

## Module Handbook

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## Course MAT-50-11-K-4

Integer Programming: Polyhedral Theory and Algorithms (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 WiSe
<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): 84031 ("Exercise Class Integer Programming")
- Details of the examination (type, duration, criteria) will be announced at the beginning of the course.

### Contents

*Integer Programming: Polyhedral Theory:*

- modelling using Integer Programming,
- polyhedra and polytopes,
- complexity,
- formulations,
- connection between Integer Programming and theory of polyhedra,
- integrality of polyhedra: Unimodularity, total dual integrality,
- matchings.

*Algorithms:*

- dynamic programming,
- relaxations,
- branch-and-Bound methods,
- cutting planes,
- column generation.

### Competencies / intended learning achievements

The students have studied and understand different algorithms and methods to solve integer optimization problems. They have learnt to model real world economic, technical and/or physical problems as integer optimization problems by using mathematical tools. They are able to critically assess the applicability and limitations of the algorithms.

### Literature

- G. Nemhauser and L. Wolsey: Integer and Combinatorial Optimization

- A. Schrijver: Combinatorial Optimization - Polyhedra and Efficiency
- A. Schrijver: Theory of Linear and Integer Programming
- L. Wolsey: Integer Programming.

## Materials

Further literature will be announced in the lecture; Exercise material is provided. Lecture recordings available at <https://videoportal.uni-kl.de/>

## 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-50-11-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-50-11-M-4]	Integer Programming: Polyhedral Theory and Algorithms	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.)		