

Program and Course Description

Automotive Production Engineering (SPO WS 20/21)

Master of Engineering (M. Eng.)

Study regulation: WS 2020/21

as per: 2023-03-27

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1 Overview

Name of the programme	Automotive Production Engineering
Study type & degree	Consecutive Master of Engineering (full time)
First start date	SS 14/15; Start only in summer semester
Standard period of study	3 semesters (90 ECTS, 48 SWS)
Study location	THI-Campus in Ingolstadt
Language of instruction	English
Cooperation	None
Admission requirement	Bachelor degree
Capacity	30 students p.a.
Programme director	Prof. Dr.-Ing. Bernhard Axmann Email: bernhard.axmann@thi.de Phone: +49 841 9348-3505

2 Introduction

The text describes the current state of the program modules in the Master's degree "Automotive Production Engineering" according to the study and examination regulations ("Studien- und Prüfungsordnung").

The module handbook ("Modulhandbuch") presents the objectives and contents of the individual compulsory and elective modules and the breakdown of SWS (semester hours per week) per module and semester.

2.1 Objectives

Based on their completed bachelor's program, graduates acquire and expand their knowledge, skills, and competencies to understand automotive production systems in their complexity theoretically, technically, and practically. Furthermore, they shall understand development processes in product development to be able to plan, develop, implement, operate, and develop such systems further in an entire technical, strategic, and managerial manner.

There is an emphasis on the graduate's qualification enabling them to in highly linked processes, recognize, plan, and execute tasks, assess the need and scope for action as well as take part in developing and managing. They can recognize the interdependency of technical, strategic, managerial, social, and further non-technical topics and integrate their actions responsibly.

Thus, students are enabled to solve complex problems that require production, engineering, and business skills by being able to develop solution concepts for practice based on scientific knowledge.

2.2 Admission requirements

- Proof of successful completion of a degree program in industrial engineering, mechanical engineering, automotive engineering, or mechatronics from a German university with at least 210 ECTS credits or equivalent or an equivalent successful domestic or foreign degree.
- All foreign applicants must submit their bachelor's degree to *uni-assist*, which verifies their eligibility and converts their grades to the German grade system. *uni-assist* will issue a so-called preliminary inspection documentation (VPD), which they must upload to the application portal (like their other documents).
- Proof of English proficiency level B2 or higher.

The binding regulations for this curriculum can be found in:

- "Studien- und Prüfungsordnung" (SPO) of Master's degree "Automotive Production Engineering" of 18.07.2016,
- "Rahmenprüfungsordnung" (RaPO),
- „Allgemeine Prüfungsordnung" (APO) of Technische Hochschule Ingolstadt,
- „Immatrikulationsatzung" of Technische Hochschule Ingolstadt.

The sequence of studies is influenced by the regulations of the study and examination regulations ("Studien- und Prüfungsordnung").

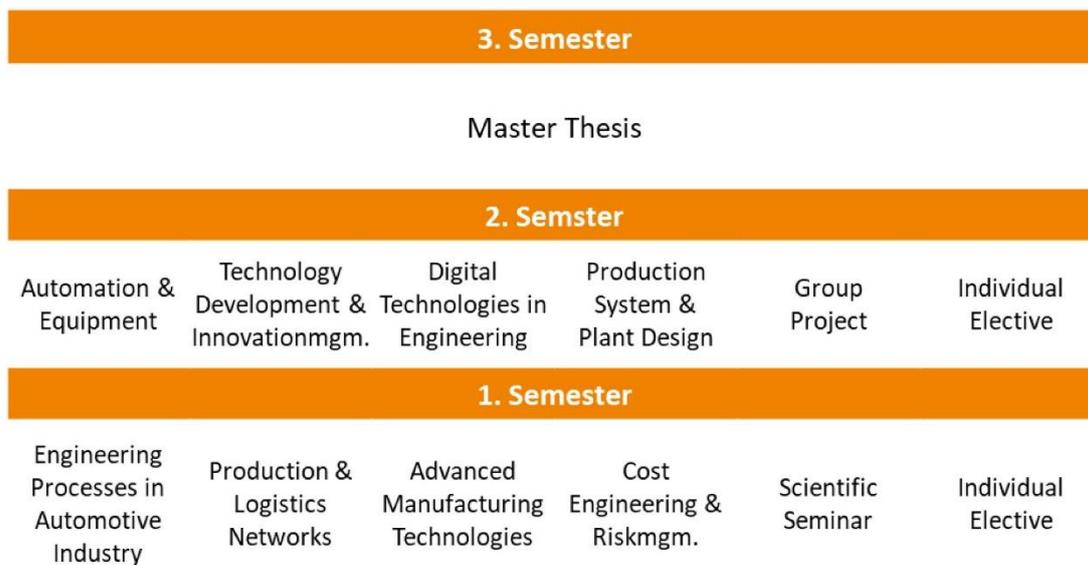
2.3 Target group

The program addresses to prospective students that

- are creative, curious, and enthusiastic about automotive and production as well as engineering and management,
- prefer a master's programme fully taught in English, like to gain intercultural experience, and go for an international career at home and abroad,
- enjoy questioning things and see themselves as a driver for change,
- are graduates of bachelor's programs or young professionals with a Bachelor's degree in industrial engineering, mechanical engineering, automotive engineering, mechatronics engineering, engineering, and management, IT, or a degree in another related discipline.

2.4 Structure of the program

The standard period of study for Master's programs amount to three theoretical semesters, whereby the third semester shall be primarily used for the completion of the master's thesis. The program is offered as a full-time course. Within the range of subjects, students are conveyed an in- depth and detailed theoretical, technical, and practical understanding of production systems in the automotive sector. This understanding goes beyond the strategic, planning, and operative development processes of these systems regarding product development.



Picture 1: Program structure

In the first semester (see Picture 1), knowledge, skills, and competencies in the field of Engineering Processes in Automotive Industry, Production and Logistics Networks, Advanced Manufacturing Technologies, Cost Engineering & Risk Management in Automotive, Scientific Research Seminar and one Individual Elective are conveyed.

The second semester includes following modules: Automation and Equipment Technologies, Technology Development & Innovation Management, Digital Technologies in Engineering, Production System and Plant Design, Group Project and one Individual Elective. In Group Project, students practicing working on a bigger task as part of a project team are given the opportunity to try out all project stages.

The Master's program concludes with the master's thesis in the third and last semester. The thesis is complemented by seminars.

There are practical elements in all modules, stressing the application-oriented profile of this master's program, e.g., by providing project and thesis topics set by partner companies.

Language and culture courses are offered during the semester times. German students can learn another foreign language.

2.5 Prerequisites for advancement

To get the title of master's thesis requires at least 30 ECTS to be achieved in the sequence of study (compare "Studien- und Prüfungsordnung" as of 18.07.2016).

3 Qualification profile

The study contents have been defined according to the requirements of industry and small and medium-sized companies as well as the qualification framework for German university degrees.

Graduates have acquired in-depth knowledge in the three main knowledge areas of the program:

- Production,
- Engineering &
- Management

and their interfaces in theory and practice.

Production engineering modules are

- Automation & Equipment
- Production System & Plant Design
- Production & Logistics Networks
- Advanced Manufacturing Technologies

Engineering modules are

- Digital Technologies in Engineering
- Engineering Processes in Automotive Industry

Management modules are

- Cost Engineering & Risk Management
- Group Project

Interfaces between management and engineering modules are

- Technology Development & Innovation Management

The two elective subjects can be freely chosen from the three knowledge areas of Production, Engineering & Management or a subject which represents an interface of these knowledge areas.

Considering the specific objectives of the individual modules (see module descriptions in the next chapter), graduates are familiar with the engineering and management methods used in the field of "Automotive Production Engineering" to work adequately.

They can quickly familiarize themselves with operational and strategic tasks in the field of "Automotive Production Engineering" by mastering not only specialist knowledge required for this, but also knowledge of managing employees (e.g., project) and designing or optimizing the necessary operational processes.

Students are especially advised of language training opportunities at Technische Hochschule Ingolstadt.

3.1 Mission statement

We prepare our students for the challenges of the future:

- The master's programme creates future competence.
- It creates a spirit of innovation and teaches entrepreneurial thinking.
- It is an interdisciplinary programme, which enables students to develop future-oriented solutions for interdisciplinary challenges.
- It qualifies students to help shape social changes such as the digital transformation and technological change. It sensitizes students to the sustainable use of the environment and resources, to socially responsible behaviour and to social commitment.

We enable our students to develop solutions to problems based on scientific knowledge:

- The master's programme includes a lot of project work. This enables students to acquire applicable problem-solving skills.
- The lecturers transfer their practical experience and teach academic knowledge. They are professionally competent, are constantly developing in their areas of expertise and contribute their research experience to teaching.
- Students acquire professional, methodical, social, and self-competences.

We open outstanding regional and international perspectives for our students:

- The master's programme is fully taught in English, addresses international students, and creates intercultural competences.
- In this way, the programme contributes to a cosmopolitan, international campus.
- Our numerous cooperation with companies in the region enables our students to start their careers in the best possible way, both regionally and internationally.

We teach and learn through personal exchange:

- Because this is a master's programme, small groups and seminar-based forms of teaching are set to enable individual exchange with the students.
- The teaching concept offers digitalized courses (e.g., inverted classroom) in combination with many practical project studies to enhance the learning progress.
- The lecturers try out new ways of innovative and experimental teaching. For example, the first half of the semester concentrates on theoretical basics, the second half on practical application.

We help all students discover and realize their individual potential:

- The master's programme includes a lot of project work. In joint project work, our students gain social skills such as the ability to cooperate and deal with conflict, and leadership skills.
- The master's programme is international and intercultural. Hence, the programme promotes performance in an appreciative cooperation. We meet each other with tolerance and openness and understand diversity as an opportunity to learn from each other and develop further.

3.2 Study objectives

3.2.1 Subject-specific competences of the study program

The graduates:

- are able to analyze complex tasks/problems in the area of complex production systems and their development, to identify their key factors and to carry out evaluations as well as hedgings,
- are able to solve problems relating to the development and operation of production systems, which are incompletely defined and demonstrate competing requirements by using scientific, theoretical as well as application-oriented methods,
- master the rules of project and process management, production systems planning, development and operation as well as their use on technical, strategic, planning, and economic problems and questions in practice, especially in the automotive production including suppliers,
- can use tried-and-tested and new production, planning, engineering, procurement, logistics, project management and staff management methods, and apply them successfully in production systems development and operation,
- are aware of digital technologies with a focus of office automation and their impact on the future work life in industrial companies.

3.2.2 Interdisciplinary competences of the study program

Methodical competences:

The graduates are able:

- to work scientifically,
- to assess holistically and systematically digital technologies,
- to plan, compile and lead projects,
- apply methods of foresight and methods of innovation and technology management,
- to develop business models methodically, to evaluate business scenarios, to apply methods of change management, risk management and technology assessment,
- to analyze interdisciplinary problems, to recognize comprehensive correlations, to transfer learned competences to new tasks and to evaluate the technical, economic, and social impact of compiled solutions.

Social competences:

The graduates are able:

- to compile complex tasks in cross-functional and international teams, to solve conflicts in teams and to lead teams,
- to speak English fluently (including technical terms),
- to react sensitively in intercultural situations,
- to communicate their competencies and to communicate generally,
- to convince and become accepted.

Personal competences:

The graduates:

- are able to organize themselves and to manage their time,
- have analytical and outcome-oriented intellectual power,
- work target-oriented and autonomously,
- are able to present results and themselves.

3.2.3 Examination concept of the study program

The focus of the selection of examination forms is on the best possible assessment of the achievement of the set learning objectives - accordingly, there is a variety of different examination forms ranging from oral and written examinations, project work and study papers as well as presentations.

Also, a project is included in the program where students learn to put theoretical knowledge into practice and to deepen it in a team. The examination form "Project" is a group work to which each student must contribute individually and whose results are presented orally or in writing.

For the form of examinations, please refer to "Studien- und Prüfungsordnung", Appendix 1, which can be found under: https://www.thi.de/fileadmin/daten/recht/SPOs_Fakultaet_WI/Master_Fakultaet_WI/Master_Automotive_Production_Engineering/2020_01_20_SPO_MA_APE_Anlage_1_V6.pdf.

3.2.4 Application of the study program

The study program "Automotive Production Engineering" has a strong application relevance as it is developed in close coordination with industry practice. It offers interdisciplinary competence teaching with an application reference, where students can participate in networking and learn how to deal

with conflicts in a practical setting. The program includes practice and transfer projects during the study, and master's thesis topics are often drawn from professional practice.

The program equips graduates with the skills and knowledge to take on qualified specialist and management roles in the field of production, factory planning, or technology development. The Scientific Research Seminar and Group Project provide students with exposure to industrial problems and scientific working methods. Overall, the study program has high relevance to the practical needs of the industry, and graduates are well-prepared for a range of career options.

3.2.5 Contribution of individual modules to the objectives of the program

Module	Professional competence	Methodology	Social competence	Personal competence
Technology Development & Innovation Management	+	++	o	o
Advanced Manufacturing Technologies	++	+	+	+
Cost Engineering & Risk Management	++	++	o	o
Engineering Processes in Automotive Industry	++	+	o	o
Production System and Plant Design	++	+	o	o
Production and Logistics Networks	++	+	o	o
Automation and Equipment Technologies	++	+	o	o
Digital Technologies in Engineering	++	++	+	+
Group Project	++	++	++	++
Electives	depends on the elective			
Scientific Research Seminar	++	++	+	+
Master's Thesis	++	++	++	++

3.3 Possible professional fields

Graduates of the Master's program Automotive Production Engineering have all skills enabling them to work as an engineer in the development of a production system at the company at their disposal. These skills enable them to work as production planner (with strategic, technological, managerial, and process-related focus), plant engineer/engineer for equipment technologies as well as plant developer, planning/production manager and manufacturing developer.

Graduates of the Master program Automotive Production Engineering are in great demand. There is a wide field of application in specialist or management roles in national or international companies and organizations.

Graduates are especially well prepared to take on specialist and management roles in the following areas:

- Engineer in the development of a production system
 - Plant & Production Engineer
 - Production & Quality Controlling
 - Planning/production manager
 - Manufacturing developer
 - Engineer for Equipment Technologies
- Quality Engineer & Manager
- Project Management
- Product and Technology Management
- Creativity and Innovation Management
- Business Development & Entrepreneurship

Graduates are also particularly well qualified for these tasks in an international context. Typical industries for the graduates of this program are:

- Automotive & Mobility Industry
- Mechanical and Electrical Engineering
- IT
- Services
- Consultancy
- Research & Education

4 Description of Modules

4.1 Compulsory Modules

Technology Development & Innovation Management			
Module abbreviation:	TDevInnM_M-APE	SPO-No.:	1
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	2
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Schwarz, Jan Oliver		
Lecturers:	Ruppert, Max; Schropp, Theresa; Schwarz, Jan Oliver		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Technology Development & Innovation Management		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center)		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>Students</p> <ul style="list-style-type: none"> • know the significance, methods, elements and processes of innovation and technology management; • understand the involvement in corporate and product development processes; • can independently use methods of innovation and technology management; • can install processes suited for systematic technology development and use methods; • know about the significance, effect, and limits of IP protection (Intellectual Property) and its targeted application as well as patenting processes. 			
Content:			
<ul style="list-style-type: none"> • Technology and innovation management • Technology development: processes, methods, examples • Benchmarking 			
Literature:			
<ul style="list-style-type: none"> • BESSANT, John R., and Joseph TIDD, 2015. <i>Innovation and Entrepreneurship</i>. T. edition. Chichester: Wiley. ISBN 978-1-119-08943-8 • BIAZZO, Stefano, FILIPPINI, Roberto, 2021. <i>Product Innovation Management: Intelligence, Discovery, Development</i> [online]. Cham: Springer PDF E-Book. ISBN 978-3-030-75011-4. Available via: Online verfügbar unter: https://ebookcentral.proquest.com/lib/kxp/detail.action?docID=6661653. 			

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- TIDD, Joseph, and John R. BESSANT, 2021. *Managing innovation: integrating technological, market and organizational change*. S. edition. Hoboken, NJ: Wiley. ISBN 978-1-119-71330-2
- TROTT, Paul, 2021. *Innovation management and new product development*. S. edition. Harlow, England; London; New York; Munich: Pearson. ISBN 9781292251547
- WEINBERG, Ulrich, 2015. *Network Thinking: was kommt nach dem Brockhaus-Denken?* Hamburg: Murmann. ISBN 978-3-86774-469-0, 3-86774-469-6

Additional remarks:

No remarks.

Advanced Manufacturing Technologies			
Module abbreviation:	AdManT_M-APE	SPO-No.:	2
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	1
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Bednarz, Martin		
Lecturers:	Bednarz, Martin		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Advanced Manufacturing Technologies		
Lecture types:	SU/Ü - Lecture with integrated exercises		
Examinations:	LN - Seminar paper: Power Point approx. 15 to 20 pages and oral presentation 15 min.		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<ul style="list-style-type: none"> • The students understand typical industry application; • They can analyse advantages and disadvantages of different manufacturing technologies; • They gain process know-how and understand the physical working principles of the technologies; • They research new trends in the industry and apply this knowledge in a paper. 			
Content:			
Advanced Manufacturing Technologies e.g.: <ul style="list-style-type: none"> • Additive Manufacturing • Laser Technologies • Technologies for Battery production • Manufacturing Technologies for fibre reinforced plastics 			
Literature:			
<ul style="list-style-type: none"> • GROOVER, Mikell P., 2013. <i>Fundamentals of modern manufacturing: materials, processes, and systems</i>. 5. edition. Hoboken, NJ: Wiley. ISBN 978-1-118-231463 • BRECHER, Christian, 2015. <i>Advances in production technology</i> [online]. Cham [u.a.]: Springer PDF E-Book. ISBN 978-3-319-12304-2, 978-3-319-12303-5. Available via: http://dx.doi.org/10.1007/978-3-319-12304-2. 			

- KALPAKJIAN, Serope and Steven R. SCHMID, 2014. *Manufacturing engineering and technology*. 7. edition. Singapore [u.a.]: Pearson. ISBN 978-0-13-312874-1, 978-981-06-9406-7

Additional remarks:

No remarks.

Cost Engineering & Risk Management			
Module abbreviation:	CostERiskM_M-APE	SPO-No.:	3
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	1
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Hecht, Dirk		
Lecturers:	Hecht, Dirk; Horák, Jiří; Ruppert, Max		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Cost Engineering & Risk Management		
Lecture types:	SU/Ü- Lecture with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students</p> <ul style="list-style-type: none"> • get to know the importance of cost engineering methods in cross functional teams; • can recognise, assess and include in their work interactions between cost engineering, innovations and product development; • can handle and apply tools of cost engineering projects and processes; • understand cost levers within different technologies (Assembly, Moulding, Die Casting, Software); • understand the importance of Risk Management; • present the classic models of Risk Management and are able to apply those; • portray the stages of Risk Management and design specific, interdisciplinary practical cases and are able to comprehend the overall context; • analyse certain situations regarding the applicability of the methods of Risk Management. • combine Risk Management with technical design and mathematical calculations 			
Content:			
<ul style="list-style-type: none"> • Cost Engineering, methods, and tools • Calculation within various technologies • Cost Engineering as part of innovations and Project Management • Classic Risk Management methods and case studies in specific technologies 			

<ul style="list-style-type: none">• Alternative methods of Risk Management and mathematical application
Literature:
<ul style="list-style-type: none">• VDI, 2011. <i>Wertanalyse - das Tool im Value Management</i>. 6. edition. Berlin [u.a.]: Springer. ISBN 978-3-540-79516-2, 978-3-540-79517-9• VENKATARAMAN, Ray R., and Jeffrey K. PINTO, 2008. <i>Cost and value management in projects</i>. Hoboken, N.J.: John Wiley & Sons. ISBN 978-0-470-06913-4, 0-470-06913-9• HECHT, Dirk, 2017. <i>Modernes Beschaffungsmanagement in Lehre und Praxis</i>. Berlin: Uni-Edition. ISBN 978-3-944072-88-3, 3-944072-88-X• WOLKE, Thomas, 2008. <i>Risikomanagement</i>. 2. Edition. München [u.a.]: Oldenbourg. ISBN 978-3-486-58714-2, 3-486-58714-5• KEITSCH, Detlef, 2007. <i>Risikomanagement</i>. Stuttgart: Schaeffer-Poeschel. ISBN 978-3-7910-2713-5, 3-7910-2713-1• HOPKIN, Paul, 2013. <i>Risk Management</i>. London; Philadelphia, PA: Kogan Page Ltd. ISBN 978-0-7494-6839-2, 0-7494-6839-4• BABBAGE, Charles, 2010. <i>On the economy of machinery and manufactures</i>. Memphis, Tenn.: General Books. ISBN 978-0-217-26690-1
Additional remarks:
No remarks.

Engineering Processes in Automotive Industry			
Module abbreviation:	EngineeProcAuto_M-APE	SPO-No.:	4
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	General Elective Subject	1
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Meyer, Roland		
Lecturers:	Meyer, Roland; Neumann, Alexander		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Engineering Processes in Automotive Industry		
Lecture types:	SU/Ü - Lecture with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students</p> <ul style="list-style-type: none"> • know the strong networked and parallel processes in the product and process development of automobiles; • can recognise, assess and include in the work interactions between production and product; • know the significance and working methods of Simultaneous Engineering (SE) including the involvement of suppliers in product design and product and process quality to meet the requirements of production; • can handle tools of project and process management and know the working methods and processes (e.g. for networking, decision-making, escalation, etc.) in large automotive and supplier companies; • know the significance of prototype, pilot production and release processes and here applied tools; • know about the significance of lean development methods and cost management. 			
Content:			
<ul style="list-style-type: none"> • Product and process development in the automotive industry • Automotive project- and process-management and according methods • Requirements and quality management tools • Pre-series process • Cost management 			

<ul style="list-style-type: none"> • Lean development
Literature: <ul style="list-style-type: none"> • STAMATIS, Diomidis H., 2001. <i>Advanced quality planning: a common-sense guide to AQP and APQP</i>. 1. edition. New York, NY: Productivity Press. ISBN 1-56327-258-X • COOPER, Robert G., 2017. <i>Winning at new products: creating value through innovation</i>. F. edition. New York, NY: Basic Books. ISBN 0-465-09332-9, 978-0-465-09332-8 • WOMACK, James P., Daniel T. JONES, and Daniel ROOS, 2007. <i>The machine that changed the world: [how lean production revolutionized the global car wars]</i>. [. edition. London [u.a.]: Simon & Schuster. ISBN 978-1-84737-055-6, 1-8473-7055-1 • WOMACK, James P., and Daniel T. JONES, 2003. <i>Lean thinking: banish waste and create wealth in your corporation</i>. London [u.a.]: Simon & Schuster. ISBN 978-0-7432-3164-0 • ROTHER, Mike, and John SHOOK, 2009. <i>Learning to see: value-stream mapping to create value and eliminate muda</i>. Version 1. edition. Cambridge, Mass.: Lean Enterprise Inst. ISBN 978-0-9667843-0-5, 0-9667843-0-8 • MORGAN, James M., and Jeffrey K. LIKER, 2006. <i>The Toyota product development system: integrating people, process, and technology</i>. New York, NY: Productivity Press. ISBN 1-56327-282-2, 978-1-563-27282-0 • REINERTSEN, Donald G., 2009. <i>The principles of product development flow: second generation lean product development</i>. Redondo Beach, Calif: Celeritas. ISBN 978-1-935401-00-1, 1-935401-00-9 • CHANG, Kuang-Hua, 2013. <i>Product manufacturing and cost estimating using CAD/CAE</i>. Burlington: Elsevier Science. ISBN 978-0-12-404600-9, 0-12-404600-2 • MITAL, Anil, ©2008. <i>Product development: a structured approach to consumer product development, design, and manufacture</i>. Amsterdam: Elsevier/Butterworth-Heinemann. ISBN 978-0-08-055641-3, 0-08-055641-8
Additional remarks:
<p>Bonus system:</p> <p>In the course, tasks can be set that lead to bonus points for the examination performance for each qualitatively completed task. The maximum crediting of bonus points takes place according to the APO.</p>

Production System and Plant Design			
Module abbreviation:	WMod_PS&PD_M-EGM	SPO-No.:	5
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	General Elective Subject	1
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Meyer, Roland		
Lecturers:	Meyer, Roland		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Production System and Plant Design		
Lecture types:	SU/Ü - Seminar with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>After this lecture subject, students are able to:</p> <ul style="list-style-type: none"> • understand and apply basics of production systems in the automotive industry; • asses and design processes, structures and elements of production systems; • understand, rate and apply variables and aims of design and control (added value, motivation, workload, ergonomics, etc.); • handle necessary basics and implement methodical approaches (MTM, REFA); • understand and use procedures and methods of manufacturing planning; • determine and optimize flow production • investigate workplaces and apply basics methods of ergonomics (e.g. workplace design); • get around and understand modern leadership; • classify the importance of digital industry 4.0 methods. 			
Content:			
<ul style="list-style-type: none"> • Basics of production systems • Production organisation strategies and shopfloor management • Machine tools in production systems • Technical capacity, MTM, REFA target time determination • Design for manufacturing and assembly (DFMA) 			

- Manufacturing and assembly planning
- Industry 4.0 applications in production systems
- Lean Leadership
- Production training

Literature:

- BOKRANZ, Rainer and Kurt LANDAU, 2006. *Produktivitätsmanagement von Arbeitssystemen: MTM-Handbuch*. Stuttgart: Schäffer-Poeschel. ISBN 3-7910-2133-8, 978-3-7910-2133-1
- BRUNNER, Franz J., 2017. *Japanische Erfolgskonzepte: KAIZEN, KVP, Lean Production Management, Total Productive Maintenance, Shopfloor Management, Toyota Production System, GD3 - Lean Development*. 4. edition. München: Hanser. ISBN 978-3-446-45428-6, 3-446-45428-4
- GRUNDIG, Claus-Gerold, 2018. *Fabrikplanung: Planungssystematik - Methoden - Anwendungen*. 6. edition. München: Hanser. ISBN 978-3-446-45400-2, 3-446-45400-4
- WESTKÄMPER, Engelbert and Carina LÖFFLER, 2016. *Strategien der Produktion: Technologien, Konzepte und Wege in die Praxis*. Berlin, Heidelberg: Springer Vieweg. ISBN 978-3-662-48913-0, 3-662-48913-9
- WIENDAHL, Hans-Peter and others, 2015. *Handbook factory planning and design*. Berlin [und 4 weitere]: Springer. ISBN 3-662-46390-3, 978-3-662-46390-1
- WIENDAHL, Hans-Peter, Jürgen REICHARDT and Peter NYHUIS, 2014. *Handbuch Fabrikplanung: Konzept, Gestaltung und Umsetzung wandlungsfähiger Produktionsstätten*. 2. edition. München [u.a.]: Hanser. ISBN 978-3-446-43892-7, 3-446-43892-0
- FREIVALDS, Andris and Benjamin W. NIEBEL, 2014. *Niebel's Methods, standards, and work design*. 13. edition. New York, NY: McGraw-Hill. ISBN 978-0-07-337636-3, 0-07-337636-1

Additional remarks:

Bonus system:

In the course, tasks can be set that lead to bonus points for the examination performance for each qualitatively completed task. The maximum crediting of bonus points takes place according to the APO.

Production and Logistics Networks			
Module abbreviation:	ProdLogis_M-APE	SPO-No.:	6
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	General Elective Subject	1
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Jattke, Andreas		
Lecturers:	Jattke, Andreas		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Production and Logistics Networks		
Lecture types:	SU/Ü - Lecture with integrated exercises		
Examinations:	mdlP - oral exam, 15 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students</p> <ul style="list-style-type: none"> • get to know the significance, elements, basic structure, design and execution of production and logistic networks in the automotive industry; • can capture and assess interactions between production network, location factors, suppliers, logistics network, own/external skills, own manufacturing penetration, product design/technologies, production design/technologies etc.; • get to know possible production strategies, their effects on the production and logistics network including suppliers' environment and can systematically assess and develop different production strategies; • can design skills strategies in conjunction with the production strategy and hence derive and establish skills development including supplier development; • get to know procurement, intra/production and distribution logistics systems used in the automotive industry (e.g. JIT, milkrun, supermarket, kanban concept, single/multi-level, combined logistics systems etc.); • can assess and fundamentally calculate the effects of different logistics concepts; • can optimize supply chains (specific design, KPI, transport- and warehousing strategies, make or buy decisions, etc.). 			
Content:			
<ul style="list-style-type: none"> • Production networks and skills strategies 			

- Logistics systems and networks
- Logistics concepts in manufacture (intralogistics)
- Supply Chain management design methodologies
- Supply Chain KPIs
- TOPSIM LOGISITCS simulation tool
- Supply chain management in line with industry 4.0 (digitalisation)

Literature:

- ERRASTI, Ander, 2013. *Global production networks: operations design and management*. 2. edition. Boca Raton, FL: CRC Press. ISBN 978-1-4665-6294-3, 1-4665-6294-3
- ZHENG, Li and Frank POSSEL-DÖLKEN, 2002. *Strategic production networks: with 17 tables*. Berlin [u.a.]: Springer. ISBN 3-540-43162-4, 978-3-642-07734-0
- ABELE, Eberhard, Ulrich NÄHER and Gernot STRUBE, 2007. *Global production: a handbook for strategy and implementation*. 1. edition. Berlin: Springer Berlin. ISBN 978-3-540-71652-5, 3-540-71652-1
- STADTLER, Hartmut, 2015. *Supply chain management and advanced planning: concepts, models, software, and case studies*. 5. edition. Berlin [u.a.]: Springer. ISBN 978-3-642-55308-0, 3-642-55308-7

Additional remarks:

No remarks.

Automation and Equipment Technologies			
Module abbreviation:	A&ET_M-APE	SPO-No.:	7
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	2
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Großmann, Daniel		
Lecturers:	Feistle, Martin; Großmann, Daniel		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Automation and Equipment Technologies		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students</p> <ul style="list-style-type: none"> • get to know the fields of application of automation technologies in automotive production including suppliers. They can determine suitable application-oriented levels of automation (economic and technological); • know the structure and individual components of automation systems and their interaction in automotive production (amongst others, steerings, software, clamping systems, robots, transport technology, systems, factory); • can derive and assess interactions between automation technology and manufacturing technology/processes, product design, production design, productivity/availability etc.; • can interpret robot systems in particular (single robot, robotic cells and gardens) mathematically and with planning (possibly do it themselves and programme using exercises/practical exercises in the lab?); • know the planning and development processes of automation systems and equipment in automotive production (e.g. robot offline programming, accessibility simulations, virtual commissioning, tooling methods planning, forming simulation etc.) and their involvement in product/production development processes; • know the involvement, processes and technology of equipment manufacture for the development, construction and production of tools and systems; • learn the methods for the construction, commissioning and quality optimisation of systems and tools in conjunction with the production start-up processes; 			

<ul style="list-style-type: none"> • get to know the tool machines used in automotive production and can assess these both technologically and economically (e.g. for procurement processes).
Content:
<ul style="list-style-type: none"> • Robotics, automation, and control technology in automotive manufacturing • Equipment manufacturing: system manufacturing, tool and mould making, tool machines
Literature:
<p><u>Compulsory:</u></p> <ul style="list-style-type: none"> • JOHN, Karl-Heinz and Michael TIEGELKAMP, 2010. <i>IEC 61131-3: programming industrial automation systems: concepts and programming languages, requirements for programming systems, decision-making aids</i>. 2. Edition. Berlin: Springer. ISBN 978-3-642-43694-9, 3-642-43694-3 • LAMB, Frank, 2013. <i>Industrial automation: hands on</i>. New York, N.Y.: McGraw-Hill Education LLC. <p><u>Recommended:</u></p> <ul style="list-style-type: none"> • BARTELT, Terry, 2011. <i>Industrial automated systems: instrumentation and motion control</i>. Clifton, NY: Delmar Cengage Learning. ISBN 978-1-4354-8888-5, 1-4354-8888-1 • STEPHENS, Matthew P. and Fred E. MEYERS, 2013. <i>Manufacturing facilities design and material handling</i>. F. edition. West Lafayette, Indiana: Purdue University Press. ISBN 978-1-61249-272-8 • THIEDE, Sebastian, 2012. <i>Energy efficiency in manufacturing systems</i>. Heidelberg: Springer. ISBN 978-3-642-25914-2, 978-3-642-25913-5 • HOFFMAN, Edward G., 2004. <i>Jig and fixture design</i>. 5. edition. New York: Thomson. ISBN 1-4018-1107-8 • GIBSON, Ian, David ROSEN, Brent STUCKER, 2015. <i>Additive manufacturing technologies: 3D printing, rapid prototyping, and direct digital manufacturing</i>. 2. Edition. New York, NY [u.a.]: Springer. ISBN 978-1-4939-2112-6, 1-4939-2112-6 • 2011. <i>Cyber-Physical Systems: Driving force for innovation in mobility, health, energy, and production</i>. Berlin, Heidelberg: Springer Berlin Heidelberg. ISBN 978-3-642-29090-9 • UHL, Axel, 2016. <i>Digital enterprise transformation: a business-driven approach to leveraging innovative IT</i>. London: Routledge, Taylor & Francis Group. ISBN 978-1-4724-4854-5 • BAUERNHANSL, Thomas, Michael TEN HOMPEL and Birgit VOGEL-HEUSER, 2014. <i>Industrie 4.0 in Produktion, Automatisierung und Logistik: Anwendung, Technologien, Migration</i>. Wiesbaden: Springer Vieweg. ISBN 978-3-658-04681-1, 3-658-04681-3
Additional remarks:
No remarks.

Digital Technologies in Engineering			
Module abbreviation:	DigiTEng_M-APE	SPO-No.:	8
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	2
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Bednarz, Martin		
Lecturers:	Basta, Georg; Lerher, Tone; Meyer, Roland		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Digital Technologies in Engineering		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	LN - StA+Coll. (student research project with colloquium), written 8-15 pages or presentation 15-20 pages; oral exam 10-15 min.		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students</p> <ul style="list-style-type: none"> • can assess the considerable significance of PLM/PDM as a means of communication in the product development process; • are familiar with the management of product and production data in the engineering process; • know and understand models, concepts and methods of PLM/PDM; • can handle exemplary, specific PLM/PDM systems; • get to know and understand CAx strategies (amongst others, for CAD, CAQ, CAE, CAM, DMU etc.) and their interactions on corporate processes; • know possibilities and systems of the “digital factory“ for production and factory design, planning and development, in particular for Simultaneous Engineering, and their involvement in the product development process; • understand the theory behind different simulation methods such as discrete event simulation, continuous simulation, FEM simulation as well as the according modelling steps; • can handle exemplary, specific systems of the digital factory (e.g. system layout, process/availability simulation, robot offline programming, system simulation, assembly and ergonomics simulation); • know foundations (FEM methodology) and different systems of (physical) manufacturing process simulation (e.g. forming simulation, casting simulation, joining simulation, painting simulation etc.) and their fields of application as well as limits. 			

Content:
<ul style="list-style-type: none"> • Product Life Cycle Management (PLM) • Product Data Management (PDM) • CAx strategies • Digital factory (planning) and manufacturing (process) simulation
Literature:
<ul style="list-style-type: none"> • HIRZ, Mario, 2013. <i>Integrated computer-aided design in automotive development: development processes, geometric fundamentals, methods of CAD, knowledge-based engineering data management</i>. Berlin [und 4 weitere]: Springer. ISBN 978-3-642-11939-2, 978-3-642-11940-8 • VAJNA, Sándor, 2009. <i>CAx für Ingenieure: eine praxisbezogene Einführung</i> [online]. Berlin: Springer Berlin PDF E-Book. ISBN 978-3-540-36038-4, 978-3-540-36039-1. Available via: http://deposit.d-nb.de/cgi-bin/dokserv?id=2842151&prov=M&dok_var=1&dok_ext=htm. • BRAESS, Hans-Hermann, SEIFFERT, Ulrich, 2003. <i>Vieweg Handbuch Kraftfahrzeugtechnik</i> [online]. Wiesbaden: Vieweg+Teubner Verlag PDF E-Book. ISBN 978-3-663-11757-5, 978-3-663-11758-2. Available via: http://dx.doi.org/10.1007/978-3-663-11757-5. • AHMED, Sayed and Wolf-Heinrich HUCHO, 2008. <i>Aerodynamik des Automobils: Strömungsmechanik, Wärmetechnik, Fahrdynamik, Komfort</i>. 5. edition. ISBN 978-3-528-03959-2 • SEIFFERT, Ulrich, 2008. <i>Virtuelle Produktentstehung für Fahrzeug und Antrieb im Kfz: Prozesse, Komponenten, Beispiele aus der Praxis</i> [online]. Wiesbaden: Vieweg + Teubner PDF E-Book. ISBN 978-3-8348-0345-0, 978-3-8348-9479-3. Available via: http://dx.doi.org/10.1007/978-3-8348-9479-3. • CANETTA, Luca, 2011. <i>Digital factory for human-oriented production systems: the integration of international research projects</i> [online]. London [u.a.]: Springer PDF E-Book. ISBN 978-1-84996-172-1, 978-1-84996-171-4. Available via: http://dx.doi.org/10.1007/978-1-84996-172-1. • WESTKÄMPER, Engelbert, 2013. <i>Digitale Produktion</i> [online]. Berlin: Springer PDF E-Book. ISBN 978-3-642-20259-9, 978-3-642-20258-2. Available via: http://dx.doi.org/10.1007/978-3-642-20259-9. • BRACHT, Uwe, GECKLER, Dieter, WENZEL, Sigrid, 2011. <i>Digitale Fabrik: Methoden und Praxisbeispiele</i> [online]. Berlin: Springer PDF E-Book. ISBN 978-3-540-89038-6, 978-3-540-88973-1. Available via: http://dx.doi.org/10.1007/978-3-540-88973-1.
Additional remarks:
No remarks.

Group Project			
Module abbreviation:	Project_M-APE	SPO-No.:	9
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	2
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only summer term
Responsible for module:	Axmann, Bernhard		
Lecturers:	Axmann, Bernhard; Hecht, Dirk; Ruppert, Max		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Group Project		
Lecture types:	S-Seminar		
Examinations:	Project report. Seminar work. Written composition approx. 10-15 pages with presentation 15-30 minutes.		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students</p> <ul style="list-style-type: none"> • can successfully work on and solve a complex, professional task in a team during the course of a semester; • can independently learn the ropes of a new, demanding professional theme, unfamiliar to them, and work on this using academic methods and engineering and economic expert knowledge gained so far; • can competently discuss and convincingly present the obtained project results and document these according to the technical and academic standards; • can develop interdisciplinary connections and understand the interaction of different specialist disciplines in engineering; • has distinctive methodological and social skills in areas such as teamwork, communication, leadership, creative techniques, project management and time management. 			
Content:			
<ul style="list-style-type: none"> • Working on a project task in a team during a semester; the project tasks differ from semester to semester. • The project is generally a complex task from the area of production systems and their development processes and is carried out in small teams with divided responsibilities, put together by the students themselves. 			

- In this type of work, knowledge acquired so far can be practically implemented by means of a practical task.
- In addition, the ability of the students to organise, carry out, document, and present a project is promoted.
- Key qualifications around teamwork, project management as well as social skills are consolidated.

Literature:

Will be specified at the beginning of the project.

Additional remarks:

No remarks.

Scientific Research Seminar			
Module abbreviation:	SciResSem_M-APE	SPO-No.:	12
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	1
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Axmann, Bernhard		
Lecturers:	Axmann, Bernhard		
Credit points / SWS:	5 ECTS / 2.5 SWS		
Workload:	Contact hours:	30 h	
	Self-study:	95 h	
	Total effort:	125 h	
Subjects of the module:	Scientific Research Seminar		
Lecture types:	S-Seminar		
Examinations:	LN - 11 Assignments		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students</p> <ul style="list-style-type: none"> • can successfully process a complex technical task within one semester; • are able to work independently into a new, challenging theme; • are able to document and present their project results; • have strong methodological and social competency in areas such as communication, project management and time management. 			
Content:			
<ul style="list-style-type: none"> • Processing of a semester-accompanying scientific question differ from semester to semester. Several topics are offered, from which one can be selected. The task is a scientific question and is handled by the student on his own responsibility. At the end of the semester, the results are summarized in the form of a report (approx. 10-15 pages) and a presentation (approx. 15-30 minutes). 			
Literature:			
Will be specified at the beginning of the seminar.			
Additional remarks:			
Seminar paper (10-15 pages) and oral presentation (15-30 min).			

Master's Thesis			
Module abbreviation:	Ma_Thes_APE	SPO-No.:	13
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Compulsory Subject	3
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	only winter term
Responsible for module:	Axmann, Bernhard		
Lecturers:	N.N.		
Credit points / SWS:	30 ECTS / 0 SWS		
Workload:	Contact hours:	0 h	
	Self-study:	750 h	
	Total effort:	750 h	
Subjects of the module:	Master's Thesis		
Lecture types:	MA		
Examinations:	Master's Thesis		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center).		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<ul style="list-style-type: none"> Acquisition and proof of the ability to work independently on complex problems from the field of Automotive Production Engineering at high academic level using the expert knowledge gained as well as academic methods and knowledge within a specified period of time. Master's students are furthermore able to classify results in a professional and interdisciplinary context and present them in the form of an academic piece of work. 			
Content:			
<ul style="list-style-type: none"> Analysis of the problem and definition of the theme Literature/patent research Formulation of the approach/methods Determination of a solution/approach Planning and development of the solution, analysis of results Classification of references to professional sources and other non- subject related references Use of academic work methods and methodology, i.e., proceeding systematically, analytically and using correct methodology, forming arguments logically and concisely, as well working in a targeted manner and time critically and presenting results in a formally correct manner 			

Literature:
Specific to the master's thesis topics.
Additional remarks:
No remarks.

4.2 Individual Electives (SS 2023)

Fallstudie Internet of Things			
Module abbreviation:	FallstudieIntThings_M-WI	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	German	1 Semester	winter/summer term
Responsible for module:	Großmann, Daniel		
Lecturers:	Großmann, Daniel		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Fallstudie Internet of Things		
Lecture types:	SU/Ü-Seminaristischer Unterricht/Übung		
Examinations:	Projektarbeit mit mdl. Präsentation (15 min) und schriftlicher Ausarbeitung (5 - 25 Seiten)		
Usability for other study programs:	Keine		
Prerequisites according examination regulation:			
Keine			
Recommended prerequisites:			
Keine			
Objectives:			
<p>Die Studierenden</p> <ul style="list-style-type: none"> • können die besonderen Eigenschaften des Internet of Things (IoT) und von IoT-Systemen erläutern • können die gesellschaftliche und wirtschaftliche Bedeutung des IoT einzuschätzen • kennen die wichtigsten Standards für die Kommunikation zwischen IoT-Geräten • kennen Techniken zur Speicherung und Verarbeitung von Daten in IoT-Systemen • kennen Architekturen und Technologien zur Strukturierung von IoT-Systemen und können diese auf eine eigene Fallstudie anwenden • kennen die Herausforderungen des Datenschutzes und der Datensicherheit in IoT-Systemen 			
Content:			
<ul style="list-style-type: none"> • Grundlagen des Internet of Things • Anwendungsbereiche • Gesellschaftliche und wirtschaftliche Bedeutung • Kommunikationsstandards und -technologien • Datenspeicherung und -verarbeitung • Design und Entwicklung 			

Literature:
Wird zu Beginn der Vorlesung bekannt gegeben.
Additional remarks:
Keine Anmerkungen.

Business Analytics & Artificial Intelligence			
Module abbreviation:	BusAn_AI_M-EGM	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Bock, Jürgen		
Lecturers:	Bock, Jürgen; Radtke, Max		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Business Analytics & Artificial Intelligence		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	Please see the subject recognition list of SCS (Study Service Center)		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students:</p> <ul style="list-style-type: none"> • develop general linear models; • interpret the results of statistical modelling in terms of goodness of fit and the significance of coefficients; • solve classification problems and evaluate the result; • develop knowledge and experience in the practical applications of machine learning and deep learning methods; • generate an understanding of procedures for formal knowledge modelling and knowledge interpretation. 			
Content:			
<ul style="list-style-type: none"> • Linear statistical models: multiple regression, multifactorial ANOVA • Unsupervised learning: clustering and PCA • Classifiers: Naive Bayes, logistic regression, CART • Definition of artificial intelligence and overview of sub-disciplines • Artificial neural networks • Graph-based knowledge representation and graph queries 			

<ul style="list-style-type: none">• Logic-based knowledge representation and automatic reasoning
Literature:
<ul style="list-style-type: none">• JAMES, Gareth, and others, 2021. <i>An introduction to statistical learning: with applications in R</i>. S. edition. New York, NY: Springer. ISBN 978-1-0716-1417-4, 1-0716-1417-7• HASTIE, Trevor, Robert TIBSHIRANI and Jerome H. FRIEDMAN, 2017. <i>The elements of statistical learning: data mining, inference, and prediction</i>. Second edition, corrected at 12. edition. New York, NY: Springer. ISBN 978-0-387-84857-0, 0-387-84857-6
Additional remarks:
No remarks.

Advanced Economics			
Module abbreviation:	Adv_Econ_M-EGM	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Eisenberg, Andrea		
Lecturers:	Eisenberg, Andrea		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total effort:		125 h
Subjects of the module:	Advanced Economics		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	schrP90 - written exam, 90 minutes		
Usability for other study programs:	None		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>The students get to:</p> <ul style="list-style-type: none"> • understand the importance of global economic system and problems for strategic business decisions in globally active companies; • be able to evaluate challenges resulting from globalization and growing international business transactions; • understand global economic problems, international economic relations and economic policy; • understand how the international monetary system works; • achieve an in-depth understanding of micro- and macroeconomic interrelationships. 			
Content:			
<ul style="list-style-type: none"> • Advanced Microeconomic theory: supply and demand, economic actors • Advanced Macroeconomics: inflation, unemployment, economic growth • Institutional economics and international economic organizations • International trade and globalization • Interest rates, international monetary policy and currency systems 			

Literature:

- MANKIW, Nicholas Gregory, and Mark P. TAYLOR, 2020. *Economics*. 5. edition. Andover, Hampshire: Cengage. ISBN 9781473768628
- MCDOWELL, Moore, 2012. *Principles of economics*. 3. edition. London [u.a.]: McGraw-Hill Higher Education. ISBN 978-0-07-712169-3, 0-07-712169-4
- TAYLOR, Timothy, 2022. *Principles of Economics. PDF* [online]. PDF e-Book.

Additional remarks:

No remarks.

Design and modelling with CATIA			
Module abbreviation:	WMod_DesModellCatia_M-APE	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Basta, Georg		
Lecturers:	Basta, Georg		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Design and modelling with CATIA		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - project work		
Usability for other study programs:	None		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
Students			
<ul style="list-style-type: none"> • are able to develop components in Part-Design and Generative Shape Design, • are able to create single part drawings and assembly drawings, • are able to organize themselves with several people in the design process. 			
Content:			
<ul style="list-style-type: none"> • Working on a constructive student research project in a team • Learn working with CATIA and practice by modelling components • Part design • Assembly design • drawings from single parts and assemblies 			
Literature:			
Will be specified at the beginning of the lecture.			

Additional remarks:

No remarks.

Introduction to AI and Neural Networks			
Module abbreviation:	WMod_IntroAINeuNet_M-APE	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Schiendorfer, Alexander		
Lecturers:	Lodes, Lukas; Schiendorfer, Alexander		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total effort:		125 h
Subjects of the module:	Introduction to AI and Neural Networks		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - written exam, 90 minutes		
Usability for other study programs:	None		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>After successfully completing the module, the students have acquired solid foundations in artificial intelligence (AI) and neural networks. In particular, they are able:</p> <ul style="list-style-type: none"> • to analyse and evaluate state of the art AI systems in automotive production • to know the difference between artificial intelligence, machine learning and deep learning • to mathematically explain the training procedure in deep learning systems • to program basic machine learning algorithms in Python and NumPy • to describe necessary steps for continuous quality assurance of learning systems • to implement modern deep learning systems using state-of-the-art software frameworks such as TensorFlow, Keras or PyTorch 			
Content:			
<ul style="list-style-type: none"> • Distinction of (classical) artificial intelligence and machine learning • The role of AI in industrial applications (Industry 4.0/Industrial IoT, Smart Factory) • Categories of machine learning (supervised / unsupervised / reinforcement learning) • Linear regression, logistic regression • Artificial neural networks: Perceptrons, feedforward neural nets 			

- Modern software frameworks and auto-differentiation: PyTorch, TensorFlow
- Training (deep) neural networks: Initialization, numerical optimization, regularization
- Deep learning architectures: Convolutional neural nets for image processing, recurrent neural nets / LSTM for sequential data

Literature:

- RUSSELL, Stuart J. and Peter NORVIG, 2021. *Artificial intelligence: a modern approach*. F. edition. Hoboken: Pearson. ISBN 978-0-13-461099-3
- GÉRON, Aurélien, September 2019. *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: concepts, tools, and techniques to build intelligent systems*. S. edition. Beijing; Boston; Farnham; Sebastopol; Tokyo: O'Reilly. ISBN 978-1-492-03261-8
- DEISENROTH, Marc Peter, A. Aldo FAISAL, and Cheng Soon ONG, 2020. *Mathematics for machine learning*. Cambridge: Cambridge University Press. ISBN 978-1-108-45514-5, 978-1-108-47004-9
- GOODFELLOW, Ian, Yoshua BENGIO and Aaron COURVILLE, 2016. *Deep learning*. Cambridge, Massachusetts; London, England: The MIT Press. ISBN <http://www.deeplearningbook.org/>

Additional remarks:

Bonus points system:

In lecture, there may be tasks and quizzes, which will lead to bonus points for the exam in case of good execution. At most 10% of the final grade can be improved via bonus points.

Transformation Processes and Change Management			
Module abbreviation:	TrProChanMana_M-GFT	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Bechthold, Laura		
Lecturers:	Bechthold, Laura		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Transformation Processes and Change Management		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	Student research project without oral presentation 8-15 pages		
Usability for other study programs:	None		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>After attending the course, the students:</p> <ul style="list-style-type: none"> • know basics of systems thinking and apply this knowledge on different levels (e.g., transformation of sociotechnical systems, organizations, or teams); • can recognize wicked problems and know, how to the manage them; • can define and explain the concept of sociotechnical systems and related transformation pathways; • know how to design transition processes for sociotechnical systems; • understand the principles and process of transformation and change processes within organizations; • know how to approach and orchestrate transformation processes from a managerial perspective; • understand and can critically reflect current trends in organizational design and related management approaches (e.g., organizational ambidexterity and objective and key results); • understand the psychological dynamics in transformation processes; • understand the relevance of stakeholder inclusion and can apply participatory methods to design multi-stakeholder processes; • can anticipate opportunities and risks of operational and social transformation processes; • know principles and practices of successful leadership in transformation processes. 			

Content:

The course is structured in two overarching blocks:

Block I: The transformation of socio-technical systems

- Wicked problems;
- Fundamentals of systems thinking (inkl. workshop on agent-based models);
- Sociotechnical systems and their transition pathways;
- Transition Design

Block II: The transformation of organizations

- Enterprise Transformation Cycle;
- Stakeholder theory and participatory methods;
- Current trends in organizational design and how to implement them;
- Current trends in organizational leadership and how to implement them;
- Leadership in change and transformation processes;
- Dealing with conflicting goals and team dynamics during change processes.

The second part of the course is complemented by an in-class simulation game to transform a fictitious company.

Literature:

- BECHTHOLD, L., M. LUDE and R. PRÜGL, 2021. Crisis Favours the Prepared Firm: How Organizational Ambidexterity Relates to Perceptions of Organizational Resilience. In: Glowka, G. ZEHREER, A., Ed. Resiliency Models and Addressing Future Risks for Family Firms in the Tourism Industry, S. 178-205.
- GEELS, F. W., 2002. Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. In: *Research Policy*. 31(8), p.1257–1274.
- GEELS, F. W., SCHOT, J., 2007. Typology of sociotechnical transition pathways. In: *Research Policy*. 36(3), p.399–417.
- HEALY, P. M., 2017. Case study: How much should a new CEO shake things up? In: *Harvard Business Review*. 2017(January-February), p.2–8.
- KOTTER, J. P., 1995. Leading Change: Why Transformation Efforts Fail. In: *Harvard Business Review*.
- O'REILLY, C. A., TUSHMAN, M. L., 2013. Organizational Ambidexterity: Past, Present, and Future. In: *Academy of Management Perspectives*. 27(4), p.324–338.
- LALOUX, Frédéric, 2014. *Reinventing organizations: a guide to creating organizations inspired by the next stage of human consciousness*. F. edition. Brussels: Nelson Parker. ISBN 978-2-960133-50-9, 2-9601335-0-1
- FRAEDRICH, E., BEIKER, S., LENZ, B., 2015. Transition pathways to fully automated driving and its implications for the sociotechnical system of automobility. In: *European Journal of Futures Research*. 3(1)
- GEELS, F. W., 2011. The multi-level perspective on sustainability transitions: Responses to seven criticisms. In: *Environmental Innovation and Societal Transitions*. 1(1), p.24–40.
- OSSENBRINK, J., HOPPMANN, J., HOFFMANN, V. H., 2019. Hybrid ambidexterity: How the environment shapes incumbents' use of structural and con-textual approaches. In: *Organization Science*. 30(6)

Additional remarks:

A voluntary bonus system is offered:

In the course, topics on methods and tools of transformation processes are offered for individual processing and presentation, which lead to bonus points for the examination performance for each qualitatively processed task. The creditability as well as maximum crediting of bonus points takes place according to the APO.

Entrepreneurship/Coaching			
Module abbreviation:	MVM_EC	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	German/English	1 semester	winter and summer term
Responsible for module:	Bader, Martin		
Lecturers:	Bader, Martin		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:	47 h	
	Self-study:	78 h	
	Total effort:	125 h	
Subjects of the module:	Entrepreneurship/Coaching		
Lecture types:	SU/Ü-Lecture with integrated exercises		
Examinations:	PA - Project work		
Usability for other study programs:	None		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>Nach erfolgreicher Teilnahme an der Modulveranstaltung sind die Studierenden in der Lage,</p> <ul style="list-style-type: none"> • eine Geschäftsidee selbst zu entwickeln, zu beurteilen und zu einem konsistenten Businessplan auszufertigen. • die Erfolgsfaktoren für bestimmte Geschäftsarten zu identifizieren und entsprechende Maßnahmen für die Umsetzung abzuleiten. • die Umsetzung konsequent vorzubereiten und die Geschäftsidee durch eine Gründung im Markt anzubahnen bzw. tatsächlich einzuführen. • sich auf die Teilnahme in Gründungswettbewerben gezielt vorzubereiten und die dort auftauchenden Herausforderungen zu erfüllen. <p>After successful participation in the course, students can</p> <ul style="list-style-type: none"> • develop, evaluate, and differentiate a business idea into a consistent business plan • identify the success factors for specific types of business and derive appropriate measures for implementation • consistently prepare the implementation and to initiate or introduce the business idea in the market by founding a company • prepare specifically for participation in start-up competitions and meet the challenges that arise there. 			

Content:

- Ideation
- Value Proposition Design
- Business Model Canvas
- Business Model Innovation
- Minimal Viable Product & Preto-/Prototyping
- Business Planning

Literature:

- Will be specified at the beginning of the lecture.

Additional remarks:

Das Coaching wird ggf. in Kooperation mit einem Business-Partner als Wirtschaftspaten durchgeführt. Durch diese Kooperation erhält jedes Team neben der Betreuung durch den THI-Dozierenden einen Praxis-Paten.

If necessary, the coaching is carried out in cooperation with a business partner as a business mentor. Through this cooperation, each team receives a practice mentor in addition to the coaching from the THI lecturer.

Integrated Safety and Assistance Systems			
Module abbreviation:	IAE_ISAS	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Botsch, Michael		
Lecturers:	Botsch, Michael; Dirndorfer, Tobias		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total effort:		125 h
Subjects of the module:	Integrated Safety and Assistance Systems		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - written exam, 90 min.		
Usability for other study programs:	None		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>After successfully completing the module, the students are able</p> <ul style="list-style-type: none"> • to explain basic vehicle components that are required for driver assistance systems and for vehicle integrated safety functions • to analyse and evaluate state of the art driver assistance systems • to describe testing procedures that are used for vehicle active safety functions • to explain mathematically the concepts for motion planning that are used in algorithms for driver assistance systems and integrated safety functions • to implement basic trajectory planning algorithms in MATLAB. 			
Content:			
<ul style="list-style-type: none"> • Introduction to IS & DAS • Examples of Driver Assistance and Integrated Vehicle Safety Systems: Parking Systems, Adaptive Cruise Control, Autonomous Emergency Braking • Position and Orientation: Pose, Representing Pose in 2-D and in 3-D • Time and Motion: Generation of Trajectories, Rate of Change, and Inverse Problem • Vehicle Motion Models: Decoupled X- and Y-Dynamics, Constant Velocity Model, Constant Steering Angle and Velocity Model, Constant Turn Rate and Acceleration Model, One-Track Model, Two-Track Model 			

<ul style="list-style-type: none">• Navigation and localization
Literature:
<ul style="list-style-type: none">• KELLY, Alonzo, 2013. <i>Mobile robotics: mathematics, models, and methods</i>. 1. Edition. New York, NY: Cambridge Univ. Press. ISBN 978-1-107-03115-9• HEISSING, Bernd, 2016. <i>Chassis Handbook: Fundamentals, Driving Dynamics, Components, Mechatronics, Perspectives</i> [online]. Wiesbaden: Vieweg+Teubner PDF E-Book. ISBN ISBN-10: 3663205193; ISBN-13: 978-3663205197.• WINNER, Hermann, HAKULI, Stephan, LOTZ, Felix, SINGER, Christina, 2019-. <i>Handbook of Driver Assistance Systems: Basic Information, Components and Systems for Active Safety and Comfort</i> [online]. Cham: Springer International Publishing PDF E-Book. ISBN 978-3-319-09840-1. Online verfügbar unter: https://doi.org/10.1007/978-3-319-09840-1.• BOTSCH, Michael, UTSCHICK, Wolfgang, 2020. <i>Fahrzeugsicherheit und automatisiertes Fahren: Methoden der Signalverarbeitung und des maschinellen Lernens</i> [online]. PDF E-Book. ISBN 978-3-446-46804-7
Additional remarks:
No remarks.

International Negotiation Training			
Module abbreviation:	WMod_InternNegoTrai_M-APE	SPO-No.:	10
Curriculum:	Programme	Module type	Semester
	Automotive Production Engineering (SPO WS 20/21)	Individual elective subject	
Module attributes:	Language of instruction	Duration of module	Frequency of offer
	English	1 semester	winter and summer term
Responsible for module:	Hecht, Dirk		
Lecturers:	Eberl, Sabine; Hecht Dirk; Schneider, Yvonne		
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours:		47 h
	Self-study:		78 h
	Total effort:		125 h
Subjects of the module:	International negotiation training		
Lecture types:	SU/Ü-Seminar with integrated exercises		
Examinations:	LN - oral exam, 15 minutes		
Usability for other study programs:	None		
Prerequisites according examination regulation:			
None			
Recommended prerequisites:			
None			
Objectives:			
<p>Students are able to</p> <ul style="list-style-type: none"> • understand the sensitivities of different cultures regarding the importance of negotiations in the purchasing environment • learn about common scientific approaches to successful negotiation management (Harvard, Schraner) • learn different methods of negotiation techniques • practice various negotiation situations in challenging environments (technology dependency, market monopolist, oligopolies, corporations) • implement learned theories in negotiation strategies and deepen them in practical exercises 			
Content:			
<p>Structured into the topics culture - methods - technology</p> <ul style="list-style-type: none"> • Methods and theories of negotiation (e.g., Harvard - International negotiation cultures) • Negotiation strategies/techniques with monopolists • Communication techniques, moderation methods • Crisis management, mediation • Technical aspects/support for rational negotiation management (e.g., video, on-site negotiation) 			

<ul style="list-style-type: none">• Practical exercises (sales talks, etc.)
Literature:
<ul style="list-style-type: none">• HEUSSEN, Benno and Jan CURSCHMANN, 2014. <i>Handbuch Vertragsverhandlung und Vertragsmanagement: Planung, Verhandlung, Design und Durchführung von Verträgen</i>. 4. Edition. Köln: Schmidt. ISBN 978-3-504-06306-1• RICHTER, Thorsten S., 2013. <i>Vertragsrecht: die Grundlagen des Wirtschaftsrechts</i>. 2. Edition. München: Verlag Franz Vahlen. ISBN 978-3-8006-4673-9, 978-3-8006-4674-6• FISHER, Roger, and William URY, 2007. <i>Getting to yes: negotiating an agreement without giving in</i>. 2. edition. London [u.a.]: Random House. ISBN 1-8441-3146-7, 0-09-924842-5• SCHRANNER, Matthias, 2019. <i>Teure Fehler: die 7 größten Fehler in schwierigen Verhandlungen</i>. 9. Edition. Berlin: Econ. ISBN 978-3-430-20075-2
Additional remarks:
No remarks.