

Module Handbook

TUK MODHB Homepage

Course of Study "Industrial Mathematics" (M.Sc.)

[MAT-88.118-SG]

Department	[MAT] Mathematik
Degree	[M.Sc.] Master (M.Sc.)
Course of Study	Industrial Mathematics
Short Name	M.Sc. Industrial Mathematics
State	[NORM] Active
Additional informations	Examination regulations [DE] Homepage of the Course of Study [DE]

Section *General Mathematics*

Core Modules (non specialised)

In this section, modules amounting to 18 - 21 credit points (CP) from the list below are to be successfully completed, among those at least 9 CP to modules from a field related to industrial mathematics. With approval of the examination board, other modules from the area of Mathematics may be selectable.

The choice of the modules is limited by the chosen mathematical specialisation:

- Modules that are directly attributable to the chosen specialisation may not be included in the section General Mathematics.

WP	MAT-50-11-M-4	Integer Programming: Polyhedral Theory and Algorithms	9.0 CP
WP	MAT-50-12-M-4	Nonlinear Optimization	9.0 CP
WP	MAT-60-11-M-4	Probability Theory	9.0 CP
WP	MAT-60-12-M-4	Regression and Time Series Analysis	9.0 CP
WP	MAT-60-14-M-6	Monte Carlo Algorithms	9.0 CP
WP	MAT-60-15-M-4	Foundations in Financial Mathematics	3.0 CP
WP	MAT-70-11-M-4	Functional Analysis	9.0 CP
WP	MAT-80-11-M-4	Differential Equations: Numerics of ODE & Introduction to PDE Not possible if the chosen specialisation is "Modelling and Scientific Computing", "Partial Differential Equations", or "Systems and Control Theory".	9.0 CP
WP	MAT-80-11A-M-4	Numerics of ODE Not possible if the chosen specialisation is "Modelling and Scientific Computing", "Partial Differential Equations", or "Systems and Control Theory".	4.5 CP
WP	MAT-80-11B-M-4	Introduction to PDE Not possible if the chosen specialisation is "Modelling and Scientific Computing", "Partial Differential Equations", or "Systems and Control Theory".	4.5 CP
WP	MAT-80-12A-M-4	Introduction to Systems and Control Theory Not possible if the chosen specialisation is "Modelling and Scientific Computing" or "Systems and Control Theory".	4.5 CP
WP	MAT-65-10-M-4	Foundations in Mathematical Image Processing Not possible if the chosen specialisation is "Image Processing and Data Analysis".	9.0 CP
WP	MAT-80-13A-M-4	Introduction to Neural Networks Not possible if the chosen specialisation is "Modelling and Scientific Computing" or "Systems and Control Theory".	4.5 CP
WP	MAT-80-17-M-6	Dynamical Systems Not possible if the chosen specialisation is "Modelling and Scientific Computing".	4.5 CP
WP	MAT-80-18-M-4	Introduction to Systems and Control Theory & Dynamical Systems Not possible if the chosen specialisation is "Modelling and Scientific Computing" or "Systems and Control Theory".	9.0 CP
WP	MAT-81-23-M-4	Differential-Algebraic Equations Not possible if the chosen specialisation is "Modelling and Scientific Computing".	4.5 CP
WP	MAT-GM-MPOOL-5	General Mathematics (Introductory Modules M.Sc.)	[3.0 - 9.0] CP
WP	MAT-AM-MPOOL-7	Applied Mathematics (Advanced Modules M.Sc.)	[4.5 - 13.5] CP
WP	MAT-RM-MPOOL-7	Pure Mathematics (Advanced Modules M.Sc.)	[4.5 - 9.0] CP

In this section, modules associated to lectures or lectures with exercise classes or project modules amounting to 18 - 21 credit points (CP) have to be completed, including at least 12 CP for advanced courses from one or two of the following teaching and research areas:

- Visualisation and Scientific Computing (Computer Science),
- Information Systems (Computer Science),
- Software Engineering (Computer Science),
- Distributed and Networked Systems (Computer Science),
- Embedded Systems and Robotics (Computer Science),
- Intelligent Systems (Computer Science).

Modules for courses with mainly mathematical content are not permitted here if they overlap with other modules of the Bachelor's or Master's examination or if the examination board states that they do not have a sufficiently advanced character.

In particular, the modules or module catalogues listed below are permissible.

Advanced Modules

WP	INF-VIS_Ba_V-MPOOL-4	Specialization Bachelor TA Visualization and Scientific Computing	[4.0 - 8.0] CP
WP	INF-14-54-M-6	High Performance Computing with GPUs	6.0 CP
WP	INF-14-55-M-6	Topology Optimization	4.5 CP
WP	INF-14-56-M-6	Optimization in Fluid Mechanics	4.5 CP
WP	INF-14-57-M-6	Algorithmic Differentiation	5.0 CP
WP	INF-10-45-M-4	Visualization and Scientific Computing (Project)	8.0 CP
WP	INF-INSY_Ba_V-MPOOL-4	Specialization Bachelor TA Information Systems	[8.0] CP
WP	INF-20-45-M-4	Information Systems (Project)	8.0 CP
WP	INF-SE_Ba_V-MPOOL-4	Specialization Bachelor TA Software Engineering	[4.0 - 8.0] CP
WP	INF-30-45-M-4	Software Engineering (Project)	8.0 CP
WP	INF-VVS_Ba_V-MPOOL-4	Specialization Bachelor TA Distributed and Networked Systems	[4.0] CP
WP	INF-40-45-M-4	Distributed and networked systems (Project)	8.0 CP
WP	INF-ES_Ba_V-MPOOL-4	Specialization Bachelor TA Embedded Systems and Robotics	[4.0 - 8.0] CP
WP	INF-60-45-M-4	Embedded Systems (Project)	8.0 CP
WP	INF-KI_Ba_V-MPOOL-4	Specialization Bachelor TA Intelligent Systems	[4.0 - 8.0] CP
WP	INF-70-45-M-4	Intelligent Systems (Project)	8.0 CP

Supplementary modules

With the approval of the examination board, one of the supplementary modules can also be included in the master's examination with a reduced number of CP.

WP	INF-02-16-M-2	Project Management	6.0 CP
WP	INF-14-53_MAT-M-6	Introduction to HPC (for Mathematics Students)	6.0 CP
WP	MV-VPE-29-M-4	Virtual Product Engineering I	3.0 CP
WP	MV-VPE-116-M-4	Virtual Product Engineering II	3.0 CP
WP	INF-02-10-M-2	Computer Organization and System Software only selectable if the specialisation Embedded Systems and Robotics is chosen	8.0 CP
WP	INF-00-12-M-2	Information Systems only selectable if the specialisation Information Systems is chosen	8.0 CP
WP	INF-02-13-M-2	Communication Systems only selectable if the specialisation Distributed and Networked Systems is chosen	4.0 CP

In this section, modules amounting to 18 - 21 credit points (CP) from the module catalogue for the chosen specialisation (see below) have to be completed .

In addition, reading courses amounting to 12 CP have to be completed. The latter usually take place with semester-changing topics that are often based on current mathematical research. Towards the end of the lecture period of each semester, the reading courses offered in the following semester for the respective specialisation areas will be presented as part of the information sessions of the individual research focuses.

Modules associated to lectures (with or without exercise classes)

WP	MAT-65-MPOOL-7	Specialisation Image Processing and Data Analysis (M.Sc.)	[4.5 - 9.0] CP
WP	MAT-8x-MPOOL-7	Specialisation Modelling and Scientific Computing (M.Sc.)	[4.5 - 9.0] CP
WP	MAT-81-MPOOL-7	Specialisation Partial Differential Equations (M.Sc.)	[4.5 - 9.0] CP
WP	MAT-82-MPOOL-7	Specialisation Systems and Control Theory (M.Sc.)	[4.5 - 9.0] CP

Reading Courses

P	MAT-RC-MOD-M-7	Reading Course Mathematical Modelling	4.0 CP
P	MAT-RC-TM-M-7	Reading Course (Industrial Mathematics)	8.0 CP

Section *Seminars*

Core Modules (non specialised)

In this section, two seminars are to be chosen, including a modelling seminar from the chosen field of mathematical specialisation. In the context of the modelling seminar, additional 4 CP for the [MAT-RC-MOD-M-7] "*Reading Course Mathematical Modelling*" are acquired (see the section Specialisation).

P	MAT-MODSEM-M-7	Modelling Seminar (Mathematics)	3.0 CP
P	MAT-SEM-M-7	Seminar (Mathematics)	3.0 CP

Section *Master Thesis*

Thesis

P	MAT-MA-MAT-M-7	Master Thesis (Mathematics, M.Sc.)	30.0 CP
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Section *Subsidiary Topic (Minor)*

Subsidiary Topic

The (elective) modules to be completed in the chosen subsidiary subject (minor) are usually modules from a Bachelor's or Master's programme offered by the respective department of TUK. They build on the modules provided for the respective subsidiary topics in the Bachelor's programme [MAT-82.105-SG]. In these cases, the achievements to be completed can be found in the examination regulations of the corresponding course of study.

Modules for courses with mainly mathematical content are not permitted here if they substantially overlap with other modules of the Bachelor's or Master's examination, or if the examination board states that they do not have a sufficiently advanced character.

Electrical Engineering

In this subsidiary topic (minor), elective compulsory modules to a total of 18 - 21 CP must be chosen from one or two of the advanced study areas

- Automation & Control (AUT)
- Embedded Systems (ESY)
- Power Engineering (ENT)
- Integrated systems
- Communication technology (COM)
- Mechatronics (MET)

of the bachelor's degree course [\[EIT-82.781-SG#2021\]](#) "Electrical and Computer Engineering"(EIT), whereby in each of the selected areas at least 6 CP are to be completed on modules from the corresponding section "Major-Specific Advanced Subjects" of the bachelor's degree course or the master's degree course [\[EIT-88.781-SG#2021\]](#) "Electrical and Computer Engineering"(EIT) or at least equivalent achievements.

The module [\[EIT-LRS-504-M-3\]](#) "Linear Control" can be selected in each of the areas.

WP	EIT-LRS-504-M-3	Linear Control	5.0 CP
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Mechanical Engineering

In this subsidiary topic (minor), elective compulsory modules to a total of 18 - 21 CP must be chosen from one or two of the areas of expertise (KF)

- KF1: Product Development in Mechanical Engineering
- KF2: Vehicle Engineering
- KF3: Material Science and Technology
- KF4: Production Technology
- KF5: Computational Engineering

of the bachelor's programme [\[MV-82.103-SG\]](#) "Mechanical Engineering". In each of the selected areas at least 6 CP have to be completed on modules from the corresponding section of the bachelor's degree course or one of the master's programmes of the Department Mechanical and Process Engineering (MV) or at least equivalent achievements.

Instead of a second area of expertise the module [\[MV-MTS-23-M-4\]](#) "Measurement and control Theory" can be selected, too.

WP	MV-MTS-23-M-4	Measurement and control Theory	8.0 CP
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Physics

In this subsidiary topic (minor), elective compulsory modules to a total of 18 - 21 CP from the following list or other advanced modules (resp. module parts) from the study programmes offered by the Department of Physics (or at least equivalent achievements) must be selected:

WP	PHY-G3-M-2	Fundamentals of quantum physics	18.0 CP
WP	PHY-E1-M-3	Physics of condensed matter and statistical physics	20.0 CP
WP	PHY-E2-M-3	atomic physics	5.0 CP