

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

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Course MAT-40-11-K-4

Commutative Algebra (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
(4V+2U)			9.0 CP	84 h	186 h

Basedata

SWS	4V+2U
CP, Effort	9.0 CP = 270 h
Position of the semester	1 Sem. in WiSe
Level	[4] Bachelor (Specialization)
Language	[EN] English
Lecturers	Fieker, Claus, Prof. Dr. (PROF DEPT: MAT) (/staff/13/) Gathmann, Andreas, Prof. Dr. (PROF DEPT: MAT) (/staff/14/) Malle, Gunter, Prof. Dr. (PROF DEPT: MAT) (/staff/25/) Schulze, Mathias, Prof. Dr. (PROF DEPT: MAT) (/staff/33/) Thiel, Ulrich, Prof. Dr. (PROF DEPT: MAT) (/staff/38/) + further Lecturers of the department Mathematics
Area of study	[MAT-AGCA] Algebra, Geometry and Computer Algebra
Additional informations	Informations about the course (https://www.mathematik.uni-kl.de/agag/lehre/)
Lifecycle-State	[NORM] Active

Possible Study achievement

- Verification of study performance: **proof of successful participation in the exercise classes (ungraded)**

- Examination number (Study achievement): 84011 ("Exercise Class Commutative Algebra")
- Details of the examination (type, duration, criteria) will be announced at the beginning of the course.

Contents

- Rings, modules, localization, Nakayama's lemma
- Noetherian / Artinian rings and modules
- Primary decomposition
- Krull's Principal Ideal Theorem, Krull dimension
- Integral ring extensions, Going-up, Going-down, normalization
- Noether normalization, Hilbert's Nullstellensatz
- Dedekind Domains, invertible ideals

Competencies / intended learning achievements

Upon completion of this module, students have studied and understood the language and methods of commutative algebra, which is necessary to continue studying in the area of algebraic geometry, computer algebra and number theory. They have recognized how taking a higher point of view, that is, the abstraction of the problem, makes it possible at once to treat and solve completely different questions simultaneously.

Literature

- M.F. Atiyah, I.G. Macdonald: Introduction to commutative algebra,
- H. Matsumura: Commutative Ring Theory,
- H. Matsumura: Commutative Algebra,
- D. Eisenbud: Commutative Algebra with a View towards Algebraic Geometry,
- G.-M. Greuel, G. Pfister: A Singular Introduction to Commutative Algebra.

Materials

Further literature will be announced in the lecture(s); exercise material is provided.

Registration

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

Requirements for attendance (informal)

Modules:

- [MAT-10-1-M-2] Fundamentals of Mathematics (M, 28.0 LP) (/mhb/modules/MAT-10-1-M-2/)

Courses

- [MAT-12-11-K-2] Algebraic Structures (2V+2U, 5.5 LP) (/mhb/courses/MAT-12-11-K-2/)
- [MAT-12-22-K-3] Introduction to Algebra (2V+1U, 4.5 LP) (/mhb/courses/MAT-12-22-K-3/)

Requirements for attendance (formal)

None

References to Course [MAT-40-11-K-4]

Module	Name	Context	
[MAT-30-10L-M-5 (/mhb/modules/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-40-11-M-4 (/mhb/modules/MAT-40-11-M-4/)]	Commutative Algebra	P: Obligatory	4V+2U, 9.0 LP
Course-Pool	Name		
[MAT-40-4V-KPOOL-4 (/mhb/coursepools/MAT-40-4V- KPOOL-4/)]	Elective Courses Algebra, Geometry and Computeralgebra (4V, B.Sc.)		
[MAT-40-KPOOL-4 (/mhb/coursepools/MAT-40-KPOOL- 4/)]	Specialisation Algebra, Geometry and Computer Algebra (B.Sc.)		