Curriculum of the Bachelor and Master Studies of Insurance Mathematics

according to the resolution passed by the
Degree Program Committee for Technical Mathematics
and Insurance Mathematics,
at Vienna Technical University, on May 27th, 2002,

not prohibited by the Federal Ministry
for Education, Science and Culture,
on June 19th, 2002 (GZ 52.351/58-VII/D/2/2002).

Preface (in german)

Die Tätigkeit von VersicherungsmathematikerInnen hat - vor allem in der Lebensversicherung - große Bedeutung und eine lange Tradition.

Die beruflichen Anforderungen an VersicherungsmathematikerInnen haben in den vergangenen Jahren durch Änderungen des gesamtwirtschaftlichen Umfelds stark zugenommen. Neben der klassischen Domäne der Lebensversicherungsmathematik gibt es zahlreiche neue Aufgaben für VersicherungsmathematikerInnen, die spezifische Kenntnisse benötigen: Pensionskassen, Beratungsunternehmen für betriebliche Altersversorgung, Gutachtertätigkeit, Sachversicherung, Rückversicherung, Asset-Liability-Management, um nur einige Bereiche zu nennen, die in den letzten Jahren stark an Bedeutung gewonnen haben.

Diese neuen Entwicklungen haben zu einem erhöhten Bedarf an universitär gut ausgebildeten Fachkräften geführt. Die TU Wien reagiert auf diese moderne Entwicklung mit der Schaffung eines dreijährigen Bakkalaureatsstudiums und eines darauf aufbauenden zweijährigen Magisterstudiums *Versicherungsmathematik*. Kürzere Normstudienzeiten sollen die Attraktivität von Studien für MaturantInnen erhöhen und die Rate der StudienabbrecherInnen senken. Außerdem erfolgt diese Gliederung im Sinne der Bologna–Erklärung, in der der Wille zu einer derartigen EU–weiten Entwicklung der Studienpläne bekundet wurde.

Das Bakkalaureatsstudium *Versicherungsmathematik* soll der facheinschlägigen, fundierten Berufsvorbildung dienen. Die zahlreichen praxisnahen Bausteine der Ausbildung des Bakkalaureatsstudiums sollen den Anforderungen des Arbeitsmarktes nach gut ausgebildeten AkadamikerInnen gerecht werden. Andererseits sind einige der Grundbausteine des Diplomstudiums Technische Mathematik verpflichtender Bestandteil des Bakkalaureatstudiums. Diese sollen eine entsprechend fundierte Mathematikausbildung sicherstellen.

Das Magisterstudium *Versicherungsmathematik* dient der Vertiefung und Ergänzung der im Bakkalaureat oder einem gleichwertigen Studium erhaltenen Berufsvorbildung. Auch beim Magisterstudium wurde großes Augenmerk auf ein ausgewogenes Verhältnis von praxisnahen und theoretischen Bestandteilen der Ausbildung gelegt. Die AbsolventInnen sollen so sowohl für höhere Positionen in der Wirtschaft als auch für weiterführende Forschungsaufgaben qualifiziert sein.

Insgesamt soll die Einführung des Bakkalaureats- und Magisterstudiums *Versicherungsmathematik* ermöglichen, daß JungakademikerInnen früh, nämlich bereits nach 6 Semestern in das Erwerbsleben einsteigen, und damit die Konkurrenzfähigkeit Österreichs im europäischen Wirtschaftsraum fördern.

The degree program committee *Technical Mathematics and Insurance Mathematics* at the faculty for Natural and Computer Sciences of Vienna Technical University issues the following degree program for the Bachelor and Master Studies of Insurance Mathematics, pursuant to the currently effective University Studies Act (Universitäts–Studiengesetz - UniStG), BGBl. I Nr. 48/1997.

The present degree program for the Bachelor and Master Studies of Insurance Mathematics comes into force on October 1st, 2002.

Contents

1 General Regulations

1.1 Duration and Structure of the Studies

(1) The Bachelor and Master Studies of Insurance Mathematics are hereby established at the Faculty of Natural and Computer Sciences of Vienna Technical University.

(2) The Bachelor Studies of Insurance Mathematics cover 6 semesters. Students must enroll for a total of 112 weekly hours of classes, of which 101 must be drawn from the core subjects ('Pflichtfächer'). The remaining weekly hours must be drawn from elective core subjects ('gebundene Wahlfächer').

(3) The Master Studies of Insurance Mathematics cover 4 semesters. Students must enroll for a total of 50 weekly hours of classes, including core subjects, elective core subjects, and elective subjects.

1.2 Course Types, Abbrevations

According to this degree program, the following course types (§ 7 (1) UniStG) are well defined:

- *Lectures (VO)* serve the purpose of imparting theoretical knowledge of parts of a subject.
- *Exercises (UE)* serve the purpose of applying the knowledge, which is acquired in lectures, to exercises.
- *Lectures entailed with exercises (VU)* are courses, which introduce into parts of the corresponding subject, with special emphasis on relevant problems of the subject, on the formation of concepts, on solutions and on practical applications of the subject matter.
- *Practical Trainings (PR)* are courses, in which students have to apply previously acquired knowledge to practical exercises.
- *Seminars (SE)* serve the purpose of research and scientific discussions.
- *Laboratory Exercises (LU)* correspond to exercises, in which students work primarily with special tools and special equipment.
- *Lectures entailed with Laboratory Exercises (VL)* correspond to lectures entailed with exercises, but the practical applications of the subject matter are carried out with the help of special tools and special equipment.

1.3 Examination Regulations

(1) For lectures (VO), there has to be a final examination about the complete contents of the course. Examinations for core subjects have to consist of a written and an oral part, with special emphasis on applications in the written part, and with special emphasis on theoretical knowledge in the oral part.

For the following courses, there are only oral exams.

- Introduction in the Probability Theory and Statistics,
- Insurance Business Administration,
- Personal Insurance Mathematics,
- Insurance Law,
- Applied Statistics.

For the following courses there are only written exams.

- Accounting and Balancing Models in the Insurance Business,
- Life Insurance Mathematics.

Examinations for elective core subjects are to be held orally.

Exceptions apply, if these courses are already committed because of another examination regulation.

(2) For exercises (UE), lectures entailed with exercises (VU), practical trainings (PR), seminars (SE), laboratory exercises (LU) and lectures entailed with laboratory exercises (VL), there has to be a permanent assessment of the students.

(3) Successful passing of an examination, as well as successful passing of the commissional examination from Section 3.7 (2) and (3), will be assessed with the following grades: 'Very Good' (1), 'Good' (2), 'Satisfactory' (3), 'Sufficient' (4). Failing of an examination corresponds to the grade 'Insufficient' (5).

(4) Grades in the degree examination certificate will be calculated as averages of the grades of all examinations, weighted by the number of weekly hours of classes per semester.

Core subjects: For each subject mentioned in this curriculum, an average grade and the corresponding number of weekly hours of classes have to be specified.

Elective core subjects: For each elective core subject basket, an average grade and the corresponding number of weekly hours of classes have to be specified.

Elective subjects: Average grade and number of weekly hours of classes have to be specified.

1.4 Exchanges between courses

In case of application by a student, the Dean of Studies has to allow, that core subjects recommended after the 4th semester, from a related field in content can be replaced up to 7 weekly hours of classes, if the general aim of professional training is not impaired.

1.5 ECTS Points

Transfer of ECTS (European Credit Transfer System) points for specific courses of the Bachelor and Master Studies of Insurance Mathematics is as follows (Whc. = weekly hours of classes per semester):

Bachelor Studies Insurance Mathematics	Whc.	ECTS
Practical placement (with bachelor thesis)	10.0	25.0
Seminar (with bachelor thesis)	3.0	6.5
Core subjects, without practical placement and seminar (1.0 whc. = 1.5 ECTS)	88.0	132.0
Elective subjects (1.0 wh. = 1.5 ECTS)	11.0	16.5
Bachelor studies, total	112.0	180.0

Master Studies Insurance Mathematics	Whc.	ECTS
Master thesis		30.0
Core subjects (1.0 whc. = 2.0 ECTS)	33.0	66.0
Elective core subjects (1.0 whc. = 1.5 ECTS)	12.0	18.0
Elective subjects (1.0 whc. = 1.2 ECTS)	5.0	6.0
Master studies, total	50.0	120.0

1.6 Academic Degrees

(1) The academic degree, which is attained by completing the Bachelor Studies of Insurance Mathematics, reads as follows: 'Bakkalaurea der technischen Wissenschaften' resp. 'Bakkalaureus der technischen Wissenschaften' (Bachelor of Technical Sciences), with shorthand notation 'Bakk. techn.'.

(2) The academic degree, which is attained by completing the Master Studies of Insurance Mathematics, reads as follows: 'Diplom-Ingenieurin' resp. 'Diplom-Ingenieur', with shorthand notation 'Dipl.-Ing.' or 'DI' (Anlage 1 Z 2.2 UniStG).

2 Bachelor Studies of Insurance Mathematics

2.1 Recommended Course Structure

Recommended for the 1st semester:	VO	PI	Total
Analysis 1	5 VO	2 UE	7
Linear Algebra 1	4 VO	2 UE	6
Introduction to Programming for TM (1st or 2nd Semester)		3 VU	3
Introduction to Insurance Mathematics		1 VU	1
Total	9	8	17

Recommended for the 2nd semester:	VO	PI	Total
Analysis 2	5 VO	2 UE	7
Linear Algebra 2	5 VO	2 UE	7
Introduction to Probability Theory and Statistics	2 VO	2 UE	4
Total	12	6	18

Recommended for the 3rd Semester:	VO	PI	Total
Measure and Probability Theory	3 VO	2 UE	5
Statistical Computing		2 VU	2
Life Insurance Mathematics	3 VO	2 UE	5
Insurance Business Administration 1	2 VO		2
Private Economic Law	2 VO		2
Total	10	6	16

Recommended for the 4th semester:	VO	PI	Total
Non–Life Insurance Mathematics	3 VO	2 UE	5
Accounting and Balancing Models in the Insurance Business	2 VO		2
Applied Statistics	2,5 VO	1,5 UE	4
Stochastic Processes and Time Series Analysis	3 VO	2 UE	5
Data Modelling		2 VU	2
Total	10,5	7,5	18
Recommended for the 5th semester:	VO	PI	Total
Personal Insurance Mathematics	3 VO	2 UE	5
Insurance Law (one–year course)	2 VO		2
AKVFM Insurance Business Administration 2		2 VU	2
AKVFM Reinsurance		2 VU	2
Objectoriented Programming		2 VL	2
Seminar (with bachelor thesis)		3 SE	3
Total	5	11	16
Recommended for the 6th semester:	VO	PI	Total
Insurance Law (one–year course)	2 VO		2
Introduction to Mathematical Finance: Discrete models		4 VU	4
Practical Placement (with Bachelor thesis)		10 PR	10
Total	2	14	16
TOTAL: Core subjects, Bachelor studies	48,5	52,5	101
Elective subjects			11
TOTAL: Bachelor studies			112

2.2 Studieneingangsphase (in german)

Die Lehrveranstaltungen aus Analysis 1 (5 VO + 2 UE) und Linearer Algebra 1 (4 VO + 2 UE) des Bakkalaureatsstudiums werden gemäß § 38 (1) UniStG als Studieneingangsphase definiert.

2.3 Completing the Bachelor Studies

The Bachelor Studies of Insurance Mathematics are considered to be completed, if the student has completed resp. passed examinations for all courses from the core subjects (101 whc.) and

11 whc. of courses from the elective subjects with positive assessment.

2.4 Core Subjects

Students have to complete courses in the following subjects (101 whc., whc. = weekly hours of classes):

Mathematics (27 whc.)

5.0 VO Analysis 1
2.0 UE Analysis 1
4.0 VO Linear Algebra 1
2.0 UE Linear Algebra 1
5.0 VO Analysis 2
2.0 UE Analysis 2
5.0 VO Linear Algebra 2
2.0 UE Linear Algebra 2

Informatics and Computer Sciences (9 whc.)

3.0 VU Introduction to Programming for TM
2.0 VU Statistical Computing
2.0 VU Data Modelling
2.0 VL Objectoriented Programming

Business Management and Law (24 whc.)

2.0 VO Private Economic Law
4.0 VO Insurance Law (one–year course)
2.0 VO Business Management for Insurers 1
2.0 VO Accounting and Balancing Models in the Insurance Business 1
2.0 VU Accounting and Balancing Models in the Insurance Business 2
2.0 VU Reinsurance
10.0 PR Practical Placement (with Bachelor Thesis)

Insurance Mathematics (23 whc.)

1.0 VU Introduction to Insurance Mathematics
3.0 VO Life Insurance Mathematics
2.0 UE Life Insurance Mathematics
3.0 VO Personal Insurance Mathematics
2.0 UE Personal Insurance Mathematics
3.0 VO Non–Life Insurance Mathematics
2.0 UE Non–Life Insurance Mathematics
4.0 VU Introduction to Mathematical Finance: Discrete Models
3.0 SE Seminar (with Bachelor Thesis)

Statistics and Probability Theory (18 whc.)

2.0 VO Introduction to Probability Theory and Statistics
2.0 UE Introduction to Probability Theory and Statistics
3.0 VO Measure and Probability Theory
2.0 UE Measure and Probability Theory
2.5 VO Applied Statistics
1.5 UE Applied Statistics
3.0 VO Stochastic Processes and Time Series Analysis
2.0 UE Stochastic Processes and Time Series Analysis

2.5 Recommended Elective Subjects

Students have to enroll for elective subjects for 11 weekly hours of classes per semester. Within the elective subjects, students can choose courses completely free from the course program of any acknowledged austrian or international university. Students have to pass examinations for these courses (§ 4 (25) UniStG). The degree program committee has decided to offer students a variety of recommended courses for their guidance only. The course names are in german.

Informatics and Computer Sciences

Datenbanksysteme (2.0 VO)
Computernumerik (2.0 VU)
Computer Mathematics Practical Training for Insurers (3.0 PR)
Algorithms and Data Structures (2.0 VO)
Programming 2 (3.0 VO + 2.0 LU)
Informatikpraktikum (10.0 PR)
Software Engineering (2.0 LU)
Internet: Technologies, Protocols, Interworking (2.0 VO)

Law

Arbeits- und Sozialrecht (2.0 VO)
Handels-u.Wechselrecht (2.0 VO)
Bank-und Wertpapierrecht (2.0 VO)
Steuerrecht (2.0 VO)
Verfassungs-u.Verwaltungsrecht (2.0 VO)
Grundzüge des Bürgerlichen Rechts (2.0 VO + 2.0 UE)
Daten- und Informatikrecht (2.0 VO + 2.0 UE)
Europäisches Wirtschaftsrecht (2.0 VO)

Micro- and Macroeconomics

Theory of Auctions (engl.Spr.) (2.0 VO)
Dynamische Makrotheorie 1 (2.0 VO)
Dynamische Makrotheorie 2 (2.0 VO)
Organisation und Personal (2.0 VO)
Organisation und Personal (2.0 UE)

Projektorganisation – Projektmanagement (2.0 VO)
Projektorganisation – Projektmanagement (2.0 UE)

Econometrics and Operations Research

AKOEK der volkswirtsch. Mikroökonometrie (1.0 UE)
AKOEK der volkswirtsch. Mikroökonometrie (2.0 VO)
Econometric Models (2.0 VO)
Econometric Models – Exercises (1.0 UE)
Optimization: Models and Methods (2.0 VO)
Optimization: Models and Methods (1.0 UE)
Mikroökonometrie in Wirtschafts- und Marktforschung (1.0 UE)
Mikroökonometrie in Wirtschafts- und Marktforschung (2.0 VO)
Ökonometrie d. Finanzmärkte (2.0 VO)
Nonlinear Dynamical Systems (2.0 VO)
Mathematical Optimization (2.0 VO)
Mathematical Optimization (1.0 UE)
Dynamic Optimization (2.0 VO)
Game Theoretic Modeling (2.0 VO)
Game Theoretic Modeling (1.0 UE)

Probability Theory and Statistics

Time Series Analysis (2.0 VO)
Time Series Analysis (2.0 UE)
Stochastic Differential Equations (2.0 VO)
Multivariate Statistics (2.0 VO)
Multivariate Statistics (1.0 UE)
Applied Bayes‘ Statistics (2.0 VO)
Wirtschaftsstatistik (2.0 VO)
Wirtschaftsstatistik (2.0 UE)

Mathematical Finance

Malliavin Calculus and Applications (in engl.Spr.) (2.0 VO)
Malliavin Calculus and Applications (in engl.Spr.) (1.0 UE)
Advanced Mathematical Finance II (in engl.Spr.) (2.0 VO)
Credit Risk Modelling (2.0 VO)
Mathematical Finance 1 (in engl.Spr.) (2.0 SE)
Mathematical Finance 2 (in engl.Spr.) (2.0 SE)

2.6 Bachelor Thesis

In the course of the following two courses, students have to write an independent, original thesis (Bachelor Thesis):

1. Seminar (SE, 3 whc.),
2. Practical Placement (PR, 10 whc.).

2.7 Qualifikationsprofil (in german)

Das Bakkalaureat Versicherungsmathematik soll qualifizierte, selbständige Fachkräfte für mittlere bis gehobene Positionen in der Versicherungsbranche ausbilden.

Die auf ein breites mathematisches Wissen gestellte Anfangsphase des Studiums soll sicherstellen, daß die Absolventinnen oder die Absolventen des Bakkalaureats vielseitig einsetzbar sind.

Andererseits soll den Studierenden ein Maximum an Praxiswissen vermittelt werden, um den Absolventinnen oder den Absolventen des Bakkalaureats einen unmittelbaren Berufseinstieg zu ermöglichen. Dies geschieht im vorgesehenen Studienplan durch das Gewicht, das auf die Gebiete Betriebswirtschaftslehre und Recht gelegt wird, aber auch durch einen innovativen thematischen Schwerpunkt im Informatikbereich. Dieser ist eine Antwort auf die Nachfrage der Versicherungsbranche nach Fachkräften, die sowohl eine versicherungsmathematische als auch eine fundierte EDV-Ausbildung besitzen.

3 Master Studies of Insurance Mathematics

3.1 Admission for the Master Studies

Admission for the Master Studies of Insurance Mathematics is granted for students, if they have either completed the Bachelor Studies of Insurance Mathematics, or some other bachelor studies, which are related in contents, or some other equivalent studies at an acknowledged austrian or international postsecundary institution. The decision about admission is made by the rector.

3.2 Recommended Course Structure

Recommended for the 7th semester:	VO	PI	Total
Risk Theory	4 VO	2 UE	6
Analysis 3 B	4 VO	2 UE	6
Total	8	4	12

Recommended for the 8th semester:	VO	PI	Total
AKVFM Advanced Life Insurance Mathematics		4 VU	4
Differential Equations A	5 VO	2 UE	7
Total	5	6	11

Recommended for the 9th semester:	VO	PI	Total
AKVFM Ruin Theory		3 VU	3
AKVFM Seminar Insurance Mathematics		2 SE	2
AKVFM Praktical Training: Selected Topics from Ins. Math.		5 PR	5
Total		10	10

Recommended for the 10th semester:	VO	PI	Total
Master thesis			
TOTAL: Core subjects, Master studies	13	20	33
Elective core subjects			12
Elective subjects			5
TOTAL: Master Studies			50

3.3 Core Subjects

Students have to complete courses in the following subjects (whc. = weekly hours of classes):

Mathematics (13 Sst.)

4.0 VO Analysis 3 B
2.0 UE Analysis 3 B
5.0 VO Differential Equations A
2.0 UE Differential Equations A

Insurance Mathematics (20 Sst.)

4.0 VU Risk Theory
2.0 UE Risk Theory
4.0 VU AKVFM Advanced Life Insurance Mathematics
3.0 VU AKVFM Ruin Theory
2.0 SE AKVFM Seminar Insurance Mathematics
5.0 PR AKVFM Practical Training: Selected Topics from Insurance Mathematics

3.4 Elective Core Subjects

Within the scope of the elective core subjects, students have to choose courses in an extent of 12 weekly hours of classes per semester from the elective core subject baskets III, VI, VIII, IX of the degree program for the studies program 'Technische Mathematik' (as listed below). Students must not choose courses, which they have completed within the scope of the core subjects respectively the elective subjects during their bachelor studies. Within each elective core subject basket there is a yearly changing supply of lectures and courses. Courses, which are assigned to a specific basket, have a corresponding shorthand expression in their name. Names of courses in the list below are in german.

	Name	Courses beginning with AK and courses listed below	whc.
III	Probability Theory and Statistics	AKWTH, AKSTA	

	Name	Courses beginning with AK and courses listed below	whc.
VI	Econometrics and Operations Research	AKOEK, AKOR	
VIII	Logic, Theoretical and Applied Informatics	AKLOG, AKTHI	
		Algorithms und Data Structures 2	4 VO
		Datenbanksysteme	2 VO + 1 LU
		Systemnahe Programmierung	2 VO + 2 LU
		Computergraphik 1	2 VO + 2 LU
		Objektorientierte Programmierung	2 VL
		Elektrotechnische Grundlagen der Informatik	3 VO + 2 LU
		Network Services	2 VU
		Mustererkennung	2 VU
IX	Financial and Actuarial Mathematics, Insurance Business Administration	AKVFM	
		Handels- und Wechselrecht	2 VO
		Bank- und Wertpapierrecht	2 VO
		Arbeits- und Sozialrecht	2 VO
		Verfassungs- und Verwaltungsrecht	2 VO
		Steuerrecht	2 VO

3.5 Elective Subjects

In the course of the Master Studies of Insurance Mathematics, students have to enroll for elective subjects for 5 weekly hours of classes. Within the elective subjects, students can choose courses completely free from the course program of any acknowledged austrian or international university.

3.6 Master Thesis

(1) Students have to write a Master Thesis in the course of their master studies.

(2) A master thesis is a scientific thesis, which has been completed in the course of the master studies, and which serves the purpose of proving the ability to work indepently on scientific

topics(§ 4 (5) UniStG). Methods used in the thesis, as well as the topic of the thesis, have to be justifiable.

(3) Either students propose the topic of their master thesis, which should belong to a part of a (core or elective core) subject listed in the degree program structure, or they can choose from a couple of proposals made by one of the available supervising professors (§ 61(2) UniStG).

(4) The topic of the master thesis has to be such that students can complete thesis within 6 months (§ 61 (2) UniStG).

(5) Students have to inform the Dean of Studies about the topic and the supervisor of their thesis, before they start to work on the thesis (§ 61 (6)).

(6) Students submit the completed thesis at the Dean of Studies for assessment. The supervising professor has to grade the thesis within two months, starting from the moment of submission (§ 61 (7) UniStG).

3.7 Qualifying Exams

(1) The first part of the qualifying exam for the master studies consists in completing all courses from the core subjects, the elective core subjects and the elective subjects.

(2) The second part of the qualifying exam for the master studies consists in a commissional examination. Students can only apply for this second part, if they can establish the successful completion of the first part of their master studies and a positive assessment of their master thesis.

(3) The final commissional examination takes place in the presence of an Examination Senate, consisting of three persons. The supervisor of the thesis must be member of the Examination Senate. If the supervisor is prevented, the student to be examined can propose an alternative examiner. The candidate has to present his/her master thesis and the subject, to which the master thesis belongs thematically. Furthermore, the examined student has to be examined about another subject, which is chosen by the Dean of Studies according to proposals made by the candidate.

3.8 Qualifikationsprofil (in german)

Das Magisterstudium Versicherungsmathematik baut auf eine solide mathematische und versicherungstechnische Grundbildung auf, wie man sie z.B. im Bakkalaureatstudium Versicherungsmathematik erwerben kann. Ziel des Magisterstudiums ist es, hochqualifizierte Führungspersönlichkeiten heranzubilden, die in der wissenschaftlichen Forschung, Entwicklung oder Lehre tätig sein können: sowohl an der Universität als auch in der Wirtschaft.

4 Contents of Core Subjects

Analysis 1 5.0 VO + 2.0 UE
Convergence, infinite series, continuity, differentiation, applications

Analysis 2 5.0 VO + 2.0 UE
Riemann-integral, metric spaces, Banach space, F-Differential in $\mathbb{R}^n$, extreme values, Taylor series expansion, differentiation of complex valued functions

Analysis 3 B 4.0 VO + 2.0 UE
Hilbert space, Fourier-series, Fourier transform, integration in Rn, parameter integrals, line and surface integrals

Applied Statistics 2.5 VO + 1.5 UE
Basic notions of parametric and non-parametric methods, linear models, variance analysis, multiple regression, Bayes-methods, estimates and sampling, computer supported exercises

Accounting and Balancing Models in the Insurance Business 2.0 VO
Accounting and balancing models in the insurance business, taxes for insurance companies

Modeling of Data 2.0 VU
Semantic modeling of data, transformation into a relational model, normal forms, data base languages

Differential Equations A 5.0 VO + 2.0 UE
classical types, existence, linear differential equations and systems, stability for the linear and the non-linear case, qualitative behaviour, examples from applications; introduction to partial differential equations (wave- and heat equations.)

Introduction to computer science for TM 3.0 VU
Basic notions of computer architecture, operating systems and net works

Introduction to Financial Mathematics: Discrete Models 4.0 VU
Modelling of financial markets, arbitrage, portfolio optimisation, binomial model, introduction to the theory of incomplete markets

Introduction to Insurance Mathematics 1.0 VU
Introductory lecture, giving an overview over insurance mathematics

Introduction to Probability Theory and Statistics 2.0 VO + 2.0 UE
Descriptive statistics, elementary probability theory, notion of random, stochastic variables, conditional distributions, sequences of stochastic variables, simple inferential statistics, software supported practical exercises

Advanced Life Insurance Mathematics 4.0 VU
General life insurance models, using the theory of stochastic processes, difference and differential equations for life insurance mathematics, Hattendorff Theorem, contracts, equity index contracts, stochastic interest rates, technical analysis

Life Insurance Mathematics 3.0 VO + 2.0 UE
Elementary financial mathematics, mortality rates, premium calculation, calculation of the net premium reserves, expense loaded premium reserves, conversion of insurance contracts

Linear Algebra 1 4.0 VO + 2.0 UE
Vector space, linear and affine maps, dual space, determinants, systems of linear equations, geometric visualization

Linear Algebra 2 5.0 VO + 2.0 UE
Eigenvalues, Jordan canonical form, bilinear forms, euclidean vector spaces, normal maps, spectral theorem, notions of numerical linear algebra (QR-decomposition), geometric visualization

Measure and Probability Theory 3.0 VO + 2.0 UE
Measure and probability spaces, Lebesgue integral, Radon-Nikodym, Fubini, notions of stochastic convergence, characteristics and generating functions, law of large numbers, central limit theorem

Object oriented Programming 2.0 VL
Introduction into the following concepts of OO: Gestaltung von Klassenhierarchien, Polymorphismus, Data Abstraction, Inheritance Concept, Exception Handling, Generic Types, Interface Concepts, Implementierung von Designpatterns und Darstellung anhand einer konkreten Programmiersprache

Personal Insurance Mathematics 3.0 VO + 2.0 UE
profit sharing in life insurance, transition probabilities in personal insurance, annuities, disability pensions, survivor pensions, calculation of pension reserves, pension funds, health insurance

Practical Placement: Selected Topics from Insurance Mathematics 5.0 PR
Current problems in insurance mathematics, if possible, in collaboration with practitioners

Private Economic Law 2.0 VO
Begriffsbildungen und Rechtsquellen des Wirtschaftsrechts, wirtschaftlich relevante Rechtsbereiche des bürgerlichen Rechts, Handelsrechts und Unternehmensorganisationsrechts, sowie europäisches Wirtschaftsrecht

Practical Placement (with Bachelor Thesis) 10.0 PR
Work on a project relating to applied problems from insurance mathematics

Risk Theory 4.0 VO + 2.0 UE
Estimation of ruin probabilities, Lundberg's inequality, approximation of distributions, risk measures, utility functions

Reinsurance 2.0 VO
General Introduction into reinsurance theory and the reinsurance business, Rückversicherungsformen (u.a. obligatorische Rückversicherung; Vertragsrückversicherung), Reinsurance forms resp. models, Rückversicherungsverrechnung

Ruin Theory 3.0 VU
Detailed analysis of the compound Poisson model, ruin probabilities for heavy tails, premiums depending on the reserve, renewal processes

General insurance 3.0 VO + 2.0 UE
Distribution of aggregate claims, ruin theory, reinsurance, principles of premium calculation, credibility theory, loss reserving

Seminar (with Bachelor Thesis) 3.0 SE
Independent Elaboration of a problem, which is relevant for the studies

Seminar: Insurance Mathematics 2.0 SE
Up–to–date problems from financial and actuarial mathematics

Computer Statistics 2.0 VU
Statistical analysis using software, linear and non-linear models

Stochastic Processes and Time Series Analysis 3.0 VO + 2.0 UE
Basics of stochastic processes, complex systems with closed feedback loops, methods of time series analysis, stationary processes and linear systems

Insurance Business Management 2.0 VO + 2.0 VU

Concept of insurance, forms of insurance, supervision, Organisation of insurance companies sales structure, risk measurement, pricing of insurance products, claims handling

Insurance Law 2.0 VO + 2.0 VO

Structure and function of insurance law, insurance contract law, insurance supervisory law, constitutional law (Organisationsrecht), European law