Hochschule Düsseldorf
University of Applied Sciences

Fachbereich Maschinenbau
und Verfahrenstechnik
Faculty of Mechanical
and Process Engineering

Stand: Februar 2021 / Last updated: February 2021

MODULE MANUAL MASTER MECHANICAL ENGINEERING

General Studies

Course
Engineering Mathematics
Simulation of Mechanical Systems
Computer-Based Measurement Technology
Finite Element Method (FEM)
Computational Fluid Dynamics

Abbreviations:

sem. = semester
SS = summer semester; WS = winter semester
SWS = credit hours per week
CP = credits according to the European Credit Transfer System
SET = Simulation and Experimental Engineering; ME = Mechanical Engineering; IWI = International Industrial Engineering

Engineering Mathematics

Modulnummer (Module number)	Workload	Präsenzzeit (Attendance)	Selbststudium (Self-study)	Studiensemester (Semester)	Angebot im (Offered in)	Dauer (Duration)
MV_MASTV_Eng Math.16	180 h	75 h	105 h	Sem. 1	SS	1 sem.

Lehrveranstaltungen (Courses)	Credits	Zuordnung zu den Curricula (Allocation to study programme)
(a) Lecture 3 SWS (b) Practical Training 2 SWS	6 CP	Master ME, SET

1 Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)

The participants have

- a solid understanding of and scientific insight to the mathematical foundations of computational engineering, including numerical and algorithmic aspects of modern software tools.
- the ability to
  - derive and extend basic numerical algorithms
  - implement, test and apply algorithms and numerical solution schemes in the context of engineering problems
  - identify, characterize and assess the computational performance of algorithmic & numerical problems

The participants are familiar with

- the basic mathematics of computational methods
- modeling issues and error sources of the computational models
- the basic aspects of verification and validation and error control

2 Inhalte (Contents)

- Linear and non-linear systems of equations (properties, numerical solution method, algorithmic aspects)
- The engineering eigenvalue problem (algebraic properties, solution strategies, numerical solution methods and algorithmic aspects)
- Numerical algorithms (numerical interpolation, numerical differentiation, numerical integration in 1D, 2D and 3D)
- Algebra of relations (Boolean algebra, transitive closure), graph theory (types of graphs and applications), paths in networks (path algebra, weighted graphs)

3 Lehrformen (Forms of teaching)

Lecture, exercise, seminar, discussion

4 Empfohlene Voraussetzungen (Recommended prerequisites)

Bachelor's degree in engineering; solid Java-programming skills, basic Matlab programming skills, fundamentals of engineering mathematics and mechanics

5 Prüfungsformen (Types of examination)

Assessment in two parts according to the following weighting for the final grade:

I. Worked and defended practical (= 30% of the final grade)
II. Written exam (duration: 90 min.) (=70% of the final grade)

The students must pass each of the two parts with a minimum of 50% of the used grading scheme.

6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** Passed examination (100%)
7	**Modulverantwortliche(r) (Person responsible for the module)** Prof. Dr.-Ing. habil. Martin Ruess
8	**Sprache (Language of instruction)** English
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** • Lecture slides and lecture notes in form of a reader (partly) are provided • Boyd, S. and Vandenberghe, L. Introduction to Applied Linear Algebra, Cambridge University Press, 2018 (chapters 6-8) • Papula, L. Mathematik für Ingenieure und Naturwissenschaftler, Verlag Vieweg [in German] **advanced** • Demmel, J. Applied Numerical Linear Algebra. SIAM, Philadelphia, 1997 • Golub, G.H. and Van Loan, C. Matrix Computations. The Johns Hopkins, University Press, Baltimore, Maryland, 3. edition, 1996

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Simulation of Mechanical Systems

Modulnummer (Module number)	Workload	Präsenzzeit (Attendance)	Selbststudium (Self-study)	Studiensemester (Semester)	Angebot im (Offered in)	Dauer (Duration)
MV_MASTV_ SimMech.16	180 h	75 h	105 h	Sem. 1	WS	1 sem.

Lehrveranstaltungen (Courses)	Credits	Zuordnung zu den Curricula (Allocation to study programmes)
a) Lecture 2 SWS b) Exercise 2 SWS c) Practical Training 1 SWS	6 CP	Master ME

1	**Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)** The students know • the theoretical and practical foundations for modelling of mechanical systems. They can • build and simulate models of kinematic chains, open or closed by kinematic or control means, as well as optimise them by simple parameter variation. • carry out scientific work in this area.
2	**Inhalte (Contents)** Modelling and simulating mechanical systems
3	**Lehrformen (Forms of teaching)** • Oral presentation with slides, computer-based simulations • Programming samples and exercises • Practical simulation evaluation by the students themselves • Guidance to independent scientific work
4	**Empfohlene Voraussetzungen (Recommended prerequisites)** Study of mechanics or technical mechanics (approximately 12 CP on bachelor's level)
5	**Prüfungsformen (Types of examination)** • Modelling and simulating a given mechanical system using software, at home or in the laboratory • Oral examination and presentation of simulation results • Examination duration: 30 min.
6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** Passed examination (100%)
7	**Modulverantwortliche(r) (Person responsible for the module)** Prof. Dr.-Ing. Andreas Jahr, lecturer
8	**Sprache (Language of instruction)** English
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** • Pdf-files of lecture slides on MOODLE learning platform • Pdf-files of exercises on MOODLE learning platform • Pdf-files of former exercises, partly with solutions on MOODLE learning platform

	Recommended literature (latest edition): • Henning, Jahr, Mrowka: Technische Mechanik mit Mathcad, Matlab und Maple, Vieweg Verlag, Wiesbaden, 2004 • John J. Craig: Introduction to Robotics, Pearson Prentice Hall, Upper Saddle River, 2005 • Specific software literature, relevant scientific papers • MATLAB Simmechanics: http://de.mathworks.com/help/physmod/sm/getting-started-with-simmechanics.html

Computer-Based Measurement Technology

Modulnummer (Module number)	Workload	Präsenzzeit (Attendance)	Selbststudium (Self-study)	Studiensemester (Semester)	Angebot im (Offered in)	Dauer (Duration)
MV_MASTV_CMT.16	180 h	75 h	105 h	1. Semester	SS	1 Semester

Lehrveranstaltungen (Courses)	Credits	Zuordnung zu den Curricula (Allocation to study programmes)
a) Lecture 2 SWS b) Laboratory 3 SWS	6 CP	Master ME, SET

1 **Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)**

Students are able to

- analyse and verify signals in the time and frequency domain,
- know advantages and disadvantages of different data acquisition systems (rms-voltmeter, sound boards versus AD converter),
- operate accelerometers, microphones, oscilloscopes and rms-voltmeter,
- distinguish between steady-state, transient and dynamic data,
- check self-designed programs and circuits by simulations, e.g. verify overall levels in the time and frequency domain (Parseval theorem),
- distinguish between correlation measurement techniques in time and frequency domain and apply the concept of coherence, phase spectrum and time delay,
- apply mathematical formulations (e.g. of the Fourier principle and statistical methods),
- develop approaches and strategies to independently gather experimental data,
- establish concepts to relate signal components to its physical origin,
- reflect and generalise fundamental principles to transfer them to various experimental problems.
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2 **Inhalte (Contents)**

- Overview of the typical measurement principles for determining position, velocity, current, pressure, sound pressure and vibration
- Fundamental principles in signal processing (Fourier-, uncertainty- and symmetry principle)
- Data acquisition, including rudimentary concepts in signal processing
- Signal analysis in time and frequency domain including transfer operations (Parseval theorem)
- Advanced operations in signal processing (windowing, averaging, overlapping)
- Signal Conditioning, Digital Filtering (low-, high- and bandpass filtering, octave band analysis)
- Applications to aeroacoustics and vibroacoustics (rotating machinery, Campbell diagram)
- Correlation techniques in time and frequency domain (auto correlation, cross correlation, coherence, phase analysis)
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3 **Lehrformen (Forms of teaching)**

- Lecture with PC presentations, videos (in-house productions)
- Practical training using provided hard- and software (e.g. Dasylab, Matlab, PAK)

4 **Empfohlene Voraussetzungen (Recommended prerequisites)**

- Basics of data acquisition and numerical mathematics (e.g. fluid mechanics and acoustics from Bachelor program of HSD)

5 **Prüfungsformen (Types of examination)**

- Term paper, written or oral consultation

6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** • Passed examination
7	**Modulverantwortliche(r) (Person responsible for the module)** • Prof. Dr.-Ing. Frank Kameier
8	**Sprache (Language of instruction)** • English
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** Lecture notes software applications on moodle or stroemungsakustik.de Recommended literature: • Karrenberg, Ulrich, Signals, Processes, and Systems, An Interactive Multimedia Introduction to Signal Processing, 3rd edition, Berlin 2013. • Schmid, Hanspeter, How to use the FFT and Matlab's pwelch function for signal and noise simulations and measurements, FHNW/IME, August 2012 https://pdfs.semanticscholar.org/82f7/98aef6346a0e14bc52f0e4eca93a8f06ff27.pdf • Hewlett Packard, The Fundamentals of Signal Analysis, Application Note 243, 1994 http://www.hpmemoryproject.org/an/pdf/an_243.pdf

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Finite Element Method (FEM)

Modulnummer (Module number)	Workload	Präsenzzeit (Attendance)	Selbststudium (Self-study)	Studiensemester (Semester)	Angebot im (Offered in)	Dauer (Duration)
MV_MASTV_ FEM.16	180 h	75 h	105 h	Sem. 1	WS	1 sem.

Lehrveranstaltungen (Courses)	Credits	Zuordnung zu den Curricula (Allocation to study programmes)
a) Lecture 3 SWS b) Practical Training 2 SWS	6 CP	Master ME, SET (Elective Module)

1 **Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)**

The participants have

- a solid understanding of and scientific insight to the fundamentals of the finite element method, including all aspects of the simulation pipeline. Moreover, they are familiar with numerical & algorithmic aspects of modern software tools.
- the ability to
  - derive the set of equations governing physical field problems
  - develop, implement and test various types of finite elements
  - choose and assess the performance properties of finite elements
  - pre- and postprocess analysis-suited models and to assess the numerical results with regard to accuracy, reliability and computational performance

The participants are familiar with

- the basic functionality of commercial finite element platforms
- modeling issues and error sources of the computational model
- the basic aspects of verification and validation

2 **Inhalte (Contents)**

- introduction to the basic principles of the Finite Element Method for the solution of problems based on ordinary/partial differential equations (fe-analysis pipeline, fields of applications)
- derivation of the governing set of equations for various physical problems (thermal, elasticity, flow problems, etc., governing differential, integral and algebraic equations, method of weighted residuals, Galerkin formulation)
- element formulations (approximation spaces, algebraic & numerical properties)
- assembly, mesh generation, enforcement of constraints, solution methods and solution properties, accuracy and convergence measures/properties, model errors
- algorithmic aspects, modeling aspects and software implementation aspects for linear analyses.
- modeling and solution of engineering problems with commercial software packages.

3 **Lehrformen (Forms of teaching)**

- Lecture: interactive classroom lecture & exercises, seminar-style tutorials, discussion rounds

	• Practical: commercial software-based problem solving, video-based & guided tutorials, The practical involves modeling problems as well as exercises with regard to the presented lecture content.
4	**Empfohlene Voraussetzungen (Recommended prerequisites)** Bachelor's degree in mechanical engineering (or in a related discipline) Subject-related prerequisites: solid Java & basic Matlab Programming Skills, Foundations of Engineering Mathematics and Mechanics
5	**Prüfungsformen (Types of examination)** Assessment in two parts according to the following weighting for the final grade : I. Worked and defended practical (= 30% of the final grade) II. Written exam (duration: 90 min.) (= 70% of the final grade) The students must pass each of the two parts with a minimum of 50% of the used grading scheme.
6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** Passed examination
7	**Modulverantwortliche(r) (Person responsible for the module)** Prof. Dr.-Ing. habil. Martin Ruess
8	**Sprache (Language of instruction)** English
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** • Lecture slides and lecture notes in form of a reader (partly) are provided • K.-J. Bathe. Finite Element Procedures, Prentice Hall, 1995 • R.D. Cook, D.S. Malkus, M.E. Plesha. Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 1989 • T.J.R. Hughes. The Finite Element Method – Linear Static and Dynamic FEA, Prentice Hall, 2000 • Gebhardt, Ch. Praxisbuch FEM mit ANSYS Workbench, Hanser Verlag München 2018

Computational Fluid Dynamics (CFD)

Modulnummer (Module number)	Workload	Präsenzzeit (Attendance)	Selbststudium (Self-study)	Studiensemester (Semester)	Angebot im (Offered in)	Dauer (Duration)
	180 h	75 h	105 h	1. Semester	SS	1 Semester

Lehrveranstaltungen (Courses)	Credits	Zuordnung zu den Curricula (Allocation to study programmes)
a) Lecture 3 SWS b) Exercise 1 SWS c) Practical Training 1 SWS	6	Master ME, SET

1 **Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)**

After successful completion of the module, the students are capable of

- understanding the differential equations that describe the transport of momentum, heat and mass in single-phase flow of Newtonian fluids, as well as their boundary conditions.
- understanding different physical flow states with corresponding mathematical and numerical implications.
- understanding discretisation principles, gridding techniques and numerical solution procedures.
- applying the learned material to solve technical flow problems, via a commercial CFD software and make a qualified analysis and evaluation of the obtained results.
- communicating in English in the subject area of the course.

2 **Inhalte (Contents)**

- Introduction
- Continuum mechanics fundamentals
- Governing equations
- Simplifications of governing equations
- Discretization methods
- Finite Volume Method (FVM) for diffusion problems in 1D
- FVM for diffusion problems in 2D/3D
- FVM for convection-diffusion problems
- Higher order schemes for the convection terms
- FVM for unsteady flows
- Solution of the Navier-Stokes equations by FVM
- FVM for unstructured grids
- Introduction to turbulence modelling
- Concluding remarks and guidelines for the solution of practical flow problems

3 **Lehrformen (Forms of teaching)**

- Lecture (Power point, overhead, blackboard),, seminar, discussion, independent elaboration

4 **Empfohlene Voraussetzungen (Recommended prerequisites)**

- Bachelor's degree in mechanical engineering (or in a related discipline), fluid mechanics, heat transfer, mathematics,

5	**Prüfungsformen (Types of examination)** • Written examination in English (in parts or in full multiple-choice, 90 min.), or oral examination (30 min.), 80% Type of examination be announced at the beginning of the course • Practical training with oral examination, 20%
6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** • Passed examination
7	**Modulverantwortliche(r) (Person responsible for the module)** • Prof. Dr.-Ing. Ali Cemal Benim
8	**Sprache (Language of instruction)** • English
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** • C. Hirsch, „Numerical Computation of Internal and External Flows, Volume I: Fundamentals of Discretization“, Wiley, 1994 • C. Hirsch, “Numerical Computation of Internal and External Flows, Volume II: Computational Methods for Inviscid and Viscous Flows”, Wiley, 1995.

Specialisation

Course
Elective Course I (to be chosen from the list of elective courses)
Elective Course II (to be chosen from the list of elective courses)
Elective Course III (to be chosen from the list of elective courses)
Elective Course IV (to be chosen from the list of elective courses)

Projects, R&D

Course
Project incl. Project Seminar (Research & Development)
Engineering Conferences
Master Thesis incl. Colloquium

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Studienprojekt inkl. Seminar (Forschung & Entwicklung)
Project incl. Project seminar (Research & Development)

Modulnummer (Module number)	**Workload**	**Präsenzzeit (Attendance)**	**Selbststudium (Self-study)**	**Studiensemester (Semester)**	**Angebot im (Offered in)**	**Dauer (Duration)**
MV_MASTV_ Projekt.16	180 h	30 h	150 h	Sem. 2	SS / WS	1 sem.

Lehrveranstaltungen (Courses)	**Credits**	**Zuordnung zu den Curricula (Allocation to study programmes)**
Seminar 2 SWS	6 CP	Masterstudiengänge: SET, IWI, ME Master ME, SET, IWI

1 **Lernergebnisse (Learning outcomes) / Kompetenzen (Compentences)**

Die Studierenden können das im Studium erlernte fachliche und methodische Wissen anwenden und erweitern. Sie wurden mit fachübergreifenden Fragestellungen, Erfahrung ziel- und terminorientierten Arbeitens im Team und damit Stärkung der sozialen Kompetenzen, Förderung des strukturierten und vernetzten Denkens, Außendarstellung und Präsentation konfrontiert.

(The students can apply and extend the methodical and specialised technical knowledge acquired during their studies. They have faced interdisciplinary questions, goal and deadline-oriented work in teams and, thus, strengthening of their social competences, promotion of structured, cross-disciplinary thinking, rhetoric and presentation.)

2 **Inhalte (Contents)**

Selbstständige Bearbeitung einer konkreten, praxisnahen und motivierenden Aufgabenstellung aus den Gebieten Prozesstechnik, Energietechnik, Umwelttechnik, Produktion oder eines gebietsübergreifenden Themas im Rahmen von Arbeitsgruppen. Besondere Betonung liegt auf Teamarbeit, auf der Notwendigkeit, sich viele Daten und Unterlagen selbst beschaffen zu müssen und auf der Verpflichtung, die Ergebnisse schriftlich und mündlich zu präsentieren.

(Either independent work on a specific, motivating task with a practical orientation from the fields of production, process, energy or environmental technology; or an interdisciplinary task in groups.
Special emphasis is on
- *teamwork,*
- *the necessity of obtaining data and documents by themselves and*
- *the obligation of presenting the results in written and oral form.)*

3 **Lehrformen (Forms of teaching)**

Einführende Vorstellung und Erläuterungen, Selbststudium, Teamarbeit, regelmäßige Betreuung und Diskussion mit den Dozenten

(Introductory presentation and explanations, self-study, teamwork, regular supervision and discussion with the lecturer)

4 **Empfohlene Voraussetzungen (Recommended prerequisites)**

Fachbezogener Bachelor sowie die für das konkrete Projekt relevanten Teilmodule aus den Gebieten Prozess- Energie- und/oder Umwelttechnik, Managementtechniken, Produktion.

(Subject-related bachelor's degree as well as courses relevant to the specific project from the fields of process, energy and/or environmental technology, management techniques, production)

5	**Prüfungsformen (Types of examination)** Schriftliche Dokumentation der Projektarbeit, Präsentation, mündliche Prüfung *(Written documentation, project work, presentation, oral examination)*
6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** Teilnahme am Projekt sowie bestandene Präsentation der Ergebnisse *(Participation in the project and successful presentation of the results)*
7	**Modulverantwortliche(r) (Person responsible for the module)** Verschiedene *(Various)*
8	**Sprache (Language of Instruction)** Deutsch und Englisch *(German and English)*
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** Spezielle Literatur wird je nach Aufgabenstellung empfohlen. *(Relevant literature will be recommended depending on the task)*

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Engineering Conferences						
Modulnummer (Module number)	**Workload**	**Präsenzzeit (Attendance)**	**Selbststudium (Self-study)**	**Studiensemester (Semester)**	**Angebot im (Offered in)**	**Dauer (Duration)**
30031	180 h	60 h	120 h	Sem. 3	WS/SS	1 sem.
Lehrveranstaltungen (Courses)		**Credits**	**Zuordnung zu den Curricula (Allocation to study programmes)**			
Seminar 4 SWS		6 CP	Master SET, IWI, ME			

1	**Lernergebnisse (Learning outcomes) / Kompetenzen (competences)** The students • understand how scientific and engineering conferences work, • know what to do to submit their own work to an international conference, • can employ common techniques of producing a scientific paper, • can identify relevant work of other researchers in relation to their own work and extract similarities and distinctions, • can digest, condense, select and express information relevant to produce a thread of their own research work, • can assess a scientific paper in oral form or as a poster.
2	**Inhalte (Contents)** • Group work on selected conference papers, to train the technical understanding, recognition of structure, distillation of core content and critical review • Exercises in writing up scientific or technical work • Exercises in scientific (poster and oral) presentation, using modern technical means • Discussion and assessment of scientific presentations • Tutorials and exercises in online search for relevant information in connection with publishing research at an international conference • Small mock conference with poster session and short oral presentations
3	**Lehrformen (Forms of teaching)** Seminar
4	**Empfohlene Voraussetzungen (Recommended prerequisites)** None
5	**Prüfungsformen (Types of examination)** Submission of a scientific paper, participation in review process, poster preparation and presentation
6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** • Completed paper, reviews and poster, successful short oral presentation of the poster • Attendance at the following mandatory sessions: introduction and registration, conference session day, poster presentation day
7	**Modulverantwortliche(r) (Person responsible for the module)** • Summer term: Prof. Dr.-Ing. Thomas Zielke, Prof. Dr.-Ing. Matthias Neef • Winter term: Prof. Dr.-Ing. Ali Cemal Benim, Prof. Dr. Carsten Deckert

8	**Sprache (Language of instruction)** English
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** Recommended literature: • Alley, Michael (2013): The craft of scientific presentations. Critical steps to succeed and critical errors to avoid. 2nd ed. New York: Springer. • Alley, Michael (2014): The craft of scientific writing. 4th ed. New York, NY: Springer. • Cargill, Margaret; O'Connor, Patrick (2013): Writing scientific research articles. Strategy and steps. 2nd ed. Chichester: Wiley-Blackwell. • Hofmann, Angelika H. (2014): Scientific writing and communication. Papers, proposals, and presentations. 2nd ed. New York, NY: Oxford Univ. Press. • Holst, Bodil: (2015): Scientific Paper Writing - A Survival Guide, CreateSpace Independent Publishing Platform, Bergen List of important/popular conferences within the scope of our master courses: • http://icpr-eame.com • CIRP Conference on Industrial Product Service Systems • ISES Solar World Congress • Solar Heating and Cooling for Buildings and Industry conference (SHC) • ASME Turbo Expo (https://www.asme.org) IEEE engineering publications: http://ieeexplore.ieee.org

Masterarbeit
(Master's Thesis)

Modulnummer (Module number)	Workload	Präsenzzeit (Attendance)	Selbststudium (Self-study)	Studiensemester (Semester)	Angebot im (Offered in)	Dauer (Duration)
MV_MASTV_ Master.16	630 h	0 h	630 h	Sem. 3	WS/SS	1 sem.

Lehrveranstaltungen (Courses)	Credits	Zuordnung zum Curriculum (Allocation to study programmes)
n/a	21 CP	Master ME, IWI, SET

1	**Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)** Die Kandidatin/der Kandidat ist in der Lage, innerhalb einer vorgegebenen Frist ein anspruchsvolles Problem aus ihrem/seinem Fach selbständig nach wissenschaftlichen Methoden auf hohem Niveau zu bearbeiten. *(The students are able to work on a complex problem from their field – independently and in a professional manner, in accordance with scientific methods, within a prescribed period of time.)*
2	**Inhalte (Contents)** Die Abschlussarbeit dient zur Bearbeitung einer wissenschaftlichen Aufgabenstellung mit einem festgelegten Umfang und in einem vorgegebenen Zeitraum (16 Wochen). Das Thema der Abschlussarbeit kann theoretischer oder experimenteller Natur sein und kann aus allen Lehr- und Forschungsgebieten des Fachbereichs stammen. *(The thesis serves to work on a scientific assignment, within a prescribed extent and period of time: 16 weeks. The subject of the thesis can be of theoretical or experimental nature and can originate from any teaching or research field of the faculty.)*
3	**Lehrformen (Forms of teaching)** Keine *(None)*
4	**Teilnahmevoraussetzungen (Recommended prerequisites)** Es müssen alle Module mit Ausnahme der Module, die nach dem jeweiligen Studienverlaufs- und Prüfungsplan für das letzte Fachsemester vorgesehen sind, erfolgreich bestanden sein. *(The students must have successfully passed all modules, except the ones scheduled for the last semester.)*
5	**Prüfungsformen (Types of examination)** Die Abschlussarbeit ist eine schriftliche Prüfungsarbeit. *(The thesis is a piece of written examination work.)*
6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** Keine *(None)*

7	**Modulverantwortliche(r) (Person responsible for the module)** Dekan *(Dean)*
8	**Dozent(in) (Lecturer)** Verschiedene Betreuer*innen *(Various supervisors)*
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** Die Abschlussarbeit kann auch in der Forschungsabteilung eines Industrieunternehmens oder einer anderen wissenschaftlichen Einrichtung des Berufsfeldes durchgeführt werden, wenn sie dort ausreichend betreut werden kann. *(Alternatively, the students can write their theses in the research department of an industrial enterprise or in another scientific organisation of the professional field, if the thesis can be sufficiently supervised.)*

Kolloquium **(*Colloquium)***						
Modulnummer (Module number)	**Workload**	**Präsenzzeit (Attendance)**	**Selbststudium (Self-study)**	**Studiensemester (Semester)**	**Angebot im (Offered in)**	**Dauer (Duration)**
MV_MASTV_ MKolloq.16	n/a	n/a	n/a	Sem. 3	SS / WS	1 sem.
Lehrveranstaltungen (Courses) n/a		**Credits** 3 CP	**Zuordnung zum Curriculum (Allocation to study programmes)** Master ME, IWI, SET			

1	**Lernergebnisse (Learning outcomes) / Kompetenzen (Competences)** Die Kandidatin/der Kandidat ist befähigt, die Ergebnisse der Abschlussarbeit, ihre fachlichen Grundlagen, ihre fächerübergreifenden Zusammenhänge und ihre außerfachlichen Bezüge mündlich darzustellen, selbständig zu begründen, gegen Einwände zu verteidigen und ihre Bedeutung für die Praxis einzuschätzen. *(The candidates are able to present the results of their theses incl. technical principles, interdisciplinary correlations and non-technical references orally, justify the theses independently, defend them against objections and assess its importance for the practical application.)*
2	**Inhalte (Contents)** Das Kolloquium ergänzt die Abschlussarbeit, wird als mündliche Prüfung durchgeführt und von den Prüferinnen und Prüfern der Abschlussarbeit gemeinsam abgenommen und bewertet. Das Kolloquium kann ein Kurzreferat des Studierenden zu den Inhalten und Ergebnissen der Abschlussarbeit beinhalten. *(The colloquium is an oral examination complementing the thesis. The examiners of the thesis jointly conduct and evaluate the colloquium. The colloquium can include a short presentation by the student on the thesis contents and results.)*
3	**Lehrformen (Forms of teaching)** Keine *(None)*
4	**Teilnahmevoraussetzungen (Recommended prerequisites)** Bestätigung einer mindestens ausreichenden Leistung in der Thesis durch die Prüfer. *(Examiners' confirmation that they graded the thesis with the minimum passing grade or better.)*
5	**Prüfungsformen (Types of examination)** Das Kolloquium ist eine mündliche Prüfung und dauert 45 Minuten. *(The colloquium is an oral examination; duration: 45 min.)*
6	**Voraussetzungen für die Vergabe von Leistungspunkten (Requirements for award of credits)** Keine *(None)*

7	**Modulverantwortliche(r) (Person responsible for the module)** Dekan *(Dean)*
8	**Dozent(in) (Lecturer)** Verschiedene Betreuer*innen *(Various supervisors)*
9	**Sonstige Informationen / Literaturempfehlungen (Further information / references)** Keine *(None)*