limited time
Contents	<ul style="list-style-type: none"> - In the bachelor's thesis topics from all fields of engineering and management with view to sustainability can be worked on. Their difficulty must be at bachelor's level. - The topic is determined by a lecturer or coordinated with an external enterprise/organisation. - Proposed topics and hints (in German) on how to write the thesis as well as additional documents (e.g. the registration form) can be found on https://www.haw-landshut.de/hochschule/fakultaeten/elektrotechnik-und-wirtschaftsingenieurwesen/downloads.html.
Media	-
Literature	According to topic.

4. Module descriptions for the foreign languages

4.1 Important notes on implementation

4.1.1 General notes

The Bachelor's degree programme "Sustainable Industrial Operations and Business" includes a compulsory foreign language:

Foreign students without German language skills must take the modules German I - III. For students who have acquired their study qualification at a German-speaking educational institution or whose native language is German or who demonstrate German language skills of at least reference level C1 or C2 of the CEFR for languages, choose a second foreign language (Foreign Language I - III) in accordance with § 5, Paragraph 1, Sentence 1 of the SPO Sustainable Industrial Operations and Business. Depending on the offer, a 2nd foreign language can be selected.

The corresponding foreign language courses can be found in the module catalogue of the faculty "Interdisciplinary Studies". The Faculty of Interdisciplinary Studies is responsible for the content and description of the modules. The module descriptions can be found in the Module Catalogue Languages of the Faculty of Interdisciplinary Studies. The module Catalogue is published on the website of the Faculty of Interdisciplinary Studies, which you can reach via the following link: <https://www.haw-landshut.de/hochschule/fakultaeten/interdisziplinaere-studien/sprachen.html>. The document is published there under the heading "Interdisciplinary Studies". The document is published there under the heading "Module Catalogue".

The language modules (German or foreign language) can generally be completed in any semester. They are assigned to specific semesters in the study and examination regulations as well as in the study and examination plan. The participation requirements for individual modules can be found in the module descriptions of the Faculty of Interdisciplinary Studies.

The following should be noted for the individual languages:

4.1.2 Foreign language I-III

The following languages can be selected as foreign language:

Spanish
Chinese

In the three modules Foreign language I, II and III, students acquire competences at the reference levels of at least A1 of the Common European Framework of Reference for Languages. The three modules comprise a total of 12 ECTS points and courses of 12 SWS. These are modules from the UNICert® Basis.

Students who choose Spanish as a 2nd foreign language and already have Spanish language skills at reference level A1 of the Common European Framework of Reference for Languages and prove these at the beginning of their studies in a placement test offered by Landshut University of Applied Sciences can alternatively acquire the ECTS points in modules at reference level A2 (UNICert® Basis) and B1 (UNICert® I).

It is strongly recommended to complete all three modules of the respective languages (German and Foreign language) in the first three semesters. Depending on previous knowledge, the following combination of foreign language courses results:

Spanish:

UNICert® Basis

Semester	Module number according to SPO	Module designation according to SPO	Module name of the faculty " Interdisciplinary Studies
1	SIOBF10	2nd foreign language I	UNICert® Basis 1a or cf.
2	SIOBF20	2nd foreign language II	UNICert® Basis 1b or cf.
3	SIOBF30	2nd foreign language III	UNICert® Basis 2a

UNICert® Basis and UNICert® I

Semester	Module number according to SPO	Module designation according to SPO	Module name of the faculty " Interdisciplinary Studies
1	SIOBF10	2nd foreign language I	UNICert® Basis 2a or cf.

2	SIOBF20	2nd foreign language II	UNIcert® Basis 2b or cf.
3	SIOBF30	2nd foreign language III	UNIcert® I 3a or cf.

Chinese:**UNICert® Basis**

Semester	Module number according to SPO	Module designation according to SPO	Module name of the faculty "Interdisciplinary Studies"
1	SIOBF10	2nd foreign language I	UNICert® Basis 1a or cf.
2	SIOBF20	2nd foreign language II	UNICert® Basis 1b or cf.
3	SIOBF30	2nd foreign language III	UNICert® Basis 2a (+ 2 b) or cf.

These recommended combinations of modules are guaranteed to overlap with other courses on the programme for Spanish and Chinese.

Before the placement test at the beginning of the first semester, each student must complete the form "Registration for Foreign Language" and hand it in to the person responsible for the programme. The following information is required:

- Selected foreign language
- Previous knowledge of the chosen foreign language

In principle, the choice made in the first semester can no longer be changed.

4.2 German I - III

Please observe the instructions for implementation in section 4.1!

The module descriptions can be found in the Module Catalogue Languages of the Faculty "Interdisciplinary Studies". The module Catalogue is published on the website of the Faculty of Interdisciplinary Studies, which you can reach via the following link: <https://www.haw-landshut.de/hochschule/fakultaeten/interdisziplinaere-studien/sprachen.html>. The document is published there under the heading "Module Catalogue".

4.3 Foreign language I - III**4.3.1 Spanish**

Please observe the instructions for implementation in section 4.1!

The module descriptions can be found in the Module Catalogue Languages of the Faculty "Interdisciplinary Studies". The module Catalogue is published on the website of the Faculty of Interdisciplinary Studies, which you can reach via the following link: <https://www.haw-landshut.de/hochschule/fakultaeten/interdisziplinaere-studien/sprachen.html>. The document is published there under the heading "Module Catalogue".

4.3.2 Chinese

The module descriptions can be found in the Module Catalogue Languages of the Faculty "Interdisciplinary Studies". The module Catalogue is published on the website of the Faculty of Interdisciplinary Studies, which you can reach via the following link: <https://www.haw-landshut.de/hochschule/fakultaeten/interdisziplinaere-studien/sprachen.html>. The document is published there under the heading "Module Catalogue".

5. Studium Generale**E100 - Studium Generale**

Module number	E100
Module name	Studium Generale
Language	German
Lecturer	see module Catalogue Studium Generale
Person responsible for the module	see module Catalogue Studium Generale

Study section	The module can be studied in any semester.
Module type	Mandatory module
Module group	-

ECTS points	6		
Workload (hours)	Total	Course	Self-study
	180	90	90
Forms of teaching	Seminar teaching/project		

Module-specific prerequisites according to SPO	-
Recommended prerequisites	-
Exam	see module Catalogue Studium Generale
Admission requirement for the examination	see module Catalogue Studium Generale
Evaluation of the examination performance	Certificates of achievement "passed with success" or "passed without success"
Proportion of the overall audit result	0/499

Module Objectives/Objectives Learning Outcomes	<ul style="list-style-type: none"> - Students know that understanding people and their life situations requires a holistic view of people. - Students know that aesthetics and culture have a fundamental influence on people and human behaviour. - Students recognise the importance of diversity in its various dimensions for society. - Students see their studies as an opportunity for comprehensive personal development beyond their professional training. - Students learn the importance of trans- and interdisciplinary scientific perspectives. - Students learn the importance of foreign language acquisition for their own personal development and broadening their professional horizons. - Students develop a reflected holistic concept of education. - They are aware of the social-ethical and scientific-ethical implications of subject-specific action. - They know their civil society responsibility and can responsibly use and reflect on their subject-specific knowledge.
Contents	The module represents the inter-faculty Studium Generale established at the university in the winter semester 2013/14, which is a component of every Bachelor's degree programme at Landshut University. It includes inter-faculty courses that are intended to contribute to general scientific educational processes and personality development through their interdisciplinary orientation.
Media	see module Catalogue Studium Generale
Literature	see module Catalogue Studium Generale