

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

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Module MAT-81-15-M-7

Asymptotic Analysis (M, 9.0 LP)

Module Identification

| Module Number | Module Name | CP (Effort) |
|---------------|----------------------------|----------------|
| MAT-81-15-M-7 | <i>Asymptotic Analysis</i> | 9.0 CP (270 h) |

Basedata

| | |
|---------------------------|---|
| CP, Effort | 9.0 CP = 270 h |
| Position of the semester | 1 Sem. irreg. |
| Level | [7] Master (Advanced) |
| Language | [EN] English |
| Module Manager | Klar, Axel, Prof. Dr. (PROF DEPT: MAT) (/staff/18/) |
| Lecturers | Klar, Axel, Prof. Dr. (PROF DEPT: MAT) (/staff/18/) Pinnau, René, Prof. Dr. (PROF DEPT: MAT) (/staff/27/) + further Lecturers of the department Mathematics |
| Area of study | [MAT-TEMA] Industrial Mathematics |
| Reference course of study | [MAT-88.105-SG] M.Sc. Mathematics (/mhb/FB-MAT/cos-538/) |
| Lifecycle-State | [NORM] Active |

Courses

| Type/SWS | Course Number | Choice in Module-Part | SL | PL | CP | Sem. |
|----------|---|--------------------------|----|-----|-----|--------|
| 2V | MAT-81-15-K-7 (/mhb/courses/MAT-81-15-K-7/) | P | - | PL1 | 4.5 | irreg. |

- About [MAT-81-15-K-7]: Title: "Asymptotic Analysis"; Presence-Time: 28 h; Self-Study: 107 h

Examination achievement PL1

- Form of examination: oral examination (20-30 Min.)

- Examination Frequency: irregular (by arrangement)
- Examination number: 86150 ("Asymptotic Analysis")

Evaluation of grades

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

Contents

From [MAT-81-15-K-7] **Asymptotic Analysis** (/mhb/courses/MAT-81-15-K-7/):

The mathematical techniques for flow computation and the theory of asymptotic expansions for differential equations are provided and analysed. In particular, the following topics are covered:

- regular and singular disturbed problems,
- scaling,
- multi-scale expansions,
- boundary layers for differential equations.

Competencies / intended learning achievements

Upon successful completion of this module, the students know and understand advanced methods for the asymptotic development of equations, in particular, differential equations. They are able to name the essential propositions of the lecture as well as to classify and to explain the presented correlations. They understand the proofs presented in the lecture and are able to reproduce and explain them. In particular, they can outline the conditions and assumptions that are necessary for the validity of the statements.

On the basis of concrete exercises, they have worked out a skilled, precise and independent handling of the terms, propositions and methods of the lecture. They have learned to transfer the methods to new problems, to analyse them and to develop solution strategies.

Literature

From [MAT-81-15-K-7] **Asymptotic Analysis** (/mhb/courses/MAT-81-15-K-7/):

- G. I. Barenblatt: Scaling,
- N. G. De Bruijn: Asymptotic methods in analysis,
- M. H. Holmes: Introduction to perturbation methods,
- U. Hornung: Homogenization and porous media,
- J. K. Hunter: Asymptotic analysis and singular perturbation theory (Lecture Notes).

Requirements for attendance (informal)

Modules:

- [MAT-10-1-M-2] Fundamentals of Mathematics (M, 28.0 LP) (/mhb/modules/MAT-10-1-M-2/)
- [MAT-80-11A-M-4] Numerics of ODE (M, 4.5 LP) (/mhb/modules/MAT-80-11A-M-4/)
- [MAT-80-11B-M-4] Introduction to PDE (M, 4.5 LP) (/mhb/modules/MAT-80-11B-M-4/)

Requirements for attendance (formal)

None

References to Module / Module Number [MAT-81-15-M-7]

| Module-Pool | Name |
|---|---|
| [MAT-70-MPOOL-7 (/mhb/modulepools/MAT-70-MPOOL-7/)] | Specialisation Stochastic Analysis (M.Sc.) |
| [MAT-81-MPOOL-7 (/mhb/modulepools/MAT-81-MPOOL-7/)] | Specialisation Partial Differential Equations (M.Sc.) |
| [MAT-8x-MPOOL-7 (/mhb/modulepools/MAT-8x-MPOOL-7/)] | Specialisation Modelling and Scientific Computing (M.Sc.) |
| [MAT-AM-MPOOL-7 (/mhb/modulepools/MAT-AM-MPOOL-7/)] | Applied Mathematics (Advanced Modules M.Sc.) |