Module Catalogue
for the master's degree study programmes

"Integrated Technology and System Development"
full-time (ITSD-FT) and
part-time (ITSD-PT)

at the Faculty of Minden Campus of
Hochschule Bielefeld
University of Applied Sciences and Arts
(HSBI)

Module catalogue

Integrated Technology and System Development (M.Eng. full-time/part-time)

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Please note: The modules' study semesters and numbering refer to the full-time version. The alternative sequence for the part-time version is indicated in footnotes.

Applied Numerics and Higher Mathematics								**Module ID** ANM
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
1.1	125 h	5	1st sem.	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours	85 h	Group work	40	German
	Exercise	0.5 weekly hours		-	32	
	Practical/Seminar	0.5 weekly hours		Portfolio work	16	
		approx. 40 h				

2 Learning outcomes/competences

The covered methods and concepts of applied mathematics are utilised throughout the master degree. The students are able to apply numerical algorithms, stability concepts and models as well as ordinary differential equations, which constitute prerequisites for the modelling of technical and business systems and for the running of computational simulations. The participants are able to determine the spectra of matrices and solutions of matrix exponential equations and obtain basic knowledge about stochastic methods, as they are required, for example, in the control of dynamic systems in the statistical analysis of production data.

3 Contents

Numerics
- Numerical solution of analytical equations
- Numerical integration and differentiation
- Introduction: Numerical solution of partial differential equations
- Introduction: Iterative solution of linear systems of equations, function approximation

Eigenvalues and matrix equations
- Eigenvalues and eigenvectors, spectrum of a matrix
- Principal axis theorem
- Matrix exponentials utilised for solving linear ODE (Ordinary Differential Equations) systems

Stochastics
- State variables, expected value, variance
- Distribution functions with focus on Gaussian normal distribution

4 Participation requirements

Formally, none. For the **"Numerics"** unit, basic knowledge of <u>any</u> higher programming language (such as C, C++, also Matlab or NumPy) is required, so that small programmes can be written and executed independently by participants.
The unit **"Eigenvalues and Matrix Equations"** requires solid knowledge in solving linear equation systems, matrix calculation and inverse matrices.
The **"Stochastics"** unit does not require any prior knowledge.

5 Form of assessment

Performance exam or written exam

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr.-Ing. Tilman Hetsch

9 Other information

"Modelling & Simulation": both modules and **practical courses** complement each other thematically. ANM teaches methods & solution strategies, MUS applications & modelling.

Modelling and Simulation								**Module ID MUS**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
1.2	125 h	5	1st sem.[1]	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours	85 h	Group work	40	German
	Exercise	0.5 weekly hours		-	32	
	Practical/Seminar	0.5 weekly hours		Portfolio work	16	
		approx. 40 h				

2 Learning outcomes/competences

The students recognise the nature (spatially distributed or discrete, at rest or in flow) of various real-world technical systems and can grasp and explain their physical, mathematical properties. They can extract the underlying model and prepare it for a suitable simulation environment. They carry out digital simulations, validate and interpret the simulation results in relation to the expected value to be assumed from the real world.

3 Contents

- Typical spatially distributed or discrete, at rest or in flux, mechanically electrical systems in mechanical engineering, electrical engineering and business management/logistics
- Mathematical and physical basic equations for model description
- Introduction to Fourier series, Fourier transform, as well as Laplace transformation and their application in ODEs
- Solution of ODEs with the help of transformation theorems and transformation tables.
- Modelling: From the real world to the model
- Numerical solution approaches for selected model classes
- Simulation tools and their numerical foundations
- Simulation: Approach, implementation and interpretation of results
- Real project

4 Participation requirements

Formally, none. Basic knowledge of physics (mechanics, electrical engineering, thermodynamics), control engineering and automation technology as well as business administration/logistics facilitate the understanding of the individual model worlds.

5 Form of assessment

Project work

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr.-Ing. Oliver Wetter

9 Other information

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[1] Part-time version: 3rd semester

Systems Engineering								**Module ID SYS**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
1.3	125 h	5	1st sem.[2]	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours		Group work	40	
	Exercise	1 weekly hours	85 h	-	32	German
		approx. 40 h				

2 Learning outcomes/competences

Students understand systems engineering as a team-oriented interdisciplinary approach to develop and realise large complex systems according to customer requirements. They are able to apply methods and tools of systems engineering in a targeted manner and thus substantially participate in the development of technical-business systems in various roles. To this end, they can delimit (sub-)systems, define the system boundaries and interfaces and set up corresponding projects and sub-projects (e.g. mechanical, electrotechnical, information technology and organisational sub-systems/projects). They have extensive knowledge and skills to actively supervise the conception and realisation of the subsystems, their integration into the overall system and its introduction, taking into account cost, time and quality aspects.

3 Contents

- Purpose, approach and methods of systems engineering
- Methodical analysis and definition of requirements
- Problem-solving methods
- Sustainable development of the system (interface specification)
- Model-based systems engineering (MBSE) with UML and SysML
- Risk management
- Product and quality assurance (e.g., FMEA)
- System verification and validation

4 Participation requirements

None

5 Form of assessment

Written or performance exam

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr.-Ing. Vanessa Uhlig-Andrae, Prof. Dr.-Ing. Sven Battermann

9 Other information

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[2] Part-time version: 3rd semester

Strategic Corporate Development								**Module ID SUE**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
1.4	125 h	5	1st sem.	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons Exercise	2 weekly hours 1 weekly hours approx. 40 h	85 h	Group work -	40 32	German

2 Learning outcomes/competences

Students understand basic theoretical approaches, methods, forms and concepts of strategic corporate development. They are able to plan, control and evaluate development processes. In addition, they know the importance of innovations for corporate development and are able to reflect on this from an ethical point of view. Application-related aspects are deepened by means of case studies.

3 Contents

Fundamentals of strategic corporate development
- Theoretical approaches
- Methods and instruments
- Concepts in the context of strategic corporate development
- Forms & obstacles of implementation
- Evaluation & reflection

Innovation Management
- Theoretical approaches
- Innovation strategies, types and forms of innovation
- Innovation processes
- Personnel dimensions of innovation
- Business model development

Ethics
- Ethics and society
- Ethics and business (compliance, corporate social responsibility, etc.)
- Ethics and people
- Ethics and innovations
- Technology assessment, risk assessment/management

Current topics in organisational and management research
Case studies

4 Participation requirements

None

5 Form of assessment

Written exam, project work or performance exam

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr. Michael Mohe

9 Other information

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Actuators and Sensors								**Module ID AKT**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
1.5	125 h	5	1st sem.	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours		Group work	40	
	Exercise	0.5 weekly hours	85 h	-	32	German
	Practical/Seminar	0.5 weekly hours		Portfolio work	16	
		approx. 40 h				

2 Learning outcomes/competences

The students know the characteristics and operating principles of different types of actuators and drives for influencing technical systems in a targeted way. The students master the functionality of drives and controlled drive systems and can apply this to actuator chains with sensor enrichments, connections between bus interfaces and physical mechanisms/principles, intelligent sensors/actuators, assembly groups, high integration.

3 Contents

Actuators and drive systems in technical systems
Electric drives
- DC motors, rotary field machines, stepper motors

Fluidic drives
- Hydraulic drives, pneumatic drives

Piezo and other types of actuators
Integrated sensors and sensor systems
Embedding actuators/drive systems with sensors in complex drive tasks
Modelling and control of drive systems using selected examples
Application areas and trends (automation, robotics, IoT integration, ...)

4 Participation requirements

Formally, none. Basic knowledge of electrical engineering, engineering mechanics and control engineering

5 Form of assessment

Written exam or project work or combination exam

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr.-Ing. Volker Becker

9 Other information

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Communications Technology								**Module ID KMT**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
1.6	125 h	5	1st sem.[3]	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours		Group work	40	
	Exercise	0.5 weekly hours	85 h	-	32	German
	Practical/Seminar	0.5 weekly hours		Portfolio work	16	
		Approx.. 40 h				

2 Learning outcomes/competences

The students know the basic principles of communication (interfaces, network topologies, communication processes) between sources and sinks in the control and automation area. Taking into account the requirements of a specific task, they are able to identify and design a suitable communication system, whether wired or wireless.

3 Contents

- Transition from point-to-point wiring to bus systems
- Network topologies
- ISO-OSI Reference Model
- Telegram structure (start, routing and address, data, checksums)
- Internet protocol (IP) and transmission control (TCP, UDP)
- Overview of communication models
- Standardised communication and fieldbuses
- Special properties of wireless and IoT systems
- Distributed systems
- Real-world examples of communication systems

4 Participation requirements

Formally, none. Basic knowledge of electrical engineering, control and automation technology

5 Form of assessment

Written exam or project work

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr. rer. nat. Philip Wette

9 Other information

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[3] Part-time version: 3rd semester

Control Systems								**Module ID RES**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.1	125 h	5	2nd sem.[4]	Annual	Winter	1 sem.	Compulsory elective, focus module	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons Exercise	2 weekly hours 1 weekly hours approx. 40 h	85 h	Group work -	40 32	German

2 Learning outcomes/competences

Students can analyse complex dynamic systems, describe their behaviour and design controllers for linearised systems. Coupled multivariable systems and higher order systems can be treated as well as time-discrete systems. They are able to apply methods for smoothing noisy data and to design estimators for variables that are not directly observable. They can assess the applicability of classical and more advanced methods. The students apply this content to solve real-world technical problems, such as machines, autonomous transport systems or the like.

3 Contents

- System description, state space analysis
- Multi-variable systems, higher order systems
- Time-discrete systems, filters and smoothing
- Parameter estimation, observers
- Optimal estimation methods, Kalman filters
- State-control
- Further developments
- Project application

4 Participation requirements

Formally, none. Contents of the ITSD modules "Applied Numerics and Higher Mathematics," "Modelling and Simulation" and "Systems Engineering." Knowledge of the terms and methods of continuous single-input single-output control engineering, matrix calculation and eigenvalues, basic knowledge in the description of stochastic quantities.

5 Form of assessment

Project work

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr.-Ing. Philipp Boysen, Prof. Dr.-Ing. Oliver Wetter

9 Other information

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[4] Part-time version: 4th semester

Information Systems Engineering								**Module ID EIS**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.2	125 h	5	2nd sem.[5]	Annual	Winter	1 sem.	Compulsory elective, focus module	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours		Group work	40	
	Exercise	1 weekly hours	85 h	-	32	German
		approx. 40 h				

2 Learning outcomes/competences

The students are able to check the feasibility of technical and business information systems in advance, to specify them and to put them out to tender. They can initiate, plan, and control corresponding IT projects and accompany their realisation, acceptance, and introduction. For this purpose, they can model and professionally document processes, functions, and data by systematically applying standard diagramming languages. This enables them to substantially participate in information system projects or life cycle phases in various roles and to act in a leading capacity.

3 Contents

- Types of information systems and projects
- Software development processes to realise information system projects
- Technical and IT concepts, requirements and functional specifications
- Diagram modelling languages (UML)
- Project-accompanying documentation
- Feasibility study
- IT requirements engineering, testability, test planning, and test execution
- Types of subcontracting, tendering, contract design, and acceptance

4 Participation requirements

Formally, none. Contents of the ITSD modules "Strategic Corporate Development" and "Systems Engineering." Basic knowledge of computer science, control & automation technology.

5 Form of assessment

Project work or performance examination

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr. rer. nat. Philip Wette

9 Other information

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[5] Part-time version: 4th semester

Engineering Project Controlling								**Module ID EPC**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.3	125 h	5	2nd sem.	Annual	Winter	1 sem.	Compulsory elective	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons Exercise	2 weekly hours 1 weekly hours approx. 40 h	85 h	Self-study material Exercise, incl. PC	40 32	German

2 Learning outcomes/competences

Based on their existing competences of management accounting and project management, students have extended or deepened knowledge and skills to ensure the profitability of engineering projects. They are able to adequately apply selected methods to various profitability controlling tasks that occur in engineering and to prepare and interpret controlling results in a management-oriented manner.

3 Contents

"Engineering Project Controlling (EPC)":

- Subject matter and economic-technical context
- Functional-methodical basics, standards, methods/tools

Application in

- Product planning and development projects
- Process optimisation projects
- Processing project-oriented customer enquiries and orders
- Other, e.g. marketing/sales projects

4 Participation requirements

Formally, none. Fundamental knowledge of project management as well as cost accounting and investment budgeting as part of industrial management.

5 Form of assessment

Written exam or combination exam

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr. rer. pol. Christoph von Uthmann

9 Other information

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Operations Management								**Module ID OPM**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.4	125 h	5	2nd sem.	Annual	Winter	1 sem.	Compulsory elective	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours		Supervised self-study	40	
	Exercise	1 weekly hours	85 h	Exercise, incl. PC	32	German
		approx. 40 h		Simulation game		

2 Learning outcomes/competences

Complementary to the module "Strategic Business Development," students have integrative knowledge and skills for planning and controlling as well as optimising the "operations" process, i.e. the order fulfilment process for the production of goods and services. They can transfer these to their business practice and are able to make decisions about the adequacy of individual qualitative and quantitative approaches (operations research) and thus carry out optimisations of (sub-)processes.
The focus is on the quotation/order phase, manufacturing and logistics/SCM as well as on the handling of engineering services.

3 Contents

- Operations Management:
  Positioning, technical-business context, functional-methodical basics, standards, methods and tools
- Operations process – sub-processes, standard systems and their interaction
- Operations Strategy: Interface to strategic corporate development
- Product development
- Process development: Process design, order planning and control

4 Participation requirements

Formally, none. Basic knowledge of industrial management or industry-related business administration, incl. internal accounting.

5 Form of assessment

Written exam or project work

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr. rer. pol. Christoph von Uthmann

9 Other information

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Flexible Automation for Small Batch Sizes								**Module ID FAL**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.5	125 h	5	2nd sem.[6]	Annual	Winter	1 sem.	Compulsory elective, focus module	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours		Supervised self-study	40	
	Exercise	1 weekly hours	85 h	Exercise	32	German
		approx. 40 h				

2 Learning outcomes/competences

The module teaches theoretical basics for the development and design of a highly individualised industrial mass production system. The students master the organisational framework conditions and their representation and implementation in the form of a technological concept. This enables them to understand the technology behind a flexible automation solution for "batch size 1" production, design it, critically assess it in the specific context, and apply it successfully on an industrial scale.

3 Contents

- Mass customisation/highly individualised mass production
- Organisational integration of "batch size 1" and mass series production
- Technological interlinking by means of handling and conveyor technology
- Use of generative manufacturing technologies metal and plastic
- Flexibility vs. automation – Elimination of set-up times
- Quality management at "batch size 1"
- Identification & statistical analysis of suitable production data
- Real-time monitoring and traceability of materials, components, products
- Case studies for successful implementation

4 Participation requirements

Formally, none. Contents of the ITSD modules "Systems Engineering," "Actuators and Sensors" and "Communications Technology." Basic knowledge of production engineering.

5 Form of assessment

Written exam or combination exam

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr.-Ing. Daniel Paßmann

9 Other information

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[6] Part-time version: 4th semester

Energy and Resource Efficiency								**Module ID ERE**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.6	125 h	5	2nd sem.	Annual	Winter	1 sem.	Compulsory elective	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Sem. lessons	2 weekly hours		Group work	40	
	Exercise	1 weekly hours	85 h	-	32	German
		approx. 40 h				

2 Learning outcomes/competences

Students master basic methods for evaluating the energy and resource efficiency of plants, processes and buildings.
They know basic organisational and technical methods for energy procurement, consumption recording and evaluation. They are able to assess and select suitable materials and equipment for technical applications with regard to their efficiency. They can build simple models for resource and energy-related questions and processes and carry out corresponding simple balancing simulations. The students know the process of resource and energy efficiency projects, are familiar with the possible applications of renewable energy systems and can evaluate the possible applications of energy storage systems in practice. Students are familiar with the current legal regulations and standards.

3 Contents

- Sustainability, CO_2 balances, climate protection
- Efficient use of resources
- Energy recovery and storage
- Modelling and balancing of material and energy flows
- Implementation of resource efficiency projects and energy audits
- Energy monitoring and management
- Legal regulations and standards, certificates
- Sustainability as a quality feature of a product
- Sustainability in factory planning and operation

4 Participation requirements

None

5 Form of assessment

Written exam or project work

6 Condition for the award of credit points

Module examination pass

7 Application of the module (in the following study programmes):

"Integrated Technology and System Development" (M.Eng., full-time and part-time version)

8 Module coordinator

Prof. Dr. Frank Hamelmann

9 Other information

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Applied Technology Project								**Module ID ATP**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.7	125 h	5	2nd sem.	Annual	Winter	1 sem.	Compulsory elective	MA
1	**Course type**		**Contact time**	**Self-study**	**Teaching forms (learning methods)**		**Planned group size**	**Language**
	Project			125 h	Project work		16	German
2	**Learning outcomes/competences**							
	Students are able to grasp concrete interdisciplinary technological problems in research and practice, structure them into meaningful sub-projects and work packages, use teamwork and apply their knowledge and skills already acquired and yet to be learned, in a targeted manner.							
3	**Contents**							
	The topics to be worked on are related to engineering or/and economics and are oriented towards the module contents of the curriculum. The topic is agreed individually between the student(s) and the university. The practical implementation or the use of technologies in the labs can be deepened.							
4	**Participation requirements**							
	At least two passed ITSD modules or individual proof of skills/successful participation in a similar project. Basic knowledge of project management.							
5	**Form of assessment**							
	Project work							
6	**Condition for the award of credit points**							
	Module examination pass							
7	**Application of the module** (in the following study programmes):							
	"Integrated Technology and System Development" (M.Eng., full-time and part-time version)							
8	**Module coordinator**							
	Prof. Dr.-Ing. Oliver Wetter (ITSD programme director)							
9	**Other information**							
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Project Work								**Module ID PRA**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
2.8	125 h	5	2nd sem.	Annual	Winter	1 sem.	Compulsory	MA
1	**Type of course**		**Contact time**	**Self-study**	**Teaching forms (learning methods)**		**Planned group size**	**Language**
	Project work			125 h	University/individual/ company project/ study work		typically 1, possibly 2	German
2	**Learning outcomes/competences**							
	With the project work, the students should demonstrate that they are capable of independently working on a task from the respective subject area, both in its subject-specific details and in the interdisciplinary contexts, according to scientific methods and within a given period of time.							
3	**Contents**							
	During or outside of the lecture period, individual problems from research or practice (also possible on site in a company) are worked on. The topics to be worked on must be related to engineering and/or business administration and be oriented towards the module contents of the curriculum. Lecturers or students may propose topics. The topic will be approved by the lecturers. The project work is to be documented in a written paper.							
4	**Participation requirements**							
	At least 4 passed ITSD modules.							
5	**Form of assessment**							
	Project work							
6	**Condition for the award of credit points**							
	Module examination pass							
7	**Application of the module** (in the following study programmes):							
	"Integrated Technology and System Development" (M.Eng., full-time and part-time version)							
8	**Module coordinator**							
	Prof. Dr.-Ing. Oliver Wetter (ITSD programme director)							
9	**Other information**							
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Master Thesis								**Module ID MAT**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
3.1	600 h	24	3rd sem.	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact time**	**Self-study**	**Teaching forms (learning methods)**	**Planned group size**	**Language**
	Master thesis		600 h	University/individual/ company master thesis	typ. 1	German

2	**Learning outcomes/competences** With the master thesis, the students should demonstrate that they are capable of independently working on a task from the respective subject area, both in its subject-specific details and in the interdisciplinary contexts, according to scientific methods and within a given period of time.
3	**Contents** The master thesis is a written paper and describes an investigation of an engineering and/or business problem and a detailed description and explanation of its solution. Lecturers or students may propose topics. The topic will be approved by the lecturers. The master thesis can be done in a subject-specific way or also through an empirical investigation or through conceptual or creative projects, or through an evaluation of available sources. A combination of these is possible. The scope of the master thesis is regulated in the Study Programme Examination Regulations (SPO) Section 15 (1).
4	**Participation requirements** According to SPO Section 15 (3)
5	**Form of assessment** Master thesis
6	**Condition for the award of credit points** Passed master thesis
7	**Application of the module** (in the following study programmes): "Integrated Technology and System Development" (M.Eng., full-time and part-time version)
8	**Module coordinator** Prof. Dr.-Ing. Oliver Wetter (ITSD programme director)
9	**Other information** -

Colloquium								**Module ID MAK**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
3.2	150 h	6	3rd sem.	Annual	Summer	1 sem.	Compulsory	MA
1	**Course type**		**Contact time**	**Self-study**	**Teaching forms (learning methods)**		**Planned group size**	**Language**
	Colloquium			150 h	University/individual/ company master thesis		typically 1	German
2	**Learning outcomes/competences** The colloquium complements the master thesis. It serves to determine whether the candidate is capable of orally presenting and independently justifying the results and benefits of the master thesis, its subject-specific foundations, the procedure, the interdisciplinary connections and the extra-subject references, as well as assessing its significance for practice. In addition, it is examined whether the candidate is able to discuss the above-mentioned points in a critical and differentiated manner.							
3	**Contents** Oral scientific disputation or defence of the written master thesis. The colloquium is to be assessed as an independent examination.							
4	**Participation requirements** Passed master thesis.							
5	**Form of assessment** Oral examination							
6	**Condition for the award of credit points** Module examination pass							
7	**Application of the module** (in the following study programmes): "Integrated Technology and System Development" (M.Eng., full-time and part-time version)							
8	**Module coordinator** Prof. Dr.-Ing. Oliver Wetter (ITSD programme director)							
9	**Other information** -							