Module Catalogue
for the Module studies (Bachelor)

Mathematics

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

Contents

The subject is divided into

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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)

07-Aug-2024 (2024-82)

22-Jan-2025 (2025-1)

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.

Summer Term 2019

(ECTS credits)

Module title			Abbreviation
Supplementary Seminar Mathematics			10-M-SEM2-152-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)
4	(not) successfully completed		--

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
A selected topic in mathematics.

Intended learning outcomes
The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate actively in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

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)   Language of assessment: German and/or English

Allocation of places
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Additional information
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Workload
120 h

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Winter Term 2019

(ECTS credits)

Module title	Abbreviation
Supplementary Seminar Mathematics	10-M-SEM2-152-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)	
4	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
A selected topic in mathematics.

Intended learning outcomes
The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate actively in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

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)   Language of assessment: German and/or English

Allocation of places
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Additional information
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Workload
120 h

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Summer Term 2020

(ECTS credits)

Module title	Abbreviation
Analysis 1	10-M-ANA1-152-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)
8	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
E-Learning and Blended Learning Mathematics 1		10-M-VHB1-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes

The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)

Ü (2)
Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (web-based, 15 to 20 hours)
Assessment offered: Once a year, winter semester

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 2			10-M-VHB2-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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
Linear Algebra 1	10-M-LNA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Winter Term 2020

(ECTS credits)

Module title			Abbreviation	
Analysis 1			10-M-ANA1-152-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)**	
8	(not) successfully completed		--	
Duration	**Module level**		**Other prerequisites**	
1 semester	undergraduate		--	

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics			10-M-ASM-152-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)
2	(not) successfully completed		--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes

The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 20 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 1		10-M-VHB1-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes

The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)

Ü (2)
Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (web-based, 15 to 20 hours)
Assessment offered: Once a year, winter semester

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 2			10-M-VHB2-152-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)
2	(not) successfully completed		--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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
Basic Notions and Methods of Mathematical Reasoning		10-M-GBM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes
The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (10 to 15 pages) Language of assessment: German and/or English

Allocation of places
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Additional information
Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload
60 h

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 1 h) § 22 II Nr. 2 f)

Module title				Abbreviation	
Linear Algebra 1				10-M-LNA1-152-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)		
8	(not) successfully completed		--		

Duration	Module level		Other prerequisites		
1 semester	undergraduate		--		

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Summer Term 2021

(ECTS credits)

Module title	Abbreviation
Analysis 1	10-M-ANA1-152-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)
8	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics			10-M-ASM-152-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)
2	(not) successfully completed		--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes

The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 20 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 1		10-M-VHB1-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes

The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)

Ü (2)
Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (web-based, 15 to 20 hours)
Assessment offered: Once a year, winter semester

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 2		10-M-VHB2-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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
Basic Notions and Methods of Mathematical Reasoning		10-M-GBM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes

The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 15 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload

60 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)

Module title	Abbreviation
Linear Algebra 1	10-M-LNA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Supplementary Seminar Mathematics	10-M-SEM2-152-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)
4	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

A selected topic in mathematics.

Intended learning outcomes

The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate actively in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)

S (2)

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)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

120 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

(ECTS credits)

Module title	Abbreviation
Analysis 1	10-M-ANA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics	10-M-ASM-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes
The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (10 to 20 pages) Language of assessment: German and/or English

Allocation of places
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Additional information
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Workload
60 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
Introduction to Functional Analysis	10-M-FAN-152-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)	
9	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Banach spaces and Hilbert spaces, bounded operators, principles of functional analysis.

Intended learning outcomes

The student knows the fundamental concepts and methods of functional analysis as well as the pertinent proof methods, is able to apply methods from linear algebra and analysis to functional analysis, and realises the broad applicability of the theory to other branches of mathematics.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: German and/or English
creditable for bonus

Allocation of places

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Additional information

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Workload

270 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 3 f)

Module title	Abbreviation
Introduction to Functional Analysis for Mathematical Physics	10-M-FANP-152-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	undergraduate	--

Contents

Banach spaces and Hilbert spaces, bounded operators, principles of functional analysis.

Intended learning outcomes

The student knows the fundamental concepts and methods of functional analysis as well as the pertinent proof methods, is able to apply methods from linear algebra and analysis to functional analysis, and realises the broad applicability of the theory to other branches of mathematics.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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) oral examination of one candidate each (15 to 30 minutes) or
b) oral examination in groups of 2 candidates (10 to 15 minutes each)
Assessment will have reference to a topic in pure mathematics as agreed upon with the examiner. Each topic may only be selected as the subject of one examination in the sub-field Gesamtüberblick Mathematische Metho-den (Overview Mathematical Methods) or in module group Ergänzung Mathematik (Supplementary Topics in Ma-thematics).
Language of assessment: German and/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
Introduction to Number Theory	10-M-ZTH-152-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)
9	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Elementary properties of divisibility, prime numbers and prime number factorisation, modular arithmetics, prime tests and methods for factorisation, structure of the residue class rings, theory of quadratic remainder, quadratic forms, diophantine approximation and diophantine equations.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of number theory. He/she is able to employ the basic methods and proof techniques independently.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: German and/or English
creditable for bonus

Allocation of places

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Additional information

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Workload

270 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
Introduction to Number Theory for Mathematical Physics		10-M-ZTHP-152-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	undergraduate	--

Contents

Elementary properties of divisibility, prime numbers and prime number factorisation, modular arithmetics, prime tests and methods for factorisation, structure of the residue class rings, theory of quadratic remainder, quadratic forms, diophantine approximation and diophantine equations.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of number theory. He/she is able to employ the basic methods and proof techniques independently.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: German and/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
E-Learning and Blended Learning Mathematics 1	10-M-VHB1-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, winter semester

Allocation of places
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Additional information
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Workload
60 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
E-Learning and Blended Learning Mathematics 2		10-M-VHB2-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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	
Supplementary Seminar Mathematics			10-M-SEM2-152-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)	
4	(not) successfully completed		--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
A selected topic in mathematics.

Intended learning outcomes
The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate actively in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

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) Language of assessment: German and/or English

Allocation of places
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Additional information
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Workload
120 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
Basic Notions and Methods of Mathematical Reasoning	10-M-GBM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes
The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (10 to 15 pages) Language of assessment: German and/or English

Allocation of places
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Additional information
Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload
60 h

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 1 h) § 22 II Nr. 2 f)

Module title	Abbreviation
Linear Algebra 1	10-M-LNA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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		10-M-SEM-152-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	undergraduate	--

Contents
A selected topic in mathematics.

Intended learning outcomes
The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate actively in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

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)   Language of assessment: German and/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)
§ 22 II Nr. 3 f)

Summer Term 2022

(ECTS credits)

Module title			Abbreviation	
Analysis 1			10-M-ANA1-152-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)**	
8	(not) successfully completed		--	
Duration	**Module level**		**Other prerequisites**	
1 semester	undergraduate		--	

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics			10-M-ASM-152-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)
2	(not) successfully completed		--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes

The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 20 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 1	10-M-VHB1-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes

The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)

Ü (2)
Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (web-based, 15 to 20 hours)
Assessment offered: Once a year, winter semester

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 2	10-M-VHB2-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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
Basic Notions and Methods of Mathematical Reasoning		10-M-GBM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes

The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 15 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload

60 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)

Module title		Abbreviation
Linear Algebra 1		10-M-LNA1-152-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)
8	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Winter Term 2022

(ECTS credits)

Module title	Abbreviation
Analysis 1	10-M-ANA1-152-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)
8	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics			10-M-ASM-152-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)
2	(not) successfully completed		--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes
The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (10 to 20 pages) Language of assessment: German and/or English

Allocation of places
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Additional information
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Workload
60 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
E-Learning and Blended Learning Mathematics 1	10-M-VHB1-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, winter semester

Allocation of places
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Additional information
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Workload
60 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
E-Learning and Blended Learning Mathematics 2	10-M-VHB2-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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
Supplementary Seminar Mathematics	10-M-SEM2-152-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)	
4	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
A selected topic in mathematics.

Intended learning outcomes
The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate actively in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

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)   Language of assessment: German and/or English

Allocation of places
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Additional information
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Workload
120 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
Basic Notions and Methods of Mathematical Reasoning			10-M-GBM-152-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)
2	(not) successfully completed		--

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes
The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)
V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (10 to 15 pages) Language of assessment: German and/or English

Allocation of places
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Additional information
Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload
60 h

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 22 II Nr. 1 h) § 22 II Nr. 2 f)

Module title	Abbreviation
Linear Algebra 1	10-M-LNA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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		10-M-SEM-152-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	undergraduate	--

Contents
A selected topic in mathematics.

Intended learning outcomes
The student gains first experience with independent scientific work. He/She masters elaboration and structuring of a given topic using selected literature, and prepares a talk on the subject. He/She is able to participate actively in a scientific discussion.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

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) Language of assessment: German and/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)
§ 22 II Nr. 3 f)

Summer Term 2023

(ECTS credits)

Module title			Abbreviation	
Analysis 1			10-M-ANA1-152-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)**	
8	(not) successfully completed		--	
Duration	**Module level**		**Other prerequisites**	
1 semester	undergraduate		--	

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Analysis 2	10-M-ANA2-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Further topological considerations, basics in differential calculus in several variables, inverse function theorem, implicit function theorem.

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics	10-M-ASM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes

The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 20 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

60 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	
Basic Notions and Methods of Mathematical Reasoning				10-M-GBM-152-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)**		
2	(not) successfully completed		--		
Duration	**Module level**		**Other prerequisites**		
1 semester	undergraduate		--		
Contents					
Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.					
Intended learning outcomes					
The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.					
Courses (type, number of weekly contact hours, language — if other than German)					
V (1) + Ü (1)					
Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)					
project (10 to 15 pages) Language of assessment: German and/or English					
Allocation of places					
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Additional information					
Additional information on module duration: block taught prior to the beginning of the lecture period.					
Workload					
60 h					
Teaching cycle					
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Referred to in LPO I (examination regulations for teaching-degree programmes)					
§ 22 II Nr. 1 h) § 22 II Nr. 2 f)					

Module title	Abbreviation
Linear Algebra 1	10-M-LNA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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	
Linear Algebra 2			10-M-LNA2-152-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)**	
8	(not) successfully completed		--	
Duration	**Module level**		**Other prerequisites**	
1 semester	undergraduate		--	

Contents

Eigenvalue theory, bilinear forms, Euclidean and unitary vector spaces, diagonalisation and Jordan normal form.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
E-Learning and Blended Learning Mathematics 1		10-M-VHB1-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, winter semester

Allocation of places
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Additional information
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Workload
60 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
E-Learning and Blended Learning Mathematics 2	10-M-VHB2-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 h

Teaching cycle
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Winter Term 2023

(ECTS credits)

Module title	Abbreviation
Analysis 1	10-M-ANA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Analysis 2		10-M-ANA2-152-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)
8	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Further topological considerations, basics in differential calculus in several variables, inverse function theorem, implicit function theorem.

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics	10-M-ASM-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes

The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 20 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 1	10-M-VHB1-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, winter semester

Allocation of places
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Additional information
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Workload
60 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
E-Learning and Blended Learning Mathematics 2			10-M-VHB2-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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
Ordinary Differential Equations			10-M-DGL-152-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)	
9	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Existence and uniqueness theorem; continuous dependence of solutions on initial values; systems of linear differential equations; matrix exponential series; linear differential equations of higher order.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of the theory of ordinary differential equations. He/she is able to apply these methods to practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: German and/or English
creditable for bonus

Allocation of places

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Additional information

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Workload

270 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
Basic Notions and Methods of Mathematical Reasoning		10-M-GBM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes

The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 15 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload

60 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)

Module title	Abbreviation
Linear Algebra 1	10-M-LNA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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	
Linear Algebra 2			10-M-LNA2-152-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)	
8	(not) successfully completed		--	

Duration	Module level		Other prerequisites	
1 semester	undergraduate		--	

Contents

Eigenvalue theory, bilinear forms, Euclidean and unitary vector spaces, diagonalisation and Jordan normal form.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Advanced Analysis			10-M-VAN-152-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)	
7	numerical grade	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Continuation of analysis in several variables, integration theorems.

Intended learning outcomes

The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: German and/or English
creditable for bonus

Allocation of places

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Additional information

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Workload

210 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Summer Term 2024

(ECTS credits)

Module title			Abbreviation	
Analysis 1			10-M-ANA1-152-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)**	
8	(not) successfully completed		--	
Duration	**Module level**		**Other prerequisites**	
1 semester	undergraduate		--	

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Analysis 2		10-M-ANA2-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Further topological considerations, basics in differential calculus in several variables, inverse function theorem, implicit function theorem.

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics	10-M-ASM-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes

The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 20 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 1		10-M-VHB1-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, winter semester

Allocation of places
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Additional information
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Workload
60 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
E-Learning and Blended Learning Mathematics 2			10-M-VHB2-152-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)
2	(not) successfully completed		--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes

The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)

Ü (2)
Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (web-based, 15 to 20 hours)
Assessment offered: Once a year, summer semester

Allocation of places

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Additional information

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Workload

60 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
Basic Notions and Methods of Mathematical Reasoning			10-M-GBM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes

The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 15 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload

60 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)

Module title	Abbreviation
Linear Algebra 1	10-M-LNA1-152-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)	
8	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Linear Algebra 2		10-M-LNA2-152-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)
8	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Eigenvalue theory, bilinear forms, Euclidean and unitary vector spaces, diagonalisation and Jordan normal form.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Winter Term 2024

(ECTS credits)

Module title			Abbreviation	
Analysis 1			10-M-ANA1-152-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)	
8	(not) successfully completed		--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Real numbers and completeness; basic topological notions; convergence and divergence of sequences and series; power series and Taylor series; basics in differential calculus in one variable; basics of integral calculus in one variable (Riemann integral and improper integral).

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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	
Analysis 2				10-M-ANA2-152-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)**		
8	(not) successfully completed		--		
Duration	**Module level**		**Other prerequisites**		
1 semester	undergraduate		--		

Contents

Further topological considerations, basics in differential calculus in several variables, inverse function theorem, implicit function theorem.

Intended learning outcomes

The student knows and masters the essential methods and notions of analysis. He/She is acquainted with the central proof methods in analysis and can employ them to solve easy problems. He/she is able to perform easy mathematical arguments independently and to express mathematical arguments precisely and clearly in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Reasoning and Writing in Mathematics	10-M-ASM-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Introduction to fundamental methods of thinking and proving, basic techniques in mathematics as well as mathematical writing;insight into examples of abstracts concepts in mathematics; approach to axiomatic and deduction.

Intended learning outcomes

The student is acquainted with the basic proof methods and techniques in mathematics. He/She is able to perform easy mathematical arguments independently and present them adequately and reasonably in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 20 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

60 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
E-Learning and Blended Learning Mathematics 1	10-M-VHB1-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ basic methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, winter semester

Allocation of places
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Additional information
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Workload
60 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
E-Learning and Blended Learning Mathematics 2	10-M-VHB2-152-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)
2	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents
Becoming familiar with and reflecting techniques in e-learning and blended learning in mathematics.

Intended learning outcomes
The student is able to employ advanced methods of e-learning and blended learning in mathematics-

Courses (type, number of weekly contact hours, language — if other than German)
Ü (2) Course type: eLearning, mostly Virtuelle Hochschule Bayern (vhb)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project (web-based, 15 to 20 hours) Assessment offered: Once a year, summer semester

Allocation of places
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Additional information
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Workload
60 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
Ordinary Differential Equations		10-M-DGL-152-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)
9	(not) successfully completed	--

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Existence and uniqueness theorem; continuous dependence of solutions on initial values; systems of linear differential equations; matrix exponential series; linear differential equations of higher order.

Intended learning outcomes

The student is acquainted with the fundamental concepts and methods of the theory of ordinary differential equations. He/she is able to apply these methods to practical problems.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: German and/or English
creditable for bonus

Allocation of places

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Additional information

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Workload

270 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
Basic Notions and Methods of Mathematical Reasoning			10-M-GBM-152-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)	
2	(not) successfully completed	--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Introduction to the basic notions and proof techniques in mathematics: approach to sets, formal logic and maps.

Intended learning outcomes

The student gets acquainted with the basic working techniques which are prerequisites for the further courses in the Bachelor's degree study programme.

Courses (type, number of weekly contact hours, language — if other than German)

V (1) + Ü (1)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project (10 to 15 pages)
Language of assessment: German and/or English

Allocation of places

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Additional information

Additional information on module duration: block taught prior to the beginning of the lecture period.

Workload

60 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)

Module title			Abbreviation	
Linear Algebra 1			10-M-LNA1-152-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)	
8	(not) successfully completed		--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Basic notions and structures; vector spaces, linear maps, systems of linear equations; theory of matrices and determinants.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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	
Linear Algebra 2			10-M-LNA2-152-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)	
8	(not) successfully completed		--	

Duration	Module level	Other prerequisites	
1 semester	undergraduate	--	

Contents

Eigenvalue theory, bilinear forms, Euclidean and unitary vector spaces, diagonalisation and Jordan normal form.

Intended learning outcomes

The student knows and masters the basic notions and essential methods of linear algebra. He/She is acquainted with the central proof methods in linear algebra and can apply them to solve easy problems. He/She is able to perform simple mathematical arguments independently, and can present them adequately in written form.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written examination (approx. 90 to 180 minutes) and written exercises (approx. 12 exercise sheets with approx. 4 exercises each)
Language of assessment: German and/or English

Allocation of places

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Additional information

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Workload

240 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
Advanced Analysis	10-M-VAN-152-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)	
7	numerical grade	--	

Duration	Module level	Other prerequisites
1 semester	undergraduate	--

Contents

Continuation of analysis in several variables, integration theorems.

Intended learning outcomes

The student is acquainted with advanced topics in analysis. Taking the example of the Lesbegue integral, he or she is able to understand the construction of a complex mathematical concept.

Courses (type, number of weekly contact hours, language — if other than German)

V (4) + Ü (2)

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 180 minutes, usually chosen) or
b) oral examination of one candidate each (15 to 30 minutes) or
c) oral examination in groups (groups of 2, 10 to 15 minutes per candidate)
Language of assessment: German and/or English
creditable for bonus

Allocation of places

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Additional information

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Workload

210 h

Teaching cycle

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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