

Module Handbook

TUK MODHB Homepage

Module MAT-14-00_ERW-M-3

Mathematics as a Potential for Solving Problems A: Modelling and Applied Mathematics (M, 12.0 LP)

Module Identification

Module Number	Module Name	CP (Effort)
MAT-14-00_ERW-M-3	<i>Mathematics as a Potential for Solving Problems A: Modelling and Applied Mathematics</i>	12.0 CP (360 h)

Basedata

CP, Effort	12.0 CP = 360 h
Position of the semester	2 Sem. from WiSe/SuSe
Level	[3] Bachelor (Core)
Language	[DE] German
Module Manager	Lossen, Christoph, Dr. habil. (WMA DEPT: MAT)
Lecturers	The Lecturers of the department Mathematics
Area of study	[MAT-EDU] Mathematics (B.Ed./M.Ed.)
Reference course of study	[MAT-B2.105-SG] ZEP LaRSP Mathematics
Lifecycle-State	[NORM] Active

Notice

This module can only be chosen by students who are studying mathematics in the certificate course of study [MAT-B2.105-SG] or [MAT-B5.105-SG].

Module Part #A "*Introduction to Scientific Programming*" (Obligatory, 3.0 LP)

Type/SWS	Course Number	Choice in Module-Part	SL	PL	CP	Sem.
1V+1U	MAT-14-00L-K-2	P	U-Schein	no	3.0	WiSe/SuSe

- About **[MAT-14-00L-K-2]**: Title: "Introduction to Scientific Programming (for Students of Teacher Training Programmes)"; Presence-Time: 28 h; Self-Study: 62 h
- About **[MAT-14-00L-K-2]**: The study achievement "**[U-Schein] proof of successful participation in the exercise classes (ungraded)**" must be obtained.

Module Part #B "*Praktische Mathematik*" (Obligatory, 9.0 LP)

Selection of a course on Practical Mathematics from the following catalogue:

Type/SWS	Course Number	Choice in Module-Part	SL	PL	CP	Sem.
4V+2U	MAT-14-13-K-3	WP	U-Schein	PL1	9.0	SuSe
4V+2U	MAT-14-11-K-3	WP	U-Schein	PL1	9.0	WiSe

- About **[MAT-14-13-K-3]**: Title: "Linear and Network Programming"; Presence-Time: 84 h; Self-Study: 186 h
- About **[MAT-14-13-K-3]**: The study achievement "**[U-Schein] proof of successful participation in the exercise classes (ungraded)**" must be obtained.
- About **[MAT-14-11-K-3]**: Title: "Introduction to Numerical Methods"; Presence-Time: 84 h; Self-Study: 186 h
- About **[MAT-14-11-K-3]**: The study achievement "**[U-Schein] proof of successful participation in the exercise classes (ungraded)**" must be obtained.

or another introductory lecture with exercise classes (4V+2U) to an area of Practical Mathematics with modelling character

Examination achievement PL1

- Form of examination: **oral examination (20-30 Min.)**
- Examination Frequency: each semester

Evaluation of grades

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

Contents

- Selection from the following topics of Practical Mathematics: numerical solving of linear systems of equations; perturbation theory; linear curve fitting problems; linear optimisation (simplex method, interior-point methods, duality theory); numerical computation of eigenvalues; numerical solving of non-linear systems of equations; approximation and interpolation; numerical integration; numerical solving of differential equations; graph theory; shortest graph problems; network flows;
- Modelling: fundamentals of model construction/modelling; modelling of small and medium application problems; independent processing of small problems (starting with the choice of the model, the application of mathematical algorithms up to the interpretation of the solution); discussion of the possible implementations;
- Introduction to scientific programming / practical course on programming: fundamental ideas of programming and basic programming structures, introduction to a current programming language, introduction to current mathematical software.

Competencies / intended learning achievements

The students

- know the basic principles of mathematical modelling and are able to work on real problems from different fields of

application with (previously known or also newly introduced) mathematical methods;

- recognise the sensitive dependence of the solutions found on the chosen model and method and they develop an understanding of the relevance of the mathematical theorems on which they are based and their prerequisites when applying numerical methods;
- use (depending on the choice of the course) methods for solving linear and non-linear systems of equations or for solving linear optimisation problems, are able to practically implement solution methods on the computer and to use standard software;
- are able to recognise and take into account problems that arise during the realisation of numerical methods on the computer;
- understand the idea of the approximate solution of mathematical problems and know typical application examples for the occurrence of optimisation and approximation problems;
- master a programming language and the use of current mathematical software; they learn to implement mathematical solution algorithms on the computer; they know about the limits of the applicability of computers and mathematical software.

Literature

see the respective course descriptions

Registration

Registration for the exercise classes via the online administration system URM (<https://urm.mathematik.uni-kl.de>).

Requirements for attendance of the module (informal)

Modules:

- [MAT-10-11-M-2] Fundamentals of Mathematics A: Linear Algebra I and Analysis I (M, 15.0 LP)
- [MAT-10-12L-M-2] Fundamentals of Mathematics B: Linear Algebra II and Analysis II (M, 9.0 LP)

Requirements for attendance of the module (formal)

None

References to Module / Module Number [MAT-14-00_ERW-M-3]

Course of Study	Section	Choice/Obligation
[MAT-B2.105-SG] ZEP LaRSP Mathematics	[Compulsory Elective Modules] Compulsory Elective Modules	[WP] Compulsory Elective
[MAT-B5.105-SG] ZEP LaBBS Mathematics	[Compulsory Elective Modules] Compulsory Elective Modules	[WP] Compulsory Elective