Technische Universität Berlin

Module and Course Description

Intake 2023

as of October 10, 2023

Master of Science

in

Global Production Engineering

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How to enroll for modules/courses

<u>Enrollment</u>
Enrollment for all courses in the GPE-online-system is mandatory each semester!

Face-to-Face classes:
During the lecture a participation list must be signed. If your name is not on that list, you have not enrolled properly. This means you must enroll for the class before the next lesson.

Our online system offers the opportunity to choose between "for credits" or "for proof of attendance".

For "credits" means:
The course will appear on your transcript and its grade will be a part of your final average grade on your master's degree certificate.

For "proof of attendance" means:
Only "lectures (VL)" are available for participation only. You can attend in lectures, but you cannot actively participate in class, group work, test, exams etc.
All other course types e.g., "exercises (UE)", "seminars (SE)" or "projects (PJ)" are not offered for "participation only" or "proof of attendance".

*Once a Course/Module have been chosen to take "for participation only" **cannot** be transferred to get it counted for credit after binding registration deadline.*

<u>Module Registration</u>
Each module that begins in a semester has a course for which an email is sent by the GPE Admin Team requesting the registration.

The registration deadline depends on the course content and the form of teaching as well as on when the first exam-relevant performances must be completed.

The answer to this email is mandatory to get a module bindingly registered.

Missing the deadline means no registration of the module.

After the deadline, the binding registration will be confirmed.

<u>Completion of the binding registration</u>
A registration confirmation list will be prepared and sent in the beginning of December. Students will be given three working days to verify the correctness.

Changing or deregistering modules are only possible by incorrect processing by the GPE Examination Office.

A Module Group Production

Module Title: *Manufacturing and Factory Planning*	**CP (ECTS):** 6	**Acronym:** MFP22	**Module Group:** Production
Responsible for Module: Prof. Dr.-Ing. Günther Seliger	**Secretary:** GPE	**E - mail:** guenther.seliger@tu-berlin.de	

Module Description

1. Qualification Goals

In the educational curriculum and practices, the students are acquainted with the basics of production and workshop planning, including the elementary knowledge on types of factories, further evaluation of technology, system theories, planning and controlling strategies of factories. Students gain state of the art knowledge about value creation, factory elements and operations management. One focus is layed on production planning and control. Through case studies, the theoretically taught contents can be deepened in extracts. Entrepreneurial thinking of students is strengthened.

The module imparts predominantly the following competence:

Technical 30%	Methodical 30%	Systemic 20%	Social 20%

2. Contents

Manufacturing as integral part of technological, logistical, economical, and ecological process chains; manufacturing processes and facilities; manufacturing scheduling; simultaneous engineering; project management; layout and material flow; human labour and qualification; application potentials for information and communication technological tools; methods and paths of innovation; object and phase-oriented task management and leadership; models of business integration and networking:
The course is separated into lectures, excercises and homework on selected topics of manufacturing and factory planing

- Concepts and definition of factory work
- Factory types
- Culture, man, and automation
- Work and technique
- Project management
- Portfolio concepts
- Calculation of process costs
- Product and process innovation
- System theory
- Sustainable manufacturing
- Energy management
- Availability
- Simulation of production systems
- Factory planning
- Layout planning
- Production network planning
- Planning of manufacturing facilities
- Planning of buildings and elements of industrial buildings
- Launching of operations
- Conceptions of factory control
- Remanufacturing
- ICT in manufacturing

3. Literature and Script

Literature, as announced in lectures according to respective subjects.
Seliger, G. (Editor), Sustainability in Manufacturing - Recovery of Resources in Product and Material Cycles, Springer Verlag, Berlin, Heidelberg 2007.
Seliger, G., Nasr, N., Bras, B., Alting, A. (Editors), Proceedings Global Conference on Sustainable Development and Life Cycle Engineering, uni - edition, Berlin 2004.
Silver, E., Pike, D., and Peterson, R., Inventory Management and Production Planning and Scheduling, Wiley, 1998.

4. Module Courses

Course Title	Type[1]	SWH[2]	CP[3]	P/W/WP[4]	WS/SS
Manufacturing and Factory Planning	IV	4	6	P	WS

Course Title	Docent/Lecturer	Language
Manufacturing and Factory Planning	Prof. Dr.-Ing. Günther Seliger	English

5. Description of Teaching Mode

Contents are presented in lecture and illustrated in case studies. Theoretical fundamentals and most important facts and data related to the topics are presented. Subsequently. Students are asked to check and consolidate

Module Title: *Manufacturing and Factory Planning*	**CP (ECTS):** 6	**Acronym:** MFP22	**Module Group:** Production

their knowledge in online quizzes and to submit weekly given homework. The results are discussed weekly in the plenum and put into theoretical context.

6. Condition for Participation

Participation: Mandatory

7. Teaching and learning activities (Effort and Credit Points)

Manufacturing and Factory Planning:
30 hours contact, 35 hours post-processing and homework, 10 hours reading, 25 hours preparation for course, 80 hours preparation for examination

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio examination according to examination regulations, Section 12.
Prerequisite for the recognition of the examination performances of:
Passing MFP-VL Test and weekly participation in online quizzes and homework.
Grading:
The course is weighted according to the respective credits.
Manufacturing and Factory Planning: 100% of module grade – 15 % weekly homework, 15% online quizzes, 70% written test (45 min.)

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants[5]

The number of participants is unlimited.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.
Exercise groups will be determined in the first lecture.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	x

Module Title: *Manufacturing and Factory Planning Case Studies*	**CP (ECTS):** 6	**Acronym:** MFP22 CS	**Module Group:** Production
Responsible for Module: Dr.-Ing. Jan Philipp Menn	**Secretary:** GPE	**E - mail:** jan.menn@gmx.net	

Module Description

1. Qualification Goals

In the educational curriculum and practices, the students are acquainted with the basics of production and workshop planning, including the elementary knowledge on types of factories, further evaluation of technology, system theories, planning and controlling strategies of factories. Students gain state of the art knowledge about value creation, factory elements and operations management. One focus is layed on production planning and control. Through group specific case studies, the contents are deepened in extracts. Entrepreneurial thinking of students is strengthened.

The module imparts predominantly the following competence:

Technical 25%	Methodical 40%	Systemic 25%	Social 10%

2. Contents

Case Studies Part one
Teams are built in order to plan a manufacturing site and production methods of a factory set to the fabrication of a determined product family. In a first step, research about factory planning techniques and strategies is done by students and presented in plenum. The three levels of sustainability are then addressed in the second step. Based on several boundary conditions students research, select, evalute and present an existing factory layout and visualize the material flow. Throughout an iterative process, the designed layouts and schemes are then improved by means of the lecture's content. A similar plant shall be opened at a new location in another country. The site selection is performed by the groups.
The teams' results are to be presented and documented. Each group is assigned with different research topics and factory conditions.

Case Studies Part two
The processes for the new plant must be improved. Therefore, a Failure Mode and Effects analysis (FMEA) of the manufacturing process and an Overall Equipment Effectiveness (OEE) must be worked out for the old already existing plant. Based on theresults improvement ideas for the new factory are developed under the new conditions. Three possible scenarios for the new location are presented and the best is chosen. In a fourth step, the material flow diagram for the new plant gets augmented with emissions, wastes and other by-products. The use of reutilization equipment is evaluated for the new plant. The chosen material flow diagram must be improved including the reutilization equipment if applicable. For the ramp-up of the new factory ideas of the training for the new employees are worked out.

3. Literature and Script

To be provided in the course.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Manufacturing and Factory Planning Case Studies Part one	PJ	2	3	WP	WS
Manufacturing and Factory Planning Case Studies Part two	PJ	2	3	WP	SS

Course Title	Docent/Lecturer	Language
Manufacturing and Factory Planning Case Studies Part one	Dr.-Ing. Jan Philipp Menn	English
Manufacturing and Factory Planning Case Studies Part two	Dr.-Ing. Jan Philipp Menn	English

5. Description of Teaching Mode

A guideline is given for both Case Studies. It describes in detail the tasks to be worked out by students. Students form groups with different factory scenarios and boundary conditions. Contents are researched and presented by the students withint the framework of the guideline. Q&A sessions are hold between the group coordinators and the lecturer to clarify upcoming questions. In exercises students' abilities are trained by solving technological business case-oriented tasks establishing problem solving capabilities. Self organized group meetings enable for problem solving in teamwork and cooperation. Challenging tasks for a respective master thesis are continuously provided in cooperation with industrial development partners.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Manufacturing and Factory Planning Case Studies	6	MFP22 CS	Production

6. Condition for Participation

Participation in "MFP Case Studies Part one" also requires participation in "MFP Case Studies Part two" and vice versa.

7. Teaching and learning activities (Effort and Credit Points)

Manufacturing and Factory Planning Case Studies I
32 hours contact, 30 hours preparation for course, 10 hours post-processing, 70 hours reading and preparation for documentation, 40 hours project work.
Manufacturing and Factory Planning Case Studies I
28 hours contact, 30 hours preparation for course, 10 hours post-processing, 70 hours reading and preparation for documentation, 40 hours project work.

8. Assessment criteria (Examination and Grades)

Examination.:
Portfolio Examination according to examination regulations.
80% participation in lectures and exercises
Grading:
Manufacturing and Factory Planning Case Studies Part one and two count each 50% of the module grade.
Thereof for each case study 25% interim presentation (min. 5 min/student), 30% final presentation (min. 5 min/student), 45% final report (thereof 2/3 for the overall assessment and 1/3 through individual contributions).

9. Duration of Module

The module can be completed within two semesters.

10. Number of Participants

The number of participants is limited to 48.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines for lecture, practical experience and exam will be announced at the beginning of each semester.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	

Module Title: *Manufacturing and Factory Planning Operations*	**CP (ECTS):** 6	**Acronym:** MFP22 OP	**Module Group:** Production
Responsible for Module: Dr.-Ing. Jens Palacios Neffke	**Secretary:** GPE	**E - mail:** jenspalacios@gmail.com	

Module Description

1. Qualification Goals

Participants will learn the basics of common elements comprising factory operations. These include but are not limited to the design of factories and production processes according to product specificities, new product introduction strategies, supply chain and logistics, factory management, as well as continuous improvement.
The course is concieved to rely fully on student participation and practical exercises. Student groups are introduced in new topics on a weekly basis, which in turn will be the foundation of the practical component of the course.

The practical component of the course consists in the development of own products (Lego vehicles), as well as the planning of assembly processes and factory operations to meet market performance expectations. Student teams will compete among themselves to demonstrate their capacity to satisfy market and customer demands.

The module imparts predominantly the following competence:

Technical 25%	Methodical 40%	Systemic 25%	Social 10%

2. Contents

- Product development and new product introduction
- Process development
- Factory planning
- Factory management
- Production planning
- Supply chain and logistic basics
- EHS basics
- Operational excellence basics

3. Literature and Script

To be provided in the course.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Manufacturing and Factory Planning Operations	UE	4	6	WP	WS

Course Title	Docent/Lecturer	Language
Manufacturing and Factory Planning Operations	Dr.-Ing. Jens Palacios Neffke	English

5. Description of Teaching Mode

Series of presentations on selected topics presented by student groups. Development of own product and production processes. Continuous improvement of production processes.

6. Condition for Participation

Mandatory: None
Preferable: Participation in “Manufacturing and Factory Planning”

7. Teaching and learning activities (Effort and Credit Points)

Contact hours: 40 hours contact, 80 hours for presentations preparation, 60 hours of product and process development.

8. Assessment criteria (Examination and Grades)

Examination: Portfolio Examination according to examination regulations, Section 12.
80% participation in lectures and exercises.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Manufacturing and Factory Planning Operations	6	MFP22 OP	Production

Grading:
The course consists in a series of presentations to be conducted by student teams, and the practical component of the course. Presentations will be graded based on criteria such as research comprehensiveness of the topic, ability to convey it to a larger audience and presentation style. The average grade of the individual presentations constitutes 50% of the final grade. The remaining 50% of the final grade is based on the performance obtained by the teams during the practical component of the course

9. Duration of Module

The module can be completed within one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines for lecture, practical experience and exam will be announced at the beginning of each semester.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	

Module Title: *Production Technology*	**CP (ECTS):** 12	**Acronym:** PT18	**Module Group:** Production
Responsible for Module: Prof. Dr.-Ing. Eckart Uhlmann	**Secretary:** PTZ 1	**E - mail:** uhlmann@iwf.tu-berlin.de	

Module Description

1. Qualification Goals

To meet the challenges of the permanently changing international markets, it is necessary to be aware not only of the global connections but also of the relations within the factory as well as of the interactions with its environment. The factory science and its special branches provide the necessary conditions in this respect. The development of modern, innovative factory structures is not a pure result of the technical progress, it is rather the outcome of combining the results of production-, economical- and sociological sciences with the experience in the operational practice.

Within the scope of the lectures and experiment-related exercises of the section Production Technology the students get a system-oriented picture of the factory, with the aim of elaborating the connections among which a factory is operated. Conventional types of factories as well as new conceptions of their further development will be examined. Another point of emphasis is the explanation of fundamental production technologies and the corresponding means of production. Great importance will be attached to the analysis of the structure of these technologies and to their correlation. The experiment-related exercises complete the lectures by in-depth treating the topics and practical exercises. The exercises belonging to the courses Production technology I and II will be carried out in a series of joint training within one semester. In this module students gain competencies in selection, planning and application of production processes.

The module imparts predominantly the following competence:

Technical 40%	Methodical 40%	Systemic 10%	Social 10%

2. Contents

The factory business forms the framework of the lecture Production Technology. Within the lecture, the issues of technological as well as management questions are addressed. Among the contents there are lectures of manufacturing processes for the manufacturing of industrial goods on the one hand and the teaching of basics of production and factory planning, product planning, work planning, quality management and technology management on the other hand. Besides the acquiring of expert knowledge, the student will get the ability of systematical problem solving.

The exercise consists of 10 single exercises: Fundamentals of cutting technology, fundamentals of numerical control, abrasive machining, non - conventional machining, dynamical behavior, thermal behavior, robot technology, industrial disassembly, safety engineering und Rapid Prototyping.

Production Technology I and Exercise (6 SWH)

- System Factory
- Product Planning
- Product Design
- Organization of Production
- Production Process Planning and Design
- Quality in Production
- Factory Planning
- Workshop Planning
- Cost and Investment Planning
- Personnel

Production Technology II (2 SWH)

- Primary Shaping
- Forming
- Cutting
- Joining
- Coating
- Heat Treatment
- Design of Manufacturing
- Product Support
- Assembly
- Cyle Economy

3. Literature and Script

Literature, as announced in lectures according to respective subjects:

- J. M. Usher, Uptal Roy, Parsaei, Integrated Product and Process Development, 1998.
- Chase, Aquilano, Jacobs, Production and Operation Management, 1999.
- Eversheim, W., Organisation in der Produktionstechnik, Düsseldorf, VDI - Verlag, 1996.
- Spur, G., Krause, F. - L., Das virtuelle Produkt, München, Wien, Hanser Verlag, 1997.
- Wiendahl, H. - P., B*etriebsorganisation für Ingenieure*, München, Wien, Hanser Verlag, 1989.

Printed and/or electronic scripts as announced in lectures.

Module Title: *Production Technology*	**CP (ECTS):** 12	**Acronym:** PT18	**Module Group:** Production

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Production Technology I	VL	2	3	P	WS
Exercise in the Test Field for Machine Tools and Manufacturing Technology Group 1	UE	4	6	P	WS
Production Technology II	VL	2	3	P	SS

Course Title	Docent/Lecturer	Language
Production Technology I	Prof. Dr.-Ing. Eckart Uhlmann	English
Exercise in the Test Field for Machine Tools and Manufacturing Technology Group 1	Dr.-Ing. Jörg Bold/ Chuong Dinh, M. Sc.	English
Production Technology II	Prof. Dr.-Ing. Eckart Uhlmann	English

5. Description of Teaching Mode

Contents are presented in lectures illustrated by case studies. In the beginning of the exercises the theoretical fundamentals and most important facts and data related to the respective topic are presented. Subsequently, detailed explanations about these topics follow at the machines and test stands in the test field of the PTZ.

6. Condition for Participation

Mandatory: None
Preferable: None

7. Teaching and learning activities (Effort and Credit Points)

Lectures: 60 hours contact, 45 hours post-processing and homework, 45 hours reading, 30 hours preparation for examination
Exercises: 60 hours contact, 45 hours preparation, 45 hours documentation, 30 hours preparation for examination
Total: 360 hours = 12 CP (30 hours = 1CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written tests:
Exercise in the Test Field
Passing the test concerning exercise´s contents
Grading:
Production Technology I - 50% of module grade
100% written test (45 min.)
Production Technology II - 50% of module grade
100% written test (45 min.)

9. Duration of Module

The module is performed within two semesters.

10. Number of Participants

Lectures: The number of participants is unlimited.
Exercises: The number of participants is limited to 20.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.
Exercise groups will be determined in the first lecture.

Module Title: *Production Technology*	**CP (ECTS):** 12	**Acronym:** PT18	**Module Group:** Production
12. Validity			
Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025) Update on: October 10, 2023			

13. Orientation Help					
Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	x

Module Title: *Additive Manufacturing*	**CP (ECTS):** 6	**Acronym:** AM	**Module Group:** Production
Responsible for Module: Dr.-Ing. Bernd Muschard	**Secretary:** GPE	**E - mail:** bernd.muschard@tu-berlin.de	

Module Description

1. Qualification Goals

The AM teaching module gives an overview about the technology of additive manufacturing, provides knowledge about the design for additive manufacturing, necessary digital tools, materials, and fields of application. Students will be prepared for a systematic understanding of this technology regarding production technological matters that consider planning, manufacturing, control, and services. By applying the contents of the lecture in the exercise, the students are prepared for the self-depended application of planning and manufacturing tasks for this technology.

The module imparts predominantly the following competence:

Technical 25%	Methodical 40%	Systemic 25%	Social 10%

2. Contents

Technology overview; industrial application; prosumer application; advantages; sustainability potentials; AM services; process chain; digital tools for AM: Computer Aided Design (CAD), mesh repair, file converter, slicer; design for additive manufacturing; VDI 3405; thermal behavior; materials for AM; AM-technologies: Fused Deposition Modelling (FDM): printer layouts, elements and structure, setting up the printer, materials overview and properties, recycling of materials, troubleshooting; Selective Laser Sintering (SLS); Laminated Object Manufacturing (LOM), Selective Laser Sintering (SLS), Electron Beam Melting (EBM), Multijet Modeling (MJM), Stereo Lithography (SLA); Open Source; communities; MakerSpaces; future perspective and outlook; hands-on-experience: group work, 3D printing challenge.

3. Literature and Script

Gebhardt, A. & Hötter, J. (2016). Additive manufacturing: 3D printing for prototyping and manufacturing.
Gibson, I., Rosen, D. & Stucker, B. (2010). Additive manufacturing technologies: Rapid prototyping to direct digital manufacturing. Berlin: Springer.
Anderson, C. & Schmid, S. (2013). Makers: The new industrial revolution. Crown Business.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Additive Manufacturing Lecture	VL	2	3	P	WS
Additive Manufacturing Project Group 1	UE	2	3	WP	WS
Additive Manufacturing Project Group 2	UE	2	3	WP	WS

Course Title	Docent/Lecturer	Language
Additive Manufacturing Lecture	Dr.-Ing. Bernd Muschard	English
Additive Manufacturing Project Group 1	Dr.-Ing. Bernd Muschard	English
Additive Manufacturing Project Group 2	Dr.-Ing. Bernd Muschard	English

5. Description of Teaching Mode

The modules consist of the lecture Additive Manufacturing (VL) and the supplementary and exemplifying exercises Additive Manufacturing Project (UE).
Explorative, situational, and problem-oriented teaching methods will be used to provide knowledge and skills about additive manufacturing. Technical as well as methodical contents will be taught. To successfully pass the module, it is necessary to participate in the lecture (VL) and the exercise (UE).
In practical exercises students are motivated to hands-on experience with 3D printers of the technologies Fused Deposition Modeling (FDM) and Selective Laser Sintering (SLS) on given projects, mostly in teamwork. The focus is laid on the application of Additive Manufacturing for prototyping and for small projects.

6. Condition for Participation

Mandatory: Participation in all exercises of the assigned project group.
Preferable: Participation in “Production Technology” and/or “Manufacturing and Factory Planning”

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Additive Manufacturing	6	AM	Production

7. Teaching and learning activities (Effort and Credit Points)

Contact hours: Lecture: 30 h, practical exercises: 20 h, Course preparation and post-processing: 50 h,
Exam preparation: 80 h
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to written test:
80% participation in lectures and exercises
Grading:
Additive Manufacturing Lecture 60% of module grade
100% written test (60 min.)
Additive Manufacturing Project 40% of module grade
50% presentation in group, 50% practical exercises and worksheets

9. Duration of Module

The module can be completed within one semester.

10. Number of Participants

Group 2 will only be offered upon request and depends on the number of students applied for the course.
Lecture: The number of participants is limited to 30.
Exercises: The number of participants is limited to 15 each.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines for lecture, practical experience and exam will be announced at the beginning of each semester.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	

B Module Group Engineering

Module Title: *Engineering Design*	**CP (ECTS):** 6	**Acronym:** ED23	**Module Group** Engineering
Responsible for Module: Prof. Dr.-Ing. Rainer Stark	**Secretary:** GPE	**E - mail:** sebastian.werner@tu-berlin.de cornelia.muessig@tu-berlin.de	

Module Description

1. Qualification Goals

Students know common machine elements and design rules in engineering. They can draft individual solutions according to ISO drawing standards and understand production drawings including dimensions and tolerances. Rules of drawing, design principles and guidelines can be applied to technical drafts.
Students have a basic insight into working with modern engineering design systems with focus on CAD, into direct and parametric modelling systems. They are prepared for modern collaboration practice in product development processes, utilizing a state-of-the-art Product Management System (PDM). Engineering students are provided with knowledge, methods, and tools for the process of virtually creating and validating a product.

The module imparts predominantly the following competence:

Technical 35%	Methodical 35%	Systemic 20%	Social 10%

2. Contents

Fundamentals of Engineering Design: function, layout, design, manufacture, and assembly; fundamentals of machine elements: use and function; durability of machine elements: load, stress, strain and failure prediction for static loading; conceptual and embodiment design. Design and draft of a mechanical product.

3. Literature and Script

Books:

- Pahl, G., Beitz, W., *Engineering Design – A Systematic Approach*, 3rd ed, London, New York, Springer, 2007.
- K. Ulrich & S. Eppinger: Product Design and Development. 5th Ed., Boston, 2011
- C. Hales & S. Gooch: Managing Engineering Design. 2nd Ed., London, 2004
- Dubbel, *Handbook of Mechanical Engineering*, London, New York, Springer, 1994.
- Norton, Robert L., Machine Design - An Integrated Approach, Pearson Educ, 2013.
- Shigley Joseph E, Mischke, Charles R., *Mechanical Engineering Design*. 6. Ed. Boston, McGraw Hill International Edition, 2001.
- Hamrock, Bernard J. et. al., *Fundamentals of Machine Elements*, Boston, WCB McGraw - Hill (www.mhhe.com) 1999.

Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Engineering Design	IV	4	6	P	WS and SS

Course Title	Docent/Lecturer	Language
Engineering Design	Dr.-Ing. Sebastian Werner / Cornelia Muessig M.Sc.	English

5. Description of Teaching Mode

Integrated lecture and exercises (provided digital and online for selfstudies with regular Q&A sessions); assignments.

6. Condition for Participation

Mandatory: Fundamental knowledge in technical mechanics. Installation on private computer of Autodesk Inventor Professional).
Preferable: Systematic Product Development, basic knowledge of machine elements and product development projects

7. Teaching and learning activities (Effort and Credit Points)

60 hours selfstudies lectures/exercises with regular Q&A sessions, 30 hours post–processing; 90h work on assignment.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group**
Engineering Design	6	ED23	Engineering

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Grading:
Engineering Design 100% of module grade thereof:
50% Practical test comprising calculation and technical drawing (75 min.); 50% individual practical assignment to be submitted during 2nd. semester

9. Duration of Module

The module can be performed within two semesters.

10. Number of Participants

The number of participants is limited to a maximum of 32 participants.

11. Inscription Formalities

Registration at the GPE Student Office may occur prior to the Registration Week. Dates and Deadlines will be announced by semester start.
Attendance in the first lecture for ED is strongly recommended. Allotment of seats on the basis first come first served. The lecturers reserve the right to refuse participants who missed the first lecture.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	x

Module Title: *CAD and Process Simulate*	**CP (ECTS):** 6	**Acronym:** CADPS	**Module Group** Engineering
Responsible for Module: Prof. Dr.-Ing. Rainer Stark	**Secretary:** GPE	**E - mail:** dybov@tu-berlin.de	

Module Description

1. Qualification Goals

During this course, students learn a variety of approaches and methods for developing, designing and simulating CAD models of objects, active devices and various industrial robots. In addition, students learn how to correctly plan and design workplaces and stations for a factory. Students learn how IT is used to support work planning, what are the tools and applications of modern digital software package functionality.
Also, methods and approaches to digital planning, design and modeling of production processes are considered and studied during lectures and exercises.
After completing the course, students gain the skills to use digital tools to plan work and assess the manufacturability of products, as well as related production processes. Students apply the knowledge gained during the lectures in an interdisciplinary practical team project where they design, plan and build a digital factory/workplace for virtual work.

The module imparts predominantly the following competence:

Technical 35%	Methodical 35%	Systemic 20%	Social 10%

2. Contents

CAD and Process Simulate:
Using *Siemens NX* and *Tecnomatix Process Simulate* software, the course covers the main topics:

- Complex computer-aided design (CAD)
- Product development and planning
- Factory and station layout design
- Design of industrial robots and their kinematic models
- Design and development of a production line
- Ergonomics test at the factory
- Virtual validation and validation tests

3. Literature and Script

Books:

- Pahl, G., Beitz, W., *Engineering Design – A Systematic Approach*, 3rd ed, London, New York, Springer, 2007.
- K. Ulrich & S. Eppinger: Product Design and Development. 5th Ed., Boston, 2011
- C. Hales & S. Gooch: Managing Engineering Design. 2nd Ed., London, 2004
- Dubbel, *Handbook of Mechanical Engineering*, London, New York, Springer, 1994.
- Norton, Robert L., Machine Design - An Integrated Approach, Pearson Educ, 2013.
- Shigley Joseph E, Mischke, Charles R., *Mechanical Engineering Design*. 6. Ed. Boston, McGraw Hill International Edition, 2001.
- Hamrock, Bernard J. et. al., *Fundamentals of Machine Elements*, Boston, WCB McGraw - Hill (www.mhhe.com) 1999.
- Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
CAD and PS	IV	4	6	P	WS

Course Title	Docent/Lecturer	Language
CAD and PS	Dipl.-Ing. A. Dybov	English

5. Description of Teaching Mode

CAD and PS:
Lectures and exercises, homework assignments, team project work

6. Condition for Participation

Mandatory: Fundamental knowledge in technical mechanics

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group**
CAD and Process Simulate	6	CADPS	Engineering
Preferable: Systematic Product Development, basic knowledge of machine elements and product development projects			

7. Teaching and learning activities (Effort and Credit Points)

CAD and PS: 60 hours lectures / exercises (integrated); 60 hours post-processing / preparation, 60 hours work on assignments

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Grading:
Module grade:
Documented practical performance (varying tasks)
Project work within a team

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to a maximum of 32 participants.

11. Inscription Formalities

Registration at the GPE Student Office may occur prior to the Registration Week. Dates and deadlines will be announced by semester start.

Attendance in the first lecture CADPS is mandatory. Allotment of seats on the basis first come first served. The lecturers reserve the right to refuse participants who missed the first lecture.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x		x	x

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Systematic Product Development	6	SPD17	Engineering
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr.-Ing. D. Göhlich	H10	tu-anh.fay@tu-berlin.de	

Module Description

1. Qualification Goals

Product Development is a key to success in the customer – manufacturer - customer chain. The objective of the lecture is to provide knowledge and skills for the use of methods in the early stages of the design process. The knowledge, understanding and use of these methods enable a continuous systematic product development. By empowering the students to recognize different methodological approaches and industrial procedures, a broad understanding and a holistic view of the product development process is taught.

The module imparts predominantly the following competence:

Technical 35%	Methodical 35%	Systemic 20%	Social 10%

2. Contents

The choice of topics is determined by the phases of the product development process and subsequent the life - cycle phases. Emphasis is being given to topics based on practical experience and research activities. The examples are drawn from all areas of mechanical engineering. Systematic Product Development is based upon experiences with the design problems and practical solutions and strives for a view that is applicable to all areas of the production process, focusing on common problems and their solutions. In particular, the following topics will be discussed.

- Introduction to SPD
- Product Planning
- Task Clarification & Problem Statement
- Interrelationships in Technical Systems
- Solution Finding Methods
- Selection & Evaluation Methods
- Basic Rules of Embodiment Design
- Developing Modular Products

During the semester, groups of students will work on a product development project, applying the methods taught in the course.

3. Literature and Script

- Pahl, G., Beitz, W., *Engineering Design – A Systematic Approach*, 3rd ed, London, New York, Springer, 2007.
- K. Ulrich & S. Eppinger: Product Design and Development. 5th Ed., Boston, 2011
- C. Hales & S. Gooch: Managing Engineering Design. 2nd Ed., London, 2004
- Dubbel, *Handbook of Mechanical Engineering*, London, New York, Springer, 1994.
- Norton, Robert L., Machine Design - An Integrated Approach, Pearson Educ, 2013.
- Shigley Joseph E, Mischke, Charles R., *Mechanical Engineering Design*. 6. Ed. Boston, McGraw Hill International Edition, 2001.
- Hamrock, Bernard J. et. al., *Fundamentals of Machine Elements*, Boston, WCB McGraw - Hill (www.mhhe.com) 1999.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Systematic Product Development IV	IV	4	6	P	SS

Course Title	Docent/Lecturer	Language
Systematic Product Development IV	Dr.-Ing. Tu-Anh Fay	English

5. Description of Teaching Mode

Integrated lecture with concrete examples to be worked on in groups.

6. Condition for Participation

Mandatory: Fundamental knowledge in engineering mechanics
Preferable: Engineering design, Project management

7. Teaching and learning activities (Effort and Credit Points)

60 hours contact, 30 hours preparation and post – processing of lecture, 60 hours work on semester project, 30 hours preparation for examination

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Systematic Product Development	6	SPD17	Engineering

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Grading:
Individual Evaluation - 25% Written test (30 min.), 25% Oral exam (30 min. in groups of approx. five students)
Group Evaluation - 50% documented practical performance.
thereof 30% project documentation, 20% workshop and presentation

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
		x			x

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Utilization of Wind Energy	12	WT22	Engineering
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr.-Ing. Paul Uwe Thamsen	GPE	j.liersch@keywind.de	

Module Description

1. Qualification Goals

The students understand the physical priciples behind the aerodynamic and electro-magnetic power conversion from the wind power to the the electrical power that is fed into the grid. Measurement techniques are learnd in wind tunnel experiments. Students are familiar with the state of the art of components, how they are manufatured and wich wind turbine concepts are available on the market. The students know in generell how to design a rotor blade for wind turbines, calculate the performance characteristics and evaluate the economics of wind farm projects and do a basic site assesment. Beside that they learn how to operate, control, and maintain wind turbines.

The module imparts predominantly the following competence:

Technical 35%	Methodical 30%	Systemic 20%	Social 15%

2. Content

Wind Turbines Basics

- Introduction to the utilization of wind power
- Aerodynamics of wind turbines
- Electricity generation
- Power Curves of Wind Turbines / Drive train components
- Experimental investigation of wind turbine characteristics
- Control of wind turbines
- Dynamics of wind turbines
- Offshore wind farms
- Supply and value chain of wind turbine markets
- Production of rotor blades

Wind Turbines Project

- Design of wind turbines
- Development of rotor blades
- Design workshop
- Selection of airfoils and aerodynamic properties
- Simulation of wind turbine power
- Certification and load calculation
- Design of rotor blades in teams
- Verification measurement of 3D printed blades
- Wind measurement and site assesment
- Wind farm planning
- Technical Operation and Maintenance of wind farms
- Wind Turbine Markets & Design (Load Assessment)
- Logistic & Transportation, Erection & Site Logistics
- Presentation of project results

3. Literature and Script

Literature, as announced in lectures according to respective subjects.
Gasch/Twele: Wind Power Plants, Springer
Hansen: Aerodynamics of Wind Turbines, Earthscan
Heier: Grid Integration of Wind Energy Conversion Systems, Wiley
Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Wind Turbines Basics	IV	4	6	P	SS
Wind Turbines Project	PJ	4	6	WP	WS

Module Title: *Utilization of Wind Energy*	**CP (ECTS):** 12	**Acronym:** WT22	**Module Group:** Engineering

Course Title	Docent/Lecturer	Language
Wind Turbines Basics	Dipl.-Ing. S. Wiens / Dipl.-Ing. J. Liersch	English
Wind Turbines Project	Dipl.-Ing. S. Wiens / Dipl.-Ing. J. Liersch	English

5. Description of Teaching Mode

Content is presented in lectures illustrated by case studies and exercises with calculations and examples. A wind tunnel with a small-scale wind turbine is used to learn by doing hands on experiments. Design of a rotor blade and planning of a wind farm is carried out as project work. Challenging tasks for a respective master thesis are continuously provided in cooperation with industrial development partners.

6. Condition for Participation

Mandatory: Wind Turbines Basics is mandatory to participate in Wind Turbines Project
Preferable: Renewable Power Technologies, Engineering Design and CAD Modeling

7. Teaching and learning activities (Effort and Credit Points)

Wind Turbines Basics:
60 hours' contact, 20 hours' reading, 60 hours' homework, 40 hours' preparation for examination
Wind Turbines Project:
60 hours' contact, 100 hours' project work and documentation, 20 hours' preparation for presentation
Total: 360 hours = 12 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Grading:
Wind Turbines Basics - 50% of module grade
Homework must be passed with success.
100% written test (60 min.)
Wind Turbines Project 50% of module grade
50% final group presentation per student (10 min.)
50% individual oral review (10 min.)

9. Duration of Module

The full module can be performed within two semesters.

10. Number of Participants

Wind Turbines Basics: The number of participants is limited to 48
Wind Turbines Project: The number of participants is limited to 24

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
			x		x

Module Title: *Renewable Power Technologies*	**CP (ECTS):** 6	**Acronym:** RPTG	**Module Group:** Engineering
Responsible for Module: Dr. Emilienne Tingwey	**Secretary:** RENAC	**E - mail:** zaehringer@renac.de	

Module Description

1. Qualification Goals

In this module students will get a comprehensive overview of the main, commercially viable and upcoming renewable power technologies, and come to understand how they work and how systems are designed.
Further on, the incorporation of renewable power capacity into electricity grids is a crucial issue for a successful development of the renewable power sector and will thus be discussed thoroughly.
This module is targeted towards students who wish to broaden their perspective and gain basic knowledge to understand the challenges of re-shaping power supply towards a higher share of renewable power generation.
The qualification goals of this module are:

- Understanding renewable power technologies
  - Technology-specific renewable resources and their potential
  - Working principles, initial system design
  - Power supply characteristics
  - Quantifying power and energy yield
  - Status quo of the technologies and potential
  - Investment and operation costs
- Enable students to assess requirements to incorporate large shares of variable renewable power capacities PV and wind into the power supply system.
  - Short term wind and PV power forecast and market operation
  - Firm capacity of wind and PV - capacity credit calculation
  - Balancing power calculation for variable renewable energy wind and PV
- Develop a fundamental understanding of the interaction of different renewable power sources in an energy supply system.

The module imparts predominantly the following competence:

Technical 50%	Methodical 20%	Systematical 20%	Social 10%

2. Contents

- Wind energy
  - Calculation of annual energy production of wind turbines and wind farms
  - Wind resources
  - Wind power technology, wind turbine generator types, wind blower calibration
- Bioenergy
  - Biogas technology, utilization of biogas
  - Biomass combustion, biomass gasification
  - First and second generation of biofuels
  - Biomass Case Study Exercise
- Photovoltaic systems
  - Applications, components, and topologies of grid-connected and off-grid systems
  - Grid-connected PV pre-feasibility study: Solar resource assessment, space requirements, energy yield
  - Rural electrification: From small home systems to large PV-diesel hybrid mini-grids
  - PV-diesel hybrid mini-grids: Dynamic energy flows and system constraints
- Integration of renewables into the power sector
  - Residual load calculation
  - Short-term Power Generation
  - Probabilistic Balancing Power Calculation
- Economic optimization of energy supply systems
  - Introduction to the concept of Levelized Costs of Electricity (LCOE)
  - Method to determine the LCOE
  - Planning of a cost optimized electricity supply system considering variable electricity demand

3. Literature and Script

Fundamentals / General interest

Module Title: *Renewable Power Technologies*	**CP (ECTS):** 6	**Acronym:** RPTG	**Module Group:** Engineering
Recommended, printed and/or electronic scripts as announced in the lectures.			

4. Module Courses					
Course Title	Type	SWH	CP	P/W/WP	WS/SS
Renewable Power Technologies Group 1	IV	4	6	WP	WS

Course Title	Docent/Lecturer	Language
Renewable Power Technologies Group 1	RENAC – Various Specialists	English

5. Description of Teaching Mode

This module is offered as a mix of instructor-led virtual and in-person seminars, exercises, student contribution (graded presentation of selected topics by each student) and a field trip (tbd: virtual or live).
An assignment in which students will have to propose an optimized design of a renewable energy-based energy supply system will be issued to students during the course. The assignment will have to be carried out by small working groups.

6. Condition for Participation

Mandatory: -
Preferable: -

7. Teaching and learning activities (Effort and Credit Points)

64 hours contact (virtual classrooms and forum), 56 hours preparation (self-study of online material, provided by RENAC Online Academy), post-processing and homework, 60 hours preparation for examination/assignment
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination: Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to written group assignment:
80% participation in lectures and exercises; participation in field trip and delivering of homework.
Grading: 50% individual presentation (15 min per student)
50% result of written group assignment (homework: Decarbonising the Energy Sector)

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The course is limited to a maximum of 20 participants.
Group 2 will only be offered upon request and depends on the number of students applied for the course.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
			x		x

Module Title:	CP (ECTS):	**Acronym:**	**Module Group:**
PV Systems/Solar Cells	12	PVSS17	Engineering
Responsible for Module:	**Secretary:**	**E - mail:**	
PD Dr. rer. nat. Thomas Dittrich	GPE	dittrich@helmholtz-berlin.de	

Module Description

1. Qualification Goals

Solar cells are the central component of PV systems. The mission of this module is to give the students a basic understanding about solar cells and about the four materials concepts for solar cells in relation to technological principles, first, and to enable the students to evaluate and to obtain empirical data about solar cells and energy conversion, second.

The module imparts predominantly the following competence:

Technical 40%	Methodical 30%	Systematical 15%	Social 15%

2. Contents

PVS Solar Cells Lecture
Introduction into photovoltaics, basic characteristics of solar cells, role of temperature and light intensity
principles of solar cells, loss mechanisms, passivation, charge-selective and ohmic contacts
maximum efficiency, Shockley-Queisser limit, tandem and multi-junction solar cells
c-Si solar cells - the mature core for mass production
solar cells based on III-V semiconductors - the champions in efficiency
thin-film solar cells - for adding values of substrate properties
nanocomposite solar cells - technologies for niche markets

PVS Solar Cells Seminar
energy demand, energy pay back factor, logistic growth
temperature, basic characteristics, and losses of solar cells
maximum efficiency, multi-junction, and concentrator solar cells
data analysis and performance ratio
strategic potential of some solar cell and energy storage technologies

PVS Solar Cells Lab Exercise and Excursions
basic characteristics of solar cells, efficiency, pyranometer, current-voltage measurement
role of resistances, temperature, and light intensity
quantum efficiency, light trap, electroluminescence
energy conversion, PV driven water storage, battery storage, PV driven fuel cell car
visits of PV R&D labs and of PV facilities

3. Literature and Script

Textbook: Thomas Dittrich “Materials Concepts for Solar cells”, 2nd Ed., World Scientific (2018)
Printouts of the lectures before each lecture, Descriptions of the tasks of the Lab Exercises

4. Module Courses

Course Title	Type	LSW	CP	P/W/WP	WS/SS
PVS Solar Cells Lecture	VL	4	6	P	SS
PVS Solar Cells Seminar	SE	2	3	P	SS
PVS Solar Cells Lab Exercise	UE	2	3	P	SS

Course Title	Docent/Lecturer	Language
PVS Solar Cells Lecture	PD Dr. rer. nat. T. Dittrich	English
PVS Solar Cells Seminar	PD Dr. rer. nat. T. Dittrich M.Sc. P. Pineda Solano	English
PVS Solar Cells Lab Exercise	PD Dr. rer. nat. T. Dittrich M.Sc. P. Pineda Solano	English

Module Title:	CP (ECTS):	**Acronym:**	**Module Group:**
PV Systems/Solar Cells	12	PVSS17	Engineering

5. Description of Teaching Mode

In the 14 lectures, the basics of solar cells and functions and combinations of materials in solar cells will be explained. The performance of solar cells will be illustrated on examples with respect to technologies. New trends and breakthroughs will be highlighted. 2 extra lectures on principles of energy storage are offered.
In the 10 seminars, selected problems in photovoltaic solar energy conversion will be discussed and solved by the students. In the 8 hands-on lab exercises, small teams of students will characterize solar cells as functions of external parameters and perform experiments on energy conversion whereas the students will prepare themselves for the lab exercises. The students will get an impression about research labs and PV facilities during 2 excursions. In the finalizing lab conference, each of the small teams of students will present and discuss one dedicated experiment or excursion. Consultations are also offered as needed.

6. Condition for Participation

Mandatory: rough knowledge about value creation in the solar industry, especially in solar manufacturing.
Preferable: none

7. Teaching and learning activities (Effort and Credit Points)

Lectures and exercises: 112 hours contact, 198 hours post-processing and homework, 50 hours reading.
Total: 360 hours = 12 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to test:
80% participation in seminar and exercises
Grading:
PVS Solar Cells Lecture – 50% of module grade
100% written test (90 min.)
PVS Solar Cells Seminar – 20% of module grade
10% individual contributions at seminars and 10% in group work
PVS Solar Cells Lab Exercise – 20% of module grade
100% short starting tests, execution, and documentation of lab exercises
PVS Solar Cells Lab Conference – 10% of module grade
100% presentation, explanation and answering questions from the audience

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
					x

Module Title: *Machine Learning and Mathematical Optimization for Engineering and Management*	**CP (ECTS):** 6	**Acronym:** MfE17	**Module Group** Engineering
Responsible for Module: Fabio D'Andreagiovanni, Ph.D.	**Secretary:** GPE	**E - mail:** f.andreagiovanni@gmail.com	

Module Description

1. Qualification Goals

Every day, we face mathematical optimization problems in our personal and professional lives: from deciding the most time-efficient way to reach our daily workplace, to selecting the most suitable and cost-effective combination of items in a grocery store for our meals, or from determining the best schedule for our work, to using models to solve the tasks at hand.
This course aims to provide the fundamental tools to translate real-world optimization problems into mathematical models and to become familiar with the most used exact and heuristic solution algorithms. The course also introduces to fundamentals of machine learning, in particular as alternative solution approach for solving optimization problems.
Special attention is given to optimization problems in production engineering and control.
Upon completion of this module, students will be qualified to deal with, model and solve complex optimization/decision problems and to use major machine learning-based solution techniques.

The module imparts predominantly the following competence:

Technical 20%	Methodical 50%	Systemic 20%	Social 10%

2. Contents

Machine Learning and Mathematical Optimization for Engineering and Management
The course introduces to the fundamentals of Linear, Non-linear and Integer Programming and to Combinatorial Optimization and of Machine Learning. Furthermore, the effects of data uncertainty on optimization will be discussed, also introducing Robust Optimization.
Solution algorithms like branch-and-bound, metaheuristics and reinforcement learning are discussed.
State-of-the-art practical case studies in network design engineering serve as specific examples for the course.

3. Literature and Script

- D. Bertsimas and J. Tsitsiklis, Introduction to Linear Programming, Athena Scientific, 1997.

S. Russell, P. Norvig, Artificial Intelligence: A Modern Approach, 4th edition, Pearson, 2021.

- L. Wolsey, Integer Programming, Wiley, 1998.

Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Mathematical Tools for Engineering and Management	IV	4	6	P	WS

Course Title	Lecturer	Language
Mathematical Tools for Engineering and Management	Fabio D'Andreagiovanni, Ph.D.	English

5. Description of Teaching Mode

Theory and applications of mathematical optimization are presented in lectures. Applications from engineering, business, and economics are utilized to convey the impact of this methodology. The exercises are aimed at training into problem modelling and solving. Software like CPLEX and GUROBI will be adopted to solve the models. Mathematical methods will be applied to solving real-world cases related to Engineering. Interpretation of the results is an integral part of the mathematical solution cycle. Case studies, carried out in teams, add to the understanding of the importance of teamwork in the solution of complex business and engineering problems.
The teaching mode: Blended learning. Seminars take place in the beginning, in the middle and by end of the teaching period. Teleconference-meetings are offered.

6. Condition for Participation

Mandatory: Basic knowledge in linear algebra, calculus basic.
Preferable: None

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group**
Machine Learning and Mathematical Optimization for Engineering and Management	6	MfE17	Engineering

7. Teaching and learning activities (Effort and Credit Points)

Lectures: 60 hours contact, 30 hours post-processing and homework, 30 hours reading, 60 hours preparation for examination.
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission written test:
Passing up to 5 practical cases (the number can vary from semester to semester, considering state of the art cases and its individual workload).
Grading:
Written Test (90 min.)

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 30 due to infrastructural restrictions, e.g., computer terminals, software licenses, task elements in practical cases, etc.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
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13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x		x	x

C Module Group Management

Module Title: *Global Production Management*	**CP (ECTS):** 12	**Acronym:** GPM	**Module Group:** Management
Responsible for Module: Prof. Dr.-Ing. Holger Kohl	**Secretary:** PTZ - 9	**E - mail:** holger.kohl@tu-berlin.de	

Module Description

1. **Qualification Goals**

The GPM teaching module provides knowledge about integrated manufacturing management tasks such as planning, scheduling and evaluation of manufacturing processes and facilities.
Students will be prepared for a systematic manufacturing management regarding micro- and macro-economic matters that consider relevant decision criteria in the framework of global conditions.
By applying scientific methods of corporate management and knowledge of global and economic relations, the students are prepared for planning and leading production.

The module imparts predominantly the following competence:

Technical 25%	Methodical 40%	Systemic 25%	Social 10%

2. Contents

World trade institutions and organizations; the European Union and globalization; trade barriers; enterprise types; global business and culture; global manufacturing strategy; procurement, global logistics; logistics control; just-in-time production; lean management; reengineering; planning of enterprises; simulation; location planning; benchmarking; knowledge management; management systems; production control; supply chain management.

3. Literature and Script

Electronic scripts as announced in lectures.
Literature:

- Kohl, H.; Riebartsch, O.: Sustainable key-figure Benchmarking for small and medium sized Enterprises. In: Seliger, G. (Hrsg.): Sustainable Manufacturing: Shaping Global Value Creation. Springer, Heidelberg, 2012.
- Kohl, H.; Al Hashemi, H.: Science Parks as main driver for the development of National Innovation Systems in resources-driven economies! The importance of Intellectual Capital Management for Sustainable Manufacturing. In: Seliger, G.; Khraisheh, M.; Jawahir, I. S. (Hrsg.): Advances in Sustainable Manufacturing. Springer-Verlag, Heidelberg, 2011, S. 45-50.
- Jochem, R.; Mertins, K.; Knothe, T. (Hrsg.): Prozessmanagement. Symposion, Düsseldorf 2010.
- Mertins, K.; Kohl, H. (Hrsg.): Benchmarking: Leitfaden für den Vergleich mit den Besten (mit CD-ROM). Symposium, Düsseldorf, 2009.
- Kai Mertins, Holger Seidel (Hrsg.): Wissensmanagement im Mittelstand. Springer Verlag, Berlin 2009.
- Kai Mertins, Peter Heisig, Jens Vorbeck: Knowledge Management. Berlin: Springer 2003.

Details to further additional readings will be given in the courses.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Global Production Management I	VL	2	3	P	WS
Learning Factory	UE	2	3	P	WS
Global Production Management II	VL	2	3	P	SS
Methods and Tools for Global Production Engineering	UE	2	3	P	SS

Course Title	Docent/Lecturer	Language
Global Production Management I	Prof. Dr.-Ing. Holger Kohl	English
Learning Factory	Natalie Petrusch, M.Sc.	English
Global Production Management II	Prof. Dr.-Ing. Holger Kohl	English
Methods and Tools for Global Production Engineering	Prof. Dr.-Ing. Holger Kohl	English

5. Description of Teaching Mode

The module consists of the lectures (VL I+II), Learning Factory (UE I) and the supplementary and exemplifying exercises on Methods and Tools for Global Production Management (UE II).
In the Learning Factory (UE I) exercise, contents are presented in lectures illustrated by case studies. In exercises students' abilities are trained by solving technological business case-oriented tasks establishing problem solving capabilities. Seminars for special task groups enable for problem solving in teamwork and

Module Title:	CP (ECTS):	Acronym:	Module Group:
Global Production Management	12	GPM	Management

cooperation. Challenging tasks for a respective master thesis are continuously provided in cooperation with industrial development partners.

The GPM exercise (UE II) will take place as block seminar for three days during the summer break. Explorative, situational, and problem-oriented teaching methods will be used to provide knowledge and skills. Technical as well as methodical contents will be taught, while real/relevant cases are applied and discussed.

6. Condition for Participation

Mandatory: None
Preferable: None

7. Teaching and learning activities (Effort and Credit Points)

Total: Contact hours: 116, Homework: 60 h, Course preparation and post-processing: 124 h, Exam preparation: 60 h.

- Global Production Management I+II: Contact hours: 50 h, Course preparation and post-processing: 50 h, Exam preparation: 80 h.
- Learning Factory (UE I) with 30 h contact, 20 hours preparation for course, 10 h reading, 30 h homework and documentation.
- Methods and Tools for Global Production Engineering (UE II) 45 h research, 45 h homework

Total: 360 hours = 12 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination: Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination: 80% participation in lectures and exercises
Passing country presentation and written homework
Grading:

- Global Production Management II (VL): 50% of module grade - written test (90 min.).
- Learning Factory (UE I): 25% of module grade - 75% written report in small groups, 25% documented practical performance in the Learning Factory
- Methods and Tools for Global Production Engineering (UE II): 25% of module grade - 100% individual written homework

9. Duration of Module

The module can be completed within two semesters.

10. Number of Participants

The number of participants is limited to 40.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines for country presentation, homework and exam will be announced at the beginning of each semester.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	

Module Title: *Quality Management*	**CP (ECTS):** 12	**Acronym:** QM19	**Module Group:** Management
Responsible for Module: Prof. Dr.-Ing. Roland Jochem	**Secretary:** PTZ 3	**E - mail:** roland.jochem@tu-berlin.de	

Module Description

1. Qualification Goals

After successfully finishing the module, the student knows the background and the framework of quality management, the methods of quality management, established problem-solving approaches, the Six Sigma approach, and the relevant methods. By participating in the practical classes, the student can transfer his/her knowledge into practical skills. The student is enabled to independently perform systematic and holistic problem-solving approaches and optimizations using quality management methods. This supports the development of methodological competence. The student can prepare the results of the project and to present and defend them under practical conditions. The students can further expand their social competence by working in teams/groups in the practical classes.

The module imparts predominantly the following competence:

Technical 30%	Methodical 30%	Systemic 20%	Social 20%

2. Contents

A consistent, company-wide focus on quality is now regarded as the most important competitive factor to ensure the satisfaction of customers and other stakeholders. However, a high-quality standard cannot be "tested" into the products, but requires not only capable processes and certified systems, but above all a pronounced quality awareness on the part of every single employee. Special characteristics such as diligence and a systematic approach must be developed in addition to purely theoretical basic knowledge to train top quality management personnel. In QM I basic knowledge of quality management is taught. Based on this, quality tools and methods will be presented to pursue systematic and holistic approaches to achieve customer satisfaction. The most important quality requirements for quality management systems of enterprises, for the creation and maintenance of capable processes, are described by the standards of the ISO 9000 family. An overview of the standards and their contents is part of this course. Total Quality Management describes a modern management system for organizational control, which explicitly propagates a holistic view and the inclusion of all stakeholders. The course provides an insight into the essential management contents for the implementation of quality management in companies. In QM II various problem-solving approaches are presented. On of the most famous approach, Six Sigma, focuses on the continuous improvement of products, processes and services based on facts and statistics. Every single phase of the Six Sigma methodology is described in detail and corresponding quality tools as well as methods are presented.

Quality Management I - VL and UE (4 SWH)

- History of quality management
- Quality requirements
- Quality, management, and service tools
- Set of standard specifications ISO 9000 et seq
- Risk Management, e.g., FMEA
- Total Quality Management, EFQM model
- Strategy – Balanced Scorecard
- Cost of Quality, Lean, TPM

Quality Management II VL and UE (4 SWH)

- approaches
- Development and definition of Six Sigma
- Project management and implementation
- Six sigma project – Define phase and methods
- Six sigma project – Measure phase and methodes
- Six sigma project – Analysis phase and methodes
- Six sigma project – Improve phase and methods
- Six sigma project – Control phase

3. Literature and Script

- James R. Evans. William R. Lindsay, *The Management and Control of Quality*, West Publishing Company.
- Keki R. Bhote, Adi K. Bhote, *World Class Quality*, AMACOM.
- Kostka, C., Mönch, A., *Change Management*, 2004.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Quality Management I	VL	2	3	P	WS
Quality Management Exercise I	UE	2	3	P	WS
Quality Management II	VL	2	3	P	SS
Quality Management Exercise II	UE	2	3	P	SS

Module Title: *Quality Management*	**CP (ECTS):** 12	**Acronym:** QM19	**Module Group:** Management

Course Title	Docent/Lecturer	Language
Quality Management I	Prof. Dr.-Ing. R. Jochem Tra Bui Thi Thanh, M.Sc.	English
Quality Management Exercise I	Turgut Refik Caglar/Robert Mies	English
Quality Management II	Prof. Dr.-Ing. R. Jochem Tra Bui Thi Thanh, M.Sc.	English
Quality Management Exercise II	Turgut Refik Caglar/Robert Mies	English

5. Description of Teaching Mode

In the lectures, basic knowledge and techniques of Quality Management are imparted. Detailed and practical knowledge and techniques are trained in six exercises. In case studies, the students learn in small groups how to apply the techniques and must present their results at the end of the course.

6. Condition for Participation

Mandatory: none
Preferable: Basic knowledge of business economics and of teamwork techniques

7. Teaching and learning activities (Effort and Credit Points)

Lectures: 60 hours contact, 45 hours post - processing and homework, 45 hours reading, 30 hours preparation for examination
Exercises: 60 hours contact, 45 hours preparation, 45 hours documentation, 30 hours preparation for examination
Total: 360 hours = 12 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
Yes. Participating in all practical classes. Only students who attended all the practical classes have admission to presentations.
Grading:
Quality Management I– 35% of module grade
100% written test (45 min.)
Quality Management Exercise I – 15% of module grade
100% Group presentation (15 min presentation in groups of 4-5 students; 10 min presentation related questions)
Quality Management II – 35% of module grade
100% written test (45 min.)
Quality Management Exercise II – 15% of module grade
100% Group presentation (15 min presentation in groups between 4 and 5 students and 10 min presentation related questions)

9. **Duration** of Module

The module can be performed within two semesters.

10. Number of Participants

Lectures: The number of participants is unlimited.
Exercises: The number of participants is limited to 60.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.
Exercise groups will be determined in the first practical class.

Module Title: *Quality Management*	**CP (ECTS):** 12	**Acronym:** QM19	**Module Group:** Management
12. Validity			
Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025) Update on: October 10, 2023			

13. Orientation Help					
Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x			x

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Environmental Management	6	EM17	Management
Responsible for Module:	**Secretary:**	**E - mail:**	
Dr.-Ing. Elisabeth Strecker	Z1	e.strecker@tu-berlin.de	

Module Description

1. Qualification Goals

The goals are to gain applicable knowledge of elements of environmental management systems. The mastery of tools for environmental management systems and the mastery of techniques for implementation of environmental management systems will enable students to design environmental management systems. The students will become motivated to environmental protection and to implement of environmental management systems.

The module imparts predominantly the following competence:

Technical 30%	Methodical 30%	Systemic 20%	Social 20%

2. Contents

The course explains causes of environmental problems and gives historical and political background information of environmental management. The students gain information about chances and risks. Environmental management will be discussed as a knowledge domain with elements of environmental management systems including issues on background, goals, body of regulations and their requirements and realization. In conclusion, the application in business and integration of management systems is considered with examples from industry.

3. Literature and Script

- ISO 14.001:2004 ff.
- Regulation (EC) No 761/2001 of the European Parliament and of the Council of 19 March 2001 allowing voluntary participation by organisations in a community eco - management and audit scheme (EMAS).
- http://europa.eu.int/comm/environment/emas.
- http://www.envirowise.gov.uk.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Environmental Management	IV	4	6	P	WS

Course Title	Docent/Lecturer	Language
Environmental Management	Dr.-Ing. Elisabeth Strecker	English

5. Description of Teaching Mode

Lecture, excursion and discussion, exercise with character of a business game in teamwork, presentation, and discussion.

6. Condition for Participation

Mandatory: None
Preferable: Industry knowledge

7. **Teaching** and learning activities (Effort and Credit Points)

60 hours contact, 60 hours preparation of presentation, 60 hours preparation of a homework as final examination.
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None.
Grading:
50% Documented practical performance – individual, 50% Documented practical performance – in group

Module Title: *Environmental Management*	**CP (ECTS):** 6	**Acronym:** EM17	**Module Group:** Management

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 25.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
		x	x		x

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Supply Chain Management	6	SCM17	Management
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr. habil Dr. Sc. Mult. D. Ivanov	H 90	dmitry.ivanov@hwr-berlin.de	

Module Description

1. Qualification Goals

This module will focus on state-of-the art approaches for designing and planning supply chains. Students will learn about examples of excellent supply chains, based on which they will be able to identify and study important building blocks, repeating patterns, and theoretical concepts crucial to supply chain design and strategy. Thereupon, they will get to know the most important concepts of managing supply chains in the medium term, i.e., supply chain planning. A specific focus will be on supply chain planning under uncertainty – one of the most important challenges that companies are facing nowadays. The courses rely heavily on the application of theoretical concepts and techniques to supply chain design and planning. A strong focus will be placed on the transferability of gained knowledge into practice by using case studies. Discussions, student presentation and classroom interaction will lead to a thorough understand of the topic. Comprehensive simulations support the learning experience

The module imparts predominantly the following competence:

Technical 20%	Methodical 40%	Systemic 20%	Social 20%

2. Contents

The integrated course" **Supply Chain Management**" covers fundamental concepts of management in the field of supply chain management, which provides competitive advantage to industry, retailers, and service providers. Strategic, planning, and operational topics within the entire cycle of supply chain management are introduced, covering processes from purchasing, production planning, transportation management and disposal of goods. Furthermore, market trends, supply chain strategies of companies and supply chain differentiation are discussed. A comprehensive simulation supports the learning experience.

The seminar "**Supply Chain Management**" combines both most recent theoretical concepts and various practice-oriented topics within the field of supply chain management. This seminar will include a project type team assignment to cutting edge supply chain topics like sustainability in supply chains, customer-aligned SCM, resilience, uncertainty, volatility, and risk management in SCM and industry-specific concepts. The team projects will be linked to industry-related challenges.

The seminar **"Supply Chain Simulation and Optimization"** is focussed on the application of operations research and simulation techniques to Global Supply Chain Design and Planning. An exemplary supply chain simulation tool is applied to work on concrete case studies. In particular, the following topics will be studied: facility location planning by greenfield analysis and network optimization, inventory control policy simulation, sourcing and production control simulation, risk analysis in the supply chains. The team projects will be linked to industry-related challenges.

3. Literature and Script

Ivanov D, Tsipoulanidis, A., Schönberger J.: Global Supply Chain and Operations Management: A Decision-Oriented Introduction to the Creation of Value. Springer 2017

Chopra, S./Meindl, P.: Supply Chain Management – Strategy, Planning & Operations, 4th edition, Upper Saddle River, 2009.

Simchi-Levi, D/ Kaminski, P./Simchi-Levi, E. – Designing and Managing the Supply Chain: Concepts, Strategies & Case studies, 3rd edition, New York, 2008.

Various case studies, which will be provided during the course.

Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	LSW	CP	P/W/WP	WS/SS
Supply Chain Management	IV	2	3	P	SS
Supply Chain Management Case Studies	SE	2	3	WP	WS
Supply Chain Simulation and Optimization	SE	2	3	WP	WS

Course Title	Docent/Lecturer	Language
Supply Chain Management	Prof. Dr. Dmitry Ivanov	English

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Supply Chain Management	6	SCM17	Management

Supply Chain Management Case Studies	Prof. Dr. Dmitry Ivanov	English
Supply Chain Simulation and Optimization	Prof. Dr. Dmitry Ivanov	English

5. Description of Teaching Mode

The respective contents are presented in a lecture including case studies. In the seminar, students solve supply chain problems and present their solutions.

6. Condition for Participation

Mandatory: none
Preferable: Logistics

7. Teaching and learning activities (Effort and Credit Points)

Supply Chain Management Integrated Course:
Contact 28, Preparation for Course 12 Preparation for Examination 20, Homework 30

Supply Chain Management Case Studies: Contact 28, Reading 32, Project work 30	Supply Chain Simulation and Optimization: Contact 28, Reading 32, Project work 30

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None.
Grading:
Supply Chain Management - 50% module grade
100% written test (60 min.)

Supply Chain Management Case Studies - 50% module grade 40% class participation 20% presentation (20 min.) 40% essay or project report. The students will work in teams for the presentation and essay / project report leading to a grade for the whole team.	Supply Chain Simulation and Optimization - 50% module grade 40% class participation 20% presentation (20 min.) 40% essay or project report. The students will work in teams for the presentation and essay / project report leading to a grade for the whole team.

9. Duration of Module

The module can be performed within two semesters.

10. Number of Participants

The number of participants is limited to 50.
Supply Chain Management Case Studies
The number of participants is limited to 25.
Students who have registered for Supply Chain Simulation and Optimization are not admitted.
Supply Chain Simulation and Optimization
The number of participants is limited to 25.
Students who have registered for Supply Chain Management Case Studies are not admitted.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Project groups will be determined in the first lecture.
Dates and deadlines will be announced by semester start.

12. Validity

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Supply Chain Management	6	SCM17	Management
Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025) Update on: October 10, 2023			

13. Orientation Help					
Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x		x	x	

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Business Administration	6	BA17	Management
Responsible for Module:	**Secretary:**	**E - mail:**	
Dr. Johannes von Hülsen	GPE	johannes.huelsen@web.de	

Module Description

1. Qualification Goals

The student knows about the various management functions and roles in the contemporary business environment. He/she is familiar with accounting and various financial management skills, required to cope with the challenges associated with jobs in an enterprise. Various theoretical concepts and frameworks such as the concept and history of money, business ethics and financial control are discussed and applied with the help of case studies and theoretical teaching material. Case studies will help the participants to have hands on exposure to the management theories and skills.
Moreover, students are enabled to become more effective negotiators in their business life. They know how to shape international negotiation situations.

The module imparts predominantly the following competence:

Technical 20%	Methodical 40%	Systematical 20%	Social/ethical 20%

2. Contents

Business Administration - Financial Management:

- The concept of money
- Revenues and profit
- Cash and other forms of money
- Time value of money
- Depreciation
- Cash flow and liquidity
- Assets and liabilities
- Income Statement
- Balance Sheet
- Financial analysis
- Business ethics

Business Administration - International Negotiation:

- BATNA, anchoring, logrolling, bartering
- positions vs. interests vs. preferences
- psychological biases
- preparing for a negotiation
- contingent contracts
- protections against hardball tactics/dirty tricks
- information exchange
- power in negotiations, distributive, and integrative strategies

3. Literature, Script

Financial Management:

- Financial Accounting for Non-Financial Managers
- Management 9th Edition, Stephen P. Robbins.
- Becoming a Manager: How new managers master the art of leadership by Linda Hill.
- Peter Drucker on the Profession of Management.
- The Case Study Hand Book: How to read, discuss and write persuasively about cases. William Ellet.
- Case Studies from Harvard Business School, ECCH (European case clearing house) and IMD.
- Other reading material will be provided during the course.

Case Studies and International Negotiation:

- Negotiation Genius, Deepak Malhotra and Max Bazerman
- The Mind and Heart of the Negotiator (5th Edition), Leigh Thompson

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Business Administration - Financial Management	IV	2	3	P	WS
Business Administration – International Negotiation	IV	2	3	P	WS

Course Title	Docent/Lecturer	Language
Business Administration - Financial Management	Dr. J. von Hülsen	English
Business Administration - International Negotiation	Caroline Heydenbluth / Marco Schauer	English

5. Description of Teaching Mode

Contents of Financial Management are presented in lectures and illustrated in case studies. Moreover, discussion groups will be conducted.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Business Administration	6	BA17	Management

The teaching/learning style for international negotiation is highly interactive, covering theory and practice, e.g. negotiation role-plays.

6. Condition for Participation

Mandatory: None
Preferable: Basic knowledge of business processes in companies

7. Teaching and learning activities (Effort and Credit Points)

Financial Management: 30 hours contact, 30 hours post processing and homework, 30 hours reading.
International Negotiation: 30 hours contact, 30 hours post processing and homework, 30 hours reading.
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None.
Grading:
Financial Management - (75%) of module grade
40% Written test (60 min.), 40% group presentation, 20% class participation.
International Negotiation - (25%) of module grade
50% individual class participation (including participation during the negotiation exercises); 50% group work (reflective learning journal)

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x			

D Module Group Intercultural Communication

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Workshop for Intercultural Communication and Relationships	0	WICR	Intercultural Communication
Responsible for Module:	**Secretary:**	**E - mail:**	
Grit Kümmele, Magister	GPE	georgetown-hu@gmx.de	

Module Description

1. Qualification Goals

The course enables students to understand the range of cultural behaviors and expectations. They learn to identify dominant cultural variables at work by case studies and get to create case studies through the participants. They will develop key principles for good communication and effective personal attributes within cultures and know how to implement knowledge transfer within different organizational structures and various cultures.

The module imparts predominantly the following competence:

Technical 25%	Methodical 25%	Systemic 25%	Social 25%

2. Contents

The students will learn about the basic constituents of a culture (including enterprise culture) with a special focus on the values and how to use this knowledge for influencing existing enterprise cultures and/or to construct new ones. They will work on their behaviors and communicative skills in intercultural encounters to be able to understand possible intercultural conflicts and to manage them. They will create their own model of an ideal enterprise culture which allows a productive atmosphere at work or in projects.

3. Literature and Script

Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Workshop for Intercultural Communication and Relationships	SE	0,5	0	P	WS

Course Title	Docent/Lecturer	Language
Workshop for Intercultural Communication and Relationships	Magister Grit Kümmele	English

5. Description of Teaching Mode

Workshop

6. Condition for Participation

Mandatory: None
Preferable: None

7. Teaching and learning activities (Effort and Credit Points)

8 hours contact

8. Assessment criteria (Examination and Grades)

Examination:
None
Grading:
Certificate of attendance will be issued upon active participation in the class.

9. Duration of Module

The module can be performed within one semester.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Workshop for Intercultural Communication and Relationships	0	WICR	Intercultural Communication

10. Number of Participants

The number of participants is unlimited.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
German for Engineers	6	GL18	Intercultural Communication
Responsible for Module:	**Secretary:**	**E - mail:**	
Christoph Hauser	GPE	christophhauser@gmx.net	

Module Description

1. Qualification Goals

The overall goal of German for Engineers is to force communicative competence in daily and academic life. The students will gain language knowledge, vocabulary as well as grammar skills. The students will strenghten their general communicative skills in the German language and develop relevant study techniques. Students will be enabled to read and understand specialised articles. Students learn how to write their CV in German language. German for Engineers strengthens the technical knowledge of students through reading and discussing engineering literature, i.e. literature on lean, production planning, car manufacturing, generators, solar panels etc. Students are enabeled to present scientific content in plenum.

The module imparts predominantly the following competence:

Technical 30%	Methodical 20%	Systemic 20%	Social 30%

2. Contents

Basic German for Engineers I (4 SWH)
Achievement or Expansion of German knowledge
Basic German for Engineers II (4 SWH)
Expansion and strengthening of German knowledge
Basic German for Engineers III (4 SWH)
Expansion and strengthening of advanced German knowledge
The levels of the German classes offered are based on the results of the German allotment test.

3. Literature and Script

Literature: As announced in lectures.
Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Basic German for Engineers I	IV	4	3	WP	WS
Basic German for Engineers II	IV	4	3	WP	SS
Basic German for Engineers III	IV	4	3	WP	WS

Course Title	Docent/Lecturer	Language
Basic German for Engineers I	Christoph Hauser	German
Basic German for Engineers II	Christoph Hauser	German
Basic German for Engineers III	Christoph Hauser	German

5. Description of Teaching Mode

Interactive learning, Project work, Presentations, Field trips

6. Condition for Participation

Mandatory: Participation in lecture's German Placement Test
Preferable: Basic German skills

7. Teaching and learning activities (Effort and Credit Points)

64h (WS) 56 (SS) contact time, 50h homework, 20h preparation each semester

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
German for Engineers	6	GL18	Intercultural Communication

Prerequisites for admission to oral or written tests:
80% participation in class; Participants are responsible for making up for any missed classes in cooperation with the lecturer.
Grading:
Basic German for Engineers I - 50% of module grade
50% oral test (max. 10 min.)
50% written test (max. 45 min.)
Basic German for Engineers II - 50% of module grade
50% oral test (max. 10 min.)
50% written test (max. 45 min.)
Basic German for Engineers III - 50% of module grade
50% oral test (max. 10 min.)
50% written test (max. 45 min.)
The two best grades of three passed courses result in the final module grade.

9. Duration of Module

The module can be performed within two semesters.

10. Number of Participants

The number of participants for each class is limited to 20.
Students, who register the class for credits will be preferred.
Additional courses might be offered upon request.

11. Inscription Formalities

Registration dates and deadlines will be announced approx. 2 weeks after placement test.
Participation Only
Exceptionally admitted. Once you have selected the class for participation only, active participation is expected as if the class had been registered for credits. Special conditions will be announced prior to binding registration.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

Module Title:	**CP (ECTS):**	**Acronym**	**Module Group:**
Global Integrated Management Systems	6	GIMS	Intercultural Communication
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr.-Ing. Roland Jochem	GPE	kaeser@ims-concepts.de	

Module Description

1. Qualification Goals

The trend towards highly integrated supply chains where companies perform an individual function within international production networks requires these business units to manage an increasing number of system-related requirements. Due to regional differences in legislation, Norms and Standards international management system standards (ISO standards) have become an appropriate instrument to define basic criteria or good management practices independent from the location where business activities are performed. Examples for these standards are ISO 9001, ISO 50001 or industry standards such as IATF 16949. Digitalization leads to an increased sensitivity of companies to install systems for information security and data protection. Cultural differences are reflected in the implementation approaches for meeting these standards. Companies that comply with these standards create stakeholders' trust (customers, society, suppliers,..) that they are capable of managing their product quality professionally, reducing hazardous effects to the environment or safety of their employees for instance – no matter what national or regional regulations impose on them. Integrated management systems, e.g. based on PAS99 standard, encomprise requirements from various systems in one common integrated system in order to manage all these criteria in the most efficient and effective way.

Students of this module will gain experience in the internationally most important management system norms for Quality, Occupational Health and Safety, Environmental, Energy and Information Security Management as well as the most important industry standards. After passing the module they will be able to interpret normative requirements and select suitable methods to shape management system implementations with respect to individual cultural and regional conditions. They will understand important concepts such as the High Level Structure, integration and synchronization of management system requirements, continual improvement (CI), strategies for integration of remote locations, maturity level assessments, and good certification practices for global organizations. They will be equipped with a set of methods and techniques for overarching management system elements such as internal audits, management reviews, process modelling, risk management, compentence management and KPI design. Students will be able to identify and interpret changes in existing and new requirements and how to adapt management systems with respect to these new requirements. Interfaces to other modules such as environmental and quality management or project management will be discussed.

The module imparts predominantly the following competence:

Technical 20%	Methodical 25%	Systemic 30%	Social 25%

2. Contents

- Introduction to Integrated Management SystemsNorming and StandardizationCertification and AccreditationImplementation of Management SystemsAnnex SL, High Level Structure and PAS 99
- Referenced Guidelines
- Quality Management System Standards
- Energy Management System Standards
- Environmental Management System Standards
- Information Security and Data Protection Regulation
- Occupational Health and Safety Management System Standards
- Introduction to Industry Specific Standards
- IATF 16949 – the Automotive Industry Standard
- ISO 13485 – The Medical Devices Industry Standard
- HACCP – The Nutrition Industry Standard
- ASME Code and R-CCM, KTA 1401 – Nuclear Industry Standards

3. Literature and Script

Literature:
PAS 99; ISO 9001, ISO 45001, ISO 50001, ISO 14001, EMAS, IATF 16949, ISO 13485, ISO 27001, EU-GDPR
Jochem, R., Menrath, M., Globales Qualitätsmanagement, 1st ed, Düsseldorf, Symposion, 2015.
Details to further additional readings will be given in the courses.

Module Title:	**CP (ECTS):**	**Acronym**	**Module Group:**
Global Integrated Management Systems	6	GIMS	Intercultural Communication

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	SS
Global Integrated Management Systems VL	VL	2	3	P	SS
Global Integrated Management Systems UE	UE	2	3	WP	SS

Course Title	Lecturer	Language
Global Integrated Management Systems VL	Dr.-Ing. Philip Käser	English
Global Integrated Management Systems UE	Dr.-Ing. Philip Käser/ Dipl.-Ing. Robert Gierke	English

5. Description of Teaching Mode

In the lectures, basic knowledge and techniques of Integrated Management Systems are imparted. Detailed and practical knowledge and techniques are trained in three exercises. In case studies, the students learn in small groups how to apply the techiques and present their results in the end of the practical class.
Explorative, situational and problem-oriented teaching methods will be used to provide knowledge and skills. Technical as well as methodical contents will be taught.

6. Condition for Participation

Mandatory: none
Preferable: Participation in Quality Management and basic knowledge in business administration

7. Teaching and learning activities (Effort and Credit Points)

Lecture: 30 hours contact, 15 hours post-processing and homework, 25 hours reading, 20 hours preparation for examination
Exercise: 30 hours contact, 15 hours preparation, 25 hours documentation, 20 hours preparation for examination
Total: 180 hours = 6 CP (30 hours = 1 CP)

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Grading:
Global Integrated Management Systems VL 50%
100% written Test – 90 min
Global Integrated Management Systems UE 50%
30% Final Group Presentations (Auditor). 70% Final Group Presentations (Auditee)

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

Lecture: The number of participants is limited to 40.
Exercises: The number of participants is limited to 20.
Group 2 will only be offered upon request and depends on the number of students applied for the course

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Prerequisite for registration is participation in the Intercultural Communication and Relationships Workshop and submission of the WICR certificate of participation to the GPE Student Office.
Dates and deadlines will be announced by semester start.

12. Validity

Module Title: *Global Integrated Management Systems*	**CP (ECTS):** 6	**Acronym** GIMS	**Module Group:** Intercultural Communication
Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025) Update on: October 10, 2023			

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x			

Module Title:	**CP (ECTS):**	**Acronym**	**Module Group:**
Sustainability - Approaches and Tools	6	SAT	Intercultural Communication
Responsible for Module:	**Secretary:**	**E - mail:**	
Dr.-Ing. Elisabeth Strecker	Z1	e.strecker@tu-berlin.de	

Module Description

1. Qualification Goals

Students have knowledge of the present sustainability idea (Triple Bottom Line), its origin and development as well as new approaches an understanding of the inter- and intragenerational dimensions of sustainability, mainly represented by natural resource use and international balance problems.
Applicable knowledge of approaches and tools for sustainable development in society, business, and private field mastery of up-to-date tools for sustainability analysis and management the motivation to implement tools in their professional and private life the ability to stay informed on important sustainability topics.

The module imparts predominantly the following competence:

Technical 10%	Methodical 30%	Systemic 30%	Social 30%

2. Contents

The course looks at sustainability from the perspectives of nature, history/science, management, policy, and private life. The focus is company sustainability / Corporate Social Responsibility in industry.
Shortly, the natural factors of a sustainable development are introduced. The students then gain knowledge about history and development of the sustainability idea and its implementation in business, policy, and private life. The integration of environmental and social aspects into these fields (or implementing the three dimensions in balance) based on intercultural specifics is the lecture core. All topics will be dealt with from an international view, as sustainability includes intra-generational equity and globalization inserts strongest impacts on countries' development. Examples for sustainability efforts shall encourage own action. Information sources for all topics help to follow important developments.

3. Literature and Script

Sources:
World Commission on Environment and Development: Report of the World Commission on Environment and Development: Our Common Future (Brundtland report), 1987
United Nations: Agenda 21. Final document of UN Conference on Environment and Development (UNCED) Rio de Janeiro, Brazil, 1992
Global Reporting Initiative (GRI) G4 Guidelines
ISO 26000 Social responsibility

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Sustainability - Approaches and tools Group 1	IV	4	6	WP	SS
Sustainability - Approaches and tools Group 2	IV	4	6	WP	WS

Course Title	Lecturer	Language
Sustainability - Approaches and tools Group 1	Dr.-Ing. E. Strecker	English
Sustainability - Approaches and tools Group 2	Dr.-Ing. E. Strecker	English

5. Description of Teaching Mode

Lecture, case studies, training / teamwork, discussion, students' presentations, field trips

6. Condition for Participation

Mandatory: None
Preferable: None

7. Teaching and learning activities (Effort and Credit Points)

60 hours contact, 60 hours preparation of presentation, 60 hours preparation of a homework assignment as final examination.

Module Title:	**CP (ECTS):**	**Acronym**	**Module Group:**
Sustainability - Approaches and Tools	6	SAT	Intercultural Communication
Total: 180 hours = 6 CP (30 hours = 1 CP).			

8. Assessment criteria (Examination and Grades)
Examination: Portfolio Examination according to examination regulations, Section 12. **Grading:** 50% Documented practical performance – individual 50% Documented practical performance – in group

9. Duration of Module
The module can be performed within one semester.

10. Number of Participants
Group 2 will only be offered upon request and depends on the number of students applied for the course. Then the following rule applies: Students who have registered and have been admitted to IIPM summer semester class will only be admitted to the SAT class in winter semester. Each class: The number of participants is limited to 25.

11. Inscription Formalities
The prerequisite for registration is participation in the Intercultural Communication and Relationships Workshop and submission of the WICR certificate of participation to the GPE Student Office. Registration at the GPE-Student office according to the GPE study and examination regulations. Dates and deadlines will be announced by semester start. <u>Special conditions</u> When planning your studies, we ask for your understanding that only the registration for the module but not the semester can be guaranteed.

12. Validity
Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025) Update on: October 10, 2023

13. Orientation Help					
Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
			x	x	

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Project Management in International and Intercultural Environments	6	PMII	Intercultural Communication
Responsible for Module:	**Secretary:**	**E - mail:**	
Dr.-Ing. Wolfgang Glitscher	GPE	dreip-consult@outlook.com	

Module Description

1. Qualification Goals

The module deals with Project Management as a tool for the realization of projects in the production environment. Students will be enabled to set up planning processes in projects, manage of ongoing projects, to use tools of risk and quality management for projects and how to set up communication and negotiation processes. They will be enabled to use the management instruments consequently.
Students know how to manage international projects and programs, located in multiple cultural regions. They are enabled to work productively in intercultural teams and know about criteria for the composition of international teams. Students are prepared for the self-depended organization of projects with an international and intercultural background. Students are acquainted with the requirements and solutions for existing and emerging IT tools for managing international projects. To anticipate possible drawbacks in managing projects, students are familiar with methods and tools on how to avoid typical mistakes. They understand that different cultures might have various views and expectations on the project goals. Students know about the important role of the project managers in international teams and how to communicate and cooperate successfully. The student is trained in professional presentations.

The module imparts predominantly the following competence:

Technical 30%	Methodical 30%	Systemic 20%	Social 20%

2. Contents

The theoretical basis of Project Management is presented during the IV course Project Management. This will be illustrated through case studies where students learn to apply the theoretical basis of Project Management by analyzing several cases from the industrial and organizational environment. A special focus is set on the area of Project Risk Management.
Contents of International and Intercultural Project Management are Magic Triangle, VUCA, Social Infection Cyclus, Competencies, Team Building, "Rapid" Design Thinking, Wicked Problems, Project Charter, System Thinking, Project Planning, Project Canvas, Purple Space for corporations, Shared Project Room: Introduction to the software Redmine, Kick-Off Meeting, Action Learning: Reflection in Action, Principles of Observation, Critical PM Skillset, KanBan, SCRUM, Agile PM, Blue Ocean Leadership, Visual Process Management

3. Literature and Script

Printed and/or electronic scripts as announced in lectures.
„International Journal of Project Management": available within the TUB-network at
http://www.sciencedirect.com/science/journal/02637863
Project Management: Best practices, Harald Kerzner (Editor), 3rd Edition, Wiley 2014
Advanced Project Management: Best practices on Implementation, Harald Kerzner (Editor), Wiley 2004
Becker, Gora, Wagner: Erfolgreiches interkulturelles Perojektmanagement, symposion 2015
Project Management Body of Knowledge (PMBOK)

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Project Management	IV	2	3	P	WS
International and Intercultural Project Management	IV	2	3	P	SS

Course Title	Docent/Lecturer	Language
Project Management	Dr.-Ing. Wolfgang Glitscher	English
International and Intercultural Project Management	Dr.-Ing. Wolfgang Glitscher	English

5. Description of Teaching Mode

Explorative, situational, and problem-oriented teaching methods will be used to provide knowledge and skills about project management. Organizational as well as methodical contents will be taught. Students work on a case as a project during the lecture.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Project Management in International and Intercultural Environments	6	PMII	Intercultural Communication

Groups will be created randomly. A peer-review of the students' groups contributes to reflect project results among the students.
In the module, students are encouraged to practically simulate an international project. Individual experiences are discussed in class, aiming at identifying common challenges and solutions for international and intercultural project management. Concrete experiences of students are reinforced with theory examples.

6. Condition for Participation

Mandatory: None
Preferable: None

7. Teaching and learning activities (Effort and Credit Points)

Project Management:
32 hours contact, 20 hours prepration for class, 20 hours exam preparation.
International and Intercultural Project Management:
28 hours contact, 20 hours project prepration, 20 hours exam preparation.
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None.
Grading:
Project Management – 50% of module grade
100% Written test (60 min.)
International and Intercultural Project Management – 50% of module grade
50% Poster presentation (10 min.), 30% Milestone presentations of project in group (30 min.),
20% Written Peer-Reveiws in group
Dates and deadlines for project, practical tasks and exam will be announced during the first lecture.

9. Duration of Module

The module can be performed within two semesters.

10. Number of Participants

The number of participants is limited to 60.

11. Inscription Formalities

The prerequisite for registration is participation in the Intercultural Communication and Relationships Workshop and submission of the WICR certificate of participation to the GPE Student Office.
Registration at the GPE-Student office according to the GPE study and examination regulations.
Group allocation is organized on a random basis. Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	x

Module Title: *Technology and Innovation Management*	**CP (ECTS):** 6	**Acronym:** TIM	**Module Group:** Intercultural Communication
Responsible for Module: Prof. Dr. Hendrik Send	**Secretary:** GPE	**E - mail:** send@hiig.de	

Module Description

1. Qualification Goals

Technological innovation is becoming more important in a globalized world where a growing number of firms compete with increasing speed. At the same time, we observe a new open paradigm in innovation and collaboration and new methods to approach the innovation process and distributed collaboration. Furthermore, to propel innovation, it is important to select the right strategy, setting up appropriate organizational structures that support innovation, and managing the network of external collaboration partners.
The module, Technology and Innovation Management provides the students with basic knowledge and capabilities in systematic planning and management of innovation for organizations. Tools, methods and concepts of innovation management will be depicted, such as idea generation, selection methods, etc.

The module imparts predominantly the following competence:

Technical 25%	Methodical 25%	Systemic 25%	Social 25%

2. Contents

In Technology Management, the theoretical content is presented in the lectures, including general theories and an interactive discussion of selected research articles. Students will work in groups on provided technologies, and several lectures contain an interactive part where the students will directly apply their acquired knowledge to their given technologies. In the end, the groups will summarize their group work in a report and present their results in a closing session.
Innovation management will follow the form of a product development process and cover all relevant aspects of the topic. We start with the relevance of innovation for organizations, go through strategic and process considerations, focus on marketing aspects, and discuss team and personal implications. To apply methods of innovation management all tutorials are arranged as a mock-up sprint development process.

3. Literature and Script

Technology Management:
Will be announced in the lecture.
Innovation Management:

- Trott, Paul 2005 Innovation management and new product development.
- Knapp, Jake, John Zeratsky, and Braden Kowitz. 2016. Sprint: how to solve big problems and test new ideas in just five days.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Technology Management	SE	2	3	P	WS
Innovation Management	SE	2	3	P	WS

Course Title	Docent/Lecturer	Language
Technology Management	Dr. Schminder	English
Innovation Management	Prof. Dr. H. Send/Dr. G. von Richthofen	English

5. Description of Teaching Mode

The contents are presented in the lectures and illustrated by case studies. Several lectures contain an interactive part where the students will also directly apply their acquired knowledge to small tasks and present their results at the lecture's end.

6. Condition for Participation

Mandatory: None
Preferable: None

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Technology and Innovation Management	6	TIM	Intercultural Communication

7. Teaching and learning activities (Effort and Credit Points)

Technology Management 50% of module grade
32 hours contact, 28 hours post - processing and homework, 15 hours reading, 15 hours preparation for examination.
Innovation Management 50% of module grade
32 hours contact, 60 hours post - processing and homework, 30 hours reading, 30 hours preparation for examination.
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None.
Grading:
Technology Management 50% of module grade
50% Written Test (60 min.)
50% Group Work (technology report & presentation in groups, each with ca. 5 students).
Innovation Management 50% of module grade
34% Written tests (30 min.)
33% Individual discussions
33% Final presentation in groups

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
The prerequisite for registration is participation in the Intercultural Communication and Relationships Workshop and submission of the WICR certificate of participation to the GPE Student Office.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	x

E Module Group Special Profile

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
GPE Seminar – Scientific Working	6	GPE SFW	Special Profile
Responsible for Module:	**Secretary:**	**E - mail:**	
Dr.-Ing. Philipp Käser	GPE	kaeser@ims-concepts.de	

Module Description

1. Qualification Goals

Engineering Innovation is the root to global wealth and welfare. Innovation occurs, when engineers work together on solving problems and applying new technologies in technological systems und economical, ecological, and social restrictions. Scientific working is the basis for efficient task fullfilment and innovation creation. Young students must be enabled to conceive, design, implement, operate real-world systems and new products and processes.

This teaching module deals with the fundamentals and methods of working in the forefront of innovation on a current research topic given by university. Students will be empowered to analyze given problems, solving tasks within a given timeframe and work out a scientific report to the current reseach topic. They will be enabled to plan the fulfilment of complex tasks within a group of people with different knowlede, skills and interests. They will acquire the competence to work successfully on any further scientific work like their master thesis or a Ph.D. topic or within a researcher group in the R&D field.

The module imparts predominantly the following competence:

Technical 30%	Methodical 20%	Systemic 30%	Social 20%

2. Contents

This seminar held as a project-oriented course is giving the class one main topic, with several subtopics. The students plan how to divert the scientific problem in several subtopics. The group plans and determines milestones and deliverables, each student takes over a specified working area within the scientific task where she/he must work on within the group.

The contents are out of the areas production technology, international management, information and communication technology, sustainability, and engineering education. Students have to execute all tasks nessecary to do independend scientific work on a given question, like analyzing the state of the art by gathering information and resources, form hypothesis, perform experiment, collect, analyze and interpret data, draw conclusions, publish results by presenting and writing papers. Students train to work successfully with methods and tools for successful research, learning and teaching.

Contents are presented in a kick-off meeting. After that students must independently organize their tasks. Process steps within their project are to learn:

- How to gather information and to quote
- How to work in groups
- How to write reports
- How to present academic results in power point presentation (Information provision, motivating the auditory, visual, and verbal information)
- How to combine different research results to come up with a new model, concept, theory
- How to write scientific articles / term papers and master theses (form, content, structure)

3. Literature, Script

Literature, as announced in lectures according to respective subjects.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
GPE Seminar- Scientific Working I	SE	1	0	P	WS
GPE Seminar- Scientific Working II	SE	2	6	P	WS

Course Title	Docent/Lecturer	Language
GPE Seminar – Scientific Working I	Dr.-Ing. B. Muschard	English
GPE Seminar – Scientific Working II	Dr.-Ing. P. Käser	English

5. Description of Teaching Mode

Basics are presented in lectures; group discussions take place

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
GPE Seminar – Scientific Working	6	GPE SFW	Special Profile

6. Condition for Participation

Mandatory: None
Preferable: None

7. Teaching and learning activities (Effort and Credit Points)

10 hours contact, 20 hours post processing and homework, 35 hours reading/researching, 75 hours working on the scientific essay

8. Assessment criteria (Examination and Grades)

Examination:
The following deliverables are required for receiving the certificate of attendance:

- Proof of attendance in all SFW I classes offered
- Proof of attendance in all SFW II classes offered
- Written abstract per group
- Written paper per group
- Written peer review report per group
- Written statement by the authors of the paper on the peer review report of the reviewer group
- Final full paper per group

Grading:
Certificate of attendance will be issued upon active participation in the class. Participation in the course is recommended as preparation for the master's thesis, as important basics of scientific work, structuring, citing and avoiding plagiarism are taught.

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is unlimited.

11. Inscription Formalities

Attending and passing this course is recommended for the Master Thesis Registration!

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Methods-Time Measurement	6	MTM17	Special Profile
Responsible for Module:	**Secretary:**	**E – mail:**	
Dr.-Ing. Jan Philipp Menn	GPE	jan.menn@gmx.net	

Module Description

1. Qualification Goals

The participants have an overview over the method for the evaluation and the continuous improvement of current and new work systems and production processes. At the end of the course, the participants are able to use the methods and their rules, as well as describing and conceiving manual workplaces on the basis of the MTM-1 and MTM Universal Analysis Systems (UAS). Additionally, it is intended for the participants to be able to divide a work sequence in repeatable cycles, both in individual or group work. The two-week MTM-1 and MTM-UAS training seminar provides participants with theory of the MTM Basic System as a prerequisite for using it in practice in the project.

The module imparts predominantly the following competence:

Technical 25%	Methodical 35%	Systemic 35%	Social 5%

2. Contents

Development and structure of the MTM Process
Historical development of the study of movement and systems with predetermined times
The development of MTM: goals, approaches (initial data, LMS, statistics, validation), research
Definitions: Time measuring units, symbols, standard timecards
Summary of the complete MTM Process building block system: aggregation and hierarchy levels, method levels, application areas, use and limits
Practical work with the MTM 1 and UAS Systems
Basic motions: reach, grasp, move, position, release; press, turn, separate; visual functions; physical movements
Actual activity and planning analysis
Case studies and exercises according to ergonomic and business criteria

3. Literature and Script

Printed scripts are provided in the lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Methods-Time Measurement Seminar	SE	2	3	P	SS
Methods-Time Measurement Project	PJ	2	3	P	WS

Course Title	Instructor/Lecturer	Language
Methods-Time Measurement Seminar	Dr.-Ing. Jan Philipp Menn	English
Methods-Time Measurement Project	Dr.-Ing. Jan Philipp Menn	English

5. Description of Teaching Mode

The course is given by an instructor, certified by the German MTM Association, using certified presentation material. MTM-1 and -UAS part will be taught in a two-week block seminar. The students will be given the opportunity to apply individually or in group work theoretical concepts with concrete exercises, that will be corrected in class. Examples of improvement of workplaces will be discussed. At the end of the theoretical teaching, videos will be analysed and their results discussed. The practical application project will allow students to suggest their own measures for workplace improvement, based on a practical industry case.
According to the availability of the laboratory, students will be given the possibility to observe manual workplaces.

6. Condition for Participation

Mandatory: None
Preferable: mechanical engineering, industrial engineering, quality management, business administration.

7. Teaching and learning activities (Effort and Credit Points)

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Methods-Time Measurement	6	MTM17	Special Profile

MTM-1 and MTM-UAS basic seminar: Takes place over two full weeks: 80h contact, 20h preparation, 20h post processing and homework.
Practical application project: Takes place as group work over approximately two months. Two interim presentations with the MTM instructor will be mandatory for the students to present the evolution of their work: 6h contact, 24h preparation of meetings and final report, 30h group work.
Total: 180 hours = 6 CP (30 hours = 1CP).

8. Assessment criteria (Examination and Grades)

Examination
Portfolio Examination according to examination regulations, Section 12.
Grading:
Methods-Time Measurement Seminar – 50% of module grade
Documented practifcal perfomrance MTM-1 (video analysis), Written test MTM-1 - multiple choice part 1 (approx. 90 mins), Written examination MTM-1, multiple choice part 2, approx. 90 mins
Methods-Time Measurement Project - 50% of the final grade
Prerequisite: At least 50% of the points of written test of MTM-UAS
Interim presentation (in groups, 5 mins per student), final presentation (in groups, 5 mins per student), final report (about 10 pages per student**)**
Requirements to receive an MTM-Certificate from the MTM Association:
MTM-1: students reach 75% or more in the MTM-1 exam
MTM-UAS: students are entitled to the MTM-1 certificate and reach 75% or more in the MTM-UAS exam

9. Duration of Module

Both MTM-1 and MTM-UAS basic seminars are given together in a two-week block course. The practical application project is a group work and lasts for about 2 months including 3 meetings with the instructor.
The module can be performed in two semesters.

10. Number of Participants

The number of participants is limited to 25.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.
Special conditions
When planning your studies, please note the special conditions for the registration of this module and its chronological order. (see also "Special conditions for the registration of certain modules" at the beginning of the module catalogue)
Costs for separate certificate
In general, the additional certificates are free of charge if the conditions stated under "8. assessment criteria" are fulfilled. GPE reserves the right to charge exam fee for missing an exam, in case additional costs are charged by the issuing association.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
		x			

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Lean Management	6	LM17	Special Profile
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr.-Ing. Holger Kohl	GPE	johannes.fischer.tub@gmail.com	

Module Description

1. Qualification Goals

The objective of the Lean Management methodology is the elimination of waste to achieve highest quality, lowest costs, and shortest lead times for the purpose of delivering maximum value to the customer. By applying Lean methods significant improvements are feasible in any industry.
The module Lean Management will provide an overview of principles, methods, and tools for efficiently designing the entire value stream of industrial goods and services. Lean Management as it is taught in this module is a systematic and systemic approach that strives for a holistic production system and that goes beyond the selective application of Lean tools.
The emphasis will be placed on the strategic aspect of Lean Management, also including the role of leadership during a Lean transformation of an organization, cultural issues, people involvement and change management topics. Besides practicing the application of basic Lean methods for production processes in factory environments, this course is also discussing the implementation of Lean methods for administration or

The module imparts predominantly the following competence:

Technical 10%	Methodical 40%	Systematical 40%	Social 10%

2. Contents

- History and definition of Lean Management: Elements of a Lean Production System, etc.
- Lean Management overarching principles: Pull & One Piece Flow, Waste reduction, Zero defects, People link the system
- Methods and tools to implement Lean Management: 5S, Value Stream Analysis and Improvement, 3P (Production Preparation Process), Lean Implementation Workshop, Standard Operations, Set-Up reduction (SMED), WIP-Limit-Method, 6Sigma, Lean Accounting, etc.

3. Literature and Script

Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Lean Management Group 1	IV	4	6	WP	SS
Lean Management Group 2	IV	4	6	WP	WS

Course Title	Docent/Lecturer	Language
Lean Management Group 1	Dipl. Kfm. Johannes Fischer	English
Lean Management Group 2	Dipl. Kfm. Johannes Fischer	English

5. Description of Teaching Mode

Method of Instruction
The class is designed to be based on active involvement and discussion. Thorough preparation is expected.
Assignments/ Deliverables and class preparation

- Each student will give a presentation about a Lean Management topic including a handout for the class.
- Homework assignment consists of reading technical literature, answering previously announced questions, and getting prepared for discussion in class.

6. Condition for Participation

None

7. Teaching and learning activities (Effort and Credit Points)

60 hours contact, 60 hours post processing and homework, 60 hours preparation for examination
Total: 180 hours = 6 CP (30 hours = 1 CP)

Module Title:	CP (ECTS):	Acronym:	Module Group:
Lean Management	6	LM17	Special Profile

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None
Grading:
20% Individual homework/participation (reading 10 articles/book sections, answering questions and participating in the reviews/lecture),
40% Presentation (recapitulation / summary / discussion) (20 min. / student),
40% Written test (90 min.)

9. Duration of Module

The module can be performed in one semester.

10. Number of Participants

Each class: The number of participants is limited to 15.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.
Presentation assignment groups will be determined in the first lecture.
Special conditions
When planning your studies, please note the special conditions for the registration of this module and its chronological order. (see also "Special conditions for the registration of certain modules" at the beginning of the module catalogue)

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x			

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Lean Production	6	LP17	Special Profile
Responsible for Module:	**Secretary:**	**E - mail:**	
Dr.-Ing. Jens Palacios Neffke	GPE	jenspalacios@gmail.com	

Module Description

1. Qualification Goals

Upon successful completion of the module, participants will have the skills required to use Lean tools and data to decrease expenses, reduce cycle times, increase volume, and improve efficiency, know the methods and calculations required to determine resources, non-valued added activities in an operation, as well as the material/resources needed to deploy and support a Lean flow stream, be able to implement necessary Lean tools and methods in the shop floor under consideration of corporative & cultural challenges such as opposition to change.

The module imparts predominantly the following competence:

Technical 15%	Methodical 40%	Systematical 40%	Social 5%

2. Contents

In a time in which manufacturing companies are forced to deliver highest-quality products with the fewest defects, while reducing personnel and material resources, Lean production has become a very popular and effective method/philosophy to streamline production processes, improve quality, and cut costs in any industry. The module introduces core principles in Lean manufacturing such as continuous improvement, waste elimination, and pull-production philosophy. The module then focuses on the methods and tools commonly used to analyze and improve the existing state of a manufacturing environment, including value stream mapping, Kaizen cycle, single minute exchange of dies (SMED), and capability index. Illustrated with case studies, the module will demonstrate the efficiency and effectivity of successfully implemented lean production approaches in global companies around the world.

History of lean; muda, mura, muri; Seven types of waste; Learning to see; Value Stream Mapping; Kaizen; SMED; Poka-Yoke; Autonomation and Jidoka; 5S; Standard work; Production levelling; work cell; Takt time; Andon; Genchi Genbutsu; Gemba; 5W and more

3. Literature, Script

Roos, D.; Womack, J P., Jones, D.T (1991): The Machine That Changed the World: The Story of Lean Production, Harper Perennial.
Womack, J. and Jones, D. (2003). Lean thinking: Banish waste and create wealth in your corporation. New York, USA: Free Press.
Rother, M.; Shook, J.; Womack, J.; Jones, D. (2001): Learning to see: Value Stream Mapping to Add Value and Eliminate Muda. Massachusetts. U.S.: The Lean Enterprise Institute.
Liker, J. (2004): The Toyota Way: 14 Management Principles from the World's greatest Manufacturer: McGraw-Hill corporation.
Shingo, S. (1996): Quick Changeover for Operators: The SMED System. Portland U.S. Productivity Press
Massaki, I. (1986): Kaizen: The key to Japan's competitive Success. Massachusetts, U.S. McGraw-Hill

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Lean Production	IV	4	6	P	SS

Course Title	Docent/Lecturer	Language
Lean Production	Dr.-Ing. Jens Palacios Neffke	English

5. Description of Teaching Mode

Method: The class is designed to be based on active involvement and discussion. Course participants will be provided with basic Lean concepts and methods, which are to be developed further by student teams throughout the semester.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Lean Production	6	LP17	Special Profile

Course Outline: The kickoff is followed by a preparation phase. After the presentation and discussion of the concepts, the tools and methods will be trained. One tool or method will be applied in a group project. The course concludes with the presentation of the project results and their discussion.

6. Condition for Participation

Mandatory: None
Preferable: Participation in the module “Manufacturing and Factory Planning”

7. Teaching and learning activities (Effort and Credit Points)

Lecture and case studies: 60 hours contact, 60 hours post processing and homework, 60 hours preparation for examination.
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None
Assignments/ Deliverables and class preparation
Course participants are provided with lean topics for them to present in class.
Student groups are built to implement lean tools in semester-long projects, specifically designed to test their lean understanding and implementation competences.
Grading:
20% Presentation in groups
30% Project conduction and report
50% Written test (60 min.)

9. Duration of Module

The module can be performed in one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.
Special conditions
When planning your studies, please note the special conditions for the registration of this module and its chronological order. (see also "Special conditions for the registration of certain modules" at the beginning of the module catalogue)

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
		x			

Module Title: *Business Models and Entrepreneurship*	**CP (ECTS):** 6	**Acronym:** BME	**Module Group:** Special Profile
Responsible for Module: Dr. Ana Paula Bezerra Barquet	**Secretary:** GPE	**E - mail:** anabarquet@gmail.com	

Module Description

1. Qualification Goals

The student learns about sustainable business models and business plans and how to design such models. The student learns the success factors of start-ups as well as tools required for international business development, international marketing and sales, market research and information management. The student is able to analyze existing business models and define own business models for startup companies. By end of the course, the student has developed an innovative business plan for international markets.

The module imparts predominantly the following competence:

Technical 25%	Methodical 40%	Systemic 25%	Social 10%

2. Contents

- Introduction: Business Canvas, business plan, startup, business finance
- StartUp ABC: The founder, Plannig your start up, Next Steps, Legal Structure, Finance, Advisory services
- Business Model: Dimensions, tools to design business models, Business model innovation (change, business units, start up, create new or modify current business model), examples
- Sustainable business model: Types of sustainable business models, examples
- Value Proposition and Customer Segment: Defining and understanding customer needs, value and benefits through products and services
- Resources, actors, and processes: Intangible and tangible resources, types of partners, business processes (customer relationship, distribution channel, etc.), examples
- Costs and revenues: Types of costs and revenues (selling product, sharing, providing services, etc.), examples
- Analyzing existing business model
- Design of a sustainable business model
- Business Plan: Business plan framework for international Start Up, business financewith focus on Cash Flow protection, Income Statement, Balance Sheet, examples
- Investor Pitch: Funding Types of Start Up, Essentials about investor pitch, pitch deck, presentations style guide, examples
- International Business Development and Marketing: The International Marketing Concept & Marketing environment, strategic planning and marketing research, customer behavior, product strategy, pricing strategy, distribution strategy and retailing, promotional strategy, extending marketing competitive advantage, digital marketing, examples
- International Sales: technical sales skill sets, sales cycle), sales strategies in international context, customer relationship management, examples

3. Literature and Script

Information will be given in the course.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Sustainable Business Models and Entrepreneurship	IV	4	6	P	WS

Course Title	Docent/Lecturer	Language
Sustainable Business Models and Entrepreneurship	Dr. Ana Paula Bezerra Barquet / Dipl.-Ing. Markus Amendt	English

5. Description of Teaching Mode

Explorative, situational, and problem-oriented teaching methods will be used to provide knowledge and skills about Sustainable Business Models and Entrepreneurship. Technical as well as methodical contents are taught. The course is designed in a highly interactive way. Existing business models are analyzed by students and presented in class. Students create innovative business models and business plans, guided by the lecturers.

Module Title:	CP (ECTS):	Acronym:	Module Group:
Business Models and Entrepreneurship	6	BME	Special Profile

6. Condition for Participation

Mandatory: -
Preferable: Manufacturing and Factory Planning, Global Production Management, Project Management

7. Teaching and learning activities (Effort and Credit Points)

64 hours contact, 96 hours course preparation and post-processing, 20 hours exam preparation
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to written test:
80% participation in lectures and exercises
Grading:
50% written test (45 min.),
5% intermediate presentation about business model (in groups),
15% presentation: pitch about business plan (in groups),
30% documentation of business plan (in groups)

9. Duration of Module

The module can be completed within one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines for lecture, practical experience and exam will be announced at the beginning of each semester.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x		x

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Simulation of Production Systems	6	SPS	Special Profile
Responsible for Module:	**Secretary:**	**E - mail:**	
Dr.-Ing. Bastian Schumacher	GPE	bastianclschumacher@gmail.com	

Module Description

1. Qualification Goals

The teaching module deals with the simulation as a method to analyze and evaluate the operation and design of manufacturing processes and facilities. Students are enabled to efficiently use the discrete- event simulation technique for application in the factory planning and production planning and control.
The following competences are gained:

- Ability to describe production systems by means of conceptual models
- Overview in the field of discrete-event simulation and state of the art of simulation tools
- Modeling and simulation with the simulation tool Tecnomatix Plant Simulation
- Analysis and improvement of production systems with discrete-event simulation
- Advantages and disadvantages of simulation / alternative techniques for improvement and optimization
- Conducting a simulation study

The module imparts predominantly the following competence:

Technical 40%	Methodical 30%	Systemic 10%	Social 20%

2. Contents

- Theory of discrete-event simulation
- Object oriented modeling techniques / object oriented programing
- Steps to conduct simulation studies and projects
- Classification of simulation packages
- Planning, conducting and evaluation of simulation experiments
- Stochastic input data and statistical analysis of simulation experiments
- Latest developments in the field of simulation, distributed simulation, web-based simulation, simulation and optimization, heuristics and algorithms for production control such as genetic algorithms or neuronal nets

3. Literature and Script

- Latest papers published in the winter simulation conference: https://informs-sim.org/
- Law, A. M.; Simulation Modeling and Analysis; McGraw-Hill, New York, NY; 5th ed. [international student edition] Edn., 2015
- Banks, Jerry; Carson, John S.; Nelson, Barry L.; Nicol, David M.: Discrete-Event System Simulation. 5th edition. Pearson, Upper Saddle River, 2010
- Bangsow, Steffen: Manufacturing Simulation with Plant Simulation and Simtalk: Usage and Programming with Examples and Solutions. Springer-Verlag, Berlin Heidelberg, 2010
- Bangsow, Steffen, Tecnomatix Plant Simulation: Modeling and Programming by Means of Examples. Springer-Verlag, Heidelberg, New York Dordrecht, London, 2015
- Self-guided script

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Simulation of Production Systems	IV	4	6	P	WS

Course Title	Docent/Lecturer	Language
Simulation of Production Systems	Dr.-Ing. Bastian Schumacher	English

5. Description of Teaching Mode

In the integrated course, the students learn the basics of simulation in production systems and the application with the simulation tool Tecnomatix Plant Simulation. In case studies, the ability to analyze simulation tasks and to handle simulation software is trained in several case studies.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Simulation of Production Systems	6	SPS	Special Profile

6. Condition for Participation

Mandatory: none
Preferable: Manufacturing and factory planning

7. Teaching and learning activities (Effort and Credit Points)

60 hours contact, 30 hours homework, 90 hours project preparation and documentation
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Grading:
50% Written test (30 min.) and documented practical performance with simulation tool, 25% Presentation (10 min. presentation) and Documentation (approx. 30 pages) of Case Study 1 in groups, 25% Presentation (10 min. presentation) and Documentation (approx. 30 pages) of Case Study 2 in groups

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 30.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x		x	

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Enterprise Architecture and IT in the Automotive Industry	6	EAAI	Special Profile
Responsible for Module:	**Secretary:**	**Email:**	
Prof. Dr.-Ing. Dieter Schacher	GPE	dieter.schacher@gmx.de	

Module Description

1. Qualification Goals

The major business drivers in the automotive industry are the vast globalization of markets with satisfied traditional markets and local competition especially in the emerging markets. Traditional European automotive companies must improve existing products, create new products or enter new lines of business to remain competitive. There is a tremendous need for a transformation of automotive companies to enhance their efficiency and effectiveness based on market orientation, new disruptive technologies, and value chain collaboration. This requires a holistic approach to design, manage and continuously improve the organization in global automotive companies.

The module imparts predominantly the following competence:

Technical 30%	Methodical 30%	Systemic 20%	Social 20%

2. Contents

This module will address the ongoing transformation of global automotive value chains, which requires organizational change and the purposeful use of information technology, and heavily relies on the involvement of the employees in transformation processes. Emphasis will be put on the interdependencies between strategy, business processes, organization, and information technology (IT).
In the first part students will be familiarized with the business processes of automotive firms and understand how changing business requirements force companies to continuously transform their organizational structure and IT landscape. In the second part students will investigate fundamental questions of information management in the automotive industry and learn how information systems support the core business processes. They will analyze the innovative use of information technology for the business, as well as for online service provisioning based on latest car IT innovations. Finally, students will learn the basic principles on systemic transformation management dealing with the necessary change in enterprise architecture, culture, and behavior in the ongoing change in the global automotive industry.
The module uses interactive lectures based on the experience of the lecturer made within Volkswagen AG and his current consultancy work in the global automotive industry. The students will take a one-day field trip to Volkswagen plant in Wolfsburg with lectures from Volkswagen IT managers and a plant tour for reflecting the topics of the module in today's business environment.

3. Literature, Script

Schacher, Dieter: Informationssystemische Prozessorganisation mit sozioorientierter Transformation.
Fraunhofer IRB Verlag: Stuttgart 2007, ISBN 978-3-8167-7285-9
Becker, J.; Kugeler, M.; Rosemann, M.: *Process Management.* Springer-Verlag: Berlin et al., 2010 ISBN 978-3-642-07800-2
Ross, J. W., Weill, P., Robertson, D. C.: *Enterprise Architecture as Strategy.* Harvard Business School Press, Boston, 2006.
Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Enterprise Architecture and IT in the Automotive Industry	VL	4	6	P	WS

Course Title	Docent/Lecturer	Language
Enterprise Architecture and IT in the Automotive Industry	Prof. Dr.-Ing. Dieter Schacher	English

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Enterprise Architecture and IT in the Automotive Industry	6	EAAI	Special Profile

5. Description of Teaching Mode

Contents are presented in lectures illustrated by case studies. The course is a mix of conventional classroom teaching and open discussion on management topics based on the industrial experiences in IT business and organization in automotive industry.

6. Condition for Participation

Mandatory: None
Preferable: Participation in the modules “Manufacturing and Factory Planning”

7. Teaching and learning activities (Effort and Credit Points)

60 hours contact including 13 lectures (á 180 min) contact, 1-day field trip to Volkswagen Wolfsburg, 60 hours post processing and homework, 60 hours preparation for examination.
Total: 180 hours = 6 CP

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None.
Grading:
180 Examination Points, thereof:
60 pts. of module grade: written test (60 min.),
60 pts. of module grade: documentation, executive summary on field trip,
60 pts. of module grade: Individual class participation.

9. Duration of Module

The module can be performed within one semester.

10. Number of Participants

The number of participants is limited to 20.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.
Course for credits only.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x		x	

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
GPE Projects	6	GPEP	Special Profile
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr.-Ing. Holger Kohl	GPE	gpeadminteam@gpe.tu-berlin.de	

Module Description

1. Qualification Goals

Engineering Innovation is the root to global wealth and welfare. Innovation occurs, when engineers work together on solving problems and applying new technologies in technological systems und economical, ecological, and social restrictions. Scientific work is the basis for efficient task fullfilment and innovation creation. Young students must be enabled to conceive, design, implement, operate real-world systems and new products and processes.
This teaching module deals with the fundamentals and methods of working in the forefront of innovation on a current research topic given by university. Students will be empowered to analyze given problems, solving tasks within a given timeframe and work out a scientific report to the current reseach topic. They will be enabled to plan the fulfilment of complex tasks within a group of people with different knowlede, skills and interests. They will acquire the competence to work successfully on any further scientific work like their master thesis or within a researcher group in the R&D field.

The module imparts predominantly the following competence:

Technical 30%	Methodical 20%	Systematical 30%	Social 20%

2. Contents

Several current research projects in which students can take active participation are introduced to the participants by the project sponsors. Students are offered the possibility to implement the theoretical knowledge acquired during their GPE studies in diverse fields of knowledge.
The students plan how to divert the scientific problem in several subtopics. The group plans and determines milestones and deliverables, each student takes over a specified working area within the scientific task where she or he must work on within the group.
The contents are out of the areas production technology and management, information and communication technology and engineering education. Students must execute all tasks nessecary to do independend scientific work on a given question, like analysing the state of the art by gathering information and resources, form hypothesis, perform experiment, collect, analyze and interpret data, draw conclusions, publish results by presenting and writing reports.
Contents are presented in a kick-off meeting. After that students must independently organize their tasks.

3. Literature and Script

Literature, as announced in lectures according to respective subjects.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
GPE Projects	PJ	4	6	P	SS

Course Title	Docent/Lecturer	Language
GPE Projects	TUB et al.	English

5. Description of Teaching Mode

Basics are presented in lectures; group discussions take place.

6. Condition for Participation

Will be announced during the general project introduction.

7. Teaching and learning activities (Effort and Credit Points)

Lecture: 30 hours contact, 40 hours post processing, 35 hours reading / researching, 75 hours project related work.
Total: 180 hours = 6 CP (30 hours = 1 CP).

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
GPE Projects	6	GPEP	Special Profile

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None**.**
Grading:
20% Assessment of the continuous work effort, 5% Project plan, 10% Intermediate presentation,
15% Final presentation (10% through a jury and 5% through the project sponsor)
50% Final report (20% for the overall assessment and 30% individual contributions)

9. Duration of Module

The module can be performed in one semester.

10. Number of Participants

Number of participants depends on the number of projects offered.
The number of participants will be announced at the project presentation.

11. Inscription Formalities

Dates and deadlines will be announced by semester start.
Projects offered by GPE:
Registration at the GPE-Student office according to the GPE study and examination regulations.
Projects offered by other departments of the TUB:
Before the start of the project, an application for recognition can be submitted to the GPE examination board. For further information, please contact the GPE team.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
	x	x	x	x	x

F Extra Curricular Modules

The following modules are not part of the regular GPE course curriculum and will not be adjusted to the GPE semester schedule. They are marked with a “TUB” before the acronym in the module description, list, and overview.

These modules are regularly offered by other TUB institutes, and they might be of interest for some GPE students.

GPE students are welcome to enroll in these modules and register them according to the GPE registration and examination regulations.

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Advanced Recycling Technologies	6	TUB-ART	Engineering
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr.-Ing. Vera Susanne Rotter	Z2	info@circulareconomy.tu-berlin.de	

Module Description

1. Qualification Goals

After the successfull completion of the module the students:

- understand societial and industrial relevance resource flows and the demand for mineral and metal raw materials,
- have a good overview and knowledge of primary and secondary supply of relevant raw materials such as steel, aluminium, copper, precious metals, phospherous, etc.,
- understand the impact of impurities in recycling processes and are able suggest removal steps,
- can adress challenges in industrial recycling processes,
- can assess and impove the recyclability of complexproducts,

are able to apply the aqurired knowledge in a broader environmental perspective.

The module imparts predominantly the following competence:

Technical 30%	Methodical 30%	Systemic 30%	Social 10%

2. Contents

- Fundamentals on primary and secondary production of abiotic raw materials (steel, aluminum, phosphorous, copper, precious metals, specialty metals)
- Use and demand of metals and minerals in the society
- Quantification of resource potentials in end-of-life flows
- Advanced sorting technologies
- Recycling-oriented product characterization
- Chemical analysis of Critical Materials in post-consumer products

Analytical tools in Resource Management (Material Flow Analysis, Recycling Performance Indicators, Reczclablity assessment) Criticality Assessment, statistical analysis of uncertainties)

3. Literature and Script

Printed and/or electronic scripts as announced in lectures.

4. Module Courses

Course Title	Type	SWH	CP	P/W/WP	WS/SS
Advanced recycling technologies	IV	4	6	P	WS

Course Title	Docent/Lecturer	Language
Advanced recycling technologies	Prof. Dr.-Ing. V. Rotter	English

5. Description of Teaching Mode

This module will be held as a weekly seminar where students learn the fundamentals and the state-of-the-art in recycling technologies. A presentation of actual research papers also illustrates the research perspective.
Exercises show the practical application of various resource management tools, and the practical laboratory training familiarizes students with the complexity of obtaining empirical data for resource management.
At the same time, student groups are working on a practical semester project in which they apply the methods and tools they have learned in current research projects.
The students solve independently a research question based on empirical data and research.
One excursion is complementing the theoretical knowledge with a practical experience.

6. Condition for Participation

Mandatory: none
Preferable: none

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Advanced Recycling Technologies	6	TUB-ART	Engineering

7. Teaching and learning activities (Effort and Credit Points)

60 hours contact, 60 hours post processing and homework, 60 hours preparation for examination.
Total: 180 hours = 6 CP (30 hours = 1 CP).

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Prerequisites for admission to oral/written examination:
None**.**
Grading:
70% oral exam (20 min.)
30% presentation plus written summary

9. Duration of Module

The module can be performed in one semester.

10. Number of Participants

The number of particpants is limited to 20.

11. Inscription Formalities

Registration at the GPE-Student office according to the GPE study and examination regulations.
Dates and deadlines will be announced by semester start.

12. Validity

Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025)
Update on: October 10, 2023

13. Orientation Help

Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
			x		

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Energy Storage Technologies	6	TUB EST	Special Profile
Responsible for Module:	**Secretary:**	**E - mail:**	
Prof. Dr.-Ing. Julia Kowal	EMH2	Julia.kowal@tu-berlin.de	

Module Description

1. Qualification Goals

After completing the module, the students can compare electrical and electrochemical energy storage systems and to choose a suitable technology for a given application.

The module imparts predominantly the following competence:

Technical 20 %	Methodical 40 %	Systemic 30 %	Social 10 %

2. Content

Different energy storage systems are discusse concerning their electrical characteristics and suitability for different applications with focus on stationary systems, but also mobile applications. Their working principle and ageing mechanisms are presented in reduced complexity.
Covered technologies:
capacitors, coils, flywheels, pumped hydro storage, compressed air, lead-acid batteries, lithium batteries, NiMH, NiCd, high temperature batteries, redox-flow batteries, metal-air batteries, thermal energy storage

3. Literature and Script

Literature: As announced in lectures and exercises according to respective subjects.
Script: Lecture slides and videos of lectures are available for download.

4. Module Courses

Course Title	Type	LSW	CP	P/W/WP	WS/SS
Energy Storage Technologies Lecture	VL	2	3	P	SS
Energy Storage Technologies Exercise	UE	2	3	P	SS

Course Title	Docent/Lecturer	Language
Energy Storage Technologies Lecture	Prof. Dr.-Ing. Julia Kowal	English
Energy Storage Technologies Exercise	Florian Rzepka	English

5. Description of Teaching Mode

In the first half of the semester, the courses consist of lectures and exercises. The lecture imparts the theoretical basics. Examples are shown and calculated in the exercise.
In the second half of the semester, the students select an application for energy storage in groups and carry out a selection and design. The results are presented and summarized in paper form.

6. Condition for Participation

Mandatory: None
Preferable: Basic knowledge in physics, chemistry, and electrical circuits

7. Teaching and learning activities (Effort and Credit Points)

Lecture: 30 hours contact, 45 hours post-processing, 15 hours preparation for exam
Exercise: 30 hours contact, 45 hours post-processing, 15 hours preparation for exam
Total: 180 h = 6 CP (30 hours = 1 CP)

8. Assessment criteria (Examination and Grades)

Examination:
Portfolio Examination according to examination regulations, Section 12.
Grading:
30% group presentation (30 min.)
20% group report (10 pages)
50% written test

Module Title:	**CP (ECTS):**	**Acronym:**	**Module Group:**
Energy Storage Technologies	6	TUB EST	Special Profile

9. Duration of Module
The module can be performed in one semester.

10. Number of Participants
The number of participants is limited to 50.

11. Inscription Formalities
Registration at the GPE-Student office according to the GPE study and examination regulations. Dates and deadlines will be announced in the first lecture of each semester. Attendance of the first lecture is mandatory for enrollment. Later registration cannot be accepted.

12. Validity
Valid for Intake 2023 (WS 2023/2024 – WS 2024/2025) Update on: October 10, 2023

13. Orientation Help					
Focus on	GMNP	POM	SUSMAN	ICT MAN	NET
					x

GPE– Glossary

[1] VL – Lecture (participation only is accepted):

In lectures, the matter specified in the curriculum will be presented by the university teacher in the form of regular lectures. The lecturer, usually a professor, gives presentations and imparts theoretical technical knowledge. Group size can vary widely and students participate through listening and asking questions.

UE – Exercise (credits only):

Knowledge from lectures is shaped out and detailed by analytical, design, or experimental examples supervised by an assistant. Medium-size groups of students learn to solve problems by working on example tasks and case studies.

IV – Integrated Course (credits only):

Various instruction forms take turns in one course without clear methodological distinction.

SE – Seminar (credits only):

Small or medium-size groups of students will learn to work self-dependently on selected topics with supervision of a professor or assistant. Discussions, presentations or written papers may be applied.

PJ – Project (credits only):

Projects involve carrying out a planning and realisation proves in a cooperative form of work.

[2] SWH: Lecture Hours per semester week

(4 SWH is four hours a week in one semester OR two hours a week in two semesters. Exercises require equivalent time additionally).

[3] CP – ECTS:

Credit point according to the European Credit Transfer System

[4] P/W/WP:

(P) Pflicht = compulsory; (W)Wahl = elective; (WP) Wahlpflicht = compulsory option; Meaning: by choosing the module the corresponding courses are compulsory;

[5] *Number of Participants*

Generally, courses will only be conducted provided that a minimum of 5 credit participants is reached. Exceptions are mentioned in the module description.

Seats in courses with a limited number of participants are allotted according to

- *the intake (3rd semester students first, if the course offered to both regular intakes)*
- *the date of the online enrollment (always on a "first come first served" basis)*