

## Module Handbook

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## Course MAT-50-12-K-4

Nonlinear Optimization (4V+2U, 9.0 LP)

### Course Type

SWS	Type	Course Form	CP (Effort)	Presence-Time / Self-Study	
-	K	Lecture with exercise classes (V/U)			
4	V	Lecture	6.0 CP	56 h	124 h
2	U	Exercise class (in small groups)	3.0 CP	28 h	62 h
<b>(4V+2U)</b>			<b>9.0 CP</b>	<b>84 h</b>	<b>186 h</b>

### Basedata

<b>SWS</b>	4V+2U
<b>CP, Effort</b>	9.0 CP = 270 h
<b>Position of the semester</b>	1 Sem. in SuSe
<b>Level</b>	[4] Bachelor (Specialization)
<b>Language</b>	[EN] English
<b>Lecturers</b>	Krumke, Sven Oliver, Prof. Dr. (PROF   DEPT: MAT) Ruzika, Stefan, Prof. Dr. (PROF   DEPT: MAT) Schöbel, Anita, Prof. Dr. (PROF   DEPT: MAT) + further Lecturers of the department Mathematics
<b>Area of study</b>	[MAT-OPT] Optimisation
<b>Additional informations</b>	<a href="#">Informations about the course</a>
<b>Lifecycle-State</b>	[NORM] Active

## Possible Study achievement

- Verification of study performance: **proof of successful participation in the exercise classes (ungraded)**
- Examination number (Study achievement): 84032 ("Exercise Class Nonlinear Optimization")
- Details of the examination (type, duration, criteria) will be announced at the beginning of the course.

### Contents

- Optimality conditions for unconstrained and constrained optimization problems,
- One-dimensional minimization; direct search methods,
- Descent methods in higher dimensions,
- CG method,
- Trust region algorithms,
- Penalty methods,
- Extended Lagrangian,
- SQP method,
- Barrier methods and primal-dual procedures.

### Competencies / intended learning achievements

The students have studied and understand different methods and algorithms to solve nonlinear optimization problems. They have learnt to model and solve real problems in the areas of economics, engineering and physics by means of transforming them into nonlinear optimization problems using mathematical methods. They are able to critically assess the possibilities and limitations of the use of these methods.

### Literature

- R. Fletcher: Practical methods of optimization,
- D.G. Luenberger: Linear and Nonlinear Programming,
- J. Stoer, C. Witzgall: Convexity and Optimization in Finite Dimensions,
- M.S. Bazaraa, H.D. Sherali, C.M. Shetty: Nonlinear Programming: Theory and Algorithms,
- K.H. Borgwardt: Optimierung, Operations Research, Spieltheorie: Mathematische Grundlagen,
- R. Horst, P.M. Pardalos, M.V. Thoai: Introduction to Global Optimization,

- H. Tuy: Convex Analysis and Global Optimization.

## Materials

Further literature will be announced in the lecture; Exercise material is provided.

## Registration

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

## Requirements for attendance (informal)

### Modules:

- [MAT-10-1-M-2] Fundamentals of Mathematics (M, 28.0 LP)
- [MAT-14-13-M-3] Linear and Network Programming (M, 9.0 LP)

## Requirements for attendance (formal)

None

## References to Course [MAT-50-12-K-4]

Module	Name	Context	
[MAT-30-10L-M-5]	Specialisation Module (Teachers Training Programme Mathematics)	WP: Obligation to choose in Obligatory-Modulteil #A (Lectures)	4V, 6.0 LP
[MAT-50-12-M-4]	Nonlinear Optimization	P: Obligatory	4V+2U, 9.0 LP
Course-Pool	Name		
[MAT-50-4V-KPOOL-4]	Elective Courses Optimisation and Stochastics (4V, B.Sc.)		
[MAT-50-KPOOL-4]	Specialisation Optimisation and Stochastics (B.Sc.)		
[MAT-70-KPOOL-4]	Specialisation Analysis and Stochastics (B.Sc.)		