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 Minden Campus of
Bielefeld University of Applied
Sciences

As of: 16 March 2020

FH Bielefeld
University of
Applied Sciences

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

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Applied Numerics and Higher Mathematics								**Abbr.** 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH	85 h	Group work	40	German
	Exercise	0.5 SCH		-	32	
	Practical/Seminar	0.5 SCH		Portfolio work	16	
		equiv. 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 any higher programming language (such as C, C++, also Matlab or NumPy) is required, so that small programs can be written and executed independently by participants. Matlab will be used, but previous knowledge is not required.
The unit **"Eigenvalues and Matrix Equations"** requires solid knowledge in solving linear equation systems, matrix calculation and inverse matrices. Basic knowledge of ODEs would be advantageous, but is not required. The **"Stochastics"** unit does not require any prior knowledge.

5 Form of assessment

Written 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 supervisor

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								**Abbr. MUS**
No.	**Workload**	**Credit points**	**Study semester**	**Frequency**	**Sem.**	**Duration**	**Type**	**Q level**
1.2	125 h	5	1st sem.	Annual	Summer	1 sem.	Compulsory	MA

1	**Course type**	**Contact hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	0.5 SCH	85 h	-	32	German
	Practical/Seminar	0.5 SCH		Portfolio work	16	
		equiv. 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 DGLs
- Solution of DGL 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 supervisor

Prof. Dr.-Ing. Oliver Wetter

9 Other information

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

1	**Course type**	**Contact hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	1 SCH equiv. 40 h	85 h	-	32	German

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
- Decomposition into subsystems and projects
- Sustainable development of the system (interface specification)
- Unified Modelling Language (UML)
- System verification and validation
- Configuration control/change management
- System documentation
- Risk management
- Product & quality assurance (e.g. Failure Mode and Effects Analysis (FMEA))

4 Participation requirements

None

5 Form of assessment

Written exam or project work or performance test

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 supervisor

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

9 Other information

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Strategic Corporate Development								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	1 SCH	85 h	-	32	German
		equiv. 40 h				

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 supervisor

Prof. Dr. Michael Mohe

9 Other information

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Actuators and Sensors								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	0.5 SCH	85 h	-	32	German
	Practical/Seminar	0.5 SCH		Portfolio work	16	
		equiv. 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, ...)

4 Participation requirements

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

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 supervisor

Prof. Dr.-Ing. Volker Becker

9 Other information

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

1	**Course type**	**Contact hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	0.5 SCH	85 h	-	32	German
	Practical/Seminar	0.5 SCH		Portfolio work	16	
		equiv. 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 bus system, whether wired or wireless.

3 Contents

- Transition from point-to-point wiring to bus systems
- Special properties of wireless systems and IoT systems
- ISO-OSI Reference Model
- Telegram structure (start, routing and address, data, checksums)
- Communication standards of standardised fieldbuses
- Network topologies
- Overview of bus systems (automation pyramid, transmission media)
- Real-world examples of bus systems

4 Participation requirements

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

5 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 supervisor

Prof. Dr. rer. nat. Philip Wette

9 Other information

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

1	**Course type**	**Contact hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	1 SCH equiv. 40 h	85 h	-	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 supervisor

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

9 Other information

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

1	**Course type**	**Contact hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	1 SCH equiv. 40 h	85 h	-	32	German

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 such as UML, BPML, ERM, PAP, ..
- 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 supervisor

Prof. Dr. rer. nat. Philip Wette

9 Other information

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Engineering Project Controlling								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH	85 h	Sem. tuition exercises, case studies self-study material	40	German
	Exercise	1 SCH equiv. 40 h			32	

2 Learning outcomes / competences

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

3 Contents

"Engineering Project Controlling (EPC)":

- Subject matter and economic-technical context
- Functional-methodical basics, standards, methods and 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 and investment management within the context of industrial management

5 Form of assessment

Combined Examination (“Kombinationsprüfung”)

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 supervisor

Prof. Dr. Christoph v. Uthmann

9 Other information

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Operations Management								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**planned Group size**	**Language**
	Sem. lessons	2 SCH		Supervised self-study	40	
	Exercise	1 SCH	85 h	Exercise, incl. PC	32	German
		equiv. 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, technical-methodical basics, standards, 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 supervisor

Endowed professorship or lecturer, until then Prof. Dr. Oliver Wetter (Academic Programme Director)

9 Other information

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

1	**Course type**	**Contact hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Supervised self-study	40	
	Exercise	1 SCH	85 h	Exercise	32	German
		equiv. 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 Communication Technology. Basic knowledge of production engineering

5 Form of assessment

Written 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 supervisor

Prof. Dr.-Ing. Daniel Paßmann

9 Other information

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Energy and Resource Efficiency								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Sem. lessons	2 SCH		Group work	40	
	Exercise	1 SCH equiv. 40 h	85 h	-	32	German

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 supervisor

Prof. Dr. Frank Hamelmann

9 Other information

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Applied Technology Project								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**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. Individual work is also possible.
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 schools can be deepened.
4	**Participation requirements** Min. two passed ITSD modules. Basic knowledge of project management and successful participation in a similar project.
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 supervisor** Prof. Dr. Oliver Wetter (Academic Programme Director)
9	**Other information** -

Project Work								**Abbr. 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	**Course type**	**Contact hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Project work		125	University/term/ company project/study work	typ. 1 2 possible if applicable	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 lecture time, 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. The topic is approved by teaching staff on the basis of the student's proposal. The project work is to be documented in a written paper.
4	**Participation requirements** Min. 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 supervisor** Prof. Dr. Oliver Wetter (designated Academic Programme Director)
9	**Other information** -

Master Thesis								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Master thesis		600	University/term paper/ 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. The topic is approved by teaching staff on the basis of the student's proposal. It 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 options is possible. The scope of the master thesis is regulated in the SPO Section 15 Para. 1.
4	**Participation requirements** According to SPO Section 15 Para. 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 supervisor** Prof. Dr. Oliver Wetter (designated Academic Programme Director)
9	**Other information** -

Colloquium								**Abbr. 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 hours**	**Self-study**	**Forms of teaching (forms of learning)**	**Planned group size**	**Language**
	Colloquium		150	University/term paper/ company master thesis	typ. 1	German

2	**Learning outcomes / competences** The colloquium complements the bachelor 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 supervisor** Prof. Dr. Oliver Wetter (designated Academic Programme Director)
9	**Other information** -