HSBI

Hochschule
Bielefeld

University of
Applied Sciences
and Arts

Study Programme Examination Regulations

(*Studiengangsprüfungsordnung* – SPO)

for the bachelor's degree programme "Industrial Engineering"

at HSBI

Faculty of Engineering and Mathematics

Please note: The German version of this document is the legally binding version. The English translation provided here is for information purposes only.

Study programme examination regulations (*Studiengangsprüfungsordnung* – SPO) for the bachelor's degree programme "Industrial Engineering" at Hochschule Bielefeld – University of Applied Sciences and Arts

as of
- 7 June 2024 -

Pursuant to Section 22(1) no. 3, Section 2(4) and Section 64(1) of the Higher Education Act of the State of North Rhine-Westphalia (*Hochschulgesetz* – HG) of 16 September 2014 (GV. NRW. p. 547) as last amended by Article 2 of the Act of 5 December 2023 (GV. NRW p. 1278) in conjunction with the General Examination Regulations (BA-RPO) for Bachelor's Degree Programmes at Hochschule Bielefeld University of Applied Sciences and Arts of 10 June 2016 (Announcement Bulletin of HSBI – Official Notices – 2016, No. 24, pp. 292–312) in the version of the amendment dated 5 October 2021 (Announcement Bulletin of HSBI – Official Notices – 2021, No. 72, pp. 816–824), the Faculty Council of the Faculty of Engineering and Mathematics at HSBI has issued the following Study Programme Examination Regulations (SPO):

Contents

I. General Information

§ 1 Scope of the Study Programme Examination Regulations

These Study Programme Examination Regulations (SPO) apply to the bachelor's degree programme "Industrial Engineering" at HSBI. They specify the General Examination Regulations for Bachelor's Degree Programmes at HSBI (*Rahmenprüfungsordnung für die Bachelorstudiengänge der Hochschule Bielefeld* – BA-RPO).

§ 2 Qualification Objective of the Programme

(1) In accordance with Section 58 HG, the studies leading to the bachelor examination intend to enable students to understand theoretical contents from engineering and economics according to the study programme and on this basis to analyse practical processes and problems of industrial engineering and to find solutions independently, while taking into account extracurricular references. The studies enhance students' existing qualifications by means of interdisciplinary learning content. They are designed to develop the students' creative and planning skills and prepare them for the bachelor examination.

(2) As part of the studies, students acquire the competence to work scientifically through intensive contact with scientific literature as part of their self-study. They receive theoretical basics in a scientifically prepared form, learn to deal with the content independently and to do research on their own to complement the contents provided directly, thus making it possible for them to process contents and prepare for the exercises of the lecture period independent of a course taking place, especially during the lecture-free period.

(3) Due to the balanced engineering and business education in the compulsory part of the programme, students are able to evaluate, organise and optimise company processes economically and technically or to place technologies and products on the market.

(4) Supplementary to Section 3(2) of the RPO-BA, as part of the Industrial Engineering degree programme students acquire the ability to work as engineers. This means that students are able to define and analyse technical problems and develop, plan and specify corresponding solution concepts. They are able to use methods and techniques to learn and solve new tasks.

(5) Graduates

1. Are able to independently apply and analyse scientific findings and methods to processes and problems from the professional field of industrial engineers and to develop practical solutions with regard to extracurricular references.
2. Are familiar with the requirements of technical production processes and are able to determine the functions, characteristics and quality requirements for the production of goods or services and to implement them sustainably, taking into account business requirements such as cost efficiency and marketing. In doing so, they are able to select and apply modern information technologies in a targeted manner.
3. Are able to relate principles of self-management and learning and problem-solving techniques to strategies of project management and teamwork.
4. Are able to work in a problem-oriented, interdisciplinary manner using their social skills, both independently and in a team.
5. Are able to formulate and present technical solutions and perspectives and discuss these with professional representatives as well as with people with other areas of expertise.
6. Are able to independently enhance their acquired expertise and critically assess with regard to applying it in problem solving.

§ 3 Academic Degree

(1) On successful completion of the bachelor examination, HSBI awards the academic degree "Bachelor of Engineering" (B.Eng.).

(2) In addition, due to HSBI's membership in the German University Consortium for International Cooperations (DHIK), it is possible to acquire a double degree with the Tecnológico de Monterrey (TEC) in Mexico. The prerequisite for obtaining the bachelor's degree at TEC is that modules of at least 60 ECTS are taken at TEC. This usually corresponds to a two-semester stay at TEC. The recognition of equivalent TEC modules at HSBI will be based on a Learning Agreement in accordance with Section 25(2) RPO-BA coordinated with the examination committee before the start of the semester abroad.

§ 4 Admission Requirements

(1) Admission to the bachelor's degree programme requires proof of a university entrance qualification in accordance with Section 49 HG NRW. Further requirements are set out in HSBI's *Einschreibungsordnung* (enrolment regulations) in its currently valid version.

(2) In addition, applicants must provide proof of English skills at level B2 CEFR. Proof can be provided through a certificate from a state or state-recognised school or university that explicitly shows English skills at least at level B2 CEFR. In addition, the following documents and certificates are recognised:

1. IELTS: score of at least 5.5,
2. TOEFL (IBT): score of at least 72,
3. TOEFL (PBT): score of at least 543,
4. TOEFL (ITP): score of at least 543,
5. Telc B2 certificate,
6. UNIcert II,
7. Cambridge FCE *First Certificate in English,*
8. Cambridge English Qualification: score of at least 160.

Applicants with a high-school degree or an equivalent university entrance qualification obtained in an English-speaking country can provide proof of their English language skills with a document provided by their school or university stating that the language of instruction was English. One or more authorised faculty members decide on the recognition of other proof.

§ 5 Examination Committee

Pursuant to Section 9(3) RPO-BA, the Examination Committee is composed as follows:

1. Four members from among the professors, thereof one chair member and one deputy chair member,
2. A member of the teaching and research staff with a university degree,
3. Two students.

II. Organisational Details

§ 6 Start of Studies, Programme Structure

(1) The study programme starts each year in the winter semester.

(2) Students in this programme form a cohort with the students in the work-integrated Industrial Engineering programme. The actual contact time of each semester is thus usually distributed over 14 weeks within the regular lecture period. This corresponds to the academic term of the work-integrated Industrial Engineering programme.

(3) Courses are usually offered annually, so adherence to the programme structure is strongly recommended.

(4) The standard time to degree is seven semesters.

(5) A total of 180 credits must be achieved in the seven-semester programme. One credit point equals a workload of 30 hours.

(6) The modules offered are all compulsory. The programme's qualification objective is based on the compulsory modules. The compulsory modules specified in the programme structure must be completed. Additional modules are modules that can be completed beyond the scope specified

in the programme structure. However, additional modules will not be considered for the overall grade and are not included in the result of the bachelor examination. Additional modules will be stated in the degree documents.

(7) In order to make the start of studies easier for students, introductory courses will take place at the beginning of the first semester.

§ 7 Modules

(1) The number of modules and their chronological sequence can be found in the programme structure in Appendix A.

(2) The module contents, the qualification goals, the learning methods, the participation requirements, the workload and the forms of assessment for the individual modules are specified in the module catalogue (Appendix B).

§ 8 Assessments, Module Examinations, Partial Examinations, Certificates of Successful Participation ("*Testate*")

(1) The information on the forms of assessment, partial examinations and certificates of successful participation ("*Testate*") and preliminary examinations for the individual modules can be found in the respective module description (Appendix B).

(2) Course-related examinations should take place at the time when the respective module is completed in the degree programme.

(3) Students will automatically be registered for the regular examination dates of all module examinations they have to take. Deregistration from a module examination is only possible in the event of illness or a comparable inability to attend that cannot be avoided. Proof of the inability to attend must be submitted.

(4) A prerequisite for compulsory registration after resumption of studies is that the student has had the opportunity to participate fully in the courses that end with these module examinations. This is generally the case if the student was enrolled for the full duration of these courses.

§ 9 Repetition of Examinations

(1) A failed module examination can be repeated twice. Students must repeat the failed examination by the next offered examination date. For each attempt, students will automatically be registered for the next possible examination date after they have failed an examination. Deregistration from a re-examination is only possible in case of an illness or an unavoidable hindrance upon presentation of suitable evidence. Module examinations are conducted at the end of the lecture period in which the module was offered or at the beginning of the subsequent lecture period. Re-examinations are regularly offered within the lecture period following the regular examination date.

(2) The bachelor thesis can only be repeated once.

(3) An examination graded at least "sufficient" cannot be repeated.

(4) Students must repeat examinations that they missed due to illness or a comparable unavoidable inability to attend at the next possible examination date.

III. Types of Module Examinations

§ 10 Forms of Module Examinations

In addition to the forms mentioned in Section 14 RPO-BA, a module examination may consist of the examination forms project work, performance examination and course assessment/certificate of successful participation ("*Testat*").

§ 11 Term Paper

Term papers are written papers that usually do not exceed 20 pages and are produced as part of a course or in connection with a project that they accompany. Depending on the requirements of the lecturer, they can be supplemented by an expert presentation of 15 to 45 minutes. For the expert presentation, Section 19(2)–(5) RPO-BA shall apply. The term paper must be submitted to the lecturer within a deadline to be determined by the lecturer.

§ 12 Project Work

(1) The project work consists of a written paper and an oral presentation.

(2) A project is a task (if possible, an interdisciplinary task) that is planned and chosen by the lecturer in collaboration with the students. It is conducted as independently as possible, with advice from the lecturers. The projects deal with specific problems holistically under practical conditions. In group projects, the lecturer distributes the content of the work among the students in fair shares.

(3) A student's individual examination performance will be determined by the responsible lecturer after the end of the respective semester according to the criteria below:

1. Documentation
2. Presentation by the individual student,
3. If applicable, contribution to the team result in a group project,
4. If applicable, team skills.

The results will be recorded in a list.

(4) The examination component of the project work is conducted as an oral presentation of 30 to 45 minutes. In the case of group projects, all students involved in the respective project must present their individual contributions and results. The oral presentation takes place in the presence of the lecturer who supervised the project work. For the oral presentation, Section 19(2)–(5) RPO-BA shall apply.

(5) The written paper must be submitted to the examiner at least one week before the oral presentation.

§ 13 Performance Examination

(1) In cases that are appropriate to the subject, a module examination can be taken in the form of a performance examination.

(2) A performance examination consists of a theoretical and a practical part. The overall grade is derived as an arithmetic mean from the grades of the individual performances according to a previously determined weighting system. The examination usually lasts no more than 60 minutes.

(3) The performance examination is usually developed by only one examiner and taken in the presence of one or more expert assessors or several examiners.

§ 14 Course Assessment/Certificate of Successful Participation ("*Testat*")

(1) A study achievement consists either of the participation in specific courses or of an individually identifiable performance (course assessment/"*Testat*"), which is made alongside a course and whose subject and requirements relates to the content of the respective course. Regular lecture attendance, active participation in seminars, active participation in exercises, presentations, drafts or internship reports, etc. can be considered course assessments. The form is individually determined by the lecturer responsible for the course and announced at the beginning of the course.

(2) Course assessments are only rated as "passed" or "failed." Failed course assessments can be repeated an unlimited number of times.

(3) The respective lecturer is responsible for the decision whether a certificate of successful participation is awarded or not. The results must be communicated to the students and the examination office.

(4) The certificate may be a prerequisite for participation in the examinations (preliminary examination).

IV. Special Study Elements

§ 15 Practical Project/Internship

(1) The mandatory practical project/internship includes a practical work placement with a workload of 6 credit points. This internship allows for more time-intensive training in practical tasks.

(2) The internship is subject to the legal regulations that HSBI as a corporation under public law must observe as a whole.

(3) It is intended to introduce students to their professional activities through concrete tasks and practical work in the company providing training. In particular, it allows them to apply the knowledge and skills acquired during their previous studies and reflect on and evaluate experience gained performing practical activities.

(4) The practical project/internship takes place no sooner than in the 4th semester and no later than in the 6th semester.

§ 16 Company Suitability

(1) Any company whose tasks permit the employment of industrial engineers is potentially suitable as a company providing training. There must be employees in the company whose qualifications make them suitable supervisors for the students during the internship. The company must be able to guarantee work experience in line with the objectives of the internship. A company's suitability will be determined by a member of the faculty's teaching staff in a written report to the examination committee. A list of suitable companies is maintained by the faculty's placements office.

(2) Upon request, the internship may take place at HSBI in exceptional cases.

(3) Students may propose a company for their internship on their own initiative. Before contacting the company, they must have to consult with the supervising lecturer.

§ 17 Contract for the Practical Project / Internship

Unless an employment relationship already exists, the company providing training and the student will conclude a contract for the internship.

§ 18 Supervision of Students During the Practical Project / Internship

During the internship, students are supervised by a lecturer. The students provide the lecturer with an insight into the work they perform at least once during the internship.

§ 19 Semester Abroad

(1) The regulations in accordance with Section 25 RPO-BA shall apply.

(2) To enhance their professional and language skills as well as intercultural competencies, students can spend a semester at a university abroad, preferably at a partner university of HSBI.

(3) To get the credits achieved abroad recognised by HSBI, students have to prepare a Learning Agreement according to Section 25(2) RPO-BA and coordinate it with the examination committee before the start of the semester abroad.

§ 20 Bachelor Thesis

(1) In the bachelor thesis, students should demonstrate their ability to independently apply the knowledge and skills they have acquired during their studies, to complex tasks. The bachelor thesis is a written paper about an investigation of an (industrial) engineering problem and a detailed explanation of its solution. It can also be carried out through an empirical investigation or through conceptual or design tasks or through an evaluation of existing sources. A combination

of these is possible. The bachelor thesis should not exceed 45 pages of text in length. The time for completion is no less than eight weeks and no more than 12 weeks.

(2) The bachelor thesis must be registered (request for admission) after completion of the sixth semester. The subject of the bachelor thesis will already be determined with the student in advance.

(3) Students who have passed all but three of the module examinations are admitted to the bachelor thesis.

(4) The request for admission may be withdrawn in written form until the decision on the request has been made without counting towards the number of possible examination attempts.

V. Degree

§ 21 Result of the Bachelor Examination

(1) The bachelor examination is considered passed when 180 credit points are reached.

(2) The bachelor examination is considered failed if the overall grade is not at least "sufficient" (4.0) or if the bachelor thesis is not considered passed in the second attempt or is considered failed.

§ 22 Overall Grade

In order to determine the overall grade for the bachelor's degree study, the grades for each graded examination are multiplied by the respective credit points reported. The sum of the weighted grades is then divided by the total number of credit points included.

§ 23 Inspection of the Examination Files

(1) The Registar's and Examination Office sets and publishes an official inspection date for viewing the examination files related to a module examination after the respective examination has been completed. If the student is not able to view the examination files on the set date, request for inspection can be made to the Registrar's and Examination Office within one month after the official inspection date.

(2) Inspection of the examination files pursuant to Section 33 BA-RPO must be requested within one year from issuance of the examination certificate or the notice of the failed bachelor examination. Section 32 of the Administrative Procedure Act for the State of North Rhine-Westphalia (*Verwaltungsverfahrensgesetz*) on the application for restitutio in integrum applies. The request must be made to the Registrar's and Examination Office.

VI. Final Provisions

§ 24 Entry into Force, Publication

These Examination Regulations shall be announced in the Announcement Bulletin of HSBI – Official Notices ("Verkündungsblatt der Hochschule Bielefeld – Amtliche Bekanntmachungen"). They shall enter into force one day after their publication.

Issued on the basis of the decision of the Faculty Council of the Faculty of Engineering and Mathematics at HSBI of 17 January 2024.

Bielefeld, 07 June 2024

The President of HSBI

Prof. Dr. Ingeborg Schramm-Wölk

Appendix A – Programme Structure

for the Bachelor's degree programme
"Industrial Engineering"

First semester			L	SL	E	P/S	∑	cps
Module number	Module title	Module ID						
3377	Basics of Programming	BOP	2	1	0	1	4	5
3375	Future Technologies and Sustainability	FTS	1	1	0	2	4	5
3378	Mathematics I	MATHS 1	2	2	0	0	4	5
3374	Principles of Economics	POE	2	2	0	0	4	5
3407 or 3376	Introduction to German Culture and Language / Intercultural Communication[1]	ICGL / ICM	2	2	0	0	4	5
						Total:	20	25
Second semester			L	SL	E	P/S	∑	cps
Module number	Module title	Module ID						
3379	Accounting and Finance	AAF	2	2	0	0	4	5
3382	Innovation and Project Management	IPMN	2	2	0	0	4	5
3383	Mathematics II	MATHS 2	2	2	0	0	4	5
3381	Physics	PHS	2	1	0	1	4	5
3380	Procurement, Production and Logistics	PPL	2	2	0	0	4	5
						Total:	20	25
Third semester			L	SL	E	P/S	∑	cps
Module number	Module title	Module ID						
3408	Basics of Mechanical Design	BMD	2	2	0	0	4	5
3386	Databases	DBS	2	2	0	0	4	5
3385	Engineering Mechanics – Statics and Strengths of Materials	EMSM	2	1	0	1	4	5
3384	Fundamentals of Electrical Engineering	FEE	2	1	0	1	4	5
3387	Statistics	STAS	2	2	0	0	4	5
						Total:	20	25
Fourth semester			L	SL	E	P/S	∑	cps
Module number	Module title	Module ID						
3390	Business Process Modelling and IT Systems	BPM	2	1	0	1	4	5

[1] For students with German university entrance qualification "Intercultural Communication (ICM)," for students with university entrance qualification obtained abroad "Introduction to German Culture and Language (ICGL)"

3389	Cost and Investment Accounting	CIA	2	2	0	0	4	5
3388	Lean Production and Industrial Engineering	LPIE	2	2	0	0	4	5
3391	Operations Research	ORC	2	2	0	0	4	5
1407	Project 1	PRIN1	0	0	0	0	0	6
						Total:	16	26
Fifth semester			L	SL	E	P/S	∑	cps
Module number	Module title	Module ID						
3392	Controlling	CRL	2	2	0	0	4	5
3393	Industrial Automation Technology	IAT	2	1	0	1	4	5
3394	Materials Engineering	MEG	2	1	0	1	4	5
3395	Production Planning and Control	PPC	2	2	0	0	4	5
1408	Project 2	PRIN2	0	0	0	0	0	6
						Total:	16	26
Sixth semester			L	SL	E	P/S	∑	cps
Module number	Module title	Module ID						
3396	Control Technology	CTG	2	1	0	1	4	5
3397	Marketing and Technical Sales	MTS	2	2	0	0	4	5
3399	Microcontroller Programming	MPM	2	1	0	1	4	5
3398	Supply Chain Management	SCMG	2	2	0	0	4	5
1406	Practical Project / Internship	PPI	0	0	0	0	0	6
						Total:	16	26
Seventh semester			L	SL	E	P/S	∑	cps
Module number	Module title	Module ID						
3406	Bachelor Thesis	BTHS	0	0	0	0	0	12
3401	Human Resources Management	HRM	2	2	0	0	4	5
3402	Industrial Communication	ICM	2	1	0	1	4	5
3400	Quality Management	QMM	2	2	0	0	4	5
						Total:	12	27
						Total:	120	180

Abbreviations of the teaching forms: L = lecture, SL = seminar lessons, E = exercise, S = seminar, P = practical, SSS = supervised self-study (all data in weekly hours per semester[2]);
cps = credit points
W/S = winter/summer semester

[2] 1 weekly hour per semester = 45 minutes

Appendix B – Module Catalogue

for the bachelor's degree programme
"Industrial Engineering"

Accounting and Finance					**AAF**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3379	150 h	5	2nd semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours[1]	30	h	45	h
	Seminar Lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: Students understand the structure and content of external accounting. They understand the system of double-entry bookkeeping, they can represent business transactions in posting records, map the posting records in accounts and develop balance sheet and income statements from the accounts. They can present the basics of the annual financial statements and the analysis of annual financial statements and illustrate them with practical examples. They understand the importance of financial issues and the relationship between the use of capital and the raising of capital, including its impact on the balance sheet. They will be able to describe the instruments and structuring of capital raising and assess their applicability to practical cases. In addition, they can determine the capital required to ensure liquidity and understand the basics of rating. Overall, the students can classify the information possibilities of external accounting and classify how operational processes are reflected in the annual financial statements.
3	Contents: • Fundamentals of Financial Accounting • Fundamentals of Accounting • Fundamentals of Financial Statement Analysis • Determining capital and liquidity requirements • Instruments of internal and external financing • Instruments of self-financing and debt financing • Rating
4	Forms of teaching: Classroom teaching in form of lectures and seminar lessons

[1] The numbers provided under "Scope" refer to the weekly hours per semester (1 weekly hour per semester = 45 minutes). For brevity, we have used "weekly hours" here.

5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Written examination or oral examination	
7	Conditions for the award of credit points Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf	
11	Other information:	
12	Language: English	

Bachelor Thesis									**BTHS**
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3406	360 h	12	7th semester			each semester			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours		0	h	360	h
	Sem. lessons	30 students	0	weekly hours		0	h	0	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	0	weekly hours		0	h	0	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h
2	Learning outcomes/competences: After successfully completing the bachelor thesis, students are able to independently work on and appropriately present a practice-oriented task from their special subject area, both in the subject-specific details and in the interdisciplinary contexts, using scientific methods within a specified period of time.								
3	Contents: The bachelor thesis is an independent scientific work from the subject area of the respective study programme with a description and explanation of its solution. It can be derived from current research projects at the university or from operational problems with an engineering character. It can also be carried out through an empirical investigation or through conceptual or design tasks or through an evaluation of existing sources. A combination of these is possible.								
4	Forms of teaching: Written composition with faculty tutoring								
5	Participation requirements:								
	Formal:	None							
	Content-related:	Coordinated topic from the student's special subject area							
6	Form of assessment:								
7	Conditions for the award of credit points:								
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)								
9	Weighting of grade for calculation of final grade: according to BRPO								
10	Module coordinator: All professors of the faculty								
11	Other information:								
12	Language: English								

Basics of Mechanical Design					BMD
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3408	150 h	5	3rd semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to ...

- Explain and apply the design process and its methods.
- Apply design rules, principles and guidelines in the design process and develop optimised designs with regard to load, material, production, sustainability, diversity aspects, recycling and maintenance.
- Create schematic diagrams and perform analytical calculations.
- Create and interpret technical drawings and explain how to handle tolerances, fits and technical surfaces.
- Can categorise computer-aided tools such as CAD, CAE or AI tools in the design process.
- Understand and use the purpose and function of machine elements (connecting, bearing and transmission elements, guides, axles and shafts, etc.) in mechanical systems.
- Explain the principles and techniques of production technologies according to DIN 8580 (forming, shaping, machining, cutting, coating, changing material properties) and select the correct procedure for specific tasks.
- Apply the basics of additive manufacturing.
- Apply their knowledge to practical design tasks and develop a product concept.

3 Contents:

1. Introduction to construction design:
   - Understanding the design process and its methods
   - Differentiating different types of designs
   - Applying product development methods
2. Requirements and design rules in construction design:
   - Applying design principles, rules and guidelines to designs
   - Developing designs that are optimal in terms of sustainability, diversity, load, material, production, maintenance, etc.
   - Designing clear, simple and secure systems
3. Tools and techniques in the design process:
   - Creating schematic diagrams and performing analytical calculations
   - Applying technical drawings and understanding tolerances, fits and technical surfaces

	• Using computer-aided tools such as CAD, CAE or AI in the design process 4. Use and understanding of machine elements: • Understanding fasteners, bearing and transmission elements in machines • Recognising guides, axles and shafts in mechanical systems 5. Overview of production techniques: • Understanding forming and shaping in production technology • Knowledge of machining and joining processes • Insight into additive manufacturing technology	
4	Forms of teaching: Classroom teaching in the form of lectures and seminar lessons	
5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or performance examination or oral examination or a combination of term paper and oral examination or a combination of written examination and performance examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Maik Lauterbach	
11	Other information:	
12	Language: English	

Basics of Programming									BOP
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3377	150 h	5	1st semester			Annual (Winter)			1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students		weekly hours		h		h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students		weekly hours		h		h

2 Learning outcomes/competences:

Students are proficient in using the terminology of computer science and apply it.
They obtain basic knowledge of the functioning of computer systems and are able to apply it.

Students understand the basic concepts of programming such as variables, data types, loops, conditions and functions in a suitable high-level language (e.g. Python).

They gain basic knowledge in the application and implementation of algorithms.

Students understand the basic principles of object-oriented programming and are able to use OOP concepts such as classes and objects.

Students should develop the ability to systematically analyse complex problems and design algorithmic solutions before translating them into code. They will also learn how to use generative AI models to generate solutions.

Students can identify and correct programme-related errors by applying effective debugging techniques.

Students can apply the acquired programming skills to engineering problems in order to develop solutions in their field of expertise.

3 Contents:

- Basic concepts
- Basic structure of computer systems and peripheral devices, functioning of computer systems
- Basic representation of data in computer systems, Boolean algebra
- Use of development environments
- Introduction to a programming language
- General structure of programmes
- Variable types, structures
- Functions for input and output
- Control structures
- Functions
- Recursion / iteration, modular programming
- Basic principles of OOP (classes, objects, inheritance, polymorphism)

	• Algorithms and Data Structures • Use of debugging tools and techniques • AI support for code writing and error detection	
4	Forms of teaching: Classroom teaching in the form of lectures, seminar lessons and practicals	
5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch	
11	Other information:	
12	Language: English	

Business Process Modelling and IT Systems					BPM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3390	150 h	5	4th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students

- Structure and evaluate the specific mode of operation of integrated standard software (ERP software).
- Design and model processes in the company with the help of modern software architectures (e.g. SOA and BPMS).
- Analyse processes and requirements of companies for the use, operation and maintenance of integrated software systems (adaptation options, interfaces to other IT systems, etc.)

3 Contents:

- Process modelling and data modelling using modelling tools such as ARIS
- Evaluation of concepts of integrated data processing (computer hierarchy systems etc.)
- Drafting reference models for designing the data, process and function models (e.g. Aachen PPS model)
- Analysis of ERP systems (architecture, structuring, database models, HANA)
- Overview of the core modules and applications of ERP systems in the process: e.g. order to cash process)

Application-oriented use cases are used to demonstrate how business processes can be implemented consistently and across software modules.

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Term paper or written examination or project work or oral examination

7 Conditions for the award of credit points:

Passed module examination

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9 Weighting of grade for calculation of final grade:

	according to BRPO
10	Module coordinator: Prof. Dr. rer. pol. Hans Peter Rauer
11	Other information:
12	Language: English

Control Technology					CTG
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3396	150 h	5	6th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, the students will be able to assign the basics from the field of control technology. The students are able to recognise the benefits of control systems in a problem-oriented manner and develop solution strategies. In addition, the students can solve simple control engineering tasks, i.e. find the corresponding controllers and their parametrisation for simple technical processes. Students can resolve and simplify more complicated control engineering structures. In addition, the students can predict the behaviour of the closed control loop on the basis of a mathematical circuit model. In small groups, the students have gained initial experience with the design and implementation of simple controls for simple processes and have implemented and tested them using common simulation software such as MATLAB Simulink.

3 Contents:

Introduction to Control Engineering

- Terms
- Definitions
- Block diagrams

Transmission link analysis

- Steady-state and dynamic behaviour
- Frequency response and floor diagram
- Determining mathematical models for technical systems

The control loop

- Basic structure of the control loop
- Control loop structures
- Stability behaviour of control loops
- Classical linear controllers
- Simple design procedures
- Parameter-optimal controls

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination	
7	Conditions for the award of credit points: Passed module examination and course assessment	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker	
11	Other information:	
12	Language: English	

Controlling					CRL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3392	150 h	5	5th semester	Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students are familiar with the basics of planning and strategic management. They are familiar with different schools of thought of strategic management, corresponding strategy approaches (e.g. resource-based view) and management concepts (e.g. knowledge/innovation management) and can apply them. In addition, the students can use operative, tactical and strategic planning instruments as well as instruments from controlling (e.g. balanced scorecard). They are able to demonstrate the importance of sustainable, resource-efficient management for the company's activities and to implement it in an intensity appropriate to the situation both on the normative and on the strategic and operational management level by means of suitable instruments. Using practical examples and case studies, the students are enabled to carry out independent control processes in companies and also to use this knowledge in the context of international cooperation.

3 Contents:

- Fundamentals of planning and strategic management
- Schools of thought in strategic management
- The normative, strategic and operational management level
- Strategic approaches
- Management concepts
- Operational, tactical and strategic planning tools
- Operational controlling tools
- International/intercultural perspectives

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	Knowledge from the following modules: 3374 Principles of Economics; 3379 Accounting and Finance; 3389 Cost and Investment Accounting;

6 Form of assessment:

Written examination or project work or oral examination

7 Conditions for the award of credit points:

Passed module examination

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9 Weighting of grade for calculation of final grade:

	according to BRPO
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf
11	Other information:
12	Language: English

Cost and Investment Accounting									CIA
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3389	150 h	5	4th semester			Annual (Summer)			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours		30	h	45	h
	Sem. lessons	30 students	2	weekly hours		30	h	45	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	0	weekly hours		0	h	0	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h

2 Learning outcomes/competences:

Students are familiar with entrepreneurial and networked thinking, including a profitability-oriented assessment in all entrepreneurial activities and decision-making areas.
They assess the advantageousness of individual investment measures, make a selection between competing investment projects and evaluate how long investments are to be utilised.
They use cost accounting as a decision-support tool.
They have a basic understanding of cost accounting and know basic standards and terms of cost accounting. They are able to critically assess and evaluate practical applications of cost accounting methods.

3 Contents:

- Fundamentals of financial mathematics
- Fundamentals of business investment decisions
- Static investment calculation methods
- Dynamic investment calculation methods
- Cost type, cost centre, cost unit accounting
- Standard cost accounting
- Planned costing
- Contribution margin accounting
- Activity-based costing
- Short-term income statement on full and partial cost basis

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or oral examination

7 Conditions for the award of credit points:

Passed module examination

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9 Weighting of grade for calculation of final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. rer. pol. Mariam Dopslaf

11	Other information:
12	Language: English

Databases								DBS
Identification number:	Workload:	Credits:	Study semester:		Frequency of the offer:			Duration:
3386	150 h	5	3rd semester		Annual (Winter)			1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students		weekly hours		h		h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students		weekly hours		h		h

2 Learning outcomes/competences:

On successful completion of the course, students

- Acquire basic knowledge about the architecture, functioning and use of database systems and know the principles of the organisation of a database system.
- Acquire knowledge of data modelling, including the importance of normalisation rules.
- Are able to carry out a complete relational database design, starting from a requirements specification.
- Are able to implement a relational database schema using SQL.
- Are proficient in standard SQL to perform simple and complex queries, as well as change operations.
- Are able to manage access rights and users, as well as implement triggers and procedures.
- Are able to plan and implement database projects.

3 Contents:

- Basics of databases
- Database design (Entity Relationship Model (ERM))
- Relational model (RM) (transformation ERM to RM, functional dependencies, normalisation, relational algebra)
- Database language SQL (Structured Query Language), Creating/modifying/deleting databases, tables and views, inserting/modifying/deleting data (Data Manipulation Language (DML), Data Definition Language (DDL)), and creating complex queries (Data Query Language (DQL))
- Access rights and user management (Data Control Language (DCL))
- Procedures and triggers

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or project work or oral examination or a combination of written examination, project work and oral examination

7 Conditions for the award of credit points:

Passed module examination

8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. nat. Alexander Maier
11	Other information:
12	Language: English

Engineering Mechanics – Statics and Strengths of Materials					EMSM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3385	150 h	5	3rd semester	Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to:

- Describe basic relationships of statics as the study of the equilibrium of forces in and on mechanical structures at rest.
- Determine the resulting effect of forces.
- Determine the effect of forces on substructures.
- Determine the internal forces and moments acting in substructures.
- Inspect the structural stability of systems.
- Calculate the forces acting at the points of contact or bearing.
- Determine the centres of gravity of bodies, surfaces or lines.
- Understand and analyse frictional operations.
- Determine tension distributions and maximum tensions in components.
- Determine the required dimensions and permissible loads of components using a strength test.
- Determine the deformation of components as a result of loads and compare it with maximum permissible values.

3 Contents:

- Basic concepts of mechanics: Force – Balance – Rigid Body
- Statics: Introduction – Plane system of forces – Centre of gravity – Static equilibrium of bodies – Freeing – Determination of support and intermediate reactions – Friction
- Strength of materials: Introduction to strength theory – Internal forces – Tensile or pressure load – Shear – Bending load – Torsional stress – Buckling stress – Composite stress

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or oral examination

7 Conditions for the award of credit points:

Passed module examination with preliminary examination

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Andrea Kaimann
11	Other information:
12	Language: English

Fundamentals of Electrical Engineering									FEE
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3384	150 h	5	3rd semester			Annual (Winter)			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours		30	h	45	h
	Sem. lessons	30 students	1	weekly hours		15	h	22.5	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	1	weekly hours		15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to ...

- Explain the basic concepts of electrical engineering and the principles of electrical flow.
- Analyse and calculate DC circuits, including complex networks and non-linear DC circuits.
- Apply the principles and rules that govern the operation of DC circuits.
- Understand and explain the properties and phenomena of the electric field.
- Apply and analyse the basic principles and laws that determine the electric field.
- Explain and understand the properties and phenomena of the magnetic field.
- Analyse the effect of the magnetic field on the environment and apply the principle of induction.
- Understand and explain the principles and practical applications associated with self-induction and external induction.
- Explain the basic concepts of AC technology and describe alternating variables in the pointer diagram.
- Analyse the behaviour of devices in AC circuits and apply appropriate calculation methods.
- Explain the properties and functions of resonant circuits and calculate the power in AC circuits.
- Apply the theoretical concepts and principles of electrical engineering in practical applications and problem-solving.

3 Contents:

DC technology

- Introduction to and principles of electrical flow
- Analysis and calculation of DC circuits
- In-depth consideration of DC circuits and their rules

The electric field

- Introduction to the electric field and its properties
- Detailed investigation of electrical fields and their laws
- Investigation of specific phenomena in the electric field

	The magnetic field • Introduction to and properties of the magnetic field • Effects of the magnetic field and principles of induction • In-depth consideration of self-induction, external induction and transformer AC technology • Introduction to the basic concepts of AC technology • Behaviour of components and calculation methods in the AC circuit • Resonance circuits and power in the AC circuit
4	Forms of teaching: Classroom teaching in the form of lectures, seminar lessons and practicals
5	Participation requirements:
	Formal: None
	Content-related: None
6	Form of assessment: Term paper or written examination or oral examination
7	Conditions for the award of credit points: Passed module examination
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker
11	Other information:
12	Language: English

Future Technologies and Sustainability									FTS
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3375	150 h	5	1st semester			Annual (Winter)			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	1	weekly hours		15	h	22.5	h
	Sem. lessons	30 students	1	weekly hours		15	h	22.5	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	2	weekly hours		30	h	45	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to:

- Describe the basic economic framework conditions of German companies at home and abroad,
- Distinguish the business divisions, functions and tasks relevant to industrial engineers,
- Identify current technical trends in future technologies and social trends such as sustainability and classify the effects of these trends in the development of industrial engineers' job profile,
- Apply the VUCA model (volatility, uncertainty, complexity, ambiguity) to today's markets and companies and discuss it,
- Identify the Sustainable Development Goals and explain the impact of companies and employees on achieving these goals,
- Summarise the necessary professional and social skills of industrial engineers.

3 Contents:

- Basic knowledge of industrial enterprises (objectives, structure, types of enterprises, business functions) and analysis of industries and markets,
- Tasks of industrial engineers within different functional areas,
- Future trends in technology and society,
- VUCA model,
- 17 Sustainable Development Goals,
- Project-based work and communication in companies,
- Management soft skills,
- Scientific work (presentation, scientific writing),
- Excursions to companies with a focus on company processes and activities that are relevant for industrial engineers

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Term paper or written examination or oral examination

7	Conditions for the award of credit points: Passed module examination
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf
11	Other information:
12	Language: English

Human Resources Management									HRM
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3401	150 h	5	7th semester			Annual (Winter)			1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to:

- Classify the tasks and role of modern human resources management in organisations.
- Assess the suitability and applicability of key HR recruitment and development tools.
- Use relevant theoretical communication concepts and models in practice and solve problems that can occur in communication processes sustainably.
- Recognise the importance of learning in the context of transformation and change and create conditions for successful individual and collective learning processes.
- Explain, review and reflect on the principles of organisational theory using practical examples.
- Assess the organisational forms of the primary and secondary organisation in terms of their applicability and context-specific relevance.
- Use relevant concepts of sustainable organisational transformation for co-design in professional practice and assess their significance to entrepreneurship.
- Identify important key skills (e.g. social skills, sustainability skills) and reflect and evaluate the requirements of today's as well as the future working world against the background of one's own skills.
- Classify key concepts and theories of human resources management and reflect on the success of leadership.
- Recognise and assess the particular relevance of sustainability as an essential element of human resources management, leadership and organisation.

3 Contents:

- Importance, objectives, tasks and selected tools of HR management
- Fundamentals of communication
- Conflict management
- Principles of human resource management
- Sustainable HR management
- Fundamentals of Learning Theory
- Organisational change
- Fundamentals of organisational theories, structural and process organisation
- Forms of organisation, primary and secondary organisation
- World of work in transformation

4 Forms of teaching:

Classroom teaching in form of lectures, seminar lessons

5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. oec. Thomas Süße	
11	Other information:	
12	Language: English	

Industrial Automation Technology									IAT
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3393	150 h	5	5th semester			Annual (Winter)			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours		30	h	45	h
	Sem. lessons	30 students	1	weekly hours		15	h	22.5	h
	Exercise	20 students		weekly hours			h		h
	Practical or seminar	15 students	1	weekly hours		15	h	22.5	h
	Supervised self-study	60 students		weekly hours			h		h

2 Learning outcomes/competences:

Upon successful completion of the course, students are able to identify the essential components of an automation system and explain their basic functioning. They are able to describe the mode of operation of conventional and PC-based programmable logic controllers and their differences. Students are familiar with selected IEC 61131 programming languages and are able to use them to implement simple programmes. Students are familiar with simple methods for designing sequence controls and can apply them to new problems and implement the design in a suitable programming language. They know the basics of bus systems and can name different bus systems and their areas of application.

3 Contents:

Introduction to control technology
- Terms
- Definitions

Bus technology
- Basics of industrial communication
- Comparison of different bus systems and their areas of application

Design and structures of industrial controls
- PLC and PC-based control
- Information processing

Structured programming according to IEC 61131
- Graphics- and text-based programming languages
- Basics of object-oriented PLC programming

Sequence controls
- Model-based control design using UML state diagram
- Practical implementation (in an IEC 61131 programming language)

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5	Participation requirements:	
	Formal:	None
	Content-related:	Knowledge from the following module: 3377 Basics of Programming;
6	Form of assessment: Project work or oral examination	
7	Conditions for the award of credit points: Passed module examination and course assessment	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade:	
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker	
11	Other information:	
12	Language: English	

Industrial Communication									ICM
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3402	150 h	5	7th semester			Annual (Winter)			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours		30	h	45	h
	Sem. lessons	30 students	1	weekly hours		15	h	22.5	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	1	weekly hours		15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h

2 Learning outcomes/competences:

The students

- Know the ISO-OSI layer model and can use it to classify different industrial fieldbuses.
- Know the importance of the individual layers and their role in industrial communication.
- Learn the importance of real-time systems and their technical background.
- Are able to match technological and technical boundary conditions of fieldbuses with technical requirements in production and their products.
- Know the advantages and disadvantages of network topologies and can assign these user requirements.
- Are able to evaluate industrial communication systems in terms of their resource and cost efficiency.

3 Contents:

The ISO/OSI layer model

1. Physical layer: Media access (copper, fibre, radio), signal sampling and synchronisation, line codes
2. Data link layer: MAC & LLC, access methods, multiplexing, protocols and their backup, collision management, error detection and correction
3. Network layer: Routing, addressing
4. Transport layer: Connectionless and connection-oriented communication (e.g. TCP, UDP), quality of service (QoS); communication endpoints (sockets), connection establishment and termination
5. Session layer: Transaction security from unreliable channels, synchronisation
6. Presentation layer: Character representation, encoding, compression
7. Application layer: Application protocols and services, client-server models

Industrially used examples of layers 1 and 2:

- Synchronous and asynchronous BUS technologies
- Real-time communication capability
- Requirement of real-time systems
- Measures for the realisation of real-time
- Structure and usability of the Ethernet protocol

	• Industrial fieldbuses: With own protocol (e.g. AS-Interface, CAN, CANopen, Profibus, HART) • Ethernet-based fieldbuses (e.g. EtherCAT, ProfiNet) • Bus technologies with single-master; multi-master, masterless buses	
4	Forms of teaching: Classroom teaching in the form of lectures, seminar lessons and practicals	
5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination or a combination of term paper and written examination or a combination of project work and oral examination	
7	Conditions for the award of credit points: Passed module examination and course assessment	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. habil. Thorsten Jungeblut	
11	Other information:	
12	Language: English	

Innovation and Project Management					IPMN
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3382	150 h	5	2nd semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students

- Are prepared to lead product development and innovation projects and teams to success in terms of holistic and strategically oriented project management (also including agile methods).
- Understand the basics of project management and can use the elementary technical vocabulary.
- Can explain the most important instruments of project management.
- Are able to lead/manage a project in a given process-organisational project organisation.
- Are able to develop and specifically use control options for different project phases (controlling of the degree of completion, cost controlling).
- Can explain the specifics of team building and project management.
- Can carry out the moderation of team meetings projects.
- Know instruments of IT-supported project management.
- Can explain the importance of corporate goals and are able to distinguish between different leadership cultures.
- Can name essential aspects of industrial property protection.

3 Contents:

- Basics of project management (terms/methods/instruments)
- Project phase models and planning systems (project preparation, project planning, project implementation, project completion)
- Agile project management
- Project organisation forms
- Innovation and change management, self-management
- Project planning (project structure plan/cost plan/resource plan/schedule)
- Project documentation/project controlling
- Risk management
- Special features of the use of methods in innovation projects (Strategic preparation/initiation, planning, monitoring and control of innovation projects)
- Leading project and innovation teams (social structures, special communication situations in projects, real and virtual project work, problem analysis and concepts for action)

	• Stakeholder management (factors influencing the successful management of projects) • Methods of idea generation (creativity techniques etc.) • Trainings and workshops on selected technical examples • Basic aspects of industrial property protection	
4	Forms of teaching: Classroom teaching in the form of lectures and seminar lessons	
5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr.-Ing. Michael Fahrig	
11	Other information:	
12	Language: English	

Intercultural Communication									ICM
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3376	150 h	5	1st semester			Annual (Winter)			1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: The students are able to classify the most important terms, theories and models of intercultural management, have developed a deeper understanding of their own and foreign cultural imprints and understand how culture influences the individual and collective perception and thus also shapes the perception processes in the world of work. Students can take intercultural aspects into account in communicative processes in working life.
3	Contents: • Multiculturalism: Phenomenon of a globalised economy • Gender and diversity aspects • Cultural dimensions • Corporate culture • Typical application situations and concrete national cultures
4	Forms of teaching: Classroom teaching in the form of lectures and seminar lessons
5	Participation requirements: Formal: German university entrance qualification Content-related: None
6	Form of assessment: Term paper or written examination or project work or oral examination
7	Conditions for the award of credit points: Passed module examination
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf
11	Other information:
12	Language: English

Introduction to German Culture and Language					IGCL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3407	150 h	5	1st semester	Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Upon completion of the module, students have

- Skills and competences at level A1 of the Common European Framework of Reference for Languages, i.e. they have a very basic range of simple phrases relating to personal matters and concrete needs.

They are able to:

- Understand and use familiar, everyday expressions and very simple sentences aimed at satisfying specific needs.
- Communicate in a simple way if the interlocutors speak slowly and clearly and are willing to help.
- Write short, simple texts.

3 Contents:

- The topics covered in the language classes are oriented towards situations or communicative actions that international students need directly to cope with their everyday life in Germany (e.g. filling out a form, making an appointment, describing daily routines, shopping groceries, booking a room, describing the way, ordering and complaining in the restaurant, etc.).
- Structures: The most important basic structures of the German language are developed: e.g. nominal phrases in sentences (declination, syntactic function), conjugation of regular, irregular and mixed verbs.
- Intercultural skills & socio-cultural knowledge: Forms of salutation and courtesy (forms of greeting, *Siezen* and *Duzen*), knowledge of Germany.

4 Forms of teaching:

Classroom teaching in the form of seminar lessons

5 Participation requirements:

Formal:	University entrance qualification obtained abroad
Content-related:	None

6 Form of assessment:

Written examination or oral examination

7 Conditions for the award of credit points:

Passed module examination and course assessment

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: HSBI's Language Center
11	Other information:
12	Language: German

Lean Production and Industrial Engineering					LPIE
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3388	150 h	5	4th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students ...

- Are able to describe the basic principles of lean production, including Muda, Jidoka and just-in-time, and explain the importance of one-piece flow in production.
- Are able to document production sequences by means of value stream planning, identify potential for improvement and derive measures for optimising the process sequences.
- Can independently apply selected lean methods in the areas of production, administration and development.
- Can describe the methods of "leadership on the ground" and foster constructive cooperation in teams.
- Are able to identify different types of waste and propose measures to avoid them.
- Can assess the effects of different lean management methods on productivity, quality and sustainability, including the impact on the UN Sustainable Development Goals.
- Can apply problem-solving techniques and strategies in real-world production environments and develop their own solutions.
- Understand and apply methods of system analysis and design to solve complex industrial and production problems.
- Are able to design workplaces and processes in accordance with ergonomic principles in order to increase efficiency and improve working conditions.
- Understand the principles of quality management and can initiate and implement continuous improvement processes in industrial production.
- Are familiar with and can effectively use current technologies and digital tools used in modern production and industrial engineering.

3 Contents:

- Vision of a Lean Company
- Problem-solving techniques and strategies
- Effects of Lean Management methods
- Value stream mapping / value stream design (theory and concrete examples)
- Production systems using the example of the Toyota Production System

	• Muda (types of waste and their avoidance) • Jidoka principle (quality in process – Andon, Poka Yoke) • Just-in-time principle (Kanban, levelling) • One-piece production in flow principle (One-Piece Flow) • Set-up time reduction (SMED "Single Minute Exchange of Die") • Employee participation and responsibility • Process standardisation and improvement work (Kaizen) • Sustainability and lean management • Planning, steering and communicating successful change processes	
4	Forms of teaching: Classroom teaching in the form of lectures and seminar lessons	
5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch	
11	Other information:	
12	Language: English	

Marketing and Technical Sales					MTS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3397	150 h	5	6th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to:

- Explain the specifics of marketing and the differences between business-to-business (B2B) and business-to-consumer (B2C) marketing;
- Compare the different methods of market research for analysing B2C and B2B markets;
- Identify the success factors and objectives of technical sales and review the determinants of the distribution channel decision;
- Describe the tools of the marketing mix (4P – product, price, promotion and place) and evaluate them with a focus on sustainability aspects;
- Classify current market trends against the background of increasing digitalisation, internationalisation and sustainability aspects;
- Interpret the essential concepts of sustainable marketing and basic models for explaining sustainable consumer behaviour;
- Apply the marketing mix design options to selected case studies;
- Discuss questions about structures and concepts in the sales of technical products, develop own solutions in learning groups and present the results.

3 Contents:

- Digitalisation and sustainability as trends in marketing
- Innovations and influences of behavioural economics
- Customer satisfaction and loyalty as marketing targets
- Buying behaviour in B2C and B2B markets
- Market research and segmentation
- Product policy in the individual product life cycle phases
- Strategies of pricing and terms
- Sales forms and channel decisions
- Basic instruments/key figures of sales controlling
- Elements of on- and offline communication

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6	Form of assessment: Written examination or project work or oral examination
7	Conditions for the award of credit points: Passed module examination
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr. Adam-Alexander Manowicz
11	Other information:
12	Language: English

Materials Engineering					MEG
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3394	150 h	5	5th semester	Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students understand the relationships between the structure of mechanical materials and their properties by

- Acquiring knowledge about the microstructural composition and its modification by alloying elements,
- Understanding the deformation behaviour as well as the transformation behaviour and phase reactions,
- Developing skills to apply material parameters to different set conditions and to transfer these to the component design
- Acquiring competences to measure and assess material properties within the framework of a material test and to bring about changes in material behaviour in a targeted manner through heat treatments or mechanical deformation.

3 Contents:

- Structure of metallic materials,
- Lattice defects and their effect on material behaviour
- Deformation and fracture: strength, toughness, ductility
- Alloying: state diagrams and iron-carbon diagrams,
- Time-temperature transformation and austenitisation
- Influence of selected alloying elements
- Hardening & tempering
- Steel designations
- Properties and material behaviour of selected steel materials such as structural steels, case-hardened and tool steels, cast iron.

Selected areas of material testing and material properties are enhanced in practicals.

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or oral examination

7	Conditions for the award of credit points: Passed module examination
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Thomas Kordisch
11	Other information:
12	Language: English

Mathematics I					**MATHS1**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3378	150 h	5	1st semester	Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

On successful completion of the course, students

- Are familiar with the mathematical way of working.
- Are able to understand and apply the introduced mathematical notation.
- Understand the basic terms and methods from the areas of algebra and analysis specified below.
- Can apply the learned methods to practice-oriented questions in the fields of technology, natural science, computer science and business.

3 Contents:

- General basics (set theory, inequalities, propositional logic, methods of proof)
- Complex numbers (definition and representation, complex calculus)
- Functions of one variable (limit and continuity, polynomial functions, rational functions, trigonometric functions, exponential function, logarithm function)
- Differential calculus for functions of one variable (differentiability, derivation rules, applications)
- Integral calculus for functions of one variable (fundamental theorem of differential and integral calculus, integration rules, integration methods, improper integrals, applications)

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or oral examination or a combination of written examination and oral examination

7 Conditions for the award of credit points:

Passed module examination

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9 Weighting of grade for calculation of final grade:

according to BRPO

10 Module coordinator:

Dr. rer. nat. Lisa Teich

11	Other information:
12	Language: English

Mathematics II					**MATHS2**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3383	150 h	5	2nd semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students		weekly hours		h		h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students		weekly hours		h		h

2 Learning outcomes/competences:

On successful completion of the course, students

- Understand the basic terms and methods from the areas of linear algebra specified below.
- Have enhanced their knowledge in the field of analysis and master the essential principles of differential calculus for functions of several variables.
- Know the most important numerical algorithms and their possible applications and are able to handle numerical problems and estimate errors of numerical calculations.
- Can implement simple algorithms in a higher programming language on a computer.
- Can develop functions into their Taylor series.
- Can apply the learned methods to practice-oriented questions in the fields of technology, natural science, computer science and business.

3 Contents:

- Linear algebra (vectors, matrices, determinants, systems of linear equations, eigenvalues and eigenvectors)
- Differential calculus for functions of several variables (functions of several variables, partial differentiation)
- Numerics (numerical determination of zeros, numerical differentiation, numerical integration)
- Taylor series
- Fourier series
- Use of software such as MATLAB C++, Python

4 Forms of teaching:

Courses in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	Knowledge from the following module: 3378 Mathematics I;

6 Form of assessment:

Written examination or oral examination or a combination of written examination and oral examination

7 Conditions for the award of credit points:

Passed module examination

8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Dr. rer. nat. Lisa Teich
11	Other information:
12	Language: English

Microcontroller Programming					**MPM**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3399	150 h	5	6th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students		weekly hours		h		h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students		weekly hours		h		h

2 Learning outcomes/competences:

The students

- Learn the basics of embedded systems based on microcontrollers and single-board computers.
- Gain practical experience in designing embedded microcontroller-based systems, sensor networks and machine-to-machine (M2M) communications.
- Are able to design and implement their own microcontroller-based hardware projects.
- Can evaluate and make judgements about systems or products based on embedded systems, e.g. performance or resource efficiency.
- Can translate customer requirements into viable technical concepts and product architectures, taking into account efficiency and modularity.

3 Contents:

- Fundamentals of Embedded Systems and Internet of Things (IoT)
- Fundamentals of processor architectures
- Embedded systems platforms (e.g. Arduino, Raspberry PI, ARM)
- Concepts and tools for the development of embedded systems
- Reading out sensors, controlling actuators
- Special peripheral components of microcontrollers (e.g. serial/parallel I/O channels, interrupt controllers, DMA controllers, AD/DA converters, counters and timers, Watchdog, power saving modes)
- Communication via bus systems, M2M communication (e.g. I2C, SPI, UART)
- Integration into overall systems

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Term paper or written examination or project work or oral examination or a combination of term paper and written examination or a combination of project work and oral examination

7	Conditions for the award of credit points: Passed module examination and course assessment
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr.-Ing. Christian Stöcker
11	Other information:
12	Language: English

Operations Research					ORC
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3391	150 h	5	4th semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students ...

- Know and understand the basic principles and theoretical concepts of operations research, including key mathematical model types and associated solution procedures.
- Can apply the various operations research models and procedures in a situational and effective manner to analyse complex problems and develop solutions.
- Are able to identify, analyse and find solutions to relevant real-world problems from the field of economics and in particular logistics with the help of suitable models and methods of operations research or to provide decision support.
- Can critically assess the suitability and effectiveness of operations research models and methodologies and understand their limitations and capabilities in the context of real-world applications.
- Recognise the relevance and possible applications of operations research in various interdisciplinary contexts and can use their knowledge in collaboration with experts from other areas.
- Are familiar with modern software tools and technologies used in operations research and can effectively use them to model, analyse and solve problems.
- Can present the results of their analysis and solution proposals clearly and convincingly, and are able to work and communicate effectively in multidisciplinary teams.

3 Contents:

- Introduction to operations research
- Models in operations research
- Subfields of operations research
- Linear optimisation
- Fundamentals of graph theory
- Transport problems
- Integer optimisation problems (pure-integer linear optimisation problems, knapsack problems)
- Combinatorial optimisation problems (assignment problems, round trip problems, postman problems, route planning problems, machine allocation problems, location problems)
- Dynamic optimisation (batch size planning)

4	Forms of teaching: Classroom teaching in the form of lectures and seminar lessons	
5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or oral examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch	
11	Other information:	
12	Language: English	

Physics					**PHS**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3381	150 h	5	2nd semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	1	weekly hours	15	h	22.5	h
	Exercise	20 students		weekly hours		h		h
	Practical or seminar	15 students	1	weekly hours	15	h	22.5	h
	Supervised self-study	60 students		weekly hours		h		h

2 Learning outcomes/competences:

Upon successful completion of the module, students are able to ...

- Identify physically motivated problems within their field of expertise.
- Select meaningful solution strategies for physical tasks.
- Select appropriate formulas to solve and apply to specific problems.
- Use important physical units and numerical representations for calculations and the acquisition and further processing of measured values.
- Perform physical tests and interpret and document their work results.

3 Contents:

Introduction to physics and basics:

- Subdomains of physics
- Conventions and mathematical basics
- Units and estimating orders of magnitude
- Basics of measurement and error handling

Mechanics:

- Kinematics: Kinematics of mass points, one- and multi-dimensional linear motion with constant acceleration, rotational motion
- Dynamics: Newtonian axioms, energy and work for linear and rotational motion

Optics:

- Geometrical optics: Light beams, reflection, refraction, dispersion, imaging through lenses and lens systems
- Wave optics: Electromagnetic waves, polarised light, interference, coherence, diffraction

4 Forms of teaching:

Classroom teaching in the form of lectures, seminar lessons and practicals

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or oral examination

7 Conditions for the award of credit points:

Passed module examination and course assessment

8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Dr. rer. nat. Lisa Teich
11	Other information:
12	Language: English

Practical Project / Internship					PPI
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
1406	180 h	6	6th semester	each semester	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	180	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

On successful completion of the module, students are able to:

- Apply and enhance study programme-specific knowledge and skills in practice.
- Work on individual issues in the company providing training holistically and under practical conditions and independently develop solution options.
- Apply their scientific work skills and gradually expand them.
- Document the individual problems and solution options dealt with in the company providing training in a scientific paper.

3 Contents:

- The topics to be dealt with represent current issues of the company provided training.
- If relevant to the issue, technical trends such as future technologies and social trends such as sustainability are also addressed.
- The topics to be worked on must be related to engineering science and be oriented towards the module contents of the curriculum.
- The topic is agreed between the student, the supervisor in the company and the examiner at the university.

4 Forms of teaching:

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

7 Conditions for the award of credit points:

Proof of practical experience form

8 Use of the module (in the following study programmes):

Industrial Engineering

9 Weighting of grade for calculation of final grade:

10 Module coordinator:

Prof. Dr. rer. pol. Mariam Dopslaf

11 Other information:

The Practical Project/Internship is ungraded.

12	Language: English

Principles of Economics									POE
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3374	150 h	5	1st semester			Annual (Winter)			1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students can classify and present the interplay of market and price and their significance for economic systems. They know the main weaknesses of a market economy system and can assess the opportunities and limits of government intervention to avoid negative effects (e.g. environmental damage), apply it to specific practical cases and categorise the consequences for the company's activities. They have basic knowledge of essential issues of business administration and can apply this to business practice. They can recognise and assess the overall interrelationships between goods, services and finance. In this way, they understand the fundamental interrelationships of the individual sub-areas of business administration. Thus, students are able to think in business terms.

Students have the basic understanding to attend the modules "Personnel and Organisation," "Business Process Modelling and IT Systems," "Procurement, Production and Logistics," "Digital Service Engineering and Services Marketing," "Accounting and Finance," "Cost and Investment Accounting," "Controlling," "Marketing and Sales," "Business Law," "Lean Production."

3 Contents:

- Corporate functions
- Economic fundamentals of the market and competition
- Significance of the enterprise in the social market economy
- Enterprises as a subject of business administration
- Enterprise objectives
- Legal forms of companies/combinations of companies
- Corporate taxes
- Fundamentals of labour law
- Marketing basics

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or project work or oral examination

7 Conditions for the award of credit points:

Passed module examination

8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf
11	Other information:
12	Language: English

Procurement, Production and Logistics					PPL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3380	150 h	5	2nd semester	Annual (Summer)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

Students are able to explain the functions of "procurement," "production" and "logistics" in a differentiated way and understand their interrelationships as well as the weaknesses of these functions. Using the selected contents and methods, they can recognise and properly assess real economic tasks and problem areas and independently develop approaches to solutions.

Students are be able to carry out a sound supplier evaluation and selection and, based on production planning, investigate suitable sourcing concepts and decide which scientific method is appropriate for sourcing and demand calculation. They can systematically analyse procurement markets to increase their transparency and recognise developments relevant to procurement.

Students learn about basic production systems and can evaluate their applicability for specific industries.

In the field of logistics, students understand practical objects from intralogistics, transport logistics and supply chain management, which enables them to analyse complex logistics systems.

3 Contents:

- Procurement market research (objects and processes)
- Procurement planning (principles, routes, dates and quantities),
- Procurement execution (supplier selection, requesting and checking of quotes, selection of quotes and ordering),
- Inventory planning (inventory types, strategies, management and monitoring),
- Planning of logistics and production processes
- Systematisation of production factors
- Planning and management of production
- Logistics planning
- Logistics systems (intralogistics, transport logistics and storage systems)
- Distribution logistics
- Modes of freight transport

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6	Form of assessment: Term paper or written examination
7	Conditions for the award of credit points: Passed module examination
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf
11	Other information:
12	Language: English

Production Planning and Control									PPC
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3395	150 h	5	5th semester			Annual (Winter)			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours		30	h	45	h
	Sem. lessons	30 students	2	weekly hours		30	h	45	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	0	weekly hours		0	h	0	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h

2 Learning outcomes/competences:

The students ...

- Understand the business fundamentals and interrelationships of production management. Are able to integrate this knowledge into the planning and control of production processes.
- Understand the core and cross-sectional functions of production planning and control (PPC) systems. Are able to analyse these functions according to their operational typology and to position them in the context of the entire enterprise.
- Understand and implement the basic objectives of production planning and control, as well as order processing procedures in production companies.
- Recognise the core tasks of production planning and control and are capable of using the methods used in this process in practice.
- Gain initial experience in handling the basic functions of a PPC system from a renowned supplier. Can apply this experience to real-world production environments.
- Are able to analyse production processes and identify and implement optimisation potentials using PPC systems.
- Develop an interdisciplinary understanding of integrating production planning and control into other business areas such as logistics, purchasing and sales.
- Improve their decision-making and problem-solving skills in the context of production planning and control, especially when faced with unexpected challenges or bottlenecks.

3 Contents:

- Challenges, goals and tasks of PPC
- PPC philosophies
- Data management in PPC
- Selection of PPC systems
- Individual tasks of production programme planning, production requirements planning as well as in-house production planning and control
- Managing the material master, BOM and routing
- Plan production, procurement and storage quantities
- Order handling types, order coordination (customer orders and production orders)

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch	
11	Other information:	
12	Language: English	

Project 1									**PRIN1**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:				
1407	180 h	6	4th semester	Annual (Summer)	1 sem.				

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours	0	h	180	h
	Sem. lessons	30 students	0	weekly hours	0	h	0	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2	Learning outcomes/competences: On successful completion of the module, students are able to: • Work independently on individual problems from engineering. • Apply their scientific work skills and gradually expand them. • Document the individual problems and solution options dealt with in a scientific paper.
3	Contents: • The topics to be dealt with represent current issues from the field of industrial engineering. • If relevant to the issue, technical trends such as future technologies and social trends such as sustainability are also addressed. • The topics to be worked on must be related to engineering science and be oriented towards the module contents of the curriculum. • The topic is coordinated between the student and the examiner at the university.
4	Forms of teaching:
5	Participation requirements: Formal: None Content-related: None
6	Form of assessment: Term paper
7	Conditions for the award of credit points: Passed module examination
8	Use of the module (in the following study programmes): Industrial Engineering
9	Weighting of grade for calculation of final grade: according to BRPO
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf
11	Other information: After consultation with the supervising lecturer, Project 1 can also be processed as part of a company internship.

12	Language: English

Project 2									**PRIN2**
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
1408	180 h	6	5th semester			Annual (Winter)			1 sem.
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	weekly hours		0	h	180	h
	Sem. lessons	30 students	0	weekly hours		0	h	0	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	0	weekly hours		0	h	0	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h
2	Learning outcomes/competences: On successful completion of the module, students are able to: • Work independently on individual problems from engineering. • Apply their scientific work skills and gradually expand them. • Document the individual problems and solution options dealt with in a scientific paper.								
3	Contents: • The topics to be dealt with represent current issues from the field of industrial engineering. • If relevant to the issue, technical trends such as future technologies and social trends such as sustainability are also addressed. • The topics to be worked on must be related to engineering science and be oriented towards the module contents of the curriculum. • The topic is coordinated between the student and the examiner at the university.								
4	Forms of teaching:								
5	Participation requirements:								
	Formal:	None							
	Content-related:	None							
6	Form of assessment: Term Paper								
7	Conditions for the award of credit points: Passed module examination								
8	Use of the module (in the following study programmes): Industrial Engineering								
9	Weighting of grade for calculation of final grade: according to BRPO								
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf								
11	Other information: After consultation with the supervising lecturer, Project 2 can also be processed as part of a company internship.								
12	Language: English								

Quality Management									**QMM**
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3400	150 h	5	7th semester			Annual (Winter)			1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

The students

- Can determine/assess the "value" (cost/benefit) of quality for a company and can understand the development of quality management.
- Understand and distinguish between the existing quality management models and can apply quality management systems in a purposeful manner.
- Can integrate quality management into existing management structures of a company.

3 Contents:

- The term 'quality'
- Basics of quality management systems (QMS), tasks and objectives of QMS in the company
- Terms and definitions in quality management
- Analysis of the costs/benefits of a QM system
- Strategies for increasing and ensuring 'quality' in the company (PDCA cycle)
- Tools, procedures, means, processes of quality planning, control, inspection and improvement
- Prerequisites for the successful use of management systems for quality management in the company
- Overarching aspects of quality management: Standardisation, certification etc.

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Term paper or written examination or project work or oral examination

7 Conditions for the award of credit points:

Passed module examination

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9 Weighting of grade for calculation of final grade:

according to BRPO

10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch
11	Other information:
12	Language: English

Statistics					**STAS**
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer:	Duration:
3387	150 h	5	3rd semester	Annual (Winter)	1 sem.

1	Course:	Planned group sizes:	Scope:		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours	30	h	45	h
	Sem. lessons	30 students	2	weekly hours	30	h	45	h
	Exercise	20 students	0	weekly hours	0	h	0	h
	Practical or seminar	15 students	0	weekly hours	0	h	0	h
	Supervised self-study	60 students	0	weekly hours	0	h	0	h

2 Learning outcomes/competences:

On successful completion of the course, students

- Can explain the basic concepts of statistics.
- Can apply the basic methods and procedures of descriptive statistics and probability theory.
- Are able to analyse economic questions and problems with statistical methods and to show correlations.
- Are able to solve tasks with the help of suitable software (SPSS, Excel, MATLAB).

3 Contents:

- Basic concepts of statistics
- Descriptive statistics (one-dimensional frequency distributions, measures for one-dimensional distributions, bivariable distributions, regression analysis)
- Basics of probability theory
- Probability distributions
- Assessing statistics (hypothesis tests, point and interval estimators)
- Use of software, e.g. Excel, SPSS, MATLAB

4 Forms of teaching:

Classroom teaching in the form of lectures and seminar lessons

5 Participation requirements:

Formal:	None
Content-related:	None

6 Form of assessment:

Written examination or project work or oral examination or a combination of written examination, project work and oral examination

7 Conditions for the award of credit points:

Passed module examination

8 Use of the module (in the following study programmes):

Industrial Engineering and Industrial Engineering (work-integrated)

9 Weighting of grade for calculation of final grade:

according to BRPO

10 Module coordinator:

Prof. Dr. Adam-Alexander Manowicz

11	Other information:
12	Language: English

Supply Chain Management									SCMG
Identification number:	Workload:	Credits:	Study semester:			Frequency of the offer:			Duration:
3398	150 h	5	6th semester			Annual (Summer)			
1	Course:	Planned group sizes:	Scope:			Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	weekly hours		30	h	45	h
	Sem. lessons	30 students	2	weekly hours		30	h	45	h
	Exercise	20 students	0	weekly hours		0	h	0	h
	Practical or seminar	15 students	0	weekly hours		0	h	0	h
	Supervised self-study	60 students	0	weekly hours		0	h	0	h

2 Learning outcomes/competences:

The students ...

- Understand the basic concepts of Supply Chain Management (SCM) and can explain the importance of an efficient and integrated supply chain for business success.
- Are able to analyse and critically evaluate the different elements of a supply chain in order to identify weaknesses and improvement potentials.
- Acquire in-depth knowledge of advanced information technologies and IT solutions used in logistics and SCM, including Enterprise Resource Planning (ERP), Warehouse Management Systems (WMS), Transport Management Systems (TMS), and Advanced Planning and Scheduling (APS) systems.
- Can compare and select the functions and characteristics of different IT solutions for the SCM to meet the specific needs of a company and its supply chain.
- Are able to plan, control and monitor the implementation of IT solutions into the existing supply chain processes to ensure a smooth and efficient integration process.
- Are capable of collecting, analysing and interpreting data from multiple sources in the supply chain to make informed decisions and strategic actions for supply chain optimisation.
- Are able to understand the importance of real-time information and data for reactive and proactive supply chain management and assess the integration of IoT and big data technologies into SCM processes.
- Recognise the challenges and risks associated with using IT solutions in SCM and can propose and implement appropriate security measures and controls to minimise risk.
- Can analyse practical case studies and scenarios where IT solutions have been successfully applied in SCM and apply their findings to develop innovative solutions to real-world challenges.
- Are able to apply their knowledge and skills to design and present a comprehensive concept for implementing an IT-enabled supply chain in a fictitious business scenario.

3	Contents: • Definition and significance of Supply Chain Management (SCM) in the modern economy • Objectives and functions of an efficient supply chain for businesses • Decisions between in-house production and outsourcing with cooperation options • Development of strategic procurement strategies to ensure goods availability • Various sourcing strategies such as insourcing, outsourcing, local and global sourcing • New sourcing approaches like eSourcing and cooperative sourcing for efficient supplier management • Identification and assessment of risks in the supply chain • Utilization of early warning systems for proactive risk avoidance and management • Information and material flows between suppliers and customers • Processes from national and international supplier search to supplier evaluation • Environmental and social aspects in the supply chain • Sustainable procurement practices and ethical supplier relationships • Internet of Things (IoT) and its significance for SCM • Automation and digital process optimization in the supply chain • Application of RFID and IoT technologies for tracking goods movement • Big data analytics for informed decision-making and forecasting • Principles of Lean Management in the supply chain • Reduction of waste and efficiency improvement • Collaboration along the supply chain for optimized processes • Integration of suppliers and customers into the SCM system • Sustainability and diversity throughout the supply chain	
4	Forms of teaching: Classroom teaching in the form of lectures and seminar lessons	
5	Participation requirements:	
	Formal:	None
	Content-related:	None
6	Form of assessment: Term paper or written examination or project work or oral examination	
7	Conditions for the award of credit points: Passed module examination	
8	Use of the module (in the following study programmes): Industrial Engineering and Industrial Engineering (work-integrated)	
9	Weighting of grade for calculation of final grade: according to BRPO	
10	Module coordinator: Prof. Dr. rer. pol. Mariam Dopslaf	
11	Other information:	
12	Language: English	