EBERHARD KARLS
UNIVERSITÄT
TÜBINGEN

Mathematisch-
Naturwissenschaftliche
Fakultät

Department of Mathematics

Module Handbook

Mathematics
Master of Education
im Höheren Lehramt an beruflichen Schulen*

Winter Semester 2025

Last updated on 29th October 2025

*This is a teaching degree for professional schools with a minor in mathematics.

Contents

1 Description of the Study Pogramme

1.1 Qualification Objectives

The study programme M.Ed. im Höheren Lehramt an beruflichen Schulen with Mathematics as a general education second subject is designed to equip future teachers at professional schools with the academic aptitude to teach mathematics. The overarching and subject-specific qualification objectives, both with regard to the content of the study programme and the competences to be acquired, are specified in the legal ordinance of the Ministry of Education and Cultural Affairs on framework requirements for the conversion of general education teacher training programmes in Baden-Württemberg.

As part of the M.Ed.im Höheren Lehramt an beruflichen Schulen with Mathematics as a general education second subject, graduates deepen their knowledge and skills in mathematics and mathematical didactics, which enable them to design targeted teaching, learning and educational processes in the subject of mathematics and to independently incorporate new subject-related and subject-linking developments into teaching and school development. Building on the fundamental issues in linear algebra, analysis, geometry and stochastics from the Bachelor of Education im Höheren Lehramt an beruflichen Schulen with Mathematics as a general education second subject, they expand their material and methodological skills in the field of subject didactic as well as in two of the fields of analysis, algebra and numerical mathematics.

Graduates are proficient in the theoretical explanatory approaches, principles and methods of mathematics, are familiar with its cognitive and working methods and can apply them in the central areas of mathematics. They can adequately present mathematical facts orally and in writing using suitable media and explain central issues in mathematical fields and their relationship to school mathematics. They are able to solve mathematical problems in a planned and strategic manner using suitable tools and to comprehend and develop mathematical proofs. Graduates are able to access and critically scrutinise current fundamental questions in mathematics based on their general knowledge. Graduates have learnt to acquire new specialised knowledge independently and are therefore able to access new mathematical theories that are incorporated into school mathematics in their later professional life.

Students combine their scientific knowledge with didactic methods, use suitable media and are able to use theoretical concepts and empirical findings from mathematics-related teaching-learning research to analyse thought processes and ideas of pupils in exercises and to guide individual learning processes. They know and evaluate the concepts for learning and teaching mathematics at school on the basis of subject-didactic theories and empirical findings. They are able to analyse, plan and exemplarily implement mathematics lessons with heterogeneous learning groups on the basis of subject-didactic concepts. Students can justify the educational value of mathematical content, convey the societal significance of mathematics and place it in the context of the objectives and content of mathematics lessons.

1.2 Structure of the Study Programme

The standard period of study for the M.Ed. im Höheren Lehramt an beruflichen Schulen is four semesters and 28 credit points must be earned in Mathematics. Depending on whether you start the programme in the winter or summer semester, the first or second semester is largely filled by the school practice component, which is accompanied by a specialised didactics course at the university. In the remaining semesters, students choose two of the three modules “Introduction to Complex Analysis and Ordinary Differential Equations’, “Algebra’ and “Numerical Mathematics’. They deepen their knowledge in two central areas of analysis or in algebra with applications to conventional questions of geometry or in another applied area of mathematics. In addition, students have the opportunity to set their own specialisation by attending a selected seminar. The study programme concludes with the Master’s thesis (15 credit points) in one of the two chosen subject areas (including their subject didactics) or in educational sciences. With the Master’s degree, students (if they fulfil any further requirements) can enter the preparatory service (traineeship), a career, a doctorate in the field of didactics of mathematics or change to a further degree programme.

Integrating a study component at a foreign university into the Secondary-school teaching degree programme in a meaningful way is a challenge, as it involves coordinating two subjects and the educational sciences; whether you try to complete parts of the programme in all areas during your stay at the other university, or whether you try to structure your studies at the University of Tübingen in such a way that parts of the programme are shifted to other semesters in order to create free time so that you do not have to complete all three areas at the other university. Complicating matters is the fact that in the field of Mathematics, all modules are mandatory, leaving little room for content customisation, and that one semester is largely occupied by the practical component. Therefore, it is essential to plan a suitable timeframe for a study component at a foreign university through a personal consultation with the Faculty Course Advisor. Essentially, from the mathematics perspective, any academic semester is suitable for this purpose. The decision will depend on the student’s previous achievements and the courses offered at the chosen foreign university.

2 Study Plans

2.1 Overview by Modules

Here we provide an overview of the study plan as a table showing the modules to be taken.

ST	Module Number	Module Title	Type of Course	Type of Module	Course-work	Type of Exam	ECTS-Points
Section 1: Mathematics							
1-4	MAT-20-02	Introduction to Complex Analysis and Ordinary Differential Equations	L+E	WPM	EC	wr. o. or.	9
1-4	MAT-20-03	Algebra	L+E	WPM	EC	wr. o. or.	9
1-4	MAT-20-11	Numerical Mathematics	L+E	WPM	EC	wr. o. or.	9
3-4	MAT-40-52	Seminar: Mathematical Specialisation	S	PMW	s.M.	Pr	4
3-4	MAT-40-53	Seminar: Mathematical Specialisation	S	PMW	s.M.	Pr	4
Section 2: Didactics of Mathematics							
1-2	MAT-80-03	Subject Didactics Mathematics 3	S+SV	PMW	-	K o. mP o. R o. H	6
Section 3: Master Thesis							
4	MAT-40-53	Master Thesis	MT	PM	s.M.	MT	15

Abbreviations:

Type of Module : PM=compulsory module, PMW=compulsory module with choice, WPM=elective module

Examination Type : MT=master's thesis, or.=oral exam, wr.=written exam, Pr=presentation, E=essay, P=portfolio, T=continous assessment tests

Teaching Format : L=lecture, LE=lecture with integrated exercises, SL=seminar or lecture, E=exercise class, T=tutorial, P=practical course, S=seminar, IC=inverted classroom

Course Work : EC=exercise certificate, PEC=practical exercise certificate, PC=practical certificate

Other : h=hours, o.=or, s.M.=see module description, ST=suggested term

2.2 Overview by the Course of Studies

Firstly, we provide an overview of the possible course of study in the form of a table both for entry in the winter semester and for entry in the summer semester.

Study Plan for Students Starting in the Winter Semester

FS	CP	Mathematics	Subject Didactics Mathematics	Master Thesis
1	3		Subject Didactics 3 (6 CP)	
2	12/21	Introduction to Complex Analysis and Ordinary Differential Equations (9 CP)		
		Algebra (9 CP)		
3	9/0	Numerical Mathematics (9 CP)		
4	4 + (15)	Seminar Mathematical Specialisation (4 CP)		Master Thesis (15 CP)

Explanation of the Abbreviations:
FS=semester, CP=credit points (ECTS points)

Only two of the three modules “Introduction to Complex Analysis and Ordinary Differential Equations’, “Algebra’ and “Numerical Mathematics’ must be taken. The ideal course of study is if one of the modules “Introduction to Complex Analysis and Ordinary Differential Equations’ or “Algebra’ is omitted.

Study Plan for Students Starting in the Summer Semester

FS	CP	Mathematics	Subject DidacticsMathematics	Master Thesis
1	12/12/3	Algebra (9 CP)	Subject Didactics 3 (6 CP)	
2	3			
3	13/4/13	Introduction to Complex Analysis and Ordinary Differential Equations (9 CP)		
		Seminar Mathematical Specialisation (4 CP)		
4	0/9/9 + (15)	Numerical Mathematics (9 CP)		Master Thesis (15 CP)

Explanation of the Abbreviations:
FS=semester, CP=credit points (ECTS points)

Only two of the three modules “Introduction to Complex Analysis and Ordinary Differential Equations’, “Algebra’ and “Numerical Mathematics’ must be taken. The first two of the modules can also be interchanged during the course of study. The ideal course of study is if “Numerical Mathematics’ is omitted.

2.3 Overview of Programme Structure with Semester Assignment

Overview of Programme Structure with Semester Assignment for Students Starting in the Winter Semester													
		Exam				Teaching				Semester			
		Type of Exam	Duration (min)	Grading	Weight in the final grade	Type of Course	Status	SWS	ECTS Points (CP)	The allocation of examinations / ECTS points to semesters is of a recommendatory nature. The allocation of ECTS points to courses are of an informative nature. Credits are only awarded upon completion of the module.			
										1. CP	2. CP	3. CP	4. CP
Section 1: Mathematics									**22**				
Introduction to Complex Analysis and Ordinary Differential Equations*								6	9*				
1.	Lecture	Wr. o. Or.	90-180 o. 20-30	g	9	I	o	4			6		
2.	Excercise class					E	o	2			3		
Algebra*								6	9*				
1.	Lecture	Wr. o. Or.	90-180 o. 20-30	g	9	I	o	4			6		
2.	Excercise class					E	o	2			3		
Numerical Mathematics*								6	9*				
1.	Lecture	Wr. o. Or.	90-180 o. 20-30	g	9	I	o	4				6	
2.	Excercise class					E	o	2				3	
Seminar Mathematical Specialisation								2	4				
1.	Seminar	Pres		g	4	S	o	2					4
Only two of the three modules marked with * must be included.													
Section 2: Subject Didactics Mathematics									**6**				
Subject Didactics 3								4	6				
1.	Seminar	Wr. o. Or. o. Pres o. TP	90-180 o. 20-30	g	3	S	o	2		3			
2.	Seminar / Lecture	Wr. o. Or. o. Pres o. TP	90-180 o. 20-30	g	3	SL	o	2			3		
Section 3: Master Thesis									**15**				
Master Thesis									15				
1.	Master Thesis	MA		g		MA	o						15

Overview of Programme Structure with Semester Assignment for Students Starting in the Winter Semester

	Exam				Teaching				Semester			
	Type of Exam	Duration (min)	Grading	Weight in the final grade	Type of Course	Status	SWS	ECTS Points (CP)	The allocation of examinations / ECTS points to semesters is of a recommendatory nature. The allocation of ECTS points to courses are of an informative nature. Credits are only awarded upon completion of the module.			
									1. CP	2. CP	3. CP	4. CP

Explanation of the Abbreviations:

Marking system	: g=graded, ng=non graded
Form of examination	: BA=bachelor thesis, Or.=oral exam, Wr.=written exam, Pres=presentation, TP=term paper
Form of teaching	: L=lecture, SL=Seminar or lecture, E=exercise class, r=revision course, P=practical training, PS=proseminar, S=seminar
Status	: o=obligatory, f=facultative
Other	: o.=or, SWS=hours in class per week, CP=credit points=ECTS Points

Overview of Programme Structure with Semester Assignment for Students Starting in the Summer Semester														
		Exam				Teaching				Semester				
		Type of Exam	Duration (min)	Grading	Weight in the final grade	Type of Course	Status	SWS	ECTS Points (CP)	The allocation of examinations / ECTS points to semesters is of a recommendatory nature. The allocation of ECTS points to courses are of an informative nature. Credits are only awarded upon completion of the module.			
										1. CP	2. CP	3. CP	4. CP
Section 1: Mathematics									**22**				
Introduction to Complex Analysis and Ordinary Differential Equations*								6	9*				
1.	Lecture	Wr. o. Or.	90-180 o. 20-30	g	9	I	o	4		6			
2.	Excercise class					E	o	2		3			
Algebra*								6	9*				
1.	Lecture	Wr. o. Or.	90-180 o. 20-30	g	9	I	o	4				6	
2.	Excercise class					E	o	2				3	
Numerical Mathematics*								6	9*				
1.	Lecture	Wr. o. Or.	90-180 o. 20-30	g	9	I	o	4					6
2.	Excercise class					E	o	2					3
Seminar Mathematical Specialisation								2	4				
1.	Seminar	Pres		g	4	S	o	2				4	
Only two of the three modules marked with * must be included.													
Section 2: Subject Didactics Mathematics									**6**				
Subject Didactics3								4	6				
1.	Seminar	Wr. o. Or. o. Pres o. TP	90-180 o. 20-30	g	3	S	o	2			3		
2.	Seminar / Lecture	Wr. o. Or. o. Pres o. TP	90-180 o. 20-30	g	3	SL	o	2		3			
Section 3: Master Thesis									**15**				
Master Thesis									15				
1.	Master Thesis	MA		g		MA	o						15

Explanation of the Abbreviations:

Marking system : g=graded, ng=non graded
Form of examination : BA=Bachelor thesis, Or.=oral exam, Wr.=written exam, Pres=presentation, TP=term paper
Form of teaching : L=lecture, SL=seminar or lecture, E= exercise class, r=revision course, P=practical training, PS=proseminar
S=Seminar :
Status : o=obligatory, f=facultative
Other : o.=or, SWS=hours in class per week, CP=credit points=ECTS Points

3 Module Descriptions

Section 1: Mathematics

Only two of the three modules MAT-20-02 Introduction to Complex Analysis and Ordinary Differential Equations, MAT-20-03 Algebra, and MAT-20-11 Numerical Mathematics need to be included.

Module Number: **MAT-20-02**	**Module Title:** Introduction to Complex Analysis and Ordinary Differential Equations		**Type of Module:** Elective Module
ECTS-Points	9		
Workload **- Time in Class** **- Self-Study**	Workload: 270 h	Time in Class: 90 h	Self-Study: 180 h
Duration	1 Semester		
Frequency	regularly in Summer Semester		
Term	1-4		
Language of Instruction	German		
Forms of Teaching and Learning	Lecture 4 SWS + Ex.cl. 2 SWS		

Content

- Complex Analysis:
  - Holomorphic functions, Cauchy-Riemann equations.
  - Antiderivatives, Cauchy's integral formula, Cauchy's integral theorem.
  - Compact convergence of families of functions, formal and convergent power series, complex-analytical functions, identity theorem.
  - Liouville's theorem, inverse function theorem for holomorphic functions, open mapping theorem, maximum principle.
  - Laurent series, holomorphic functions with isolated singularities, Casorati-Weierstrass theorem.
  - Residue theorem and applications.
- Ordinary differential equations, a choice of the following:
  - Picard-Lindelöf existence and uniqueness theorem.
  - Linear ordinary differential equations, Gronwall's lemma.
  - Continous dependence on initial conditions, differential dependence on initial conditions.
  - Basics of dynamical systems, stability of equilibrium positions, characteristic exponents, first integrals, Liapunov-functions.
  - Ordinary differential equations over the complex numbers.
  - Regularity, the criterion of Fuchs.
  - The method of Frobenius.

Objectives

The students know the foundations of the theory of complex analysis and ordinary differential equations. The are acquainted to essential calculation techniques and can calculate line integrals as well as explicitly solve simple differential equations. They know fundamental applications of the theory like e.g. the fundamental theorem of algebra and the Newtonian equations of motion. They also have the ability to transfer abstract questions into concrete problems of complex analysis or respectively of ordinary differential equations and solve them this way.
In the exercise classes they have acquired a confident, precise and independent handling of the terms, statements and methods of the lecture. Furthermore the presentation and communication skills of the students was trained by written assignments and presenting their own solutions. The students are capable of adopting knowledge by self-study and at the same time their capacity for teamwork was enhanced by working in small groups.

Requirements for obtaining Credits / Grading (Weighting if applicable)

Title	Type of Course	Status	SWS	ECTS	Coursework	Type of Exam	Dur. of Exam (min)	Grading	Weight for Grade
Introduction to Complex Analysis and ODEs.	L	o	4	6	yes	wr. o. or.	90-180 o. 20-30	g	100
	E	o	2	3					

In this module an exercise certificate is to be acquired as coursework. For participation in the examination the coursework must have been acquired. Whether the examination is written or oral is decided by the instructor with approval by the head of the examination board.

Literature	**Possible References :** • Lars Valerian Ahlfors: Complex analysis. McGraw-Hill 1979. • John B. Conway: Functions of one complex variable. Springer 1996. • Wolfgang Fischer, Ingo Lieb: Einführung in die Komplexe Analysis. Springer 2010. • Walter Rudin: Reelle und komplexe Analysis. Oldenbourg 2009. • Earl A. Coddington, Norman Levinson: Theory of ordinary differential equations. McGraw-Hill 1955. • William T. Reid: Ordinary differential equations. John Wiley & Sons 1971. • Hille, Einar: Ordinary differential equations in the complex domain. Dover Publications 1997. • Wasow, Wolfgang: Asymptotic expansions for ordinary differential equations. John Wiley 1965.
Transfer	If applicable the module is a prerequisite for the modules Seminar Specialisation Mathematics and Master Thesis.
Prerequisites	There are no further prerequisites.
Responsible Persons	Anton Deitmar, Reiner Schätzle

Abbreviations:

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Teaching Format	: L=lecture, LE=lecture with integrated exercises, SL=seminar or lecture, E=exercise class, T=tutorial, P=practical course, S=seminar, IC=inverted classroom
Status	: o=obligatory, f=facultative
Other	: h=hours, o.=or, s.M.=see module description, SWS=contact hours per week

<table>
<tr><td>Module Number:
MAT-20-03</td><td colspan="3">Module Title:
Algebra</td><td>Type of Module:
Elective Module</td></tr>
<tr><td>ECTS-Points</td><td colspan="4">9</td></tr>
<tr><td>Workload
- Time in Class
- Self-Study</td><td>Workload:
270 h</td><td colspan="2">Time in Class:
90 h</td><td>Self-Study:
180 h</td></tr>
<tr><td>Duration</td><td colspan="4">1 Semester</td></tr>
<tr><td>Frequency</td><td colspan="4">regularly in Summer Semester</td></tr>
<tr><td>Term</td><td colspan="4">1-4</td></tr>
<tr><td>Language of Instruction</td><td colspan="4">German</td></tr>
<tr><td>Forms of Teaching and Learning</td><td colspan="4">Lecture 4 SWS + Ex.cl. 2 SWS</td></tr>
<tr><td>Content</td><td colspan="4">• Groups and structure theory of finite groups.
• Rings, ideals, polynomial rings, divisibility theory.
• Fields and field extensions.
• Geometric and algebraic applications of field theory.</td></tr>
<tr><td>Objectives</td><td colspan="4">The students deepen their structural thinking, know basic algebraic concepts and can apply them on other mathematical disciplines. They understand, in particular, through the example of field theory, how the interaction of different branches of algebra leads to new insights, e.g. answers to classical problems from antiquity. In the process they have experienced, that the coaction of different areas of mathematics can be essential for solving concrete problems.
In the exercise classes they have acquired a confident, precise and independent handling of the terms, statements and methods of the lecture. Furthermore the presentation and communication skills of the students was trained by written assignments and presenting their own solutions. The students are capable of adopting knowledge by self-study and at the same time their capacity for teamwork was enhanced by working in small groups.</td></tr>
<tr><td>Requirements for obtaining Credits / Grading (Weighting if applicable)</td><td colspan="4">
<table>
<tr><th>Title</th><th>Type of Course</th><th>Status</th><th>SWS</th><th>ECTS</th><th>Coursework</th><th>Type of Exam</th><th>Dur. of Exam (min)</th><th>Grading</th><th>Weight for Grade</th></tr>
<tr><td>Algebra</td><td>L</td><td>o</td><td>4</td><td>6</td><td rowspan="2">yes</td><td rowspan="2">wr. o.
or.</td><td rowspan="2">90-180
o. 20-30</td><td rowspan="2">g</td><td rowspan="2">100</td></tr>
<tr><td>E</td><td>o</td><td>2</td><td>3</td></tr>
</table>
In this module an exercise certificate is to be acquired as coursework. For participation in the examination the coursework must have been acquired. Whether the examination is written or oral is decided by the instructor with approval by the head of the examination board.</td></tr>
</table>

Literature	**Possible References :** • Siegfried Bosch: Algebra. Springer 2009. • Gerd Fischer, Reinhard Sacher: Einführung in die Algebra. Teubner 1983. • Christian Karpfinger, Kurt Meyberg: Algebra: Gruppen-Ringe-Körper. Springer Spektrum 2010. • Kurt Meyberg: Algebra 1. Hanser 1980. • Kurt Meyberg: Algebra 2. Hanser 1976. • Hans-Jörg Reiffen, Günter Scheja, Udo Vetter: Algebra. Bibliographisches Institut 1984.
Transfer	If applicable, the module is requirement for the modules Seminar Specialisation Mathematics and Master Thesis.
Prerequisites	There are no further prerequisites.
Responsible Persons	Jürgen Hausen, Hannah Markwig, Thomas Markwig

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Status	: o=obligatory, f=facultative
Other	: h=hours, o.=or, s.M.=see module description, SWS=contact hours per week

<table>
<tr><td>Module Number:
MAT-20-11</td><td colspan="2">Module Title:
Numerical Mathematics</td><td>Type of Module:
Elective Module</td></tr>
<tr><td>ECTS-Points</td><td colspan="3">9</td></tr>
<tr><td>Workload
- Time in Class
- Self-Study</td><td>Workload:
270 h</td><td>Time in Class:
90 h</td><td>Self-Study:
180 h</td></tr>
<tr><td>Duration</td><td colspan="3">1 Semester</td></tr>
<tr><td>Frequency</td><td colspan="3">regularly in Winter Semester</td></tr>
<tr><td>Term</td><td colspan="3">1-4</td></tr>
<tr><td>Language of Instruction</td><td colspan="3">German</td></tr>
<tr><td>Forms of Teaching and Learning</td><td colspan="3">Lecture 4 SWS + Ex.cl. 2 SWS</td></tr>
<tr><td>Content</td><td colspan="3">• Interpolation and approximation of functions.
• Numeric integration and differentiation.
• Systems of linear equations and linear curve fitting.
• Systems of non-linear equations and non-linear curve fitting.
• Initial value problems for ordinary differential equations.</td></tr>
<tr><td>Objectives</td><td colspan="3">The students know the foundations of numerical mathematics and are capable of performing basic calculation techniques. They understand to bring the knowledge gathered in the modules Analysis and Linear Algbra in the analysis of numerical methods and to use the methods for specific problems. Their algorithmic thinking was enhanced and they are acquainted to the analysis of algorithms with a view to questions of efficiency and complexity.
In the exercise classes they have acquired a confident, precise and independent handling of the terms, statements and methods of the lecture. Furthermore the presentation and communication skills of the students were trained by written assignments and presenting their own solutions. The students are capable of adopting knowledge by self-study and at the same time their capacity for teamwork was enhanced by working in small groups.</td></tr>
<tr><td>Requirements for obtaining Credits / Grading (Weighting if applicable)</td><td colspan="3">
<table>
<tr><th>Title</th><th>Type of Course</th><th>Status</th><th>SWS</th><th>ECTS</th><th>Coursework</th><th>Type of Exam</th><th>Dur. of Exam (min)</th><th>Grading</th><th>Weight for Grade</th></tr>
<tr><td rowspan="2">Numerical Mathematics</td><td>L</td><td>o</td><td>4</td><td>6</td><td rowspan="2">yes</td><td rowspan="2">wr. o. or.</td><td rowspan="2">90-180 o. 20-30</td><td rowspan="2">g</td><td rowspan="2">100</td></tr>
<tr><td>E</td><td>o</td><td>2</td><td>3</td></tr>
</table>
In this module an exercise certificate is to be acquired as coursework. For participation in the examination the coursework must have been acquired. Whether the examination is written or oral is decided by the instructor with approval by the head of the examination board.</td></tr>
<tr><td>Literature</td><td colspan="3">Possible References :
• Peter Deuflhard, Andreas Hohmann: Numerische Mathematik 1. De Gruyter 2008.
• Martin Hanke-Bourgeois: Grundlagen der Numerischen Mathematik und des Wissenschaftlichen Rechnens. Vieweg+Teubner 2009.</td></tr>
<tr><td>Transfer</td><td colspan="3">If applicable, the module is prerequisite for the modules Seminar Specialisation Mathematics and Master Thesis.</td></tr>
</table>

Prerequisites	There are no further prerequisites.
Responsible Persons	Christian Lubich, Andreas Prohl

Abbreviations:

Grading System	: g=graded, ng=not graded
Examination Type	: MT=master's thesis, or.=oral exam, wr.=written exam, Pr=presentation, E=essay, P=portfolio, T=continous assessment tests
Teaching Format	: L=lecture, LE=lecture with integrated exercises, SL=seminar or lecture, E=exercise class, T=tutorial, P=practical course, S=seminar, IC=inverted classroom
Status	: o=obligatory, f=facultative
Other	: h=hours, o.=or, s.M.=see module description, SWS=contact hours per week

Module Number: MAT-40-52	**Module Title:** Seminar: Mathematical Specialisation		**Type of Module:** Compulsory Module with Choice
ECTS-Points	4		
Workload - Time in Class - Self-Study	Workload: 90 h	Time in Class: 30 h	Self-Study: 60 h
Duration	1 Semester		
Frequency	every Semester		
Term	3-4		
Language of Instruction	German		
Forms of Teaching and Learning	Seminar, talk, presentation, e-learning, blended learning		
Content	Various topics from the advanced fields of mathematics.		
Objectives	The students independently work on a coherent mathematical topic and prepare it in a didactical appealing fashion. They learn how to present their work to a group, how to be responsive to questions regarding the content and how to lead a professional discussion. The work and the presentation may be the foundation or a deepened study in the scope of a master thesis.		

Requirements for obtaining Credits / Grading (Weighting if applicable)

Title	Type of Course	Status	SWS	ECTS	Coursework	Type of Exam	Dur. of Exam (min)	Grading	Weight for Grade
Seminar	S	o	2	4	yes	Pr	60-90	g	100

The acquisition of the credit points requires alongside with a successful presentation the regular active participation in the course, like by asking questions, contributing to a discussion or working on problem tasks. Additionally a written elaboration of the own talk or the issue of a handout for the participants may be required. These further efforts constitute the coursework of the module.

Transfer	-
Prerequisites	The participation in the module requires the successful completion of at least one of the modules Introduction to Complex Analysis and Ordinary Differential Equations, Algebra or Numerical Mathematics.
Responsible Persons	The dean of studies at the Department of Mathematics

Abbreviations:

Grading System : g=graded, ng=not graded

Examination Type : MT=master's thesis, or.=oral exam, wr.=written exam, Pr=presentation, E=essay, P=portfolio, T=continous assessment tests

Teaching Format : L=lecture, LE=lecture with integrated exercises, SL=seminar or lecture, E=exercise class, T=tutorial, P=practical course, S=seminar, IC=inverted classroom

Status : o=obligatory, f=facultative

Other : h=hours, o.=or, s.M.=see module description, SWS=contact hours per week

<table>
<tr><td>Module Number:
MAT-40-53</td><td colspan="2">Module Title:
Seminar: Mathematical Specialisation</td><td>Type of Module:
Compulsory Module with Choice</td></tr>
<tr><td>ECTS-Points</td><td colspan="3">4</td></tr>
<tr><td>Workload
- Time in Class
- Self-Study</td><td>Workload:
90 h</td><td>Time in Class:
30 h</td><td>Self-Study:
60 h</td></tr>
<tr><td>Duration</td><td colspan="3">1 Semester</td></tr>
<tr><td>Frequency</td><td colspan="3">every Semester</td></tr>
<tr><td>Term</td><td colspan="3">3-4</td></tr>
<tr><td>Language of Instruction</td><td colspan="3">German</td></tr>
<tr><td>Forms of Teaching and Learning</td><td colspan="3">Seminar, talk, presentation, e-learning, blended learning</td></tr>
<tr><td>Content</td><td colspan="3">Various topics from the advanced fields of mathematics.</td></tr>
<tr><td>Objectives</td><td colspan="3">The students independently work on a coherent mathematical topic and prepare it in a didactical appealing fashion. They learn how to present their work to a group, how to be responsive to questions regarding the content and how to lead a professional discussion. The work and the presentation may be the foundation or a deepened study in the scope of a master thesis.</td></tr>
<tr><td>Requirements for obtaining Credits / Grading (Weighting if applicable)</td><td colspan="3">
<table>
<tr><th>Title</th><th>Type of Course</th><th>Status</th><th>SWS</th><th>ECTS</th><th>Coursework</th><th>Type of Exam</th><th>Dur. of Exam (min)</th><th>Grading</th><th>Weight for Grade</th></tr>
<tr><td>Seminar</td><td>S</td><td>o</td><td>2</td><td>4</td><td>yes</td><td>Pr</td><td>60-90</td><td>g</td><td>100</td></tr>
</table>
The acquisition of the credit points requires alongside with a successful presentation the regular active participation in the course, like by asking questions, contributing to a discussion or working on problem tasks. Additionally a written elaboration of the own talk or the issue of a handout for the participants may be required. These further efforts constitute the coursework of the module.
</td></tr>
<tr><td>Transfer</td><td colspan="3">-</td></tr>
<tr><td>Prerequisites</td><td colspan="3">The participation in the module requires the successful completion of at least one of the modules Introduction to Complex Analysis and Ordinary Differential Equations or Stochastics.</td></tr>
<tr><td>Responsible Persons</td><td colspan="3">The dean of studies at the Department of Mathematics</td></tr>
</table>

Abbreviations:

Grading System : g=graded, ng=not graded

Examination Type : MT=master's thesis, or.=oral exam, wr.=written exam, Pr=presentation, E=essay, P=portfolio, T=continous assessment tests

Teaching Format : L=lecture, LE=lecture with integrated exercises, SL=seminar or lecture, E=exercise class, T=tutorial, P=practical course, S=seminar, IC=inverted classroom

Status : o=obligatory, f=facultative

Other : h=hours, o.=or, s.M.=see module description, SWS=contact hours per week

Section 2: Didactics of Mathematics

<table>
<tr><td>Module Number:
MAT-80-03</td><td colspan="2">Module Title:
Subject Didactics Mathematics 3</td><td>Type of Module:
Compulsory Module with Choice</td></tr>
<tr><td>ECTS-Points</td><td colspan="3">6</td></tr>
<tr><td>Workload
- Time in Class
- Self-Study</td><td>Workload:
180 h</td><td>Time in Class:
60 h</td><td>Self-Study:
120 h</td></tr>
<tr><td>Duration</td><td colspan="3">2 Semester</td></tr>
<tr><td>Frequency</td><td colspan="3">every Semester</td></tr>
<tr><td>Term</td><td colspan="3">1-2</td></tr>
<tr><td>Language of Instruction</td><td colspan="3">German</td></tr>
<tr><td>Forms of Teaching and Learning</td><td colspan="3">Lecture, exercise, proseminar, talk, presentation, e-learning, blended learning, project work, case studies</td></tr>
<tr><td>Content</td><td colspan="3">In the first part varying topics are covered, who are especially related to the teaching profession and are also suited for a didactical refurbishment of the school internship semester. In the second part varying topics from didactics will be studied, which can lead up to recent research in didactics.</td></tr>
<tr><td>Objectives</td><td colspan="3">The students
know subject didactical principles and educational concepts and can evaluate and scrutinise them,
can compare and evaluate subject related approaches to central terms and theorems of the treated fields,
can plan, execute, analyse and evaluate competence oriented mathematical education on the basis of subject didactical concepts,
can motivate the general educating value of mathematical contents and methods and the social importance of mathematics and put it in context with the goals and contents of mathematical education,
can specifically use subject specific media,
can create a portfolio and document important experiences, findings and insights in a structured manner.</td></tr>
<tr><td>Requirements for obtaining Credits / Grading (Weighting if applicable)</td><td colspan="3">
<table>
<tr><th>Title</th><th>Type of Course</th><th>Status</th><th>SWS</th><th>ECTS</th><th>Coursework</th><th>Type of Exam</th><th>Dur. of Exam (min)</th><th>Grading</th><th>Weight for Grade</th></tr>
<tr><td>Subject didactics 3: professional knowledge</td><td>S</td><td>o</td><td>2</td><td>3</td><td>yes</td><td>K o. mP o. R o. H</td><td>90-180 o. 20-30</td><td>g</td><td>50</td></tr>
<tr><td>Subject didactics 3: elective specialisation</td><td>SV</td><td>o</td><td>2</td><td>3</td><td>yes</td><td>K o. mP o. R o. H</td><td>90-180 o. 20-30</td><td>g</td><td>50</td></tr>
</table>
The module consists of two parts (Professional Knowledge and Elective Specialisation), for which the teaching learning methods (lecture, exercise or seminar) as well as the type of examination (written or oral exam, presentation or paper) are usually different. This is taken into account by the fact that, the examination in this module consists of two equally weighted parts.
</td></tr>
</table>

Transfer	-
Prerequisites	There are no prerequisites for participating in the module.
Responsible Persons	Frank Loose, Walther Paravicini

Abbreviations:

Grading System	: g=graded, ng=not graded
Examination Type	: MT=master's thesis, or.=oral exam, wr.=written exam, Pr=presentation, E=essay, P=portfolio, T=continous assessment tests
Teaching Format	: L=lecture, LE=lecture with integrated exercises, SL=seminar or lecture, E=exercise class, T=tutorial, P=practical course, S=seminar, IC=inverted classroom
Status	: o=obligatory, f=facultative
Other	: h=hours, o.=or, s.M.=see module description, SWS=contact hours per week

Section 3: Master Thesis

Module Number: MAT-40-53	**Module Title:** Master Thesis		**Type of Module:** Compulsory Module
ECTS-Points	15		
Workload - Time in Class - Self-Study	Workload: 450 h	Time in Class: 0 h	Self-Study: 450 h
Duration	1 Semester		
Frequency	every Semester		
Term	4		
Language of Instruction	German		
Forms of Teaching and Learning	Master thesis		
Content	The master's thesis represents the culmination of the master's degree programme. Under the guidance of a supervisor, students are required to work on a well-defined problem in mathematics (including mathematics education), which may extend to the frontiers of current research. This involves using scientific methods and presenting the results in written form. Specifically, this includes: • formulating a scientific research question in consultation with the supervisor; • independently searching for and studying relevant scientific literature; • formulating appropriate research questions and methodological approaches for their solution; • independently carrying out the project, as well as presenting the project and its results in writing and, if applicable, orally, within the context of the current state of research. The results should contribute to scientific knowledge.		
Objectives	The students: • are capable of familiarising themselves with a problem, which may extend to the frontiers of current research, within a given timeframe and independently developing a solution approach, • can increasingly apply appropriate scientific methods independently and present the results in a scientifically appropriate manner, • are able to independently work on a scientific topic while applying their mathematical methodological knowledge, • deepen their problem-solving skills and can transfer their methodological knowledge, • are able to present the results of their project to a professional audience.		

Requirements for obtaining Credits / Grading (Weighting if applicable)

Title	Type of Course	Status	SWS	ECTS	Coursework	Type of Exam	Dur. of Exam (min)	Grading	Weight for Grade
Master Thesis	MT	o	-	15	no	MT	-	g	100

Transfer	-

Prerequisites	Academic admission requirements for the master's thesis module include, in addition to the general conditions specified in the general part of the study and examination regulations the successful completion of at least one of the modules Introduction to Complex Analysis and Ordinary Differential Equations, Algebra or Numerical Mathematics.
Responsible Persons	The dean of studies at the Department of Mathematics

Abbreviations:

Grading System	: g=graded, ng=not graded
Examination Type	: MT=master's thesis, or.=oral exam, wr.=written exam, Pr=presentation, E=essay, P=portfolio, T=continous assessment tests
Teaching Format	: L=lecture, LE=lecture with integrated exercises, SL=seminar or lecture, E=exercise class, T=tutorial, P=practical course, S=seminar, IC=inverted classroom
Status	: o=obligatory, f=facultative
Other	: h=hours, o.=or, s.M.=see module description, SWS=contact hours per week