

Module Handbook (<https://modhb.uni-kl.de/>)

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Notes on the module handbook of the department Mechanical and Process Engineering

Die hier dargestellten veröffentlichten Studiengang-, Modul- und Kursdaten des Fachbereichs Maschinenbau und Verfahrenstechnik ersetzen die Modulbeschreibungen im KIS und wurden mit Ausnahme folgender Studiengänge am 28.10.2020 verabschiedet.

Ausnahmen:

- BSc. Bio- und Chemieingenieurwissenschaften (Stand WS 20/21): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_BSc_BCI.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_BSc_BCI.pdf)
- BEd. Lehramt Metalltechnik (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Bachelor_Lehramt_Metalltechnik.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Bachelor_Lehramt_Metalltechnik.pdf)
- MSc. Bio- und Chemieingenieurwissenschaften (Stand WS 20/21): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_Msc_BCI.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MH_Msc_BCI.pdf)
- MEd. Lehramt Metalltechnik Werkstoffe und Fertigung (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Werkstoffe_und_Fertigung.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Werkstoffe_und_Fertigung.pdf)
- MEd. Lehramt Metalltechnik Maschinen- und Fahrzeugtechnik (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Fahrzeugtechnik.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Fahrzeugtechnik.pdf)
- MEd. Lehramt Metalltechnik Verfahrenstechnik (Stand WS 19/20): https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Verfahrenstechnik.pdf (https://www.mv.uni-kl.de/fileadmin/mv/Studium_Lehre/Modulhandbuecher/MHB_Master_Lehramt_Metalltechnik_-_Verfahrenstechnik.pdf)

Module MV-TM-136-M-4

Finite Elements (M, 6.0 LP)

Module Identification

Module Number	Module Name	CP (Effort)
MV-TM-136-M-4	<i>Finite Elements</i>	6.0 CP (180 h)

Basedata

CP, Effort	6.0 CP = 180 h
Position of the semester	1 Sem. in SuSe
Level	[4] Bachelor (Specialization)
Language	[DE] German
Module Manager	Müller, Ralf, Prof. Dr.-Ing. (PROF DEPT: MV) (/staff/83/) Sator, Christian, Dr.-Ing. (WMA DEPT: MV) (/staff/84/)
Lecturers	Sala, Ramses, Dr.-Ing. (WMA DEPT: MV) (/staff/640/) Sator, Christian, Dr.-Ing. (WMA DEPT: MV) (/staff/84/)
Area of study	[MV-LTM] Applied Mechanics
Reference course of study	[MV-82.103-SG] B.Sc. Mechanical Engineering (/mhb/FB-MV/cos-508/)
Lifecycle-State	[NORM] Active

Courses

Type/SWS	Course Number	Choice in Module-Part	SL	PL	CP	Sem.
3V+1U	MV-TM-86012-K-4	P	-	PL1	6.0	SuSe

- About **[MV-TM-86012-K-4]**: Title: "Finite Elements"; Presence-Time: 56 h; Self-Study: 124 h

Examination achievement PL1

- Form of examination: **written exam (Klausur) (75-105 Min.)**
- Examination Frequency: each semester
- Examination number: 10136 ("Finite Elements")

Evaluation of grades

The grade of the module examination is also the module grade.

Contents

From **[MV-TM-86012-K-4] Finite Elements** (/mhb/courses/MV-TM-86012-K-4/):

- Principles of the numerical solution for boundary value problems (weighted residuals, collocation and Ritz methods for trusses and beams)
- One-dimensional discretization with the Finite Element Method (FEM)
- Element technology for one- and two-dimensional problems (shape functions, numerical integration, isoparametric concept).
- Assembly of the global equation system (element stiffness matrix, element residuals)
- Truss and beam elements
- Displacement and mixed-formulation based elements for plane elasticity problems

Competencies / intended learning achievements

From **[MV-TM-86012-K-4] Finite Elements** (/mhb/courses/MV-TM-86012-K-4/):

1. Lecture

The students are able to

- Describe and apply several numerical methods for boundary value problems from the field of engineering mechanics
- Formulate truss and beam elements
- Calculate shape functions and their derivatives in the scope of the isoparametric concept
- Construct and apply shape functions for finite elements in two dimensional models
- Calculate plane elasticity problems

2. Exercises

The students are able to

- Apply various numerical methods on truss and beam constructions with Matlab
- Implement truss and beam elements in DAEdalon
- Calculate truss, beam and plane elasticity problems with DAEdalon
- Develop, implement and test element formulations

Literature

From [MV-TM-86012-K-4] Finite Elements (/mhb/courses/MV-TM-86012-K-4/):

- Gross, Hauger, Wriggers: Technische Mechanik 4 – Hydromechanik, Elemente der Höheren Mechanik, Numerische Methoden, Springer
- Gross, Hauger, Schröder, Werner: Formeln und Aufgaben zur Technischen Mechanik 4 – Hydromechanik, Elemente der Höheren Mechanik, Numerische Methoden, Springer
- Wriggers: Nichtlineare Finite-Element-Methoden, Springer
- Silber, Steinwender: Bauteilberechnung und Optimierung mit der FEM
- Bathe: Finite Element Methoden, Springer
- Hughes: The Finite Element Method, Prentice Hall
- Zienkiewicz, Taylor: The Finite Element Method: The Basis, Butterworth-Heinemann
- Zienkiewicz, Taylor: The Finite Element Method: Solid Mechanics, ButterworthHeinemann

Requirements for attendance (informal)

Knowledge of Continuum mechanics is an advantage

Modules:

- [MV-TM-279-M-4] Engineering Mechanics IV (M, 4.0 LP) (/mhb/modules/MV-TM-279-M-4/)
- [MV-TM-7-M-1] Applied Mechanics I (M, 5.0 LP) (/mhb/modules/MV-TM-7-M-1/)
- [MV-TM-8-M-4] Applied Mechanics II (M, 5.0 LP) (/mhb/modules/MV-TM-8-M-4/)
- [MV-TM-9-M-4] Engineering Mechanics III (M, 5.0 LP) (/mhb/modules/MV-TM-9-M-4/)

Requirements for attendance (formal)

None

References to Module / Module Number [MV-TM-136-M-4]

Course of Study	Section	Choice/Obligation
[INF-88.79-SG] M.Sc. Computer Science (/mhb/FB-INF/cos-536/)	Formal Fundamentals	[WP] Compulsory Elective
[MV-82.103-SG] B.Sc. Mechanical Engineering (/mhb/FB-MV/cos-508/)	KF5: Computational Engineering (if chosen)	[P] Compulsory