

Module Catalogue

for the Module studies (Master)

Mathematics

Examination regulations version: 2019
Responsible: Faculty of Mathematics and Computer Science
Responsible: Institute of Mathematics

Contents

The subject is divided into	3
Abbreviations used, Conventions, Notes, In accordance with	4
Winter Term 2019	6
Research in Groups - Deformation Quantization	7
Seminar in Non-linear Analysis	8
Summer Term 2019	9
Algorithmic Number Theory	10
Winter Term 2021	11
Algorithmic Number Theory	12
Applied Analysis	13
Research in Groups - Algebra	14
Research in Groups - Deformation Quantization	15
Research in Groups - Differential Geometry	16
Selected Topics in Analysis	17
Geometric Complex Analysis	18
Partial Differential Equations of Mathematical Physics	19
Seminar Mathematics in the Sciences	20

The subject is divided into

section / sub-section		starting page
Winter Term 2019	0	6
Summer Term 2019	0	9
Winter Term 2021	0	11

Abbreviations used

Course types: **E** = field trip, **K** = colloquium, **O** = conversatorium, **P** = placement/lab course, **R** = project, **S** = seminar, **T** = tutorial, **Ü** = exercise, **V** = lecture

Term: **SS** = summer semester, **WS** = winter semester

Methods of grading: **NUM** = numerical grade, **B/NB** = (not) successfully completed

Regulations: **(L)ASPO** = general academic and examination regulations (for teaching-degree programmes), **FSB** = subject-specific provisions, **SFB** = list of modules

Other: **A** = thesis, **LV** = course(s), **PL** = assessment(s), **TN** = participants, **VL** = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

15-May-2019 (2019-36)

27-Jun-2019 (2019-41)

14-Nov-2019 (2019-52)

22-Jan-2020 (2020-13)

06-May-2020 (2020-39)

22-Jul-2020 (2020-57)

17-Dec-2020 (2020-110)

10-Mar-2021 (2021-17)

09-Jun-2021 (2021-58)

22-Dec-2021 (2021-85)

05-Jul-2022 (2022-52)

31-Jan-2023 (2022-86)

15-Jun-2023 (2023-58)

13-Dec-2023 (2023-107)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.

Winter Term 2019

(o ECTS credits)

Module title		Abbreviation
Research in Groups - Deformation Quantization		10-M=GDFQ-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in deformation quantization.		
Intended learning outcomes		
The student gains insight into contemporary research problems in Deformation Quantization. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
talk (60 to 120 minutes) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Seminar in Non-linear Analysis		10-M=SNLA-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in non-linear analysis.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
talk (60 to 120 minutes) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Summer Term 2019

(o ECTS credits)

Module title		Abbreviation
Algorithmic Number Theory		10-M=VAZT-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Binary numbers, computation of the greatest common divisor, pseudoprime tests, computation of primitive roots. Primality tests for Fermat and Mersenne numbers, factorisation methods (Pollard-Rho, (p-1)-method, elliptic curve method, quadratic sieve method), discrete logarithm.		
Intended learning outcomes		
The student knows about the theoretical foundations and the possible applications of several methods in algorithmic number theory.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German and/or English Assessment offered: Only when announced in the semester in which the courses are offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Winter Term 2021

(o ECTS credits)

Module title		Abbreviation
Algorithmic Number Theory		10-M=VAZT-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Binary numbers, computation of the greatest common divisor, pseudoprime tests, computation of primitive roots. Primality tests for Fermat and Mersenne numbers, factorisation methods (Pollard-Rho, (p-1)-method, elliptic curve method, quadratic sieve method), discrete logarithm.		
Intended learning outcomes		
The student knows about the theoretical foundations and the possible applications of several methods in algorithmic number theory.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German and/or English Assessment offered: Only when announced in the semester in which the courses are offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Applied Analysis		10-M=AAAN-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In-depth study of functional analysis and operator theory, Sobolev spaces and partial differential equations, theory of Hilbert spaces and Fourier analysis, spectral theory and quantum mechanics, numerical methods (in particular FEM methods), principles of functional analysis, function spaces, embedding theorems, compactness, theory of elliptic, parabolic and hyperbolic partial differential equations with methods from functional analysis.		
Intended learning outcomes		
The student is acquainted with the fundamental notions, methods and results of higher analysis. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics and other natural and engineering sciences.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Research in Groups - Algebra		10-M=GALG-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in algebra (e. g. ring theory, commutative algebra, differential algebra, local fields, computer algebra, algebras, division rings, quadratic forms).		
Intended learning outcomes		
The student gains insight into contemporary research problems in algebra. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
talk (60 to 120 minutes) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Research in Groups - Deformation Quantization		10-M=GDFQ-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in deformation quantization.		
Intended learning outcomes		
The student gains insight into contemporary research problems in Deformation Quantization. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
talk (60 to 120 minutes) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Research in Groups - Differential Geometry		10-M=GDGE-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Selected modern topics in differential geometry.		
Intended learning outcomes		
The student gains insight into contemporary research problems in Differential Geometry. He/She masters advanced techniques in this field and can apply them to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (2) + S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
talk (60 to 120 minutes) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Selected Topics in Analysis		10-M=VANA-161-mo1
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
In-depth discussion of a specialised topic in analysis taking into account recent developments and interrelations with other mathematical concepts.		
Intended learning outcomes		
The student is acquainted with advanced results in a selected topic in analysis, and is able to apply these to complex problems.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Geometric Complex Analysis		10-M=VGFT-192-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Advanced methods and results in geometric complex analysis (e.g. conformal maps, conformal Riemannian metrics, quasiconformal maps, harmonic functions, biholomorphic maps).		
Intended learning outcomes		
The student is acquainted with fundamental concepts, methods and results in geometric complex analysis, is able to classify these results within more general theories and knows about the connections of geometric complex analysis with other fields of mathematics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Language of assessment: German and/or English Assessment offered: Only when announced in the semester in which the courses are offered and in the subsequent semester creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Partial Differential Equations of Mathematical Physics		10-M=VPDP-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
10	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
Elliptic, parabolic, and hyperbolic equations; Laplace equation, heat equation and wave equation as standard examples; initial and boundary value problems; well-posed and ill-posed problems; solution methods; extensions and generalisations; Hilbert space methods; Sobolev spaces and Fourier transforms.		
Intended learning outcomes		
The student is acquainted with fundamental concepts and solution methods in the theory of partial differential equations, as well as standard examples from mathematical physics. He/She is able to establish a connection between his/her acquired skills and other branches of mathematics and questions in physics.		
Courses (type, number of weekly contact hours, language — if other than German)		
V (4) + Ü (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
a) written examination (approx. 90 to 120 minutes, usually chosen) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, 15 minutes per candidate) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English creditable for bonus		
Allocation of places		
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Additional information		
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Workload		
300 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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Module title		Abbreviation
Seminar Mathematics in the Sciences		10-M=SMSC-161-m01
Module coordinator		Module offered by
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
ECTS	Method of grading	Only after succ. compl. of module(s)
5	numerical grade	--
Duration	Module level	Other prerequisites
1 semester	graduate	--
Contents		
A modern topic in mathematics in the sciences.		
Intended learning outcomes		
The student is able to elaborate a contemporary research topic. This includes comprehending and structuring of the topic and the available literature, preparing a talk and the ability to participate in a scientific discussion.		
Courses (type, number of weekly contact hours, language — if other than German)		
S (2) Module taught in: German and/or English		
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)		
talk (60 to 120 minutes) Assessment offered: In the semester in which the course is offered and in the subsequent semester Language of assessment: German or English		
Allocation of places		
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Additional information		
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Workload		
150 h		
Teaching cycle		
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Referred to in LPO I (examination regulations for teaching-degree programmes)		
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