Module Handbook

Faculty of Engineering

Study Program “Applied Artificial Intelligence” (MAAI)

Degree awarded: “Master of Science” (M.Sc.)

Effective as of:	**Summer term 2026**
Course Leader:	**Prof. Dr.-Ing. Nicolaj Stache**
Issued in printed form:	**04.08.2025**
Workload:	**1500 h**
SPO:	**1**

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Overview of the Modules and Courses in the Master's Program

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Course MAAI 1.2: Applied AI Lab	Prof. Dr.-Ing. Nicolaj Stache Prof. Dr.-Ing. Carsten Lanquillon
Module MAAI 2: AI Profiles	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI 2.01: Advanced Reinforcement Learning	Prof. Dr.-Ing. Nicolaj Stache
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Course MAAI 2.04: Explainable AI (XAI)	Prof. Dr.-Ing. Carsten Lanquillon
Course MAAI 2.05: Mechanistic Interpretability	Prof. Dr.-Ing. Carsten Lanquillon
Course MAAI 2.06: Embedded AI	Prof. Dr. rer. nat. Marco Wagner
Course MAAI 2.07: AI in Mobility	Dr. Mihai Kocsis
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Course MAAI 2.09: AI Ethics	Prof. Ulrike Weingart, PhD
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Course MAAI 2.13: Milestones of AI-based Imaging Research	Prof. Dr. rer. nat. Alexander Windberger
Course MAAI 2.14: AI-assisted Quality Assurance in Agile Software Processes	Dr. sc. hum. Richard Zowalla
Course MAAI 2.15: Advanced Data Management & Engineering	Prof. Dr. rer. nat. Helmut Beckmann
Module MAAI 3: Domain Profiles	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI HE 3.01: Software Assisted Medical Diagnostics	Prof. Dr. Markus Graf Prof. Dr.-Ing. Daniel Pfeifer
Course MAAI HE 3.02: Mixed Reality Lab	Prof. Dr.-Ing. Gerrit Meixner
Course MAAI HE 3.03: Software as medical	Prof. Dr. Wendelin Schramm

device	
Course MAAI HE 3.04: Foundations in Human-Computer Interaction	Prof. Dr.-Ing. Gerrit Meixner
Course MAAI HE 3.05: Personalized Healthcare	Prof. Dr. Christian Fegeler
Course MAAI BA 3.01: Leadership and Communication	Prof. Dr. Susanne Wilpers
Course MAAI BA 3.02: Business Ethics	Prof. Ulrike Weingart, PhD
Course MAAI BA 3.03: Entrepreneurship and Innovation	Prof. Dr. Ralf Dillerup
Course MAAI BA 3.04: Business Simulation	Prof. Dr. Ralf Dillerup
Course MAAI BA 3.05: Strategic Management	Prof. Dr. Ralf Dillerup
Course MAAI BA 3.06: Advanced Digital Marketing	Prof. Dr. Dario Müller
Course MAAI BA 3.07: Digital Human Resource Management	Prof. Dr. Susanne Wilpers
Course MAAI BA 3.08: Managing Global Supply Chains	Prof. Dr. Carola Schulz
Course MAAI BA 3.09: Research Methods and Applications in Logistics I	Prof. Dr. Carola Schulz
Course MAAI BA 3.10: Optimization of Supply Chains	Prof. Dr. Sebastian Kapser
Course MAAI BA 3.11: Digital Business Models, Innovation & Strategy	Prof. Dr.-Ing. Jochen Günther
Course MAAI BA 3.12: Business Process Management	Prof. Dr. Philipp Küller
Course MAAI BA 3.13: Digital Transformation	Prof. Dr.-Ing. Jochen Günther
Course MAAI BA 3.14: Business Process Optimization & Automation	Prof. Dr. Philipp Küller
Course MAAI ENG 3.01: Numerical Methods and Optimization	Prof. Dr.-Ing. Peter Ott (im Modulhandbuch steht: Prof. Dr.-Ing. Uwe Gleiter)
Course MAAI ENG 3.02: Advanced Suspension Systems	Prof. Dr.-Ing. Georg von Tardy-Tuch
Course MAAI ENG 3.03: Autonomous Systems: Architecture and Planning	Prof. Dr.-Ing. Raoul Zöllner
Course MAAI ENG 3.04: Reinforcement learning for embedded control systems	Prof. Dr.-Ing. Frank Tränkle
Course MAAI ENG 3.05: Autonomous Systems: Perception and Situation understanding	Prof. Dr.-Ing. Raoul Zöllner Prof. Dr.-Ing. Nicolaj Stache (Hessenthaler)
Course MAAI ENG 3.06: Digital Signal	Prof. Dr. Volker Stahl

Processing and pattern recognition	
Course MAAI ENG 3.07: Selected topics in manufacturing engineering	Prof. Dr.-Ing. Dipl.-Wirt Arndt Birkert
Course MAAI ENG 3.08: Real-time Systems	Prof. Dr.-Ing. Carsten Wittenberg
Course MAAI ENG 3.09: Industrial Processes in Material Engineering	Prof. Dr.-Ing. Marc Wettlaufer
Course MAAI ENG 3.10: Lightweight Car Body Engineering	Prof. Dr.-Ing. Dipl.-Wirt Arndt Birkert
Course MAAI ENG 3.11: Optical Sensors	Prof. Dr.-Ing. Peter Ott
Course MAAI ENG 3.12: Machine Learning in Computer Vision	Prof. Dr. rer. nat. Dieter Maier
Course MAAI SE 3.01: Information Visualisation	Dr. sc. hum. Monika Pobiruchin
Course MAAI SE 3.02: Usability Evaluation and Testing	Prof. Dr. rer. nat. Alexandra Reichenbach
Course MAAI SE 3.03: Change and Innovation Management	Prof. Dr.-Ing. Tomas Benz
Course MAAI SE 3.04: Digital Transformation - Case Studies	Prof. Dr. Christine Reck
Course MAAI SE 3.05: Digital Transformation - Strategies and Technologies	Prof. Dr. Christine Reck
Module MAAI 4a: Application Project with Colloquium	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI 4a.1: Application Project	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI 4a.2: Application Colloquium	Prof. Dr.-Ing. Nicolaj Stache
Module MAAI 4b: Research Project with Colloquium	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI 4b.1: Research Project	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI 4b.2: Research Colloquium	Prof. Dr.-Ing. Nicolaj Stache
Module MAAI 5: Elective Courses	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI 5.1: Project Management Training	Prof. Dr.-Ing. Patrick Balve
Course MAAI 5.2: Advanced Modelling and Simulation	Prof. Dr. Markus Scholle
Course MAAI 5.3: Numerics of Partial Differential Equations	Prof. Dr. Markus Scholle
Module MAAI 6: Master Thesis	Prof. Dr.-Ing. Nicolaj Stache
Course MAAI 6.1: Master Thesis	Prof. Dr.-Ing. Nicolaj Stache

Abbreviation Glossary

Abbreviation	Course Type
V	Lecture
L	Laboratory
S	Seminar
Ü	Exercise
PS	Simulation

Abbreviation	Examination Type
LK	Course-accompanying with written exam
LM	Course-accompanying with oral exam
LL	Course-accompanying with laboratory work
LR	Course-accompanying with presentation
LE	Course-accompanying with design project
LA	Course-accompanying with practical work
LKBK	Course-accompanying with a combined examination with a written exam as the final assessment
LKBM	Course-accompanying with combined examination with a final oral exam
LKBR	Course-accompanying with combined examination with a final presentation
LP	Course-related portfolio assessment
PK	Cross-course with written exam
PM	Cross-course with oral exam
PR	Cross-course with presentation
PA	Cross-course with practical work

Abbreviation	Preliminary Examination Type
SK	Preliminary examination with written exam
SL	Preliminary examination with laboratory work
SR	Preliminary examination with presentation
SE	Preliminary examination with design project
SA	Preliminary examination with practical work
SP	Preliminary examination with project work
SKBK	Preliminary examination with combined exam with a final written exam
SKBM	Preliminary examination with combined exam with a final oral exam
SKBR	Preliminary examination with combined exam with a final presentation

Abbreviation	Master Thesis Type
PT	Final Thesis (Master Thesis)

Aim of the Master's Program in Applied Artificial Intelligence

The Master's program Applied Artificial Intelligence (MAAI) aims to educate highly qualified professionals in the field of Artificial Intelligence (AI), equipping them to excel in both practical and research-based challenges. It is designed for graduates of the Bachelor's program "Applied Artificial Intelligence" (AKIB) as well as related disciplines and has a strong international focus. The program is offered in English and provides students with the choice between two specializations: "Application" and "Research."

Depending on the chosen specialization, students are specifically prepared for different fields of expertise:

1. Practice-Oriented Application Development (Application):

   Students acquire in-depth knowledge of the practical implementation of AI technologies across various application domains. They learn to develop complex AI-based systems, take on leadership roles in interdisciplinary project teams, and successfully implement these projects within such teams.

2. Research-Oriented Specialization (Research):

   The focus is on the scientific exploration of current challenges in the field of Artificial Intelligence. Students gain the competence to independently develop innovative research approaches and to rigorously evaluate them using scientific methods.

The curriculum includes both advanced mathematical and computer science modules as well as application-oriented subjects. Special emphasis is placed on machine learning, data analysis, artificial neural networks, and other advanced AI methods. Students can specialize in specific domains (see Appendix). Collaboration with experts in these fields fosters the practical application of acquired knowledge.

Key Objectives of the Program:

- Imparting Specialized Knowledge: Students gain a deep understanding of data science, machine learning, and AI technologies.
- Practical and Research Orientation: Combining theoretical knowledge with practical projects and scientific research.
- Interdisciplinary Qualification: Ability to apply AI in diverse fields and industries.
- International Orientation: Preparing graduates for the global job market through English-language courses and international perspectives.
- Social Responsibility: Enabling students to actively shape social, technical, and economic processes through AI.

The MAAI Master's program is aimed at technology-oriented graduates and early-career professionals who wish to deepen their knowledge of AI and contribute to the advancement of AI technologies in business, academia, and society. The modular structure of the study program allows for individual specialization, while the focus on application-oriented foundational knowledge and problem-solving methodology ensures comprehensive qualification.

Domain Profiles

In Module M3 "Domain Profile", students select a specific focus area that is documented on their certificate. This is achieved by successfully completing courses worth at least 10 ECTS credits within a Domain Profile. The current Domain Profiles include the following topics:

Health (HE): Artificial Intelligence in Medicine and Health Informatics

Artificial Intelligence is revolutionizing healthcare through innovative approaches in diagnostics, image processing, and decision support systems. Students acquire knowledge of AI-based software solutions for medical applications. These include clinical decision support, medical image processing, and the development of interactive systems, focusing on usability and regulatory requirements. Topics include:

- AI-supported medical diagnostics and decision support (Software Assisted Medical Diagnostics, Clinical Decision Support Systems)
- AI in medical image processing (Advanced Approaches for AI-based Image Processing, Milestones of AI-based Imaging Research)
- Human-machine interaction and usability in medicine (Mixed Reality Lab, Foundations in Human-Computer Interaction, Usability Evaluation and Testing)
- Regulatory and technological aspects of medical software (Software as Medical Device, Personalized Healthcare)

Digital Business (DB): Processes and Business Intelligence

The digital transformation requires efficient modeling, optimization, and automation of business processes, as well as innovative strategies for developing digital business models. Students learn methods for process management and analysis and develop strategies for digital corporate governance. Topics include:

- Modeling and optimization of business processes (Business Process Management, Business Process Optimization & Automation)
- Digital business strategies and transformation (Digital Business Models, Innovation & Strategy, Digital Transformation)

Logistics (LOG): AI and Optimization in Logistics and Supply Chain Management

AI-powered technologies enhance material flow, supply chains, and logistics processes. Students learn methods for simulating and optimizing global supply chains as well as data-driven decision models for the logistics industry. Topics include:

- AI-supported simulation and optimization of logistics processes (Material Flow Simulation with AI, Optimization of Supply Chains)
- Research and management in global supply chains (Research Methods and Applications in Logistics I, Managing Global Supply Chains)

Business Administration (BA): Management, Innovation, and the Digital Workplace

Modern business management requires digital skills, innovation management, and strategic decision-making. Students gain knowledge in leadership, corporate ethics, digital business models, and strategic management. Topics include:

- Leadership, ethics, and strategic management (Leadership and Communication, Business Ethics, Strategic Management)

- Entrepreneurship and digital innovations (Entrepreneurship and Innovation, Business Simulation)
- Marketing and human resource management in the digital economy (Advanced Digital Marketing, Digital Human Resource Management)

Engineering (ENG): Material Sciences and Autonomous Systems

Autonomous systems, AI-driven sensor technology, and materials science are key areas of modern engineering. Students learn methods for developing, optimizing, and controlling autonomous systems as well as AI-supported manufacturing technologies. Topics include:

- Architecture and control of autonomous systems (Autonomous Systems: Architecture and Planning, Autonomous Systems – Path Planning and Control, Autonomous Systems: Perception and Situation Understanding)
- AI in control engineering and real-time systems (Reinforcement Learning for Embedded Control Systems, Real-time Systems)
- Sensor technologies and signal processing (Optical Sensors, Digital Signal Processing and Pattern Recognition, Numerical Methods and Optimization)
- Materials science and manufacturing technology (Industrial Processes in Material Engineering, Lightweight Car Body Engineering, Selected Topics in Manufacturing Engineering)

Software Engineering (SE): Change and Innovation Management in Digital Transformation

The digital transformation is increasingly shaped by the use of artificial intelligence (AI). Companies face the challenge of implementing innovations efficiently, managing change processes, and making data-driven decisions. Students acquire in-depth knowledge of the strategic use of AI to optimize business models, evaluate technological developments, and successfully manage digital transformation processes. Topics include:

- Change and innovation management in the age of AI (Change and Innovation Management)
- Strategies and case studies on AI-driven digital transformation (Digital Transformation - Strategies and Technologies, Digital Transformation - Case Studies)
- Information visualization and data-driven decision models with AI (Information Visualization)

Module MAAI 1 176010 Methods and Practices

Duration of the module	1. Semester
SWS	6
Type of examination	Module grade (without examination) consists of weighted individual assessments.
Credit points (ECTS)	10
Requirements for awarding credit points	
Person responsible for the module	Prof. Dr.-Ing. Nicolaj Stache
Teaching, learning and examination methods	As described for the lectures of the module.
Contents	In Module M1, all students are prepared for their future project work by learning the fundamentals of scientific research in "Research in Applied AI" (5 ECTS) and gaining a hands-on approach in the "Applied AI Lab" (5 ECTS). These foundational elements ensure that students start their projects at a similar level of preparation, particularly supporting Modules M4a and M4b.
Professional competence: In-depth knowledge and comprehension	The students acquire fundamental methodological and practical competencies in the field of Artificial Intelligence, enabling them to engage in the areas of "Research in Applied AI" and "Applied AI Lab." The M1 module covers the basics of scientific work, experimentation, and analysis in the context of Artificial Intelligence. In addition, a practice-oriented approach is promoted, where students work on application-oriented projects. The goal is to provide students with a solid foundation that enables them to successfully engage in later projects and internships.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students acquire fundamental technical and methodological knowledge in the field of Artificial Intelligence, enabling them to apply scientific working methods and practice-oriented approaches.
Personal competence: Social competence	Students work in small groups on tasks and projects, present their results, and communicate their approaches and solutions in the context of Artificial Intelligence.
Personal competence: Independence / autonomy	Students are able to independently identify, formulate, and solve problems in the field of Artificial Intelligence. They can gather, evaluate, and integrate relevant information into their projects.

Competence level according to GQF	7
Requirements for participation	
Additional module details	The M1 "Methods and Practices" module is a prerequisite for subsequent modules in applied Artificial Intelligence. Successful participation is required for later involvement in practical and research-oriented projects in the Master's program.
Scheduled	See timetable.
Combined assessments	If relevant, it will be defined within the first three weeks of the lectures.

Course MAAI 1.1 176011 Research in Applied AI

This course is a mandatory course in the MAAI 1 module.

Person responsible for the course	Prof. Dr. rer. nat. Alexandra Reichenbach
Semester	1
Frequency	Winter term / Summer term
Type of course	V/S = Lecture with integrated seminar
Language of instruction	English
Course title	Research in Applied AI
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Mandatory course
Requirements for participation	
Teaching / learning methods	Individual lectures on topics of scientific research. Seminar with discussion of recent research articles. Lab visits to research institutions focusing on applied artificial intelligence, including presentations and scientific discourses. Group work with individual coaching sessions.
Professional competence: In-depth knowledge and comprehension	Students know the principles of good scientific practice and know what is important in scientific research and scientific writing. They also know research institutes associated with the degree program and have gained an insight into possible future fields of work. The students know how to carry out more extensive literature research using literature databases such as IEEE Xplore or ACM Digital Library and, if necessary, how to obtain the articles they find via electronic journal libraries. They also know how to obtain knowledge about a

	scientific topic based on the literature and how to communicate it comprehensibly in a review article.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students practiced discourse with scientists from the field of applied artificial intelligence and, in some cases, independently familiarized themselves with the relevant specialist areas. The students have acquired the ability to carry out more extensive literature research using literature databases such as IEEE Xplore or ACM Digital Library and such as Pubmed and, if necessary, to obtain the articles found via electronic journal libraries. They have also acquired the ability to examine a scientific topic based on original literature and to communicate it comprehensibly in a review article. Scientific peer review was practiced.
Personal competence: Social competence	Students experienced and practiced a constructive culture of scientific discourse. The students practice scientific work in groups and the process of giving and receiving feedback.
Personal competence: Independence / autonomy	Students can independently develop scientific content from in the research field of applied artificial intelligence using original research articles. The students independently develop a new scientific topic.
Competence level according to GQF	7
Contents	Scientific research: - literature search, scientific sources, citation, research question Scientific writing: - structure, language and style, evaluation of scientific work Getting to know selected local research institutes and their research topics. Recent scientific topics from a sub-area of applied artificial intelligence are discussed in greater depth and then developed and presented by the participants in a scientific review. The work of the peers is subject to a review.
Recommended optional programme components	
Additional specifics	Lab visits are organised as lecture series in the AI-related research institutes at HHN.

Literature / learning sources	Script incl recent literature will be published at the beginning of each semester
Scheduled	See timetable.
Combined assessments	Will be announced in the first three weeks of the semester

Course MAAI 1.2 176012 Applied AI Lab

This course is a mandatory course in the MAAI 1 module.

Person responsible for the course	Prof. Dr.-Ing. Nicolaj Stache Prof. Dr.-Ing. Carsten Lanquillon
Semester	1
Frequency	Winter term / Summer term
Type of course	L/S = Laboratory with Seminar
Language of instruction	English
Course title	Applied AI Lab
Credit points (ECTS)	5
SWS	2
Workload - contact hours	30
Workload - self-study	95
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Mandatory course
Requirements for participation	Proficiency in Python programming is required. Basic knowledge of machine learning concepts and familiarity with at least one machine learning framework (e.g., TensorFlow or PyTorch) are recommended.
Teaching / learning methods	The course integrates introductory lecture sessions with guided hands-on lab activities and project work. Students receive ongoing support through coaching and structured feedback sessions.
Professional competence: In-depth knowledge and comprehension	Students gain an understanding of the core principles and challenges in applying AI techniques to practical problems. They are introduced to key methods and tools for building AI systems in real-world contexts.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students acquire practical skills in implementing AI solutions for specific application areas. They learn to adapt and apply AI algorithms using Python and evaluate the performance of their solutions.

Personal competence: Social competence	Through presentation of solutions and collaboration, students will: - communicate technical details of AI solutions and results of their application to other students - answer questions on and discuss demanding technical issues with peers
Personal competence: Independence / autonomy	Students strengthen their ability to independently manage technical projects, solve problems, and reflect on their progress. They develop the confidence to tackle new challenges in applied AI.
Competence level according to GQF	7
Contents	- Introduction to the application of AI in selected domains such as industrial robotics and natural language processing. - Practical implementation of AI algorithms using Python and relevant frameworks. - Evaluation of AI models and system performance in different contexts. - Further considerations and challenges in applied AI.
Recommended optional programme components	Research in Applied AI
Additional specifics	Kickoff in Sontheim, followed by sessions in Sontheim and BC, depending on the thematic focus.
Literature / learning sources	Géron, A. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. O'Reilly. Chollet, F. Deep Learning with Python. Manning Publications. Online documentation and tutorials for Python AI frameworks.
Scheduled	See timetable.
Combined assessments	

Module MAAI 2 176020 AI Profiles

Duration of the module	2. Semester
SWS	16
Type of examination	Module grade (without examination) consists of weighted individual assessments.
Credit points (ECTS)	20
Requirements for awarding credit points	
Person responsible for the module	Prof. Dr.-Ing. Nicolaj Stache
Teaching, learning and examination methods	As described for the lectures of the module.
Contents	Module M2 "AI Profile" offers a wide range of specialized lectures covering advanced topics in artificial intelligence. These include Reinforcement Learning, Quantum Machine Learning, Generative Models for Autonomous Driving, Explainable AI (XAI), AI in Mobility, and Sustainability and Ethical Issues in AI. Additional topics include the integration of AI into embedded systems, cloud-based AI, AI-assisted quality assurance, and GPU programming for deep learning. These lectures provide in-depth insights into the latest technologies and their applications.
Professional competence: In-depth knowledge and comprehension	Through a selection of various events, students have the opportunity to scientifically expand their knowledge according to their own interests.
Professional competence: Conative skills, analysis and synthesis of knowledge	In their elective studies, students acquire in-depth theoretical knowledge and its practical application depending on the courses they choose.
Personal competence: Social competence	Depending on the chosen course, students work on tasks and selected topics in small groups, thereby developing teamwork skills. They are able to communicate professionally using the technical terms introduced in the lecture.
Personal competence: Independence / autonomy	The lecture content is independently deepened through exercises or application examples, depending on the chosen course. Students can classify, identify, formulate, and solve lecture-related questions. They are also able to collect, evaluate, and independently interpret relevant information.
Competence level according to GQF	7
Requirements for participation	
Additional module details	The Module can be used as Module M2 (AI Profiles), but the lectures of this module can also

	be chosen for the Module M5 (Elective Courses).
Scheduled	See timetable.
Combined assessments	If relevant, it will be defined within the first three weeks of the lectures.

Course MAAI 2.01 176021 Advanced Reinforcement Learning

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr.-Ing. Nicolaj Stache
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Advanced Reinforcement Learning
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	Lecture with integrated programming exercises: Presentation of theoretical content by the lecturer Practical programming tasks to deepen understanding Group discussions and Q&A sessions Project work in small groups or individually
Professional competence: In-depth knowledge and comprehension	• Students understand the mathematical foundations of Reinforcement Learning (e.g., MDPs, value functions, and policy functions). • They can explain and compare classical and advanced RL methods. • They understand the challenges of modern RL approaches (e.g., stability, scalability, exploration).
Professional competence: Conative skills,	• Students can effectively design and implement

analysis and synthesis of knowledge	their own RL environments. • They can apply advanced Deep Reinforcement Learning algorithms to problems, adjust parameters appropriately, and evaluate the results.
Personal competence: Social competence	• Students learn to plan and execute projects in groups. • They can present results clearly and engage in scientific discussions.
Personal competence: Independence / autonomy	• Students independently develop problem-solving strategies. • They learn how to find and understand papers on complex Deep RL algorithms.
Competence level according to GQF	7
Contents	1. Fundamentals of Reinforcement Learning (RL) Markov Decision Processes (MDPs) Value-function-based methods (e.g., Monte Carlo, Temporal-Difference Learning) Policy-based approaches Exploration vs. Exploitation 2. Classical RL Algorithms Q-Learning and its variants SARSA 3. Deep RL Methods Policy-gradient methods (e.g., REINFORCE, Actor-Critic) Proximal Policy Optimization (PPO) Deep Deterministic Policy Gradient (DDPG) and Twin Delayed DDPG (TD3) Soft Actor-Critic (SAC) 4. Recent Methods and Trends Meta-Reinforcement Learning (e.g., RL^2) Multi-Agent Reinforcement Learning (MARL) Hierarchical RL 5. Sim-to-Real Transfer Domain Randomization Domain Adaptation

	6. Model-Based Reinforcement Learning (MBRL) AlphaZero Dreamer 7. Applications and Practical Projects RL in simulations (e.g., OpenAI Gym, Mujoco) Designing and evaluating custom RL environments Applying state-of-the-art RL algorithms to real-world problems
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Grundlagenliteratur: * Sutton, R. S., & Barto, A. G. (2018). Reinforcement Learning: An Introduction (2nd Edition). MIT Press. * Szepesvári, C. (2010). Algorithms for Reinforcement Learning. Morgan & Claypool. Vertiefungsliteratur: * Lillicrap, T. P. et al. (2015). Continuous Control with Deep Reinforcement Learning. * Schulman, J. et al. (2017). Proximal Policy Optimization Algorithms. * Haarnoja, T. et al. (2018). Soft Actor-Critic Algorithms and Applications. Praktische Ressourcen: * OpenAI Gym: https://gym.openai.com * Mujoco: https://mujoco.org * RLlib (Ray): https://docs.ray.io/en/latest/rllib.html
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.02 176022 Quantum Machine Learning

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr. rer. nat. Alexander Windberger
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Quantum Machine Learning
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LKBK = Course-accompanying with a combined examination with a written exam as the final assessment
Exam duration	60
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	Lectures: Instructor-led introduction to quantum computing (QC) principles and quantum machine learning (QML) techniques Hands-on Exercises: Programming of quantum circuits using Python-based QC simulators Student Presentations: Presentation of specific QML algorithms, their characteristics, and applications Group Discussions: Exploration of challenges and potential in the field of quantum machine learning Self-Study: Independent research, reading, and practice with coding exercises
Professional competence: In-depth knowledge and comprehension	Familiarity with fundamental concepts of quantum computing, including the unique properties of

	qubits and quantum operations Understanding of how quantum algorithms differ from classical approaches, particularly in machine learning contexts Recognition of current research directions and future potentials in quantum computing and quantum machine learning
Professional competence: Conative skills, analysis and synthesis of knowledge	Develop basic quantum circuits and perform simulations in Python Implement and experiment with selected QML algorithms, analyzing their performance and scalability Interpret results in the context of quantum vs. classical approaches, identifying strengths and weaknesses Apply critical thinking to evaluate QML techniques for various real-world or research scenarios
Personal competence: Social competence	Collaborative Learning: Work in groups to discuss quantum algorithms, troubleshoot code, and evaluate results Communication Skills: Clearly present QML concepts and technical details to peers and instructors Feedback Culture: Provide and incorporate constructive feedback during presentations and group critiques
Personal competence: Independence / autonomy	Self-Initiated Study: Independently research advanced topics in quantum computing and QML Time Management: Effectively plan the coding, documentation, and presentation of QML experiments Self-Reflection: Continuously monitor and assess personal learning progress to identify areas requiring further exploration
Competence level according to GQF	7
Contents	Fundamentals of Quantum Computing (QC): State of the Art and Perspectives Programming QC in Python simulators Selected Quantum Machine Learning (QML) algorithms: Implementation, specific characteristics, and potential

Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	lecture notes, code examples, scientific publication and online resources on selected topics
Scheduled	See timetable.
Combined assessments	Will be announced in the first three weeks of the semester

Course MAAI 2.03 176023 Advanced Generative Models for Automated and Connected Driving

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Marc René Zofka
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	S = Seminar
Language of instruction	English
Course title	Advanced Generative Models for Automated and Connected Driving
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	Students investigate, analyze, and present current research work in the field of Generative AI in the domain of Automated and Connected Driving. The seminar emphasizes practical insights by examining open-source algorithms and frameworks (e.g., classifiers, generators, simulators) published in state-of-the-art literature, as well as the datasets used for training and evaluation. Depending on the available research literature, the work may also be conducted in groups. In addition to acquiring methodological knowledge, students focus on practical application, analysis, presentation, and scientific discourse.
Professional competence: In-depth knowledge and comprehension	Students will address AI based methods as basis for Automated and Connected Driving, the Validation and Verification as well as related and adjacent problems. Using specific questions and

	problems as examples, students learn to investigate methods of generative AI and to evaluate the use of data sources for training and evaluation. The handling of open source algorithms and open data datasets will be discussed and practiced.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will learn to acquire and analyse literature of the current state of the art from literature databases and sources such as IEEE, ACM, etc.
Personal competence: Social competence	Students will learn to prepare, present and discuss methods and algorithms from literature of the current state of the art.
Personal competence: Independence / autonomy	Students will learn how to independently analyse the state of the art literature and evaluate research work according to its preliminary and subsequent work.
Competence level according to GQF	7
Contents	The learning content addresses approaches of Generative AI (NeRF, LLM, GNN, ...) in the context of the applications for a) autonomous driving (functional view) and b) validation and verification of autonomous driving. In addition to analyzing methodological approaches, practical implementations of the methods (open source) and underlying data sets (open data) for training and evaluation will be evaluated and presented by the students.
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.04 176024 Explainable AI (XAI)

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr.-Ing. Carsten Lanquillon
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	L/S = Laboratory with Seminar
Language of instruction	English
Course title	Explainable AI (XAI)
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LP = Course-related portfolio assessment
Exam duration	Presentation (30-45 minutes), technical paper (8-10 pages)
Type of course unit	AI Profile Elective course
Requirements for participation	Formally none, but basic knowledge of AI and machine learning as well as Python is required.
Teaching / learning methods	Introductory lectures (keynote presentations), paper presentations and discussions, problem-based learning in group work (student projects/case studies)
Professional competence: In-depth knowledge and comprehension	Students will acquire comprehensive and in-depth knowledge in explainable AI (XAI), building upon their prior expertise in artificial intelligence and machine learning. Upon completion, students will understand: -The necessity of explainability in AI systems, key concepts, methods, and theories of XAI. -Various XAI approaches, including post-hoc explanations, inherently interpretable models, and local and global explanation methods.

	-The limitations and challenges of interpreting complex models, and the relevance of explanations in critical domains such as healthcare, finance, and autonomous systems. -Ethical and regulatory aspects of explainability within a broader societal context. -Current research trends, identifying existing gaps and exploring potential new solutions. This knowledge serves as the foundation for the independent development, evaluation, and application of XAI methods in research and practical contexts, with the overarching goal of making AI models' decision-making processes transparent, interpretable, and understandable to humans, ensuring trust, accountability, and compliance with ethical and regulatory standards.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will be able to: -Select, implement, and adapt appropriate XAI methods (e.g., SHAP, LIME, Layer-Wise Relevance Propagation, Counterfactual Explanations) based on specific application cases and requirements. -Present complex data relationships transparently and prepare explanations tailored to different stakeholders. -Extend existing AI models with explainable components and assess the quality of explanations using quantitative and qualitative metrics. -Evaluate and optimize AI models (e.g., decision trees, neural networks, deep learning models) for interpretability and transparency. -Formulate their own research questions and develop methodologically sound solutions for challenges in the XAI field, such as handling uncertainty and complexity in deep models. Through these skills, students will be equipped to contribute to AI systems that are transparent, interpretable, and understandable, fostering trust and compliance in various applications.
Personal competence: Social competence	Through lectures, workshops, and practical group work, students will learn to: -Collaborate in interdisciplinary teams, integrating technical AI expertise with domain-specific

	knowledge from law, ethics, and engineering. -Communicate model interpretation results effectively to both technical and non-technical stakeholders. -Consider diverse perspectives and requirements (e.g., usability vs. data protection, regulatory compliance vs. technical feasibility). -Recognize and discuss ethical conflicts and social implications of explainable AI, integrating them into decision-making processes. -Develop solutions for XAI challenges in group projects and present them convincingly, contributing to the broader goal of fostering transparency and accountability in AI systems.
Personal competence: Independence / autonomy	Students will: -Independently reflect on the need for explainable AI in their professional or research environment and set continuous learning goals. -Make informed decisions about the design, implementation, and deployment of explainable AI systems, considering technical, ethical, and societal implications. -Stay current with new and evolving XAI methods and integrate them into their own projects. -Continuously evaluate the suitability of XAI techniques for specific requirements and understand their limitations. -Take responsibility for the quality and integrity of their AI work, reflecting on their contributions within the broader context of innovation, transparency, and societal expectations, ensuring AI models remain interpretable and trustworthy.
Competence level according to GQF	7
Contents	This comprehensive course on explainable AI (XAI) covers fundamentals including motivations, definitions, and the distinction between post-hoc explanations and inherently interpretable models. The curriculum provides hands-on experience with practical interpretation methods like SHAP and LIME, along with their application across various model types using Python tools. The content emphasizes evaluation through quantitative and qualitative metrics, while focusing on effective communication of complex

	model decisions through user-friendly interfaces. The program includes real-world applications in domains such as health, business, and engineering and incorporates discussions of ethical, legal, and social implications. The combined theoretical foundation and practical implementation experience enables the design of explainable AI solutions that foster trust and accountability.
Recommended optional programme components	Mechanistic Interpretability
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	-Adadi, A., & Berrada, M. (2018). Peeking Inside the Black-Box: A Survey on Explainable Artificial Intelligence (XAI). IEEE Access. -Barredo Arrieta, A., et al. (2020). Explainable Artificial Intelligence (XAI): Concepts, taxonomies, opportunities and challenges. Information Fusion. -Doshi-Velez, F., & Kim, B. (2017). Towards a Rigorous Science of Interpretable Machine Learning. arXiv preprint. -Gilpin, L.H., et al. (2018). Explaining Explanations: An Approach to Evaluating Interpretability of Machine Learning. arXiv preprint. -Hall, P. (2018). Machine Learning Interpretability with Python. O’Reilly Media. -Koh, P.W., et al. (2020). Understanding Black-box Predictions via Influence Functions -Lundberg, S.M. & Lee, S.-I. (2017). A unified approach to interpreting model predictions. In Proceedings of the 31st International Conference on Neural Information Processing Systems (NIPS '17). Curran Associates Inc., Red Hook, NY, USA, 4768–4777. -Molnar, C. (2022). Interpretable Machine Learning. Lulu.com. -Montavon, G. et al. (2019). Methods for Interpreting and Understanding Deep Neural Networks. -Parisineni, S.R.A., & Pal, M. (2024). Enhancing trust and interpretability of complex machine learning models using local interpretable model agnostic shap explanations. Int J Data Sci Anal 18, 457–466. -Ribeiro, M.T., Singh, S., & Guestrin, C. (2016). "Why Should I Trust You?": Explaining the

	Predictions of Any Classifier. In Proceedings of the 22nd ACM SIGKDD International Conference on Knowledge Discovery and Data Mining (KDD '16). Association for Computing Machinery, New York, NY, USA, 1135–1144. -Salih, A.M., Raisi-Estabragh, Z., Galazzo, I.B., Radeva, P., Petersen, S.E., Lekadir, K. and Menegaz, G. (2024), A Perspective on Explainable Artificial Intelligence Methods: SHAP and LIME. Adv. Intell. Syst., 7: 2400304. -Samek, W. et al. (2017). Explainable AI: Interpreting, Explaining and Visualizing Deep Learning.
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.05 176025 Mechanistic Interpretability

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr.-Ing. Carsten Lanquillon
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	L/S = Laboratory with Seminar
Language of instruction	English
Course title	Mechanistic Interpretability
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LP = Course-related portfolio assessment
Exam duration	Presentation (30-45 min.), technical paper (8-10 pp)
Type of course unit	AI Profile Elective course
Requirements for participation	Formally none, but basic knowledge of AI and machine learning as well as Python is required.
Teaching / learning methods	Introductory lectures (keynote presentations), paper presentations and discussions, problem-based learning in group work (student projects/case studies)
Professional competence: In-depth knowledge and comprehension	Students will acquire comprehensive knowledge in mechanistic interpretability, building upon their expertise in AI and machine learning to study and understand how AI models work internally. Upon completion, students will understand: -Core principles and necessity of mechanistic interpretability in AI systems -Internal mechanisms of neural networks, particularly transformers, including circuits, attention heads, and activation patterns -Key challenges such as superposition,

	polysemantic neurons, and emergent behaviours -Mathematical frameworks for analyzing model behavior and information flow -Ethical implications and safety considerations, including bias detection and transparency-security trade-offs
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will be able to: -Use specialized tools and libraries such as TransformerLens, CircuitsVis, PyTorch hooks for model analysis and visualization -Design and conduct causal interventions to validate hypotheses about model mechanisms -Reverse-engineer architectures in language and vision models -Implement model editing and interpretability-driven safety solutions -Develop and validate robust explanations using appropriate metrics -Apply mechanistic insights to improve model transparency and safety
Personal competence: Social competence	Through collaborative work, students will: -Work effectively in interdisciplinary teams to audit AI systems -Communicate mechanistic insights to both technical and non-technical stakeholders -Engage in constructive peer review and feedback processes -Consider and debate diverse perspectives on transparency and safety requirements and ethical implications
Personal competence: Independence / autonomy	Students will: -Formulate original research questions and design systematic investigations -Evaluate and adapt cutting-edge mechanistic interpretability methods -Reflect on societal impact and potential misuse of AI models -Take responsibility for research integrity and

	reproducibility -Maintain current knowledge of evolving tools and literature
Competence level according to GQF	7
Contents	Mechanistic interpretability aims to understand how neural networks process information and generate outputs by reverse engineering their internal mechanisms. The content covers neural network fundamentals including architectures, information flow, and core concepts like circuits, superposition, and scaling laws, alongside causal interventions and explanation frameworks. Practical techniques encompass activation analysis, circuit discovery, visualization methods, and model editing tools, with focus on robust explanation metrics. Advanced topics address emergent behaviours in large models, automated circuit discovery, and the intersection of transparency and security, while examining safety mechanisms and future directions. The combination of theory and hands-on applications enables systematic analysis of neural networks' information processing and output generation.
Recommended optional programme components	Explainable AI
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	-Anthropic (2023). Core Views on AI Safety and Mechanistic Interpretability -Cammarata, N. et al. (2020). Circuits Thread. (Distill) -Elhage, N. et al. (2022). A Mathematical Framework for Transformer Circuits. (Anthropic) -Kästner, L., Crook, B. Explaining AI through mechanistic interpretability. Euro Jnl Phil Sci 14, 52 (2024). https://doi.org/10.1007/s13194-024-00614-4 -Nanda, N. (2023). Transformer Circuits Tutorial Series -Olah, C., et al. (2020). Zoom In: An Introduction to Circuits -Sharkey, L., et al. (2025). Open Problems in Mechanistic Interpretability. -Wang, K., et al. (2022). Interpretability in the Wild: Reverse-Engineering GPT-4's Math Abilities

	-Zeiler, M.D. & Fergus, R. (2014). Visualizing and Understanding Convolutional Networks. Current technical contributions from conference proceedings (e.g. NeurIPS, ICLR, ACL) and research blogs (e.g. Distill.pub, Anthropic Research) will be announced in the course.
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.06 176026 Embedded AI

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr. rer. nat. Marco Wagner
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Embedded AI
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LKBK = Course-accompanying with a combined examination with a written exam as the final assessment
Exam duration	90
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	Lecture with integrated (programming) exercises: - Presentation of theoretical content by the lecturer - Self-guided learning in small groups or individually - Practical programming tasks to deepen the content - Group discussions and Q&A sessions - Project work in small groups or individually
Professional competence: In-depth knowledge and comprehension	Students understand the differences between model execution on high performance computers and embedded systems Students are familiar with the most important KPIs for model resources

	Students understand the most important methods to increase model efficiency Students are familiar with the most important software frameworks for embedded AI Students are familiar with the most important hardware elements to support model execution and training Students understand the typical process of creating and optimizing model for embedded AI
Professional competence: Conative skills, analysis and synthesis of knowledge	Students can criticially evaluate which measures or methods are sutiable for different use cases Students are able to analyze and rate the different metrics and KPIs of optimized models Students are able to learn additional methods for compression and optimization in a self-guided manner
Personal competence: Social competence	Students will learn to understand and how to interact with different expert groups an stakeholders in embedded AI development Students are able to solve technical challenges in the area of embedded AI, both as an individual and in a team
Personal competence: Independence / autonomy	As part of the integrated exercises, students can reflect on their own knowledge level and align their learning processes accordingly. Students can independently and responsibly apply their knowledge and methods, develop solutions, and present them.
Competence level according to GQF	7
Contents	Model optimization and compression are important measures in order to allow efficient execution of neural networks, especially in resource-constrained embedded systems. Furthermore, additional hardware elements and software frameworks for embedded AI are discussed, both in training and inference.
Recommended optional programme components	-
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Chip Huyen: “Designing Machine Learning Systems”, O'Reilly Media, Inc. 2022, ISBN: 9781098107963 Daniel Situnayake, Jenny Plunkett: “AI at the Edge”, O'Reilly Media, Inc. 2023, ISBN: 9781098120207

	Gian Marco Iodice: “TinyML Cookbook: Combine machine learning with microcontrollers to solve real-world problems”, Packt Publishing Limited 2023, ISBN: 9781837637362 Pete Warden and Daniel Situnayake: “TinyML: machine learning with TensorFlow Lite on Arduino and ultra-low-power microcontrollers”, O'Reilly Media, Inc. 2020, ISBN: 9781492052043
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.07 176027 AI in Mobility

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Dr. Mihai Kocsis
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	S = Seminar
Language of instruction	English
Course title	AI in Mobility
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	The seminar begins with presentation of theoretical content by the lecturer, providing a foundation for understanding the key concepts and applications of Artificial Intelligence in mobility. Students will then explore, analyze, and present state-of-the-art research and practical applications in areas such as autonomous vehicles, traffic optimization, and shared mobility.
Professional competence: In-depth knowledge and comprehension	Students get a comprehensive understanding of how Artificial Intelligence is transforming the transportation and mobility landscape. •Understanding the role of AI technologies (machine learning, deep learning, and computer vision) in mobility. •Exploring key concepts such as autonomous driving, traffic management, shared mobility, and logistics optimization.

	•Hands-on experience with tools, frameworks, and datasets commonly used in mobility-related AI applications (e.g., Python, TensorFlow, SUMO, Carla). •AI solutions for challenges in urban traffic management, vehicle routing, and demand forecasting. •Simulation and testing of mobility scenarios using real-world or synthetic data. •Analyzing real-world case studies to evaluate the effectiveness of AI-based mobility solutions. •Identifying challenges in scaling and deploying AI technologies in transportation systems. •Understanding the ethical considerations surrounding AI in mobility. •Exploring current regulatory frameworks and their impact on AI deployment in transportation. •Gaining insights into emerging trends and innovations in AI for mobility, such as flying taxis, hyperloop systems, and Mobility-as-a-Service (MaaS).
Professional competence: Conative skills, analysis and synthesis of knowledge	In addition to the technical lecture content, the course is intended to encourage creative thinking for developing sustainable and intelligent transportation systems of the future.
Personal competence: Social competence	Students are able to engage in scientific discourse and constructive critique of AI applications in mobility.
Personal competence: Independence / autonomy	Students investigate state-of-the-art research (classifiers, simulators, optimization algorithms). Students present research findings and practical implementations effectively in written and verbal formats.
Competence level according to GQF	7
Contents	1.Overview of AI applications in mobility: autonomous vehicles, predictive maintenance, traffic optimization, and shared mobility. 2.AI and Autonomous Vehicles 3.Image and video processing for pedestrian and vehicle detection. Applications in traffic monitoring and accident prevention.

	4.AI techniques for traffic prediction and congestion management; Machine learning models for traffic flow; Smart traffic signals and route optimization. 5.AI for Shared and Sustainable Mobility: Applications of AI in ride-sharing and micro-mobility; Demand prediction and fleet management algorithms. 6.AI in Logistics and Freight Transport: Route planning, cargo tracking, and warehouse automation. 7.Simulation and Digital Twins for Mobility Systems: Digital twins for urban planning and vehicle testing; AI’s role in scenario testing and decision-making 8.Ethical considerations in AI-driven mobility: Safety, privacy, and data security. 9.Future Trends in AI Mobility: Flying taxis, hyperloops, and autonomous delivery systems; The role of AI in Mobility-as-a-Service (MaaS).
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.08 176028 Social Bias in AI

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr. Nicola Marsden
Semester	1 / 2 Semester
Frequency	1x/year
Type of course	V/L = Lecture with integrated laboratory
Language of instruction	English
Course title	Social Bias in AI
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	Interactive lectures on social bias in AI and de-biasing strategies. Critical evaluation of recent academic papers on social bias and fairness in AI. Moderated group work analyzing real-world examples of biased AI systems. Project-based learning to design de-biasing solutions. Student presentations to synthesize and communicate findings.
Professional competence: In-depth knowledge and comprehension	Students will: Understand the origins and consequences of social bias in AI systems. Gain knowledge of ethical frameworks for mitigating social bias. Explore state-of-the-art de-biasing techniques for

	addressing social inequalities in AI.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will: Critically analyze AI systems for social bias and fairness issues. Design and evaluate de-biasing interventions to promote fairness. Synthesize research on social bias in AI into actionable insights.
Personal competence: Social competence	Students will: Collaborate in diverse teams to tackle challenges related to social bias. Facilitate discussions on ethical implications of biased AI. Respect diverse perspectives to foster inclusive problem-solving.
Personal competence: Independence / autonomy	Students will: Independently evaluate current research on social bias in AI. Reflect on their own biases and ethical responsibilities as AI practitioners. Apply knowledge to address real-world challenges in de-biasing AI systems.
Competence level according to GQF	7
Contents	Foundations of social bias in AI: types, origins, and societal impact. Ethical and cultural considerations in addressing social bias. Methods for identifying and mitigating social bias in datasets and models. Case studies of social bias in AI applications (e.g., hiring, healthcare, law enforcement). Human-centered, inclusive design principles for AI systems.
Recommended optional programme components	
Additional specifics	open
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.09 176029 AI Ethics

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Ulrike Weingart, PhD
Semester	1 / 2 Semester
Frequency	1x/year
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	AI Ethics
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LP = Course-related portfolio assessment
Exam duration	Presentation (15-20 min.), paper (10 pp)
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	The course uses a combination of interactive lectures, discussions and problem-based learning. Students critically engage with recent academic papers and real-world case studies on AI ethics, focusing on issues such as social bias, transparency and accountability. Facilitated group work and project-based learning encourage collaborative analysis and the development of mitigation strategies. Case studies and student presentations enhance practical understanding and communication skills.
Professional competence: In-depth knowledge and comprehension	Students will -Develop a basic understanding of ethical principles in AI, including fairness, transparency and accountability. -Critically analyse biases in AI systems and evaluate strategies for mitigating ethical risks. -Examine the legal and societal implications of AI

	deployment and explore frameworks for responsible AI governance.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will -Apply ethical frameworks to evaluate AI systems and identify potential biases -Develop critical thinking skills to analyse and interpret ethical challenges in AI through case studies and academic literature. -Formulate and present well-reasoned arguments about AI ethics and propose solutions for responsible AI development and governance.
Personal competence: Social competence	Students will: -Engage in constructive discussions about ethical dilemmas in AI, respecting different perspectives. -Work in teams to analyse real-world cases and develop ethical AI solutions. -Improve their ability to communicate complex ethical issues effectively to both technical and non-technical audiences.
Personal competence: Independence / autonomy	Students will: -Independently explore ethical challenges in AI and critically reflect on their societal implications. -Take responsibility for evaluating AI systems using ethical frameworks and guidelines. -Develop self-directed learning skills to keep abreast of evolving AI ethics debates and regulatory developments.
Competence level according to GQF	7
Contents	The AI Ethics module covers fundamental ethical principles in AI, including fairness, transparency, accountability, and privacy. It begins with an introduction to the history of ethics and explores the question: Why AI Ethics? Students will investigate ethical values and principles relevant to interactions between humans and intelligent machines, examining key normative ethical theories and their application to AI Ethics. The course considers public perceptions of AI ethics, the professional responsibilities of

	computer scientists, and the regulatory landscape, including governance frameworks that integrate social, legal, technical and political concerns. Core concepts of AI ethics such as bias, fairness, transparency and accountability will be analysed in depth, along with practical approaches to implementing responsible AI development. Through case studies, students will explore real-world challenges and strategies for ethical AI deployment, including the design of AI ethics committees. Finally, the module reflects on the future of AI and its societal implications, covering topics such as labour market changes, cross-cultural understanding, decision-making and human rights.
Recommended optional programme components	Basic knowledge / interest of philosophy/ ethics and the English Language
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	Books: Gerard O’Regan (2024), Ethical and Legal Aspects of Computing. A Professional Perspective from Software Engineering, ISBN 978-3-031-52664-0 Klaus Mainzer, (2024), Philosophisches Handbuch Künstliche Intelligenz. Springer 978-3-658-19606-6 Paula Boddington (2023), AI Ethics. A Textbook. Springer, 978-981-19-9384-8 Markus D. Dubber; Frank Pasquale; Sunit Das (2021), The Oxford Handbook of Ethics of AI, Oxford University Press, 9780197601440 S. Matthew Liao (2020), Ethics of Artificial Intelligence, Oxford University Press, 9780190905040 Online: AI and Ethics, Editors-in-Chief: John MacIntyre, Larry Medsker, Springer, Journal (accessible via Springer Link) Ethics of Artificial Intelligence by the UNESCO, https://www.unesco.org/en/artificial-intelligence/recommendation-ethics Further literature will be provided shortly before the start of the module AI Ethics

Scheduled	See timetable.
Combined assessments	

Course MAAI 2.10 176031 Digital Twin Design for Automated and Connected Mobility

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Marc René Zofka
Semester	1 / 2 Semester
Frequency	1x/year
Type of course	V/P = Lecture with accompanying project
Language of instruction	English
Course title	Digital Twin Design for Automated and Connected Mobility
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	Required proficiency in at least one object-oriented programming language, C++ or Python.
Teaching / learning methods	Presentation of theoretical content by the lecturer Lectures with practical examples, videos, code snippets, and simulations where applicable Self-study: preparation and review of lectures Accompanying project work in small groups or individually, including C++/Python components using ROS2
Professional competence: In-depth knowledge and comprehension	Students will gain knowledge about: • Concepts of digital twins • The difference between simulations and digital twins • Key modeling languages used in digital twins for

	traffic environments • Applications of sensor technology, communication, and actuators in smart traffic environments, both vehicle-based and infrastructure-based * Application of AI in advanced driver assistance systems (ADAS), highly automated driving (HAD) and Smart Infrastructure • Approaches for V2X-communication between vehicles as well as between vehicles and smart infrastructure * Application of Mixed Reality in Digital Twins * Test Areas for Automated and Connected Driving Students will be able to: • Real Prototype Control Units, such as V2X roadside and onboard units, using ros2 with Python/C++ • Extract virtual sensor data from digital twin • Control actuator signals of a smart vehicle or smart infrastructure within a digital twin • Set up scenarios in an example simulation environment • Implement smart vehicle or infracture functions (GLOSA, CACC,...)
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will gain competence in designing digital twins for mobility applications. They will develop skills in problem-solving, collaboration and practical implementation skills.
Personal competence: Social competence	Teamwork and collaborative skills through group projects
Personal competence: Independence / autonomy	Self-study, independent engagement with theoretical concepts, researching solutions
Competence level according to GQF	7
Contents	The lecture "Design of Digital Twins for Automated and Connected Mobility Applications" provides a systematic overview of digital twins in the context of automated and connected driving. It covers the fundamentals, functions, and methods within vehicles as well as smart infrastructure. Using these intelligent systems in traffic environments as an example, various participants and their role as sensor-actuator

	systems are analyzed. This lecture aims to enable students to identify fundamental requirements for the creation of digital twins in a technology- and information-driven manner (including models, communication, middleware, etc.) and to design mobility systems and their digital twins accordingly. Students will be enabled to develop their own solutions for specific application cases while considering functionalities, interfaces, and their expandability. Accompanying the lecture, practical code examples, libraries, and scenarios in simulation environments will be provided to support self-study. The accompanying teaching project aims to transfer theoretical knowledge into practice by integrating a concrete problem into a traffic (flow) simulation, real control units, and traffic displays within a digital twin, ultimately integrating them into a shared environmental model.
Recommended optional programme components	Autonomous Systems: Deep Learning Autonomous Systems: Path Planning and Control
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.11 176032 Mobility services and Autonomous Driving

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Dr. Mihai Kocsis
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/P = Lecture with accompanying project
Language of instruction	English
Course title	Mobility services and Autonomous Driving
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	Programming skills in C++ or Python
Teaching / learning methods	The lecturer provides comprehensive presentations introducing key concepts, technologies, and trends related to mobility services and autonomous driving. Exercises and small projects allow students to apply theoretical knowledge, work with simulation tools, and analyze real-world data.
Professional competence: In-depth knowledge and comprehension	The students: •Understand concepts, trends, and societal impacts of autonomous mobility. •Learn the fundamentals of sensors, AI, V2X communication, and simulation. •Analyze mobility services such as ride-sharing, MaaS, and fleet management. •Comprehend the concept of Software Defined Vehicles (SDV) and its challenges. •Apply AI for autonomous systems, traffic

	optimization, and mobility services. •Use simulation and software tools like ROS2, CARLA, and Autoware. •Develop practical solutions through simulation, data analysis, and prototyping. •Evaluate future trends such as Urban Air Mobility and sustainable transportation.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will gain competence in applying technologies like AI, sensors, V2X, and simulation tools to analyse and optimize mobility services and traffic flows. They will develop problem-solving, collaboration, and future-oriented thinking skills and be able to assess emerging trends in autonomous and sustainable mobility.
Personal competence: Social competence	Teamwork and collaborative skills through group projects
Personal competence: Independence / autonomy	
Competence level according to GQF	7
Contents	1. Introduction to mobility services (ride-sharing, MaaS) and autonomous driving 2. Autonomous driving technologies: sensors, AI, V2X communication, simulation 3. Mobility services: ride-hailing, car/bike-sharing, fleet management, renewable energy integration 3. Software Defined Vehicles (SDV): concepts, OTA updates, challenges 4. AI for autonomous driving and mobility services: object recognition, route optimization, traffic flow control 5. Tools and simulation: ROS2, CARLA, Autoware, traffic simulation, data analysis 6. Project work: development and evaluation of innovative mobility concepts 7. Future trends: AI in mobility, Urban Air Mobility, sustainable transportation concepts
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.12 172492 Advanced Approaches for AI-based image processing

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr. rer. nat. Alexander Windberger
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	L = Laboratory
Language of instruction	English
Course title	Advanced Approaches for AI-based image processing
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	Lectures to convey theoretical foundations, Exercises and programming tutorials for practical application of the concepts learned, Project work in groups involving the practical implementation of vision based deep learning models and use cases, Independent study
Professional competence: In-depth knowledge and comprehension	Understanding the theoretical foundations of deep learning models in image processing, Assessing the applicability of various models and methods for specific image processing tasks, Knowledge of key metrics and evaluation procedures for assessing model quality
Professional competence: Conative skills,	Independent implementation of deep learning

analysis and synthesis of knowledge	approaches for image classification and localization, Comparing and selecting suitable models and architectures for complex image processing tasks, Analyzing and optimizing model performance through hyperparameter tuning, suitable datasets, and validation metrics
Personal competence: Social competence	Teamwork through joint project work (planning, coordination, and presentation of results), Communication and discussion of technical solutions within a team and in group settings, Collaboration in troubleshooting and developing solutions together
Personal competence: Independence / autonomy	Self-directed learning and deepening knowledge through literature and online research, Independent problem-solving when developing and validating deep learning models, Reflecting on one’s own approach to continuously improve methodological skills
Competence level according to GQF	7
Contents	Advanced methods for classification and localization tasks with deep learning. Validation of models using appropriate metrics. Approaches to increasing the transparency and reliability of deep learning systems. Course-accompanying projects.
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	lecture notes, code examples, scientific publication and online resources on selected topics
Scheduled	See timetable.
Combined assessments	Will be announced in the first three weeks of the semester

Course MAAI 2.13 172493 Milestones of AI-based Imaging Research

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr. rer. nat. Alexander Windberger
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	S = Seminar
Language of instruction	English
Course title	Milestones of AI-based Imaging Research
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	AI Profile Elective course
Requirements for participation	
Teaching / learning methods	Journal Club: Joint reading and discussion of selected scientific publications Introductory Lectures: Instructor-led introductions to relevant topics and publications Student Presentations: Presentations and moderation by students based on selected articles Group Discussions: Critical reflection on the contents during discussions and feedback sessions Self-Study: Independent research, reading, and analysis of further sources
Professional competence: In-depth knowledge and comprehension	Overview of key research results and their historical context in AI-based imaging In-depth understanding of significant architectures and approaches Reflection on the importance of publicly available

	datasets and code for reproducibility Assessment of scientific progress based on methodological quality and practical relevance
Professional competence: Conative skills, analysis and synthesis of knowledge	Research and locate current scientific publications in journals and conference proceedings Analyze and structure research findings and their experimental setups Present and convey complex content in an accessible manner Critically question and argue regarding study quality, reproducibility, and practical relevance
Personal competence: Social competence	Cooperative Discussion: Contribute constructively in group work and discussion rounds Feedback Culture: Learn to offer and receive constructive criticism Teamwork: Collaborate on problem-solving based on scientific sources
Personal competence: Independence / autonomy	Initiative: Independently select and prepare publications and their context Time and Self-Management: Structure learning processes for preparation, presentation, and reflection Self-Reflection: Continuously assess one’s own learning progress and deepen knowledge as needed
Competence level according to GQF	7
Contents	Historical milestones (from 2012 to the present) of deep learning-based imaging Core concepts of machine learning in image processing based on the respective original publications Scientific research methodology Analysis and evaluation of models and their results Current trends and future developments in AI-based imaging
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	lecture notes, code examples, scientific publication and online resources on selected

	topics
Scheduled	See timetable.
Combined assessments	Will be announced in the first three weeks of the semester

Course MAAI 2.14 262313 AI-assisted Quality Assurance in Agile Software Processes

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Dr. sc. hum. Richard Zowalla
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	AI-assisted Quality Assurance in Agile Software Processes
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LKBK = Course-accompanying with a combined examination with a written exam as the final assessment
Exam duration	60
Type of course unit	AI Profile Elective course
Requirements for participation	None Beneficial: •Sound knowledge of Java (or another object-orientated language. •Knowledge of software development processes, basic understanding of artificial intelligence and machine learning methods.
Teaching / learning methods	•Lectures and theoretical discussions •Hands-on exercises and practical applications •Analysis and discussion of current research

	papers •Guest lectures from industry experts •Group projects and presentation
Professional competence: In-depth knowledge and comprehension	Students will be introduced to the integration of AI and ML techniques in quality assurance and code review, covering the fundamental principles required for implementing AI-driven approaches in agile software development. They will learn the essential concepts of AI-powered tools and methodologies, focusing on their practical application within user-centered, agile development processes to enhance software quality and efficiency.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will: •Have a comprehensive understanding of how AI can enhance quality assurance practices and code review processes within agile software development. •Be able to apply AI-driven approaches to improve software quality, streamline development processes, and increase the efficiency of code reviews. •Demonstrate the ability to integrate AI-powered tools into real-world agile development scenarios. •Critically analyze and address ethical considerations related to AI applications in quality assurance and code review, including issues of bias and fairness.
Personal competence: Social competence	The students are enabled to evaluate the work results of others from a professional and objective point of view and to communicate to communicate appreciative, constructive criticism.
Personal competence: Independence / autonomy	Students are enabled to familiarize themselves independently with their own and external scientific issues. The students can carry out (specialized) research independently, select the appropriate (software) tools for automated, AI-based testing and apply what they have learnt in the apply what they have learnt in the course to a specific work situation in a concrete work situation.

Competence level according to GQF	7
Contents	Basics of Software Quality (SWQ) Management: SWQ Attributes SWQ Measures SWQ Scenarios Classical / Traditional approaches to enhance (Code) Quality AI-Assisted SWQ Introduction to AI-based Testing Using Generative AI (LLMs) for Testing Activities Ethical Considerations and Bias Mitigation
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Will be announced in the first course unit
Scheduled	See timetable.
Combined assessments	

Course MAAI 2.15 285641 Advanced Data Management & Engineering

This course is a mandatory course in the MAAI 2 module.

Person responsible for the course	Prof. Dr. rer. nat. Helmut Beckmann
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Advanced Data Management & Engineering
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LP = Course-related portfolio assessment
Exam duration	Presentation (30-45 min.), technical paper (8-10 pp)
Type of course unit	AI Profile Elective course
Requirements for participation	Foundation Knowledge in Databases and (Enterprise) Data Management
Teaching / learning methods	Lecture, discussions, problem-based learning in group work (student projects/case studies)
Professional competence: In-depth knowledge and comprehension	Students are able to understand the importance, methods and pitfalls of enterprise wide data management issues. Students acquire the ability to recognise methodologies and technologies, understand their potential and apply them typical problems and requirements in the different areas of data management and data engineering as one of the most important parts of data management. By working on a specific research question, students will practise the scientific oriented generation of a study work in the form of a scientific paper. Themes will be given by the lecturer according to actual directions in data management.
Professional competence: Conative skills,	Students will learn to acquire and analyse

analysis and synthesis of knowledge	literature of the current state of the art from literature databases and sources such as IEEE, ACM, etc. as a basis to generate a scientific state of the art paper.
Personal competence: Social competence	Students will learn to prepare, present and discuss methods and algorithms from literature of the current state of the art.
Personal competence: Independence / autonomy	Students will learn how to independently analyse the state of the art literature and evaluate research work according to its preliminary and subsequent work.
Competence level according to GQF	7
Contents	Including non-relational database systems, especially for AI applications such as vector stores, etc.
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	Marcel Hebing, Martin Manhembué (2024): Data Science Management. O'Reilly 2024, ISBN 978-3-96009-214-8 Joe Reis, Matt Housley (2022): Fundamentals of Data Engineering: Plan and Build Robust Data Systems. O'Reilly, ISBN 978-1098108304 Martin Kleppmann (2017): Designing Data-Intensive Applications: The Bid Idea Behind Relaible, Scalable, and Maintainable Systems. O'Reilly, ISBN 978-1449373320 Zhamak Dehghani (2022): Data mesh: Delivering Data-Driven Value at Scale. O'Reilly, ISBN 978-1492092391 Jake VanderPlas (2022): Python Data Science Handbook: Essential Tools for Working with Data. O'Reilly, ISBN 978-1098121228 Ole Olesen-Bagneux (2023): The Enterprise Data Catalog: Improve Data Discovery, Ensure Data Governance, and Enable Innovation. O'Reilly, ISBN 978-1492098713 James Serra (2024): Deciphering Data Architectures: Choosing Between a Modern Data Warehouse, Data Fabric, Data Lakehouse, and Data Mesh. O'Reilly, ISBN 978-1098150761 Evren Eryurek et al. (2021): Data Governance: The Definitive Guide: People, Processes, and Tools. O'Reilly, ISBN 978-1492063490 Felix, Gessert et al. (2020): Fast and Scalable

	Cloud Data Management. Springer International, ISBN 9783030435066 Martin, Treder (2020): The Chief Data Officer Management Handbook: Set Up and Run an Organization's Data Supply Chein. Apress, Berkeley, ISBN 9781484261156 Andreas Meier; Michael Kaufmann (2019): SQL & NoSQL databases. Springer Vieweg, Wiesbaden, ISBN 9783658245498
Scheduled	See timetable.
Combined assessments	

Module MAAI 3 176050 Domain Profiles

Duration of the module	2. Semester
SWS	8
Type of examination	Module grade (without examination) consists of weighted individual assessments.
Credit points (ECTS)	10
Requirements for awarding credit points	
Person responsible for the module	Prof. Dr.-Ing. Nicolaj Stache
Teaching, learning and examination methods	As described for the lectures of the module.
Contents	In Module M3, students select a specific focus area, which is recorded on their transcript. This focus is achieved by successfully completing courses totalling at least 10 ECTS credits from a Domain Profile. Additionally, in the elective module M5 "Electives," students have the option to take courses from another Domain Profile, allowing them to complete two Domain Profiles during their master's studies.
Professional competence: In-depth knowledge and comprehension	Through a selection of various events, students have the opportunity to scientifically expand their knowledge according to their own interests.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students acquire in-depth theoretical knowledge and its practical application depending on the chosen elective courses.
Personal competence: Social competence	Students work on tasks and selected topics in small groups, depending on the chosen course, thereby developing teamwork skills. They are able to communicate professionally using the technical terminology from the lecture.
Personal competence: Independence / autonomy	The lecture content is independently deepened through exercises or application examples, depending on the chosen course. Students can categorize, identify, formulate, and solve lecture-related questions. They are able to collect, evaluate, and independently interpret relevant information.
Competence level according to GQF	7
Requirements for participation	
Additional module details	The Module can be used as Module M3 (Domain Profiles), but the lectures of this module can also be chosen for the Module M5 (Elective Courses).

Scheduled	See timetable.
Combined assessments	If relevant, it will be defined within the first three weeks of the lectures.

Course MAAI HE 3.01 176051 Software Assisted Medical Diagnostics

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Markus Graf Prof. Dr.-Ing. Daniel Pfeifer
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/L = Lecture with integrated laboratory
Language of instruction	English
Course title	Software Assisted Medical Diagnostics
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LK = Course-accompanying with written exam
Exam duration	60
Type of course unit	Domain Profile Health - Elective course
Requirements for participation	
Teaching / learning methods	Lectures, presentations
Professional competence: In-depth knowledge and comprehension	Students are familiar with biomedical fundamentals for acquiring necessary data, signals, and images to design and develop diagnostic processes and systems. They have an overview of basic concepts of image acquisition in radiology and know how these can generally be used for diagnosis. They have an understanding of the fundamentals of pathogen diagnostics based on DNA / RNA sequencing. They know major tools for metagenomics analysis and understand the core algorithms governing these tools. They are able to interpret metagenomic analysis results from a statistical perspective and are capable of assessing the use of this technology in medical diagnostics and adjacent fields.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students can break down the necessary pre-processing and processing steps from data acquisition to diagnostic-supporting visualization

	and reporting into their components. They are familiar with technologies and methods to build these systems.
Personal competence: Social competence	
Personal competence: Independence / autonomy	Students acquire the ability to develop an overview in complex diagnostic projects and its application context.
Competence level according to GQF	7
Contents	Introduction to imaging technology and (meta)genomics. Concepts and processes that are needed to support clinicians with diagnostics. Understanding necessary steps to develop and improve medical diagnostic systems. Regarding Metagenomics: •Introduction to Genomics, DNA, RNA •Taxonomy and Human Pathogens •Genomic Online-Databases •DNA / RNA-Sequencing Methods •Major Analysis Tasks in Bioinformatics (Assembly, Alignment, Phylogenetic) •Metagenomics for Pathogen Diagnostics •Further Applications of Metagenomics
Recommended optional programme components	Optional: Personalized Medicine, Clinical Decision Support Systems, Advance Approaches for AI-based image processing
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Presentation/Slides Books: •Heinz Handels, Medical image computing for computer-supported diagnostics and therapy •Henrik Christensen (Editor), Introduction to Bioinformatics in Microbiology •Andreas D. Baxevanis (Editor), Bioinformatics
Scheduled	See timetable.
Combined assessments	

Course MAAI HE 3.02 262333 Mixed Reality Lab

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Gerrit Meixner
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Mixed Reality Lab
Credit points (ECTS)	6
SWS	4
Workload - contact hours	60
Workload - self-study	90
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Health - Elective course
Requirements for participation	
Teaching / learning methods	Contact hours: • lectures • Introduction to project topics • building of project teams • meetings to guide and supervise project work Self-study: • study of literature • preparation of project meetings • Become acquainted with the chosen project topic • Execution of a team project You have to prepare, present and defend a presentation on the team project
Professional competence: In-depth knowledge and comprehension	The topics of Augmented Reality, Virtual Reality and Mixed Reality is coming more and more into our daily lives. These technologies can support

	humans during their daily tasks in business and also in their private lives. Students will learn initial knowledge in the area of Mixed Reality and will practically work in teams on different reelevant topics.
Professional competence: Conative skills, analysis and synthesis of knowledge	A team project is part of this lecture. In order to succeed the students have to do literature research, apply methods to structure their thoughts (e.g. mind mapping), structure their own work as well as the work of the team.
Personal competence: Social competence	People from all over the world are attending our master's program. Thus, students have to work together in teams with people from other countries and with different cultural backgrounds. In order to be able to do this they have to agree on rules to make effective work possible. Reliability, punctuality and a constructive way to issue criticism are typical pain points for the student teams.
Personal competence: Independence / autonomy	The project work asks for self-dependence. Project meetings on a regular basis guide the work, but the work itself has to be done by the team autonomously.
Competence level according to GQF	7
Contents	Introduction to AR, VR and MR, History, Hardware, Software, Application areas, practical implementation
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	• Virtual und Augmented Reality (VR / AR): Grundlagen und Methoden der Virtuellen und Augmentierten Realität, 3662588609 • The VR Book: Human-Centered Design for Virtual Reality, 1970001127 • Virtual & Augmented Reality For Dummies, 1119481341 • Handbook of Virtual Environments: Design, Implementation, and Applications, 1138074632 • Augmented Reality: Principles and Practice, 0321883578
Scheduled	See timetable.
Combined assessments	

Course MAAI HE 3.03 172343 Software as medical device

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Wendelin Schramm
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Software as medical device
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LK = Course-accompanying with written exam
Exam duration	60
Type of course unit	Domain Profile Health - Elective course
Requirements for participation	
Teaching / learning methods	Teaching format: Lecture with integrated exercises and self-study Media formats: PowerPoint, blackboard, and computer-based exercises
Professional competence: In-depth knowledge and comprehension	After successfully completing the course, students will be able to: • Describe what makes software a medical device and what measures need to be taken • Explain the relationships between European directives (MDR, MDD), the Medical Devices Act (MPG and AIMD, IVDD), and harmonized standards • Identify the necessity of a quality management system (ISO 13485) for medical device manufacturers • Explain the importance of risk management throughout the entire development process of a medical device

	• Name the individual stages of the lifecycle model and their associated tasks • State the requirements for usability and their formal foundations
Professional competence: Conative skills, analysis and synthesis of knowledge	After successfully completing the course, students will be able to: • Determine whether a software meets the requirements for a medical device according to MDR/MDD/MPG • Classify medical devices according to the regulations of MDR and MDD • Plan and develop software in compliance with regulatory requirements (MDR/MDD/MPG) and create the necessary technical documentation • Establish a software lifecycle according to regulatory requirements (IEC 62304) • Implement measures for risk analysis (ISO 14971) and usability (IEC 62366) of medical devices
Personal competence: Social competence	
Personal competence: Independence / autonomy	Students are familiar with key legal regulations and research methods, and they can independently gather the necessary detailed information.
Competence level according to GQF	7
Contents	• Medical Device Regulation (MDR) and review of • Medical Devices Act (MPG, as well as AIMD, IVDD) • Regulatory requirements in the USA and other selected countries • Quality management (ISO 13485) • Risk management for medical devices (ISO 14971) • Software lifecycle for medical devices (IEC 62304) • Usability of medical devices • Technical documentation • Clinical evaluation
Recommended optional programme components	Lectures assigned to the Diagnosis and Therapy Systems profile as well as the Software Development in Medicine profile.

Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	1) Hastenteufel M, Renaud S (2019) Software als Medizinprodukt, Springer Verlag 2) Johner C, Hölzer-Klüpfel M, Wittdorf S (2015) Basiswissen medizinische Software, dpunkt.verlag
Scheduled	See timetable.
Combined assessments	

Course MAAI HE 3.04 172378 Foundations in Human-Computer Interaction

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Gerrit Meixner
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Foundations in Human-Computer Interaction
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LK = Course-accompanying with written exam
Exam duration	60
Type of course unit	Domain Profile Health - Elective course
Requirements for participation	
Teaching / learning methods	Lecture; Presentations
Professional competence: In-depth knowledge and comprehension	The students get an introduction to software ergonomics and its goals, the basics necessary for the usable design of software as well as the basics about usable design through a user-centered software development process.
Professional competence: Conative skills, analysis and synthesis of knowledge	
Personal competence: Social competence	
Personal competence: Independence / autonomy	
Competence level according to GQF	7
Contents	• Human task software • History of human-computer interaction • Standards, guidelines and design principles • Basics of psychology (thinking, acting, learning,

	storing) • Basics of work sciences (work and activity design, images of people, ergonomics, stress, under / overstrain) • Input and output devices • Interaction techniques • Human-centered development process (analysis, specification, design, prototyping, evaluation)
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	• Alan Dix, Janet Finlay, Gregory D. Abowd, and Russell Beale: Human-Computer Interaction (3rd Edition), Pearson, 2004, ISBN: 978-0130461094 • Ben Shneiderman: Designing the User Interface: Strategies for Effective Human-Computer Interaction (6th Edition) , Pearson-prentice Hall , 2017, ISBN: 978-1292153919 • Donald A. Norman: The Design of Everyday Things: Revised and Expanded Edition , Basic Books, 2013, ISBN: 978-0465050659 • Jennifer Preece, Yvonne Rogers, and Helen Sharp: Interaction Design: Beyond Human-Computer Interaction (5th Edition) , Wiley, 2019, ISBN: 978-1119547259
Scheduled	See timetable.
Combined assessments	Will be published during the first three weeks of lectures

Course MAAI HE 3.05 172388 Personalized Healthcare

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Christian Fegeler
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Personalized Healthcare
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Health - Elective course
Requirements for participation	
Teaching / learning methods	Lecture on fundamental concepts, impulse lectures from application and research projects, individual mentoring sessions, and student presentations of results.
Professional competence: In-depth knowledge and comprehension	Students are familiar with the concepts of personalized medicine and the translational approaches from research to application. They understand the difference between evidence-based knowledge and individualized disease and treatment progressions. Additionally, they have an overview of digitalization approaches in this field.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students have practiced working with digital knowledge sources and interacting with the documentation of individual case progressions.
Personal competence: Social competence	Students have learned about and practiced working in transdisciplinary teams.
Personal competence: Independence / autonomy	Students can independently develop an overview of a complex project or application context, communicate in a topic-focused manner with

	their team, and formulate their own tasks or hypotheses.
Competence level according to GQF	7
Contents	Fundamentals of Personalized Medicine Concepts and Their Digital Implementation in Current Application and Research Projects (e.g., Molecular Tumor Boards, Patient-Reported Outcome). Direct Contact Opportunities with Healthcare Providers and Research Groups.
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus. Can be credited towards the profile enhancement of the "Bioinformatics" profile (M6a) and "Data Science" (M6c) as well as the elective modules Biomedical Informatics (M3, M7, M8). The semester tasks provide an opportunity to engage in concrete application and research projects and can be used as orientation for the Research Project (172393).
Literature / learning sources	Script available on the learning platform. Topics for the semester project will be introduced during the first session.
Scheduled	See timetable.
Combined assessments	

Course MAAI BA 3.01 154261 Leadership and Communication

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Susanne Wilpers
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	S/Ü = Seminar with exercise
Language of instruction	English
Course title	Leadership and Communication
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	The students work in teams to develop solutions for case studies in the area of leadership
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Business Administration - Elective course
Requirements for participation	very good knowledge of English
Teaching / learning methods	• lecture • joint practical group exercises during face-to-face times • Video feedback • presentations • Preparation of homework
Professional competence: In-depth knowledge and comprehension	In the course, students learn about the importance of leadership in companies. They can list, describe and reproduce the most important leadership theories. They analyze, criticize and evaluate leadership approaches and leadership models and can differentiate communication theories. They will learn how different communication styles can be used in a targeted manner.

Professional competence: Conative skills, analysis and synthesis of knowledge	Students are able to outline and compare leadership approaches and communication strategies using examples in case studies. From this, students develop a deeper understanding of leadership models and their application in professional practice. Differentiating theories allows them to distinguish between good and bad leadership models.
Personal competence: Social competence	The students are enabled to assume their own role in the team and to complete the task for the final presentation and the homework together. They communicate in a target group-specific manner and conduct feedback discussions in an appreciative manner. At the end of the event, the students present the topic of their paper to the plenary session and can present and discuss their own points of view.
Personal competence: Independence / autonomy	The students receive important inspiration for developing their own leadership personality. They can contrast and evaluate different leadership and communication models and evaluate the advantages and disadvantages of the models. They are also empowered to decide which they want to use themselves in the future.
Competence level according to GQF	7
Contents	This compulsory course covers basic procedures and methods of managing people in organizations. The event is designed so that students can experience for themselves the theoretical background of organizational theory and the role management plays in it. The focus is on the development of key competencies, like social skills. In addition, students gain knowledge about: the role of the manager, history of leadership theories, approaches and methods of personnel management, procedures for analyzing leadership styles, planning and problem solving as well as individual responsibility, communication and negotiation styles. Students are motivated to apply the theoretical knowledge in their own experiences in companies and organizations. Organizations are understood as dynamic systems.
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus. In parallel to the theoretical event, practical exercises on leadership behavior are carried out, for example with role plays. Regular use of guest lecturers. The teaching language is English

Literature / learning sources	• Peter G. Northouse: Leadership, current edition • Robbins, S.; Judge, TA: Organizational Behavior, Prentice Hall, current edition • Schuler, H. (Ed.): Textbook of personnel psychology, Göttingen Hogrefe, current edition
Scheduled	See timetable.
Combined assessments	No combined exam

Course MAAI BA 3.02 154262 Business Ethics

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Ulrike Weingart, PhD
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	S/Ü = Seminar with exercise
Language of instruction	English
Course title	Business Ethics
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	The preparation and follow-up to the event as well as exam preparation are included in the self-study workload.
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Business Administration - Elective course
Requirements for participation	Knowledge of English
Teaching / learning methods	Interactive lecture with e-learning materials, often with expert interviews. Inclusion of video material, case studies, and short presentations by students.
Professional competence: In-depth knowledge and comprehension	After successfully completing the module, students demonstrate in-depth knowledge of the central ethical principles and theories (here especially the normative ethical theories). Students understand how these concepts can be applied in the real business world. They can identify ethical dilemmas in corporate management and assess the associated effects. This understanding enables them to make informed and ethical responsible decisions in a business context.
Professional competence: Conative skills, analysis and synthesis of knowledge	The development of knowledge is promoted through various teaching methods and practical case studies. Students learn to independently analyze complex ethical issues and develop

	solutions. Overall, after completing the module, they will be both theoretically sound and able to practically deal with ethical challenges in the business world.
Personal competence: Social competence	The participants of the event can communicate in English in intercultural teams, achieve work results together, present and justify them in front of international groups. The students put together information and solutions for their own problem cases, which they work in cooperative groups with other problem cases relate, assess and present arguments to experts. They are able to develop complex and new interdisciplinary solutions to dynamically changing requirements and to apply them in a targeted and critical manner in an economic and social context.
Personal competence: Independence / autonomy	Students can independently design and evaluate work processes (creating presentations, working on case studies) in an intercultural context. They are able to independently define the goals for their learning and work processes, reflect them and bring them into harmony with the group participants. They pay attention to their sustainable acquisition of knowledge.
Competence level according to GQF	7
Contents	-. Introducing Business Ethics: What is Business Ethics and why is it important? -. Framing Business Ethics: CSR, Stakeholders, and Citizenship -. Evaluating Business Ethics: Normative Ethical Theories (focus of the module) -. Making Decisions in Business Ethics: Descriptive Ethical Theories -. Managing Business Ethics: Tools & Techniques of Business Ethics Management
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus. Expert interviews are carried out.
Literature / learning sources	Andrew Crane, Dirk Matten, Sarah Glozer, Laura J. Spence: Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalization. Oxford University Press, 5th edition, 2019.
Scheduled	See timetable.
Combined assessments	No combined exam.

Course MAAI BA 3.03 154263 Entrepreneurship and Innovation

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Ralf Dillerup
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Entrepreneurship and Innovation
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	A business plan pitching event will be the concluding element of the course.
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Business Administration - Elective course
Requirements for participation	It is highly recommended to study this module as one of the last courses in the program. Special Business Simulation should be passed before this course.
Teaching / learning methods	1. Design thinking and how to apply it 2. Ongoing coaching sessions that empower and support the entrepreneurs in the process of using the Design Thinking methodology 3. Traditional and open innovation processes 4. Innovation eco systems 5. Final pitch presentation
Professional competence: In-depth knowledge and comprehension	LO 11: Students will be able to define and explain the fundamentals of design thinking; biomimicry, open innovation and circular economy LO 13: Students will be able to empathize with customers, define a human centered challenge,

	identify prototype solutions and test assumptions embedded in solutions to develop independently creative and well-founded business ideas for complex practical challenges; LO 14: Students will be able to apply acquired knowledge objectively and independently to develop, test and grow entrepreneurial ideas.
Professional competence: Conative skills, analysis and synthesis of knowledge	LO 11: Students will be able to define and explain the fundamentals of design thinking; biomimicry, open innovation and circular economy LO 13: Students will be able to empathize with customers, define a human centered challenge, ideate, prototype solutions and test assumptions embedded in solutions to develop independently creative and well-founded business ideas for complex practical challenges; LO 14: Students will be able to apply acquired knowledge objectively and independently to develop, test and grow entrepreneurial ideas
Personal competence: Social competence	LO 13: Students will be able to empathize with customers, define a human centered challenge, ideate, prototype solutions and test assumptions embedded in solutions to develop independently creative and well-founded business ideas for complex practical challenges LO 31: Students will be able to communicate their independently developed entrepreneurial ideas to third parties in a clear, concise, and stylistically appropriate manner.
Personal competence: Independence / autonomy	LO 31: Students will be able to communicate their independently developed entrepreneurial ideas to third parties in a clear, concise, and stylistically appropriate manner. LO 52: Students will be able to compare and contrast differing interests and viewpoints of stakeholders
Competence level according to GQF	7
Contents	Design Thinking is a leading innovation methodology and a triedand-tested approach to creative problem solving. The course teaches how to use design thinking to build and deliver to the world a sustainable, human-centered, financially viable and feasible business. It enables entrepreneurs to understand the needs of their customers and develop rapid prototypes to test and iterate business concepts. This course will help the students to de-risk their business ideas and craft a sustainable business model that

	is rooted in the people they wish to serve. In addition to Design Thinking, it looks into the concepts of circular economy, and Biomimicry (innovation inspired by nature) to inspire the students to understand and apply sustainable concepts and solutions to their business ideas which will ensure the application of sustainable business practices. Last but not least, the course provides individual coaching sessions with each student to support the understanding and the application of the methodologies taught to the growth of their business ideas.
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus. Capstone course in the BU programme.
Literature / learning sources	• Chesbrough, H. W. (2003). Open Innovation: The new imperative for creating and benefiting from technology. Boston: Harvard Business School Press • Bagley, O.B., (2014). Biomimicry: How Nature Can Streamline Your Business for Innovation, Forbes • Liedtka, J., (2018) Why design thinking works, Harvard Business Review • Thomke S., Nickisch C., (2020), How to set up and learn from experimentation, Harvard Business Review
Scheduled	See timetable. Blocked mode at the end of the program.
Combined assessments	No combined examination

Course MAAI BA 3.04 154271 Business Simulation

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Ralf Dillerup
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	S/Ü = Seminar with exercise
Language of instruction	English
Course title	Business Simulation
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Business Administration - Elective course
Requirements for participation	
Teaching / learning methods	• students must be prepared to read widely outside the subject • computer simulation methods such as System Dynamics or TOPSIM • lecture session with compulsory attendance • teamwork & presentations
Professional competence: In-depth knowledge and comprehension	The course bases on the introduction into strategic management and picks up the contents learned there. The additional learning outcome is the cross-sectional perspective and links in general management. In a capstone approach the business simulation enables the students to fill knowledge gaps if necessary.
Professional competence: Conative skills, analysis and synthesis of knowledge	The students apply concepts of strategic management concept by using the business simulation technique with those they able to plan and think strategically. They analyze the interactions between all areas of a company and

	evaluate the overall business situations.
Personal competence: Social competence	The business simulation enables a risk-free decision-making setup as business managers. This includes decision-making under time pressure, uncertainty and other limitations as a training field as entrepreneurs. Working in diverse groups with an international exposure forces the students to solve problems in teams, train the ability to deal with conflicts and leadership communication.
Personal competence: Independence / autonomy	The students experience business management as a pattern of decision-making processes. They need to make their own decisions based on a clear, focused managerial analysis and experience the consequences of their strategic behavior. The students undergo a profound experience of their own success and the success factors.
Competence level according to GQF	7
Contents	• Application of value based management • Developing, implementing and reflecting strategies • The strategic management process • Industry and Competitive Analysis • Strategic Analysis of industry structure • Porter's competitive forces and rivalry analysis • Strategic Capability - Internal analysis • SWOT analysis • Developing and implementing planning tools to improve forecast and planning quality • Strategic decisions in all business areas
Recommended optional programme components	The strategic management course should have been studied before business simulation.
Additional specifics	Take place at the Bildungscampus. IT is a management simulation-based learning approach.
Literature / learning sources	• Simulation software manuals • Participants' manuals of the business simulation • Further materials provided as needed
Scheduled	See timetable. Blocked mode.

Combined assessments	No combined examination

Course MAAI BA 3.05 154272 Strategic Management

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Ralf Dillerup
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	S/Ü = Seminar with exercise
Language of instruction	English
Course title	Strategic Management
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	The preparation and follow-up to the event as well as exam preparation are included in the self-study workload.
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Business Administration - Elective course
Requirements for participation	Completion of the in-depth business administration courses in the 4th and 6th semesters is recommended and the content there is required. In particular, reference is made to the content of the Controlling course.
Teaching / learning methods	• Independent preparation through supported literature study • Question and answer sequences to build understanding • Discussion of central topics • Use of classic case studies • Incorporation of current strategy topics from newspaper articles • Involvement of company representatives and current issues and developments
Professional competence: In-depth knowledge	After successfully attending the course, students have a deeper understanding of the differences

and comprehension	and approaches to strategic business management. They can name and interpret the essential concepts of normative and strategic leadership decisions. They understand the basis and connections of strategic management. • Teaching classic core content of corporate management • Understanding of corporate management contexts • Be able to apply key concepts and methods • Transfer to use cases • Actively taking up current company cases • Getting to know the strategies of a variety of international companies
Professional competence: Conative skills, analysis and synthesis of knowledge	Students are able to carry out internal and external company analyzes and develop strategy recommendations based on the results. They can apply the central concepts and methods presented to current business cases from practice. The students analyze the strategies of a large number of international companies. They can also assess the aspects of implementation and change of strategic concepts. • Teaching classic core content of corporate management • Understanding of corporate management contexts • Be able to apply key concepts and methods • Transfer to use cases • Actively taking up current company cases • Getting to know the strategies of a variety of international companies
Personal competence: Social competence	By analyzing current company situations in teamwork, an in-depth exchange takes place about different strategic concepts for corporate management in the area of tension between financial value orientation and ethical-moral value orientation. The heterogeneity of group opinions and viewpoints in these discussions trains the ability to deal with conflict and criticism.
Personal competence: Independence / autonomy	The concepts presented in the event and the company examples enable a great deal Interpretation space for possible alternative solutions. Each student must independently develop strategy options and reflect on the

	effects on their ethical and moral value structure.
Competence level according to GQF	7
Contents	• Basic concepts and system of corporate management • Link to normative corporate management • Value-oriented corporate management • Market-oriented corporate management, especially portfolio concepts • Resource-oriented corporate management • Strategy implementation • Leadership of change
Recommended optional programme components	Business Simulation should, if possible, be attended immediately afterwards, not beforehand.
Additional specifics	Take place at the Bildungscampus. Inclusion of guest lecturers
Literature / learning sources	• Dillerup, R./Stoi, R.: Corporate Management, 6th edition, Munich 2022. • Magazines especially Harvard Business Manager • Dillerup, R./Stoi, R. (eds.): Case studies on Corporate Management, Munich 2012.
Scheduled	See timetable. Block event in the first half of the semester.
Combined assessments	Examination components in the semester period are made up of weighted individual components. The details will be announced at the start of the event.

Course MAAI BA 3.06 154363 Advanced Digital Marketing

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Dario Müller
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Advanced Digital Marketing
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	Simulation game for digital marketing at a high level
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Business Administration - Elective course
Requirements for participation	
Teaching / learning methods	Simulation game
Professional competence: In-depth knowledge and comprehension	All aspects of digital marketing are part of the digital simulation game and are conveyed as part of the simulation.
Professional competence: Conative skills, analysis and synthesis of knowledge	After the course, students will be able to implement a digital marketing campaign in all phases.
Personal competence: Social competence	The simulation game is carried out in a group.
Personal competence: Independence / autonomy	The project is organized and carried out independently by the students. Good coordination within the group is a prerequisite for success.
Competence level according to GQF	7
Contents	BU6 Simulation game, SEO, SEA, social media marketing

Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	Larson, Draper (2019), Digital Marketing Essentials, Stukent Inc., ISBN: 978-0998713816 Kollmann, T. (2016): E-Business, basics of electronic business processes in of the Digital Economy, ISBN-10: 978-3-658-07669-6 Kollmann, T. (2013): Online Marketing: Basics of Sales policy on the Net Economy, 2nd edition, Kohlhammer Verlag, Stuttgart, ISBN-103170230247 Han, Y.-J., Nunes, J., Drèze, X. (2010). Signaling status with Luxury Goods: The Role of Brand Prominence. Journal of Marketing Vol. 74, p. 15-30 Deges, Frank (2020): Basics of E-Commerce, Springer Gabler Graf, Alexander and Schneider, Holger (2016): The ECommerceBook Heinemann, Gerrit (2019): The new online trade, 10th edition
Scheduled	See timetable. The event will take place blocked.
Combined assessments	

Course MAAI BA 3.07 154562 Digital Human Resource Management

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Susanne Wilpers
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Digital Human Resource Management
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	Regular deployment of guest lecturers, excursions to companies and trade fairs as well as COILS (Collaborative International Learning) with partner universities
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Business Administration - Elective course
Requirements for participation	
Teaching / learning methods	Lecture • Lectures • Discussions • Exercises • Case Studies • Tests
Professional competence: In-depth knowledge and comprehension	By attending the event, students gain a well-founded insight into the strategic integration of digital human resources and business psychology in a company. They can explain the methods and instruments of human resources in a generic, technical and strategic perspective. They are also able to differentiate between different modern approaches to human resources management in such a way that they noticeably improve the performance of the organization. In addition, they can formulate specific contexts of digital human resources in English.
Professional competence: Conative skills,	The students are able to work in groups to

analysis and synthesis of knowledge	discuss, analyze and target questions relating to the strategic digital orientation of a company with regard to human resources strategy and the application of business psychology to represent. They can present complex subject-related problems and solutions in an argumentative manner and present them in English lectures in a target-specific manner.
Personal competence: Social competence	At the end of the event, students can take on the responsibility of leading a project group that analyzes and evaluates a partial aspect of a company's strategic digital orientation. In mixed groups, students are able to work together effectively and critically question tasks.
Personal competence: Independence / autonomy	The students evaluate various approaches to solving current human resources policy issues and thus acquire a high level of ability to reflect on their learning and work processes. They can weigh up and evaluate the opposing sides of pragmatic positions in a differentiated manner. This promotes their ability to make independent assessments.
Competence level according to GQF	7
Contents	BU6 This course provides an overview of the discipline of human resources management and its use of digitalization in modern HR applications. This course delves deeper into the topic of digital human resources management. The HR areas will be historical HR theories, digital HR motivation theories, basic and contemporary Leadership styles, culture, methods and tools for attracting and retaining effective employees, maximizing performance and group psychology are covered.
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	Mondal, S.R. et al (2022). HR Analytics and digital HR HR Practices. Palgrave Macmilan. Dessler, G. (2020). Fundamentals of human resource management. Pearson Robbins, S.P. & Judge, T.A. (2018). Essentials of organizational behavior. Pearson. Stewart, G.L.; Brown, KG (2010): HRM - Linking Strategy to Practice, 2nd Ed., Wiley 2010 and others in the event

Scheduled	See timetable.
Combined assessments	

Course MAAI BA 3.08 161331 Managing Global Supply Chains

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Carola Schulz
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Managing Global Supply Chains
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Logistics - Elective course
Requirements for participation	Basic logistics knowledge (terminology, fundamental concepts) should be known.
Teaching / learning methods	Lecture, exercises, group work, case studies, simulations, role-playing, excursions, coaching sessions, expert lectures…
Professional competence: In-depth knowledge and comprehension	Students review and deepen their knowledge of the fundamentals of Supply Chain Management (SCM). They learn about the challenges and trends in SCM and how to address them through practical examples. Additionally, they develop the ability to collect, process, and analyze relevant information for decision-making.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students learn to filter decision-relevant information from a case study and structure it for a group discussion. Through group work, they practice reflecting on past decisions, business constellations, and theoretical foundations, as well as preparing them in a structured, target-audience-oriented, and comprehensible manner.
Personal competence: Social competence	Students learn to navigate team structures through collaboration in small groups, to contribute and, if necessary, defend their own

	opinions, and to take on various roles. They also learn to advocate for their own goals and to prepare, communicate, reflect upon, and defend their knowledge in presentations, discussions, or other forms of communication tailored to their audience.
Personal competence: Independence / autonomy	They are enabled to independently develop or evaluate courses of action and to present their own opinions in a group or before a decision-making body.
Competence level according to GQF	7
Contents	• Fundamentals of Supply Chain Management (SCM) • Trends and challenges in managing global value chains • Sustainability and Circular Economy • Digitalization in SCM • Additional topics as outlined in the syllabus
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	• Case studies and preparatory literature are provided by the lecturer or made available through the library • Lecture materials on ILIAS • Literature references according to the course syllabus
Scheduled	See timetable.
Combined assessments	See Syllabus

Course MAAI BA 3.09 161361 Research Methods and Applications in Logistics I

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Carola Schulz
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Research Methods and Applications in Logistics I
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Logistics - Elective course
Requirements for participation	Rudimentary knowledge of mathematics and statistics
Teaching / learning methods	
Professional competence: In-depth knowledge and comprehension	Scientific methods are a fundamental component of data-driven decision-making and strategy development. They serve to collect, analyze, and plan business decisions. In this course, we focus on research methods, statistical data collection, and analysis, as well as the significance of scientific methods in a global and business context within the logistics industry. The course builds upon students' existing knowledge of statistics and mathematics as a foundation. From there, the methodological toolkit is expanded, particularly in the areas of data collection and analysis.
Professional competence: Conative skills, analysis and synthesis of knowledge	• Students are able to understand the principles and requirements of research work. • Students are familiar with fundamental methods

	of data collection and analysis and can apply these methods to their own empirical projects.
Personal competence: Social competence	Students work in study groups, learning to navigate team structures and take on different roles.
Personal competence: Independence / autonomy	Students independently engage with complex topics and develop solutions.
Competence level according to GQF	7
Contents	• Goals and fundamental principles of research work • Application of appropriate research approaches to own projects and tasks • Research design • Selection of a suitable research approach • Principles and methods of data collection and analysis • Data analysis in qualitative research
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	See Syllabus

Course MAAI BA 3.10 161371 Optimization of Supply Chains

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Sebastian Kapser
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Optimization of Supply Chains
Credit points (ECTS)	5
SWS	4
Workload - contact hours	45
Workload - self-study	80
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Logistics - Elective course
Requirements for participation	The course "Optimization of Supply Chains" can only be attended if the course "Managing Global Supply Chains" has been completed beforehand. • Supply Chain basic to advanced knowledge (concepts, etc.) • Knowledge in basic management tools (e.g. SWOT, Porters 5 Forces)
Teaching / learning methods	
Professional competence: In-depth knowledge and comprehension	• Knowledge of trends/challenges in SCM • Knowledge/Review of basics in SCM • Analytical decision making • Awareness of sustainability/ethical issues • Negoziation theory/skills • Knowledge about relevant technological trends
Professional competence: Conative skills, analysis and synthesis of knowledge	• become familiar with different ways of dealing with larger interrelated problems • be able to discuss new solutions and to

	evaluate and improve them
Personal competence: Social competence	• Teamwork • Negoziation • Communicating • Moderating and presenting • Critically reflecting decisions
Personal competence: Independence / autonomy	Students deal independently with complex issues and develop solutions
Competence level according to GQF	7
Contents	• trends in SCM • challenges in SCM • sustainability • ethical issues
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	see syllabus
Scheduled	See timetable.
Combined assessments	See Syllabus

Course MAAI BA 3.11 285561 Digital Business Models, Innovation & Strategy

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Jochen Günther
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Digital Business Models, Innovation & Strategy
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LR = Course-accompanying with presentation
Exam duration	Presentation (20 min.)
Type of course unit	Domain Profile Digital Business - Elective course
Requirements for participation	
Teaching / learning methods	Lecture, instructional dialogue, group work, self-directed learning, problem-based learning
Professional competence: In-depth knowledge and comprehension	Graduates have demonstrated advanced knowledge and understanding that builds upon and significantly extends the foundational Bachelor-level knowledge. •They are capable of defining, interpreting, and critically reflecting on the characteristics, limitations, terminology, and theoretical foundations of digital business models, innovation, and strategy. •They possess specialized knowledge at the forefront of research and practice in the fields of digital business models, innovation management, and strategic corporate leadership. •This knowledge serves as the foundation for developing, analyzing, and applying innovative business model ideas, in both application-

	oriented and research-focused contexts. •Graduates evaluate the advantages, disadvantages, and potential of various business models in a scientifically sound manner, considering both academic approaches and methodological consideration
Professional competence: Conative skills, analysis and synthesis of knowledge	Graduates •solve strategic and entrepreneurial problems using specialized professional and conceptual skills, •analyze and develop alternative approaches to designing digital business models even in the presence of incomplete information, •assess methods for developing and implementing innovative business models and apply them appropriately to specific situations, •integrate new and existing knowledge into complex contexts and use this for solving multidisciplinary challenges, •develop innovative business model concepts or methods and successfully implement them, •critically reflect on scientific results and justify evidence-based decisions, •independently carry out practice-oriented projects, •formulate research questions related to digital business models and their strategic applications, operationalize them methodically, and critically interpret the results.
Personal competence: Social competence	The module content is taught through lectures and group work, during which participants acquire the following competencies: •Integrating and involving other participants in collaborative tasks with a focus on goal-oriented solutions, •Recognizing potential conflicts in collaboration and developing constructive strategies to address them, •Facilitating conceptual and situationally appropriate solution processes, •Leading domain-specific and interdisciplinary discussions, and developing theoretically

	grounded alternative solutions.
Personal competence: Independence / autonomy	Graduates •develop a professional self-concept aligned with current scientific and professional standards in the analysis and design of digital business models, •reflect on their actions regarding entrepreneurial, societal, and cultural expectations and refine them further, •leverage decision-making and design freedoms to advance business models and critically evaluate the outcomes of their decisions, •define goals for innovative, application- or research-oriented tasks, taking economic, societal, and cultural contexts into account.
Competence level according to GQF	7
Contents	In dynamic markets, product and process innovations often reach their limits in achieving sustainable competitive advantages. Simultaneously, digital technologies and new media enable the creation of novel business models with innovative value creation and revenue mechanisms. The goal of the module is to enable participants to independently analyze, design, and strategically apply digital business models within complex corporate environments. Module Topics: •Introduction to digital business models: necessity, scope, and strategic significance, •Fundamental concepts and methods for developing innovative business models, •The influence of IT and digital media on business models, •Interdependencies between business model design and corporate strategies, •Phases and approaches in business model development, •Integration with Customer Experience, Design Thinking, and innovation management.
Recommended optional programme components	

Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	•Gassmann, O., Frankenberger, K., Csik, M.: The Business Model Navigator, FT Publishing Pearson •Kim, W. and Mauborgne, R.: Blue Ocean Strategy: How to Create Uncontested Market Space and Make the Competition Irrelevant. Expanded edn. Boston, MA: Harvard Business Review Press. •Osterwalder, A., & Pigneur, Y.: Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Hoboken, NJ: Wiley. •Tidd, J., Bessant, J.: Managing Innovation: Integrating Technological, Market and Organizational Change. Hoboken, NJ: Wiley •Rothaermel, F.: Strategic Management. New York, NY: McGraw-Hill Education.
Scheduled	See timetable.
Combined assessments	

Course MAAI BA 3.12 285562 Business Process Management

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Philipp Küller
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Business Process Management
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LP = Course-related portfolio assessment
Exam duration	
Type of course unit	Domain Profile Digital Business - Elective course
Requirements for participation	None
Teaching / learning methods	Lectures plus exercises, modelling, group work, papers/presentations, case studies and tests.
Professional competence: In-depth knowledge and comprehension	Students are able to contextualize business processes, their significance within the business context, and their management. Business processes are understood both as objects of digitalization and as sources of requirements for information technologies, particularly robotics or artificial intelligence.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students independently and collaboratively acquire methods for addressing business processes throughout their lifecycle. They are able to share their findings effectively with peers and apply systematic approaches to analyze processes and organizations. Furthermore, they can develop well-founded improvement proposals using appropriate methodologies.
Personal competence: Social competence	Students engage in objective and professional exchanges on course content and integrate stakeholders into tasks in a goal-oriented manner, considering the specific group dynamics.

	They acquire fundamental skills for interacting with stakeholders in the context of business process management (e.g., through interviews during process analysis).
Personal competence: Independence / autonomy	Through a mix of diverse tasks such as assessments, presentations, and modeling, students take responsibility for their own learning. The mutual teaching of methods further promotes their sense of accountability.
Competence level according to GQF	7
Contents	- Fundamental concepts, lifecycle, and methods of Business Process Management (BPM) - Design and modeling of business processes using BPMN 2.0 - Process Mining for analysis and monitoring - Approaches to modifying business processes, such as adaptation, redesign, and digitalization - Analysis of processes in the context of business capabilities and organizational functions - Value chains, networks, and digital business ecosystems
Recommended optional programme components	None.
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	Dumas, M., la Rosa, M., Mendling, J., & Reijers, H. A. (2018): Fundamentals of Business Process Management Springer, Berlin, Heidelberg. Springer, Berlin, Heidelberg. vom Brocke, J. & Rosemann, M. (2015): Handbook on Business Process Management 1+2. Springer, Berlin,Heidelberg.
Scheduled	See timetable.
Combined assessments	Will be published in the first three weeks of the course.

Course MAAI BA 3.13 285661 Digital Transformation

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Jochen Günther
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Digital Transformation
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LR = Course-accompanying with presentation
Exam duration	Presentation (20 min.)
Type of course unit	Domain Profile Digital Business - Elective course
Requirements for participation	
Teaching / learning methods	Lecture, instructional dialogue, group work, self-directed learning, problem-based learning
Professional competence: In-depth knowledge and comprehension	Graduates have demonstrated advanced knowledge and understanding that builds upon and significantly extends the foundational Bachelor-level knowledge. •They can define and interpret key terminology, theoretical perspectives, as well as the specific characteristics and limitations of the field of digital transformation. •They are familiar with major leadership theories and their contextual factors and possess comprehensive, detailed, and specialized knowledge of current and significant leadership theories, particularly in relation to the challenges of digital transformation. •They understand the latest developments in research and practice regarding digital transformation and its interdependencies with leadership, especially its impact on organizational

	culture and structure. •This knowledge and understanding provide a foundation for the development and/or application of independent ideas. Graduates can identify gaps in theoretical explanations and use these to explore new research fields or topics, either in an application-oriented or research-oriented context.
Professional competence: Conative skills, analysis and synthesis of knowledge	Graduates •evaluate the alternative application or classification of a topic within foundational transformation theories, even in the presence of incomplete information, particularly in the context of digital transformation, •develop new ideas for research projects or assess the effects of introducing digital transformation initiatives in organizations and their implications (e.g., change management), •apply their knowledge and problem-solving skills to new and unfamiliar situations (e.g., analyzing and interpreting leadership behavior in transformation processes) in broader or multidisciplinary contexts related to their field of study (e.g., connections between leadership, digitalization, and business model innovation), •build on acquired knowledge and independently acquire new knowledge and skills (e.g., extending known transformation theories to new developments, such as agile leadership or non-hierarchical organizational structures in digitally transformed environments), •identify gaps and practical challenges within leadership theories and develop research questions and methodologies for independent research in digital transformation and leadership
Personal competence: Social competence	The content of the course (e.g. principles of digital transformation, and their interconnections with innovation management and leadership) is developed through lectures and group work. Graduates will learn: •to involve others in collaborative tasks while considering the dynamics of group situations, •to identify potential conflicts in teamwork and reflect on these within the context of dynamic, digital transformation processes, •to ensure the effective execution of situationally

	appropriate solutions through constructive and conceptual actions, •to conduct domain-specific and interdisciplinary discussions, •to exchange ideas on alternative, theoretically founded solutions and apply these to digital transformation challenges.
Personal competence: Independence / autonomy	Graduates •develop a professional self-concept aligned with current professional and academic standards in organizational transformation and digital leadership, •justify their own and others’ leadership actions with theoretical and methodological knowledge and reflect critically on possible alternatives, •assess their own leadership abilities in the context of digital transformation, use autonomy in decision-making and design, and further develop these skills systematically, •critically evaluate their entrepreneurial actions in light of societal expectations and consequences and refine their professional approach, •define goals for new application- or research-oriented tasks while considering the societal, economic, and cultural impacts, •independently acquire new knowledge, particularly in the areas of digital leadership and transformative organizational development.
Competence level according to GQF	7
Contents	Students understand the specific characteristics of digital transformation and its interdependencies with leadership and organizational development. They identify challenges related to leadership in dynamic, technology-driven change processes and are familiar with theoretical models for explanation and design. Students can apply theoretical knowledge to practical cases and critically evaluate the differences and commonalities between theory and practice. The course includes: •Foundations of digital transformation and its impact on organizations,

	•Key aspects and theories of leadership in the context of digital transformation, •Employee motivation and performance management in digital environments, •Group and team dynamics in digitally transformed organizations, •Communication and conflict management during transformation processes, •Agile organizational models and digital organizational development, •Managing and steering change processes in companies, •Strategies and tools for successful digital transformation, •Interconnections between leadership, digitalization, innovation management, and business model
Recommended optional programme components	
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	•Schallmo, D.R.A. and Williams, C.A. (2018). Digital Transformation Now!: Guiding the Successful Digitalization of Your Business Model. Cham: Springer. •Westerman, G., Bonnet, D., and McAfee, A. (2014). Leading Digital: Turning Technology into Business Transformation. Boston, MA: Harvard Business Review Press. •Davenport, T.H. and Redman, T.C. (2020). The AI Advantage: How to Put the Artificial Intelligence Revolution to Work. Cambridge, MA: MIT Press. •Kane, G.C., Palmer, D., Philips, A.N., and Kiron, D. (2021). The Technology Fallacy: How People Are the Real Key to Digital Transformation. Cambridge, MA: MIT Press. •Harrison, C. (2018): Leadership Theory and Research – A Critical Approach to New and Existing Paradigms •Richter, N.; Jackson, P.; Schildhauer, T. (2018): Entrepreneurial Innovation and Leadership - Preparing for a Digital Future •Matt, C., Hess, T., and Benlian, A. (2015). Digital Transformation Strategies. Business &

	Information Systems Engineering, 57(5), pp. 339-343.
Scheduled	See timetable.
Combined assessments	

Course MAAI BA 3.14 285662 Business Process Optimization & Automation

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Philipp Küller
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Business Process Optimization & Automation
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LP = Course-related portfolio assessment
Exam duration	
Type of course unit	Domain Profile Digital Business - Elective course
Requirements for participation	If no prior knowledge of business processes is available, attending the "Business Process Management" course is recommended.
Teaching / learning methods	Lectures and projects in small groups under supervision of the lecturer
Professional competence: In-depth knowledge and comprehension	Students are able to understand the importance of optimising business processes. Students acquire the ability to recognise technologies, understand their potential and apply them to business problems and requirements. By working on a prototype project, students will practise acquiring an entirely new technology.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students acquire the skills to familiarise themselves with previously unknown business problems (of a business process) and to apply a new technology to them. The ability to autonomously acquire practical knowledge of technologies is trained. Business understanding is also practised. Dealing with uncertainties and unforeseen circumstances will be trained.

Personal competence: Social competence	Students work in a team and have to coordinate themselves independently. They interact with an (external) client and train their communication skills and the ability to organise themselves. They analyse the results of their work based on feedback sessions with the (external) client. They collaborate with other groups, exchange ideas in the spirit of collegial counselling, but also criticise objectively as part of the discourse
Personal competence: Independence / autonomy	Students provide well-founded guidance and support to team members. They present complex issues in a structured, focused, and audience-oriented manner. They work collaboratively in teams on a defined topic. Additionally, they take responsibility for acquiring both business and technological knowledge and skills.
Competence level according to GQF	7
Contents	- Optimization and automation of business processes in the context of digital transformation - Comprehensive overview of current and relevant technologies for process automation, with a focus on hyperautomation, AI and low-code approaches - Introduction to methods of process optimization - Adoption of state-of-the-art technologies for business transformation, including technology management, technology radar and technology scouting - Practical application: Development of technological prototypes for the modernisation of selected business processes utilising the introduced methods and technologies
Recommended optional programme components	None.
Additional specifics	Take place at the Bildungscampus.
Literature / learning sources	Dumas, M., la Rosa, M., Mendling, J., & Reijers, H. A. (2018): Fundamentals of Business Process Management Springer, Berlin, Heidelberg. Springer, Berlin, Heidelberg. vom Brocke, J. & Rosemann, M. (2015): Handbook on Business Process Management 1+2. Springer, Berlin,Heidelberg.
Scheduled	See timetable.
Combined assessments	Will be published in the first three weeks of the course.

Course MAAI ENG 3.01 305416 - Numerical Methods and Optimization

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Peter Ott (im Modulhandbuch steht: Prof. Dr.-Ing. Uwe Gleiter)
Semester	1 / 2 Semester
Frequency	Winter term / Summer term (im Modulhandbuch steht: WiSe)
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Numerical Methods and Optimization
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	32,5
Workload - self-study	30
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	
Teaching / learning methods	Lecture, excercises with MATLAB
Professional competence: In-depth knowledge and comprehension	• Understanding the basics and the properties of the methods and algorithms
Professional competence: Conative skills, analysis and synthesis of knowledge	• Application of the methods by MATLAB
Personal competence: Social competence	Depending on the selected course, students work on assignments and selected topics in small groups, thereby developing teamwork skills. They are able to communicate with engineering colleagues on a professional level using the technical terminology from the lecture.
Personal competence: Independence / autonomy	Independently apply methods of numerical analysis and optimization
Competence level according to GQF	7

Contents	Numerical Methods: • Numerical Differentiation • Interpolation • B-Splines • Numerical Integration • Root Finding • Ordinary Differential Equations Optimization: • Linear Least-Square Problems • Nonlinear Least Square Problems • Learning Algorithm for Neural Networks
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Dahmen, Wolfgang, Reusken, Arnold Numerik für Ingenieure und Naturwissenschaftler: Springer Berlin Heidelberg 2008 Berlin, Heidelberg Braga-Neto, Ulisses Fundamentals of Pattern Recognition and Machine Learning: Springer International Publishing 2020 Cham Shape Interrogation for Computer Aided Design and Manufacturing MIT Hyperbook , https://web.mit.edu/hyperbook/Patrikalakis-Maekawa-Cho/mathe.html Andreas Antoniou, Wu-Sheng Lu, Practical Optimization-Algorithms and Engineering Applications, Springer 2021
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.02 305442 Advanced Suspension Systems

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Georg von Tardy-Tuch
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Advanced Suspension Systems
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	• Kinematics and Kinetics • Axle Concepts (e.g. ASE KFZ-Technik II) • Materials
Teaching / learning methods	• lecture with presentation • preparation and post-processing of the given lectures
Professional competence: In-depth knowledge and comprehension	• material requirements in automotive applications (stress, strain, fatigue) • kinematics and elastokinematics of suspension systems (toe, camber, cambergain, antisquad, antidive, etc.) • special applications (inerter, pitch link, heave roll, etc.)
Professional competence: Conative skills, analysis and synthesis of knowledge	Students will gain a deeper insight in kinematics, material choices and dynamic behavior of suspension systems. Beside cost efficient designs, an understanding of more elevated and advanced technologies is achieved.

Personal competence: Social competence	Participants practice creating and giving a short technical presentation in small groups, based on research and technical analysis.
Personal competence: Independence / autonomy	Students will be enabled to analyze suspension kinematics and understand their function and benefits.
Competence level according to GQF	7
Contents	• Material considerations • Kinematic suspension design • Dynamic suspension elements • Elastokinematic elements • Kinematic vehicle behavior • Kinematic suspension analysis
Recommended optional programme components	Active chassis systems
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Trzesniowski Rennwagentechnik Heißing&Ersoy Fahrwerkhandbuch Matschinsky Radführung der Straßenfahrzeuge
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.03 305445 Autonomous Systems: Architecture and Planning

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Raoul Zöllner
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Autonomous Systems: Architecture and Planning
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	
Teaching / learning methods	Lecture with integrated exercises and case studies
Professional competence: In-depth knowledge and comprehension	The students possess comprehensive and specialized knowledge at the forefront of current research in the field of Architecture and Planning.
Professional competence: Conative skills, analysis and synthesis of knowledge	In their elective studies, students acquire advanced theoretical knowledge and its practical application, depending on the courses they choose.
Personal competence: Social competence	Depending on the chosen course, students work on assignments and selected topics in small groups, thereby developing their teamwork skills. They are able to communicate with engineering colleagues on a professional level using the technical terminology from the lectures.
Personal competence: Independence / autonomy	The lecture content is independently reinforced through exercises and practical examples, depending on the selected courses. Students are

	able to categorize, identify, formulate, and solve questions from the lectures. They are capable of gathering, evaluating, and independently interpreting relevant information.
Competence level according to GQF	7
Contents	• Introduction to autonomous systems • Architectures of autonomous systems • Characteristics, strengths & weaknesses of different set-ups • Planning
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Will be announced in the first lecture.
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.04 305447 Reinforcement learning for embedded control systems

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Frank Tränkle
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/L = Lecture with integrated laboratory
Language of instruction	English
Course title	Reinforcement learning for embedded control systems
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	Basic knowledge on Bachelor level in • modeling dynamic state-space models • frequency-response-based design of PID controllers • procedural programming • team work
Teaching / learning methods	This course is organized in two sections: • lecture with integrated exercises • lab projects in teams As part of the lab projects, automated driving functions are implemented in simulation scenarios, and on Mini-Auto-Drive (lab experiment for autonomous driving).
Professional competence: In-depth knowledge and comprehension	The participants gain interdisplinary knowledge in modeling / simulating vehicle dynamics. The participants learn how to apply model-driven

	software engineering for embedded control application. The participants learn the theory of reinforcement learning in the context of embedded control. The participant lean how to program reinforcement learning agents and how train and validate reinforcement learning agents for motion planning and control.
Professional competence: Conative skills, analysis and synthesis of knowledge	The participants gain the knowledge on how to apply simulation models, speed and path following controllers in driving scenarios, such as race tracks, parking, crossroads, roundabouts etc.
Personal competence: Social competence	The participants develop solutions in a highly complex context as team work and are able to define, implement and sustain interfaces to collaborating teams.
Personal competence: Independence / autonomy	The participants are able to design, implement and test complex software systems for automated driving in individual responsibility.
Competence level according to GQF	7
Contents	- Software architecture of autonomous driving - Vehicle dynamics simulation - Model-driven software engineering - Reinforcement learning for embedded control - Temporal difference learning - Deep reinforcement learning - Programming, training and validating reinforcement learning agents - Application of reinforcement learning agents for motion planning and control
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Frank Tränkle: Autonomous Systems: Path Planning and Control, English Manuscript, Hochschule Heilbronn, 2021 Frank Tränkle: Modellbasierte Entwicklung mechatronischer Systeme: mit Software- und Simulationsbeispielen für autonomes Fahren, DeGruyter Studium, Taschenbuch, 2021 Breymann, U.: C++: eine Einführung. Hanser München, 2016 Stroustrup, B.: Eine Tour durch C++: Die kurze Einführung inden neuen Standard C++11,

	Hanser München, 2015 Website http://www.ros.org
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.05 305448 Autonomous Systems: Perception and Situation understanding

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Raoul Zöllner Prof. Dr.-Ing. Nicolaj Stache (Hessenthaler)
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/L = Lecture with integrated laboratory
Language of instruction	English
Course title	Autonomous Systems: Perception and Situation understanding
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	Various exercises on coordinate transformations in monocular cameras, creation of short Python scripts to deepen the understanding of the content. Various project assignments as examination components.
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	• Knowledge of at least one programming language (highly likely to use MATLAB / Python or C depending on the project)
Teaching / learning methods	• Lecture with practical exercises • Experiments with sensor setups on the test vehicle as part of the project work • Working with available databases / pre-processed data • Preparation and review of lectures, self-directed learning
Professional competence: In-depth knowledge and comprehension	Students learn the fundamentals of perception systems, starting with architecture, including sensor calibration, and progressing to the

	representation of processed data in an environment model. This provides an understanding of what a sensor setup for an automated vehicle looks like—and why. Furthermore, the course covers how data is processed to achieve scene understanding. This course complements the "Autonomous Systems: Deep Learning" course, which provides a detailed insight into data interpretation through deep learning for various applications. In comparison, this course offers a broader perspective on sensors and sensor technologies, including hardware setups, while focusing more on the application of automated driving and Advanced Driver Assistance Systems (ADAS).
Professional competence: Conative skills, analysis and synthesis of knowledge	Students are familiar with current driver assistance systems and can describe their functionality. They understand various hardware setups and are aware of their advantages and disadvantages for different driver assistance systems. Additionally, students acquire knowledge of all sensors required for automated driving functions and can explain their operation. Furthermore, they are able to compute camera transformations in different coordinate systems, generate disparity images, and match point clouds using the learned algorithms.
Personal competence: Social competence	Students learn, using technical topics as examples, how to engage in group discussions and present their own viewpoints objectively.
Personal competence: Independence / autonomy	Students independently develop technical problem-solving strategies.
Competence level according to GQF	7
Contents	• Overview on Advanced Driver Assistance Systems and automated driving • Sensors for perception of environment • Calibration: sensors as measuring tools, Transformation of sensor data • Recording 3D data and movements • Object identification in sensor data • Object-Tracking
Recommended optional programme components	Autonome Systeme: Deep Learning
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	•Hartley, Zisserman: Multiple View Geometry in Computer Vision, Cambridge University Press,

	2004. ISBN:978-0521540513 •Winner, Hakuli, Lotz, Singer (Editors): Handbook of Driver Assistance Systems, Springer, 2015. ISBN: 978-3319123516; German edition: Handbuch Fahrerassistenzsysteme: Grundlagen, Komponenten und Systeme für aktive Sicherheit und Komfort, Springer, 2015. ISBN 978-3658057336
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.06 305450 Digital Signal Processing and pattern recognition

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Volker Stahl
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/L = Lecture with integrated laboratory
Language of instruction	English
Course title	Digital Signal Processing and pattern recognition
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	• Mathematical foundations at the level of a bachelor’s degree in an engineering discipline, particularly complex numbers, Fourier series, Fourier transform • Programming skills
Teaching / learning methods	• Lecture with exercises • Lecture-accompanying project
Professional competence: In-depth knowledge and comprehension	Students acquire the fundamentals of digital signal processing. They understand the relationship between the time and frequency domains for formulating and solving problems. They know how to transition between analog and discrete representation through sampling and signal reconstruction, enabling efficient problem-solving using digital computers. Students understand the fundamental approaches to signal classification. They master the relevant statistical principles and estimation methods required for this purpose.

Professional competence: Conative skills, analysis and synthesis of knowledge	Students can solve problems in signal processing, such as filtering, sampling rate changes, and modulation, and apply their knowledge to new tasks. They are capable of implementing pattern recognition systems, assessing their feasibility and complexity, and evaluating existing systems. They can apply theoretical methods and algorithms from signal processing and statistics for these purposes.
Personal competence: Social competence	Students work on a lecture-accompanying project in a team. Since the workload is too high for one individual, teamwork skills and social competence are required and further developed.
Personal competence: Independence / autonomy	Students apply the knowledge gained in the lecture to solve a larger project task. This involves not only understanding and reviewing lecture content and implementing the mathematical methods in software, but also conducting literature research. This process demands a high level of independence, self-responsibility, and time management.
Competence level according to GQF	7
Contents	• Convolution • Dirac impulse • Fourier series • Fourier transformation • Modulation • Sampling theorem, aliasing • Signal reconstruction • Digital FIR filters • Discrete Fourier transformation • Fast Fourier transformation (FFT) • Fast convolution using FFT • Project: Signal transmission with modulation • Matching methods with nonlinear time distortion • Graph search algorithms • Statistical models and classification • Hidden Markov models • Viterbi training • Maximum likelihood parameter estimation

	• Vector quantization, LBG algorithm, annealing • Decorrelation • Project: Speech recognition
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	•A.V. Oppenheim, R.W. Schafer, Discrete Time Signal Processing, Prentice Hall, 1989 •J.H. McClellan, R.W. Schafer, M.A. Yoder, Signal Processing First, Pearson 2003 •G.A. Fink, Mustererkennung mit Markov-Modellen, Teubner 2003 •K. Bosch, Elementare Einführung in die Wahrscheinlichkeitsrechnung, Vieweg 2010 •K. Bosch, Elementare Einführung in die angewandte Statistik,Vieweg 2010 •T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning, Springer 2001
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.07 305489 Selected topics in manufacturing engineering

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Dipl.-Wirt Arndt Birkert
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Selected topics in manufacturing engineering
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LK = Course-accompanying with written exam
Exam duration	60
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	There is no formal requirement for participation. However, attending the lectures "Cutting and Erosion Manufacturing Processes" and "Forming Manufacturing Processes" is recommended.
Teaching / learning methods	Lecture with exercise/review questions on selected manufacturing processes and methods related to production (e.g., statistical methods in manufacturing, cost calculation in production) – content may be updated or supplemented periodically. In some cases, group work on current selected topics (e.g., additive manufacturing of metal components) is included.
Professional competence: In-depth knowledge and comprehension	Acquisition of basic knowledge of methods required in manufacturing engineering (e.g., statistical methods in quality management, cost calculation). • Familiarization with additional manufacturing processes (as a supplement to the bachelor's lecture) and deepening knowledge of already

	known processes. • Understanding the fundamental relationships between product and process (e.g., in gear manufacturing). • Developing a "product-oriented perspective" on the manufacturing process (Design-for-Manufacturing, Design-to-Cost).
Professional competence: Conative skills, analysis and synthesis of knowledge	Acquisition of the competence to combine learned knowledge in a way that enables independent process development and further process optimization. In addition to the technical lecture content, the course encourages students to access product- and process-relevant knowledge through virtual platforms, particularly the Internet.
Personal competence: Social competence	Students learn, using technical topics as examples, how to engage in group discussions and objectively present their own viewpoints.
Personal competence: Independence / autonomy	
Competence level according to GQF	7
Contents	
Recommended optional programme components	FEM simulation of forming manufacturing processes
Additional specifics	Take place at the Sontheim campus. Guest lecturers are engaged each semester depending on the program. Additionally, one off-site visit per semester (such as a company tour with a professional lecture or a technology training session) is held.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.08 305495 Real-time Systems

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Carsten Wittenberg
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Real-time Systems
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LK = Course-accompanying with written exam
Exam duration	60
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	Basic computer science knowledge: • Programming skills • Operating systems
Teaching / learning methods	Lecture with integrated exercises
Professional competence: In-depth knowledge and comprehension	Understanding the challenges of real-time systems: • Resource allocation • Meeting timing constraints/conflicting timing requirements • Development of real-time concepts with a focus on scheduling
Professional competence: Conative skills, analysis and synthesis of knowledge	
Personal competence: Social competence	Students independently reflect on their own knowledge level. Using current examples, they develop innovative solutions on their own.
Personal competence: Independence / autonomy	For current and often unfamiliar issues, suitable concepts are developed that meet real-time

	requirements.
Competence level according to GQF	7
Contents	• Classification of real-time systems • Behavior of real-time applications • Scheduling and workload management • Preemption • Priority assignment • Concurrency and causality • Resource allocation
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	•Wörn, Brinkschulte: Echtzeitsysteme. Springer-Verlag, ISBN3-540-20588-8 •D. Zöbel: Echtzeitsysteme. Springer-Verlag, ISBN978-3-540-76395-6 •Vorlesungsinhalte
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.09 305502 Industrial Processes in Material Engineering

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Marc Wettlaufer
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Industrial Processes in Material Engineering
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LK = Course-accompanying with written exam
Exam duration	90
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	Basic knowledge of materials science
Teaching / learning methods	• Lecture • Group work • Exercises • Review sessions, Q&A • Exam preparation
Professional competence: In-depth knowledge and comprehension	Students understand how materials science issues are embedded in industrial processes and how they can be positively and constructively influenced. This is achieved through knowledge of the structure of modern companies, project organization, and fundamental materials science principles.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students possess a broad range of methods for addressing complex problems in the context of materials science issues. They are able to formulate concrete recommendations for action to tackle industrial challenges.

Personal competence: Social competence	Students independently work on complex case studies, organize themselves by dividing tasks, and deepen their subject expertise. They are capable of presenting and defending their results before experts.
Personal competence: Independence / autonomy	Students independently take responsibility for planning, implementing, and reflecting on the knowledge they have learned together.
Competence level according to GQF	7
Contents	1. Introduction 2. Strategy and Processes 3. Simultaneous Engineering 4. Parallelization 4.1 Project Management 4.2 Initial Phase 4.3 Early Project Phase 4.4 Intermediate Phase 4.5 Proj. Closure 5. Integration 5.1 Company Organization 5.2 Acquisition, Quotation, Sales 5.3 Development 5.4 Manufacturing 5.5 Purchasing 6. Standardization 6.1 Specifications in Mat.-Eng. 6.2 Development 6.3 Default Materials and Selection Process 6.4 Manufacturing 6.5 Purchasing 7. Summary
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus. The lecture develops the concept of a materials strategy. This enables a holistic and structured approach to the topic of "Industrial Processes in Materials Technology." In this way, materials science can be developed beyond the usual primarily

	technical-scientific perspective into a strategic and process-oriented field.
Literature / learning sources	Script and the referenced literature sources contained therein.
Scheduled	See timetable.
Combined assessments	2,5

Course MAAI ENG 3.10 305504 Lightweight Car Body Engineering

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Dipl.-Wirt Arndt Birkert
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V = Lecture
Language of instruction	English
Course title	Lightweight Car Body Engineering
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LK = Course-accompanying with written exam
Exam duration	60
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	
Teaching / learning methods	Lecture
Professional competence: In-depth knowledge and comprehension	Students should gain an overview of modern body construction and lightweight body design.
Professional competence: Conative skills, analysis and synthesis of knowledge	Acquisition of the competence to combine learned knowledge in a way that allows its application to other mechanical structures beyond automotive body construction. In addition to the technical lecture content, the course encourages students to access product-relevant knowledge through virtual platforms, particularly the Internet.
Personal competence: Social competence	Students learn, using technical topics as examples, how to engage in group discussions and objectively present their own viewpoints.
Personal competence: Independence / autonomy	
Competence level according to GQF	7
Contents	• Introduction to body construction in general and lightweight body construction in particular

	• Body development process • Body materials • Body manufacturing and production processes • Body dimensioning concept with tolerance management • Static and dynamic structural behavior of car bodies • Crash behavior of car bodies • Basic lightweight design approaches and specific lightweight solutions
Recommended optional programme components	FEM simulation of forming manufacturing processes and selected topics in manufacturing technology
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Ostermann: Anwendungstechnologie Aluminium Kurek: Karosserieleichtbau in der Automobilindustrie
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.11 305506 Optical Sensors

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Peter Ott
Semester	1 / 2 Semester
Frequency	Winter term / Summer term (im Modulhandbuch steht: SoSe)
Type of course	V/L = Lecture with integrated laboratory
Language of instruction	English
Course title	Optical Sensors
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	
Teaching / learning methods	Lecture, project lab on optical sensing
Professional competence: In-depth knowledge and comprehension	• Ability to apply technical optics in the context of optical sensing • Knowledge and simulation of wave optical effects in optical sensing • Understanding of methods for optical distance and shape measurement, including their characteristics and applications
Professional competence: Conative skills, analysis and synthesis of knowledge	• Ability to simulate simple wave optical effects • Independently deduce and understand the operating principle of an optical sensor
Personal competence: Social competence	Depending on the selected course, students work on assignments and selected topics in small groups, thereby developing teamwork skills. They are able to communicate with engineering colleagues on a professional level using the technical terminology from the lecture.

Personal competence: Independence / autonomy	• Independently deduce the operating principle of an optical sensor
Competence level according to GQF	7
Contents	• Systems Theory of Optical Imaging • Basics of diffraction • Discrete Fourier transform for simulating optical diffraction and imaging • MATLAB examples and assignments • Point spread function of optical imaging • Optical transfer function of optical imaging • Measurement methods of the transfer function • Lab experiment (measurement of the transfer function of a camera) • Optical Metrology for Production • Introduction in Metrology for Production • 2D camera metrology • Triangulation methods • Time-of-flight methods • Interferometry • Lab experiment (camera calibration)
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	1. Ausführliches Lernmodul in ILIAS 2. Ausführliche MATLAB-Beispiele in ILIAS zur wellenoptischen Simulation der Abbildung 3. Gasvik, K.J., Optical Metrology, Wiley, 2002 4. Förstner, W., Wrobel, B., Photogrammetric Computer Vision: Statistics, Geometry, Orientation and Reconstruction, Springer, 2016 5. Luhmann, T., Nahbereichsphotogrammetrie, Wichmann, 2003 6. Naumann, H., Schröder, G., Löffler-Mang, M., Bauelemente der Optik, Hanser, 2014
Scheduled	See timetable.
Combined assessments	

Course MAAI ENG 3.12 XXXXXX Machine Learning in Computer Vision

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. rer. nat. Dieter Maier
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/L = Lecture with integrated laboratory
Language of instruction	English
Course title	Machine Learning in Computer Vision
Credit points (ECTS)	5
SWS	4
Workload - contact hours	60
Workload - self-study	65
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Engineering - Elective course
Requirements for participation	
Teaching / learning methods	Lecture, project lab on computer vision
Professional competence: In-depth knowledge and comprehension	You should get to know image processing and machine learning in its current fields of application and be able to solve simple tasks independently. Furthermore, you should also be able to create a concept to solve complex machine learning tasks in the field of image processing.
Professional competence: Conative skills, analysis and synthesis of knowledge	The students should have grasped the subject area of machine learning for image processing to such an extent that they are able to independently implement a complex image processing project. Furthermore, they should incorporate their own new ideas into this project in order to be able to evaluate this procedure in comparison to conventional methods.
Personal competence: Social competence	The students should independently design, implement and evaluate complex image processing projects in small groups.
Personal competence: Independence / autonomy	The students should regularly compare their self-

	imposed goals with their achievements according to the project plan. In doing so, it is essential to recognise and reflect on the extent to which these deviate from one another and to work out the reasons for this.
Competence level according to GQF	7
Contents	• filtering and segmentation in image processing • feature extraction and identification in image processing • coordinate tranformations • 3D image processing applications • classification methods • different machine learning algorithm • camera calibration methods • OpenCv applications • Lab experiment
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Kruse et. al. Computational Intelligence ; Springer Viewg, Wiesbaden 2015
Scheduled	See timetable.
Combined assessments	

Course MAAI SE 3.01 172383 Information Visualisation

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Dr. sc. hum. Monika Pobiruchin
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Information Visualisation
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Software Engineering - Elective course
Requirements for participation	None
Teaching / learning methods	Lecture with integrated exercises; independent project work alongside the lecture
Professional competence: In-depth knowledge and comprehension	After completing the course, students will be familiar with: • Target-audience-specific communication channels and how to effectively use them • Data Visualization Principles • Fundamental elements of visual language for flipchart visualization • Software solutions for visualization, such as R/ggplot2, LaTeX/TikZ
Professional competence: Conative skills, analysis and synthesis of knowledge	Students are able to: • Visually represent their own and others' knowledge structures • Evaluate their own and others' knowledge structures regarding the quality of information

	visualization • Assess (software) solutions for information visualization based on their intended use • Appropriately apply (software) solutions for information visualization
Personal competence: Social competence	Students are enabled to evaluate the work of others from a professionally objective perspective and to provide constructive, respectful feedback.
Personal competence: Independence / autonomy	Students are enabled to independently familiarize themselves with their own and others’ scientific topics and visualize them for specific target audiences. They can conduct independent (technical) research, select appropriate (software) tools, and apply the knowledge gained from the course to real-world work situations.
Competence level according to GQF	7
Contents	Students will be enabled to prepare complex topics in a target group-specific manner for colleagues/workgroups, the scientific community, and the general public/non-experts. Students will learn to visually present research findings, for example, in the form of (visual) abstracts, scientific posters/presentations (conference contributions), and journal articles. This also includes the visually appealing preparation of information for viewers, known as "Visual Facilitating." Students will become familiar with common software tools and packages used for information visualization. In addition, the course provides fundamental knowledge in science communication and journalism to equip students with the skills needed to effectively convey research findings to scientific audiences as well as other societal sectors (business, politics).
Recommended optional programme components	
Additional specifics	Notice for students of the program Medizinische Informatik (MIM): Can be credited toward the profiles „Bioinformatik” (M6a), „Data Science” (M6c), „Informationsmanagement” (M6d), as well „Softwareentwicklung” (M6e) as well as the elective modules „Biomedizinische Informatik 1,2,3" (M3, M7, M8). Notice for Software Engineering (SEM) students: Can be credited toward the profiles "Advanced Software Engineering and Data Science" and

	"Human-Computer Interaction."
Literature / learning sources	• Tufte, E. Beautiful Evidence, Graphics Press, 2006 • Chang, W. R Graphics Cookbook. Practical Recipes for Visualizing Data, 2nd ed., O‘Reilly Media Inc., 2018 • Haussmann, M. UZMO - Denken mit dem Stift: Visuell präsentieren, dokumentieren und erkunden, Redline Verlag, 2014. • Hichert, R, Faisst, J. Gefüllt, gerahmt, schraffiert. Wie visuelle Einheitlichkeit die Kommunikation mit Berichten, Präsentationen und Dashboards verbessert. 1. Auflage. Verlag Franz Vahlen. 2019.
Scheduled	See timetable.
Combined assessments	Is defined during the first three weeks of the course.

Course MAAI SE 3.02 172397 Usability Evaluation and Testing

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. rer. nat. Alexandra Reichenbach
Semester	1 / 2 Semester
Frequency	Winter term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Usability Evaluation and Testing
Credit points (ECTS)	6
SWS	4
Workload - contact hours	60
Workload - self-study	90
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Software Engineering - Elective course
Requirements for participation	
Teaching / learning methods	Lectures, projects in small groups under supervision of the lecturer
Professional competence: In-depth knowledge and comprehension	The students know the psychological concepts that are important for user-centered design and testing. They know the rationale behind usability testing and have expanded their knowledge of empirical methods.
Professional competence: Conative skills, analysis and synthesis of knowledge	The students have trained the design and analysis of questionnaires. The students have trained the design, management, analysis and report of usability tests.
Personal competence: Social competence	Working in teams, working with test subjects.
Personal competence: Independence / autonomy	Independent application of the concept and method learned in the lectures.
Competence level according to GQF	7
Contents	User-centered design process. Usability testing in theory and practice.

	Design and analysis of questionnaires in theory and practice.
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus. Eligible for the MIM profiles "Informationsmanagement in der Medizin" and "Software-Entwicklug in der Medizin" (M6d, M6e), the MSEM profile „Human Computer Interaction”.
Literature / learning sources	Barnum, C. M. (2020). Usability testing essentials: ready, set...test!. Morgan Kaufmann.
Scheduled	See timetable.
Combined assessments	Will be published in the first three weeks of the course.

Course MAAI SE 3.03 262351 Change and Innovation Management

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr.-Ing. Tomas Benz
Semester	1 / 2 Semester
Frequency	1x/year
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Change and Innovation Management
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Software Engineering - Elective course
Requirements for participation	
Teaching / learning methods	
Professional competence: In-depth knowledge and comprehension	”Driving Change for Innovation” In a first part of our lecture, we apply the knowledge from the lectures in Leadership and Project Management to change in organization and especially IT companies. Organizational change has not only existed since keywords such as digital transformation, Industry 4.0, agile organizations or influences caused by new work considerations affect companies. We examine various examples and models of change and thus obtain a methodological basis for analysing different procedures in the company. In addition, we look at the change in companies from different perspectives in various case studies. Changing in organizations can be externally driven (”changing of environment”) and internally driven (”drive to excellence”) – both sides are interesting, when we have a look on Innovation Management. When environment and society is

	changing organization has to innovate in order to stay in market. In a second part we will have a closer look on Innovation Management, starting from terms and conditions to specific software tools and going on to methodology and innovation approaches.
Professional competence: Conative skills, analysis and synthesis of knowledge	
Personal competence: Social competence	work in interdisciplinary teams, organize such teams
Personal competence: Independence / autonomy	
Competence level according to GQF	7
Contents	Specific Content • Introduction to change management - reasons for change • Examples of various externally and internally motivated changes • Models of change • Case Studies - Agile Organizations, Digital Transformation, Design Thinking • Tools and methodology for innovation management • Innovation platforms • Innovation in organizations • The phases "Empathy", "Ideate" and "Prototype" in Innovation Management.
Recommended optional programme components	
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI SE 3.04 262352 Digital Transformation - Case Studies

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Christine Reck
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Digital Transformation - Case Studies
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Software Engineering - Elective course
Requirements for participation	There are no prerequisites for this lecture.
Teaching / learning methods	Contact hours • lectures • guided exercises • Introduction to project topics • building of project teams • meetings to guide and supervise project work Self-study: • study of literature • preparation of project meetings • Become acquainted with the chosen project topic • Execution of a team project You have to prepare, present and defend a presentation on the

	team project.
Professional competence: In-depth knowledge and comprehension	Processes are influenced by IT systems and vice versa. In Digital Transformation new Technologies lead to new or altered processes. The students think about Digital Business Processes and the relationship between a business model and a business process. A business model describes the rationale of how an organization creates, delivers, and captures value. It defines on a strategic level ”what to do”. Business processes define on an operational level ”how to do it”. Business Model and Business processes need to be aligned. Changes to Business models need to be reflected in changed Business processes.
Professional competence: Conative skills, analysis and synthesis of knowledge	A team project is part of this lecture. In order to succeed the students have to do literature research, apply methods to structure their thoughts (e.g. mind mapping), structure their own work as well as the work of the team.
Personal competence: Social competence	People from all over the world are attending our master's program. Thus, students have to work together in teams with people from other countries and with different cultural backgrounds. In order to be able to do this they have to agree on rules to make effective work possible. Reliability, punctuality and a constructive way to issue criticism are typical pain points for the student teams.
Personal competence: Independence / autonomy	The project work asks for self-dependence. Project meetings on a regular basis guide the work, but the work itself has to be done by the team autonomously.
Competence level according to GQF	7
Contents	Digital Transformation almost always means a change in business processes. Entirely new processes or changed processes. The students get to know a business process modeling language (BPMN) in order to be able to describe business processes in an understandable and useful way. Each student models an example process. The students then decide on a process or a business model to be digitalized, depict the status as-is as BPMN model, depict the target state as BPMN model, investigate the technology needed for the target state and do a qualitative cost estimation. In the end, they have to sum up. What does the digitalization buy you? What does the digitalization cost you? Would you recommend doing the digitalization? Why?

Recommended optional programme components	262353 Digital Transformation - Strategies and Technologies
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	Is defined during the first three weeks of the course.

Course MAAI SE 3.05 262353 Digital Transformation - Strategies and Technologies

This course is a mandatory course in the MAAI 3 module.

Person responsible for the course	Prof. Dr. Christine Reck
Semester	1 / 2 Semester
Frequency	Summer term
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Digital Transformation - Strategies and Technologies
Credit points (ECTS)	6
SWS	4
Workload - contact hours	60
Workload - self-study	90
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Domain Profile Software Engineering - Elective course
Requirements for participation	There are no prerequisites for this lecture.
Teaching / learning methods	Contact hours • lectures • guided exercises • Introduction to project topics • building of project teams • meetings to guide and supervise project work Self-study: • study of literature • preparation of project meetings • Become acquainted with the chosen project topic • Execution of a team project

	You have to prepare, present and defend a presentation on the team project.
Professional competence: In-depth knowledge and comprehension	Students have to think about why IT is of strategic importance for an enterprise: optimal support of business processes, doing key processes better or faster, deliver products and/or services of higher quality, better suitable for customer’s needs or achieve shorter time-to-market for innovations. Enterprises need to keep up with new technology. They have to decide whether new technology helps them to have more success or better results. One of the most thrilling developments at the moment is digital transformation of enterprises. Thus, students learn about digitization and digitalization and the digital transformation.
Professional competence: Conative skills, analysis and synthesis of knowledge	A team project is part of this lecture. In order to succeed the students have to do literature research, apply methods to structure their thoughts (e.g. mind mapping), structure their own work as well as the work of the team.
Personal competence: Social competence	People from all over the world are attending our master's program. Thus, students have to work together in teams with people from other countries and with different cultural backgrounds. In order to be able to do this they have to agree on rules to make effective work possible. Reliability, punctuality and a constructive way to issue criticism are typical pain points for the student teams.
Personal competence: Independence / autonomy	The project work asks for self-dependence. Project meetings on a regular basis guide the work, but the work itself has to be done by the team autonomously
Competence level according to GQF	7
Contents	Definition of Digital Transformation. Relationship between Digital Transformation on the one hand side and Strategy and Business Model on the other hand side. Digital Transformation is shown using the example enterprise Global Bike Sharing (GBS). Exercises using the example enterprise illustrate different strategy types, the business model of the company (using the magic triangle), the changes to the ”old” business model as a consequence of the digital transformation (using the business model canvas) as well as a number of business patterns. Change management is touched as one of the success factors for digital transformation. Different Innovation typologies (product, service, product-service) and

	determinants of digital innovation (e.g. technological opportunities) are discussed. Megatrends and enabling technologies for digital transformation are examined. The students work on project topics to deep-dive into the megatrends and technologies.
Recommended optional programme components	262352 Digital Transformation - Case Studies
Additional specifics	Take place at the Sontheim campus.
Literature / learning sources	Detailed Literature list is given for each part of the lecture.
Scheduled	See timetable.
Combined assessments	Is defined during the first three weeks of the course.

Module MAAI 4a 176100 Application Project with Colloquium

Duration of the module	2. Semester
SWS	8
Type of examination	Module grade (without examination) consists of weighted individual assessments.
Credit points (ECTS)	10
Requirements for awarding credit points	Successful completion of the practice-oriented project, the written project report, and the presentation in the colloquium.
Person responsible for the module	Prof. Dr.-Ing. Nicolaj Stache
Teaching, learning and examination methods	Practical project work, written project report, colloquium
Contents	Students deepen their knowledge in the practical application of artificial intelligence by further developing a practice-oriented project from the first semester. They apply AI technologies in real-world use cases, document their results, and present them in the colloquium.
Professional competence: In-depth knowledge and comprehension	Students deepen their knowledge in the practical application of AI technologies and enhance their ability to develop and implement them in real-world scenarios.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students enhance their skills in applying AI to concrete projects, develop solutions based on current technologies, and utilize scientific methods for problem-solving.
Personal competence: Social competence	Students work in teams, communicate with technical precision, and present their results in a colloquium. In doing so, they enhance their teamwork skills and their ability to communicate with professional colleagues.
Personal competence: Independence / autonomy	Students independently work on further developing their project, collect and evaluate relevant information, and present their findings in a written report and a colloquium.
Competence level according to GQF	7
Requirements for participation	Successful completion of the first semesters and selection of the “Application” specialization.
Additional module details	The module offers a practice-oriented deepening of knowledge and is geared towards a future career in industry. The project work prepares students for a career in the practical application

	of AI.
Scheduled	See timetable.
Combined assessments	Module grade based on the written project report and the presentation in the colloquium.

Course MAAI 4a.1 176101 Application Project

This course is a mandatory course in the MAAI 4a module.

Person responsible for the course	Prof. Dr.-Ing. Nicolaj Stache
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	L/S = Laboratory with Seminar
Language of instruction	English
Course title	Application Project
Credit points (ECTS)	9
SWS	7
Workload - contact hours	105
Workload - self-study	120
Detailed remarks on the workload	The project includes both practical work and accompanying theoretical studies that are required for successful implementation and the final thesis.
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Mandatory course for students of the "Application" track
Requirements for participation	
Teaching / learning methods	Independent project work, regular supervision, presentations
Professional competence: In-depth knowledge and comprehension	Application of AI technologies in real-world projects, advanced knowledge in the field of application development.
Professional competence: Conative skills, analysis and synthesis of knowledge	Ability to develop and implement AI solutions, problem-solving skills in practice-oriented scenarios.
Personal competence: Social competence	Ability to collaborate in a team, communicate effectively, and present project results.
Personal competence: Independence / autonomy	Independent handling of a practice-oriented project
Competence level according to GQF	7
Contents	Deepening the practical application of AI in real-world use cases, development, and

	implementation of software projects.
Recommended optional programme components	Introduction to machine learning, software engineering, project management
Additional specifics	
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 4a.2 176102 Application Colloquium

This course is a mandatory course in the MAAI 4a module.

Person responsible for the course	Prof. Dr.-Ing. Nicolaj Stache
Semester	2
Frequency	Winter term / Summer term
Type of course	S = Seminar
Language of instruction	English
Course title	Application Colloquium
Credit points (ECTS)	1
SWS	1
Workload - contact hours	15
Workload - self-study	10
Detailed remarks on the workload	
Type of examination	SR = Preliminary examination with presentation
Exam duration	
Type of course unit	Mandatory course for students of the "Application" track
Requirements for participation	
Teaching / learning methods	Coaching sessions with the lecturer, presentations, colloquia
Professional competence: In-depth knowledge and comprehension	Students should improve their ability to deliver media-supported, free speeches on technical topics or projects and engage in discussions about these projects with both experts and non-experts. Through the oral examination, students must demonstrate their ability to recognize interrelationships within the subject area and integrate specific questions into these contexts. This should showcase their ability for abstract and analytical thinking.
Professional competence: Conative skills, analysis and synthesis of knowledge	The student demonstrates not only subject-specific knowledge but also the ability to transfer knowledge and understand interconnections as a matter of course.
Personal competence: Social competence	Students present the results in a clearly structured paper that is understandable for professionals.

Personal competence: Independence / autonomy	Students defend their thesis in the form of a presentation and discussion before an audience.
Competence level according to GQF	7
Contents	Structure and Execution • Preparing a presentation • Writing speeches • Fundamentals of communication • Intention and message • Forms of presentation • Delivering a presentation • Language • From text to script • Visual aids • Psychological aspects • The speaker's relationship with visual materials • The room • Presentation style • Rehearsals and technical run-throughs • The final rehearsal • The day of the performance
Recommended optional programme components	
Additional specifics	
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Module MAAI 4b 176110 Research Project with Colloquium

Duration of the module	2. Semester
SWS	16
Type of examination	Module grade (without examination) consists of weighted individual assessments.
Credit points (ECTS)	20
Requirements for awarding credit points	Successful completion of the scientific research project, as well as the presentation and defense of the results in the colloquium.
Person responsible for the module	Prof. Dr.-Ing. Nicolaj Stache
Teaching, learning and examination methods	Scientific project work, colloquium
Contents	Students work on a scientific research project that exposes them to current scientific questions and provides initial research experience. The results of this project culminate in a scientific publication, which is presented and defended in the colloquium.
Professional competence: In-depth knowledge and comprehension	Students expand their knowledge of scientific research processes, from identifying relevant questions to the scientific publication of their results.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students learn advanced scientific methods, analyze data, and develop solutions for open questions in the field of Artificial Intelligence. Upon successful completion of the module, students should be able to: - Tackle complex research tasks using scientific methods - Produce well-founded written work - Publicly defend their ideas and results against professional critique
Personal competence: Social competence	Students engage in discussing and presenting their research findings, communicate at a scientific level, and enhance their ability to present and defend their work.
Personal competence: Independence / autonomy	Students independently work on the research project, collect and evaluate relevant scientific data, and develop a well-founded scientific publication.
Competence level according to GQF	7

Requirements for participation	Successful completion of the first semesters and selection of the "Research" specialization.
Additional module details	The module prepares students for a scientific career and enhances their ability to conduct research and present results scientifically.
Scheduled	See timetable.
Combined assessments	Module grade based on the written report, the scientific publication, as well as the presentation and defense in the colloquium.

Course MAAI 4b.1 176111 Research Project

This course is a mandatory course in the MAAI 4b module.

Person responsible for the course	Prof. Dr.-Ing. Nicolaj Stache
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	L/S = Laboratory with Seminar
Language of instruction	English
Course title	Research Project
Credit points (ECTS)	18
SWS	14
Workload - contact hours	210
Workload - self-study	240
Detailed remarks on the workload	Includes intensive literature research, theoretical modeling, and the execution of experiments or simulations.
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Mandatory course for students of the "Research" track
Requirements for participation	
Teaching / learning methods	Independent research, scientific publications, presentations, and discussions
Professional competence: In-depth knowledge and comprehension	Advanced knowledge in scientific research, ethical and societal issues in the context of AI.
Professional competence: Conative skills, analysis and synthesis of knowledge	Ability to conduct scientific research, produce scientific papers, and publish research findings.
Personal competence: Social competence	Ability to discuss and defend scientific results in an interdisciplinary environment.
Personal competence: Independence / autonomy	Independent exploration of a scientific subfield, active participation in scientific discussions
Competence level according to GQF	7
Contents	Working on a current scientific research project in the field of AI, developing a scientific publication.

Recommended optional programme components	Research methods, academic writing, ethical issues in AI
Additional specifics	
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 4b.2 176112 Research Colloquium

This course is a mandatory course in the MAAI 4b module.

Person responsible for the course	Prof. Dr.-Ing. Nicolaj Stache
Semester	2
Frequency	Winter term / Summer term
Type of course	S = Seminar
Language of instruction	English
Course title	Research Colloquium
Credit points (ECTS)	2
SWS	2
Workload - contact hours	30
Workload - self-study	20
Detailed remarks on the workload	
Type of examination	SR = Preliminary examination with presentation
Exam duration	
Type of course unit	Mandatory course for students of the "Research" track
Requirements for participation	
Teaching / learning methods	Coaching sessions with the lecturer, presentations, colloquia
Professional competence: In-depth knowledge and comprehension	Students should improve their ability to deliver media-supported, free speeches on technical topics or projects and engage in discussions about these projects with both experts and non-experts. Through the oral examination, students must demonstrate their ability to recognize the interrelationships within the subject area and integrate specific questions into these contexts. This process should showcase their ability for abstract and analytical thinking.
Professional competence: Conative skills, analysis and synthesis of knowledge	The student demonstrates not only subject-specific knowledge but also the ability to transfer knowledge and understand interconnections as a matter of course.
Personal competence: Social competence	Students present the results in a clearly structured paper that is understandable for professionals.

Personal competence: Independence / autonomy	Students defend their thesis in the form of a presentation and discussion before an audience.
Competence level according to GQF	7
Contents	Structure and Execution • Preparing a presentation • Writing speeches • Fundamentals of communication • Intention and message • Forms of presentation • Delivering a presentation • Language • From text to script • Visual aids • Psychological aspects • The speaker’s relationship with visual materials • The room • Presentation style • Rehearsals and technical run-throughs • The final rehearsal • The day of the performance
Recommended optional programme components	
Additional specifics	
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Module MAAI 5 176120 Elective Courses

Duration of the module	1. Semester
SWS	8
Type of examination	Module grade (without examination) consists of weighted individual assessments.
Credit points (ECTS)	10
Requirements for awarding credit points	
Person responsible for the module	Prof. Dr.-Ing. Nicolaj Stache
Teaching, learning and examination methods	As described for the lectures of the module.
Contents	In Module M5 "Elective Courses," students choose from practice-oriented elective courses that promote both entrepreneurial and technical competencies while enabling individual specializations. Additionally, courses from Modules M2 "AI Profile" and M3 "Domain Profile" can be taken to further deepen AI and domain-specific skills. This flexibility allows students in the M5 "Elective Courses" module to select courses from an additional Domain Profile, enabling them to combine two areas of focus during their Master's studies. Furthermore, it is possible to attend courses from other comparable Master's programs, provided they meet the competency level of the MAAI Master's program and are recognized accordingly.
Professional competence: In-depth knowledge and comprehension	Through a selection of various events, students have the opportunity to scientifically expand their knowledge according to their own interests.
Professional competence: Conative skills, analysis and synthesis of knowledge	Students acquire in-depth theoretical knowledge and its practical application depending on the chosen elective courses.
Personal competence: Social competence	Students work on tasks and selected topics in small groups, depending on the chosen course, thereby developing teamwork skills. They are able to communicate professionally using the technical terminology from the lecture.
Personal competence: Independence / autonomy	The lecture content is independently deepened through exercises or application examples, depending on the chosen course. Students can classify, identify, formulate, and solve lecture-related questions. They are also able to collect, evaluate, and independently interpret relevant information.

Competence level according to GQF	7
Requirements for participation	
Additional module details	The Module M5 (Elective Courses) includes elective courses. However, lectures from Modules M2 (AI Profile) and/or M3 (Domain Profile) can also be chosen for Module M5.
Scheduled	See timetable.
Combined assessments	If relevant, it will be defined within the first three weeks of the lectures.

Course MAAI 5.1 176121 Project Management Training

This course is a mandatory course in the MAAI 5 module.

Person responsible for the course	Prof. Dr.-Ing. Patrick Balve
Semester	1 / 2 Semester
Frequency	Winter term / Summer term
Type of course	S = Seminar
Language of instruction	English
Course title	Project Management Training
Credit points (ECTS)	2,5
SWS	2
Workload - contact hours	30
Workload - self-study	32,5
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Elective Course
Requirements for participation	
Teaching / learning methods	Mini-lectures on selected topics with follow-up application and discussion, literature research, student presentations, applying theory to students' own projects, peer learning and feedback sessions, documentation practice (project journals) as precursor to the end-of-semester report
Professional competence: In-depth knowledge and comprehension	* Project planning and scope definition in both traditionally and agile managed projects, project scheduling, project reporting, risk assessment and mitigation, stakeholder management, meeting management * Project canvas: structure and application * Scrum framework: the rules of the game * Distinctive features of Kanban
Professional competence: Conative skills, analysis and synthesis of knowledge	* Scoping projects, setting goals, creating realistic timelines * Identifying and analyzing stakeholder needs

	and risks * Progress tracking * Resolving issues and unexpected challenges in (student) projects * Running dailies, retrospectives, and lessons learned sessions * Prompt engineering in large language models to acquire new knowledge on project management * Writing about an own project in a structured and meaningful way.
Personal competence: Social competence	Fostering of interpersonal skills like collaborative leadership, conflict resolution, cultural awareness, and active listening.
Personal competence: Independence / autonomy	Developing personal competencies such as self-organization, time management, decision-making, presentation skills, resilience in facing challenges - complemented by the capacity for self-reflection and continuous improvement.
Competence level according to GQF	7
Contents	Topics treated in this course: * Understanding the basics of project management * Project lifecycle models (waterfall, agile, hybrid approaches) * Understanding project scope, stakeholder management, and risk assessment * Elements of project communication * Using a project canvas * Applying agile frameworks like Scrum and Kanban * How to successfully fail a project?
Recommended optional programme components	This seminaristic course is intended to accompany an application or research project. It is not designed as a stand-alone course.
Additional specifics	Take place at the Sontheim campus. With sufficient interest and additional learning effort, the course enables the acquisition of an external project management certificate from Scrum.org or the GPM.
Literature / learning sources	* Anderson, David J. & Carmichael, Andy: Essential Kanban Condensed. 2016, https://kanbanbooks.com/essential-kanban-

	condensed/ * Berkun, Scott: Making Things Happen : Mastering Project Management. O'Reilly, 2008. * Dittmann, Karen & Dirbanis, Konstantin: Project Management (IPMA) : Study Guide for Level D and Basis Certificate (GPM). 2nd ed., Freiburg : Haufe, 2024. * Flick, Michaela & Flick, Mathias: Understanding Pracitcal Project Management : A Guide for Project Work. - Freiburg : Haufe, 2024. * Habermann, Frank: Over the fence : rediscover the joy of projects, develop new ideas better, and have more fun working together. Berlin : Becota, 2018. * Olson, David L.: Project Management Tools. Singapore : Springer, 2024. * Schwaber, Ken & Sutherland, Jeff: Scrum Guide. 2020, https://scrumguides.org/
Scheduled	See timetable.
Combined assessments	

Course MAAI 5.2 176122 Advanced Modelling and Simulation

This course is a mandatory course in the MAAI 5 module.

Person responsible for the course	Prof. Dr. Markus Scholle
Semester	1 / 2 Semester
Frequency	1x/year
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Advanced Modelling and Simulation
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Elective Course
Requirements for participation	
Teaching / learning methods	
Professional competence: In-depth knowledge and comprehension	The students understand the basic principles and the theorems based on them as well as their applicability
Professional competence: Conative skills, analysis and synthesis of knowledge	The students are able to apply the recently acquired mathematical methods for analyzing and solving problems in fluid and solid mechanics, thermodynamics and Maxwell theory in accordance with the corresponding physical principles/theorems. They have strategies at their disposal to check the validity of their results.
Personal competence: Social competence	The students participate interactively in the development of the lecture content.
Personal competence: Independence / autonomy	Students are able to solve problems without massive guidance by the professor.
Competence level according to GQF	7
Contents	Specific Content • Mathematical foundations

	• Scalar, vector and tensor fields • Physical balance equations in fluid and solid mechanics, Maxwell equations • Dimensional analysis, non-dimensional numbers, similarity solutions • Potential fields, Green's function methods • Variational calculus of fields, Noether's theorem, second variation • Ritz's direct method • Numerical methods
Recommended optional programme components	Numerics of Partial Differential Equations
Additional specifics	Take place at the Sontheim campus. Students who join both lectures "Advanced Modelling and Simulation" and "Numerics of Partial Differential Equations" can optionally deliver one practical work (LA) embracing both topics
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Course MAAI 5.3 176123 Numerics of Partial Differential Equations

This course is a mandatory course in the MAAI 5 module.

Person responsible for the course	Prof. Dr. Markus Scholle
Semester	1 / 2 Semester
Frequency	1x/year
Type of course	V/Ü = Lecture with integrated exercise
Language of instruction	English
Course title	Numerics of Partial Differential Equations
Credit points (ECTS)	3
SWS	2
Workload - contact hours	30
Workload - self-study	45
Detailed remarks on the workload	
Type of examination	LA = Course-accompanying with practical work
Exam duration	
Type of course unit	Elective Course
Requirements for participation	
Teaching / learning methods	
Professional competence: In-depth knowledge and comprehension	The students understand the basic principles and the theorems based on them as well as their applicability
Professional competence: Conative skills, analysis and synthesis of knowledge	The students are able to apply the mathematical methods they have acquired to analyze and solve problems. They have strategies to check the validity of their results.
Personal competence: Social competence	The students participate interactively in the development of the lecture content.
Personal competence: Independence / autonomy	Students are able to solve problems without massive guidance by the professor.
Competence level according to GQF	7
Contents	Specific Content • Mathematical foundations • Classification of partial differential equations (PDE), occurrences in Physics

	• Finite differences (FD) • Finite volumes (FV) • Variational calculus of fields, weak formulations, Finite elements (FE) • Spectral discretion
Recommended optional programme components	Advanced Modelling and Simulation
Additional specifics	Take place at the Sontheim campus. Students who join both lectures "Advanced Modelling and Simulation" and "Numerics of Partial Differential Equations" can optionally deliver one practical work (LA) embracing both topics
Literature / learning sources	
Scheduled	See timetable.
Combined assessments	

Module MAAI 6 176150 Master Thesis

Duration of the module	1. Semester
SWS	24
Type of examination	Module grade (without examination) consists of weighted individual assessments.
Credit points (ECTS)	30
Requirements for awarding credit points	Successful completion of the master's thesis and oral defense of the thesis as part of a colloquium.
Person responsible for the module	Prof. Dr.-Ing. Nicolaj Stache
Teaching, learning and examination methods	As described for the lectures of the module.
Contents	In Module M6, the Master's Thesis, students make a significant contribution to scientific research in the field of applied artificial intelligence. With a processing time of four months and a valuation of 30 ECTS credits, they demonstrate their ability to independently address a complex scientific question using well-founded scientific methods. The Master's Thesis...
Professional competence: In-depth knowledge and comprehension	The module consists of two parts: the Master Colloquium and the Master Thesis. Students are expected to demonstrate their ability to conduct independent research, apply scientific methods, and write a thesis on a specific research question. The thesis project is supervised by a professor and a secondary supervisor. While working on the thesis, students participate in the Thesis Colloquium, where they present their research, defend their work, and receive feedback.
Professional competence: Conative skills, analysis and synthesis of knowledge	Upon successful completion of the module, students should be able to tackle complex research tasks using scientific methods, produce well-founded written work, and publicly defend their ideas and results against professional critique.
Personal competence: Social competence	Students make a scientifically grounded contribution to solving a problem and present the results in a clearly structured paper that is understandable for professionals.
Personal competence: Independence / autonomy	Students are required to independently familiarize themselves with a complex task within a relatively short time. The written report must be produced independently, using only specified

	sources.
Competence level according to GQF	7
Requirements for participation	
Additional module details	The master's thesis can be registered no earlier than after the lecture period of the second semester. The registration of the master's thesis requires the approval of the chairperson of the relevant examination committee.
Scheduled	See timetable.
Combined assessments	If relevant, it will be defined within the first three weeks of the lectures.

Course MAAI 6.1 176151 Master Thesis

This course is a mandatory course in the MAAI 6 module.

Person responsible for the course	Prof. Dr.-Ing. Nicolaj Stache
Semester	3
Frequency	Winter term / Summer term
Type of course	
Language of instruction	English
Course title	Master Thesis
Credit points (ECTS)	30
SWS	
Workload - contact hours	
Workload - self-study	
Detailed remarks on the workload	
Type of examination	PT = Final thesis (Master thesis)
Exam duration	
Type of course unit	Mandatory course
Requirements for participation	
Teaching / learning methods	Written thesis under supervision and guidance of a professor and a secondary supervisor. The thesis describes the students practical research on a clearly defined and agreed upon topic in a limited time frame. Optionally, the research may be performed at a company, research lab or organisation other than the university.
Professional competence: In-depth knowledge and comprehension	Students demonstrate the ability to • apply the knowledge and skills gained during their studies to a specific research problem. • develop a deeper understanding of a problem area and the work that has been done in that area. • weigh alternative approaches to solving a problem and making informed decisions. • produce concrete results given a research question by applying scientific methods. • write a well-structured document describing their theoretical, practical or experimental

	research and results.
Professional competence: Conative skills, analysis and synthesis of knowledge	Upon successful completion of the module, students should be able to tackle complex research tasks using scientific methods, produce well-founded written work, and publicly defend their ideas and results against professional critique.
Personal competence: Social competence	Based on scientific methods, students contribute to solving a problem and provide a clearly structured description of their results that can be understood by experts in their field.
Personal competence: Independence / autonomy	Students are required to develop and understanding of a problem area in a limited amount of time. The research and writing requires students to work independently using only sources that have to be listed in the thesis document.
Competence level according to GQF	7
Contents	Scientific Problem Solving with Supervision • Objective and specific task definition of the scientific project • Explanation of the methodological approach • Summary of existing relevant research on the chosen topic • Addressing the task • Results with scientifically substantiated evaluation • Discussion and conclusions with a clear rationale • Summary
Recommended optional programme components	Students take part in the Thesis Colloquium while they work on their thesis project.
Additional specifics	
Literature / learning sources	Scholz D.: Diplomarbeiten normgerecht verfassen,Vogel,Würzburg, 2006 Esselborn-Krumbiegel H.: Von der Idee zumText. Eine Anleitung zum wissenschaftlichen Schreiben, UTB Schöningh, Paderborn-München-Wien-Zürich, 2004
Scheduled	See timetable.
Combined assessments	

Appendix

General Information:

- Courses offered by the IT and TE faculties take place at the Sontheim campus, while courses offered by the WI faculty are held at the Bildungscampus.
- The M5 module, "Elective Courses", offers the opportunity to select courses from the M2 "AI Profile" and M3 "Domain Profile" modules. This enables students to set an additional focus within the "Application" study track or establish a primary focus within the "Research" study track. For example, a focus can be achieved by successfully completing courses totaling at least 10 ECTS credits from another domain profile.

AI Profile and Associated Courses

The Module M2 "AI Profile" offers a diverse range of specialized courses covering key topics in Artificial Intelligence (AI). The module emphasizes both theoretical foundations and advanced methods, along with practical applications. This is complemented by interdisciplinary perspectives that highlight the technical, economic, and societal aspects of AI.

The following table provides a concise overview of the available courses, showcasing the module's broad content spectrum. Students not only gain in-depth subject knowledge but also develop the ability to critically evaluate AI technologies and apply them effectively across various domains.

The following courses can be attended in both the first and second semesters.

Course number	Course title	Type of course	SWS	Exam type	Exam duration	Credit points (ECTS)	Frequency
176021	Advanced Reinforcement Learning	V/Ü	4	LA	-	5	Winter term
176022	Quantum Machine Learning	V/Ü	2	LKBK	60	2,5	Summer term
176023	Advanced Generative Models for Automated and Connected Driving	S	2	LA	-	2,5	Winter term
176024	Explainable AI (XAI)	L/S	4	LP	Presentation (30-45 minutes), technical paper (8-10 pages)	5	Winter term
176025	Mechanistic Interpretability	L/S	4	LP	Presentation (30-45 min.), technical paper (8-10 pp)	5	Summer term
176026	Embedded AI	V/Ü	4	LKBK	90	5	Winter term
176027	AI in Mobility	S	2	LA	-	2,5	Summer

							term
176028	Social Bias in AI	V/L	2	LA	-	2,5	1x/year
176029	AI Ethics	V/Ü	2	LP	Presentation (15-20 min.), paper (10 pp)	2,5	1x/year
176031	Digital Twin Design for Automated and Connected Mobility	V/P	4	LA	-	5	1x/year
176032	Mobility services and Autonomous Driving	V/P	4	LA	-	5	Winter term
172492	Advanced Approaches for AI-based image processing	L	2	LA	-	3	Winter term
172493	Milestones of AI-based Imaging Research	S	2	LA	-	3	Summer term
262313	AI-assisted Quality Assurance in Agile Software Processes	V/Ü	2	LKBK	60	3	Winter term
285641	Advanced Data Management & Engineering	V/Ü	4	LP	Presentation (30-45 min.), technical paper (8-10 pp)	5	Summer term

Table X Courses for the AI Profile

Domain Profile and Associated Courses

To fulfill the requirements of Module M3, students select a specialization from various application areas within the Domain Profile (M3) during the first and second semesters. A specialization is considered successfully completed when courses totaling at least 10 ECTS credits from a specific Domain Profile have been passed.

Additionally, within the framework of Module Elective Courses (M5), students may also choose elective courses from the Domain Profiles (M3). By completing courses worth at least 10 ECTS credits from a Domain Profile (M3) within Module M5, students can set a targeted focus as well.

The following courses can be attended in both the first and second semesters.

Please find below an overview of the domain profiles and their corresponding abbreviations.

Domain Profile	Domain Profile Abbreviation
Health	HE
Digital Business	DB
Logistics	LOG
Business Administration	BA
Engineering	ENG
Software Engineering	SE

The column 'Also for Profile' indicates whether a course, in addition to the “Domain Profile” listed in the left column, can also be credited to one or more other domain profiles. This column therefore lists all additional profiles for which the course is also eligible. However, it is important to note that double counting is not permitted. This means that even if a course is suitable for multiple profiles, it can only be credited toward one profile within the program.

Profile	Also for Profile	Course number	Course title	Type of course	SWS	Exam	Exam duration	Credit points (ECTS)	Frequency
HE		176051	Software Assisted Medical Diagnostics	V/L	2	LK	60	3	Winter term
HE	ENG, SE	262333	Mixed Reality Lab	V/Ü	4	LA	-	6	Summer term
HE	SE	172343	Software as medical device	V/Ü	2	LK	60	3	Winter term
HE	ENG, SE	172378	Foundations in Human-Computer Interaction	V/Ü	2	LK	60	3	Winter term

HE		172388	Personalized Healthcare	V/Ü	2	LA	-	3	Summer term
BA		154261	Leadership and Communication	S/Ü	4	LA	-	5	Winter term / Summer term
BA		154262	Business Ethics	S/Ü	4	LA	-	5	Winter term / Summer term
BA		154263	Entrepreneurship and Innovation	V/Ü	4	LA	-	5	Winter term / Summer term
BA		154271	Business Simulation	S/Ü	4	LA	-	5	Winter term / Summer term
BA		154272	Strategic Management	S/Ü	4	LA	-	5	Winter term / Summer term
BA		154363	Advanced Digital Marketing	V/Ü	4	LA	-	5	Winter term / Summer term
BA		154562	Digital Human Resource Management	V/Ü	4	LA	-	5	Winter term / Summer term
LOG		161331	Managing Global Supply Chains	V/Ü	4	LA	-	5	Winter term / Summer term
LOG		161361	Research Methods and Applications in Logistics I	V/Ü	4	LA	-	5	Winter term / Summer term
LOG		161371	Optimization of Supply Chains	V/Ü	4	LA	-	5	Winter term / Summer term
DB		285561	Digital Business Models,	V/Ü	4	LR	Presentation (20	5	Winter term

			Innovation & Strategy				min.)		
DB		285562	Business Process Management	V/Ü	4	LP	-	5	Winter term
DB		285661	Digital Transformation	V/Ü	4	LR	Presentation (20 min.)	5	Summer term
DB		285662	Business Process Optimization & Automation	V/Ü	4	LP	-	5	Summer term
ENG	HE, LOG	305416	Numerical Methods and Optimization	V/Ü	2	LA	-	2,5	Winter term / Summer term
ENG		305442	Advanced Suspension Systems	V/Ü	2	LA	-	2,5	Summer term
ENG		305445	Autonomous Systems: Architecture and Planning	V/Ü	2	LA	-	2,5	Winter term
ENG		305447	Reinforcement learning for embedded control systems	V/L	4	LA	-	5	Winter term
ENG		305448	Autonomous Systems: Perception and Situation understanding	V/L	4	LA	-	5	Summer term
ENG		305450	Digital Signal Processing and pattern recognition	V/L	4	LA	-	5	Winter term
ENG		305489	Selected topics in manufacturing engineering	V/Ü	2	LK	60	2,5	Winter term
ENG		305495	Real-time Systems	V/Ü	2	LK	60	2,5	Winter term

ENG		305502	Industrial Processes in Material Engineering	V/Ü	2	LK	90	2,5	Summer term
ENG		305504	Lightweight Car Body Engineering	V	2	LK	60	2,5	Summer term
ENG	HE	305506	Optical Sensors	V/L	4	LA	-	5	Winter term / Summer term
ENG	HE, SE	XXXXXX	Machine Learning in Computer Vision	V/L	4	LA	-	5	Winter term
SE	DB, ENG	172383	Information Visualisation	V/Ü	2	LA	-	3	Winter term
SE		172397	Usability Evaluation and Testing	V/Ü	4	LA	-	6	Winter term
SE		262351	Change and Innovation Management	V/Ü	2	LA	-	3	1x/year
SE	DB, LOG	262352	Digital Transformation - Case Studies	V/Ü	2	LA	-	3	Summer term
SE	DB	262353	Digital Transformation - Strategies and Technologies	V/Ü	4	LA	-	6	Summer term

Table Y Courses for the Domain Profile

Elective Courses and Associated Courses and Modules

The Module M5 "Elective Courses" offers students the opportunity to select from a diverse range of elective courses. The focus is on enabling students to tailor their studies to align with their personal interests and professional goals. These courses not only enhance subject-specific knowledge but also strengthen entrepreneurial, technical, and interdisciplinary skills.

The following table provides a structured overview of the available elective courses. It illustrates how students can deepen their specialization through practical content and specifically build competencies in areas such as project management, agile methods, as well as other topics from Module M2 "AI Profile" and Module M3 "Domain Profile".

Furthermore, upon request to the responsible examination board, students may also choose elective courses from a Master's program at Heilbronn University or another university, provided that these courses align with the competency objectives of the program. The recognition of such courses is subject to approval by the responsible examination board.

Course number	Course title	Type of course	SWS	Exam	Exam duration	Credit points (ECTS)	Frequency
176121	Project Management Training	S	2	LA	-	2,5	Winter term / Summer term
176122	Advanced Modelling and Simulation	V/Ü	2	LA	-	3	1x/year
176123	Numerics of Partial Differential Equations	V/Ü	2	LA	-	3	1x/year

Table Z Courses for the Elective Courses