Programme-specific Section of the Curriculum for the MSc Programme in Actuarial Mathematics at the Faculty of Science, University of Copenhagen

2010 (Rev. 2019)

Contents

1 Title, affiliation and language
A shared section that applies to all BSc and MSc Programmes at the Faculty of Science is linked to this programme-specific curriculum.

1.1 Title
The MSc Programme in Actuarial Mathematics leads to a Master of Science (MSc) in Actuarial Mathematics with the Danish title: *Cand.act. (candidatus/candidata actuariae).*

1.2 Affiliation
The programme is affiliated with the Study Board of Mathematics and Computer Science, and the students can both elect, and be elected, to this study board.

1.3 Corps of external examiners
The following corps of external examiners is used for the central parts of the MSc Programme:

- Corps of External Examiners for Mathematics (*matematik*).

1.4 Language
The language of this MSc Programme is English.

2 Academic profile
2.1 Purpose
The MSc programme in Actuarial Mathematics is a research-based programme, the objective of which is to provide the student with the mathematical knowledge and insights required to work independently and in a professionally sound manner within the insurance profession and contribute to the further development of this theoretical field.

2.2 General programme profile
The programme provides a general introduction to both life and non-life insurance mathematics. The student can subsequently specialise in one of these disciplines or in fields such as stochastic processes, risk management, financial theory and statistical analysis.

Actuarial mathematics, probability theory, finance, statistics and computer science are the key subject areas of the programme.

2.3 General structure of the programme
The MSc Programme is set at 120 ECTS.

There are no defined specialisations in this programme.

2.4 Career opportunities
The MSc Programme in Actuarial Mathematics qualifies students to become professionals within business functions and/or areas such as:

- A PhD programme
- Actuarial functions in insurance companies.
- Regulative authorities.
- Specialized software development.

3 Description of competence profiles

Students following the MSc Programme acquire the knowledge, skills and competences listed below. Students will also acquire other qualifications through elective subject elements and other study activities.

3.1 Competence profile

On completion of the programme, an MSc in Actuarial Mathematics has acquired the following:

Knowledge about:

- General theory for stochastic processes, including various special classes of processes: Martingales, Counting Processes, Renewal Processes, Stochastic Integrals and more.
- Stochastic differential equations with applications to finance.
- Risk measures and extreme value theory.
- Ruin theory, in particular the Cramér-Lundberg model.
- Credit modelling and operational risk modelling.
- Claim reservation.
- Term structure theory and market reserves.
- Parametric and non-parametric statistical models for insurance applications.
- Selected research-active fields with life and non-life insurance mathematics.

Skills in/to:

- Read and understand actuarial mathematical and statistical original literature.
- Communicate actuarial mathematical issues on a scientific basis.
- Account orally and in writing for inquiries into open actuarial mathematical issues.
- Derive and solve differential equations describing actuarial problems.
- Determine arbitrage free prices for financial claims.
- Compute ruin probabilities and value-at-risk.
- Analyse statistical models for insurance applications.

Competences in/to:

- Structure an inquiry into open actuarial mathematical issues, regarding both life and non-life insurance mathematics and divide it into smaller easily accessible challenges.
- Further develop and adapt probabilistic and statistical models for real-life challenges.
- Conduct independent, stringent argumentation.
- Independently take responsibility for his or her own professional development and specialisation.
- Reflect on methodologies for analysing and solving actuarial mathematical issues at a scientific level.

4 Admission requirements

With a Bachelor's degree in Actuarial Mathematics from the University of Copenhagen the student is granted reserved access and guaranteed a place on the MSc Programme in Actuarial Mathematics if the student applies before the application deadline during the first application period after the completion of the Bachelor's degree.

4.1 Applicants with a Bachelor's degree in Actuarial Mathematics

Applicants with a Bachelor's degree in Actuarial Mathematics from the University of Copenhagen may be admitted if their programme includes the following:

- Subject elements in advanced probability (at least 15 ECTS)

4.2 Applicants with a closely related Bachelor's degree

Applicants with a Bachelor's degree in Mathematics-Economics or Mathematics from the University of Copenhagen may also be admitted if their programme includes the following:

- Subject elements in life insurance mathematics (at least 7.5 ECTS).
- Subject elements in non-life insurance mathematics (at least 7.5 ECTS).
- Subject elements in statistics on a measure-theoretical basis (at least 15 ECTS).
- Subject elements in advanced probability (at least 15 ECTS)

4.3 Applicants with a related Bachelor's degree

Applicants with a Bachelor's degree in the following:

- Computer Science, Physics or Chemistry from the University of Copenhagen or other Danish or international universities.
- Mathematics or Mathematics-Economics from other Danish or international universities.

may also be admitted if their programme includes the following elements:

- Subject elements in mathematical analysis, including measure theory — at least 22.5 ECTS
- Subject elements in linear algebra — at least 7.5 ECTS
- Subject elements in life insurance mathematics — at least 7.5 ECTS
- Subject elements in non-life insurance mathematics — at least 7.5 ECTS
- Subject elements in statistics on a measure-theoretical basis — at least 15 ECTS
- Subject elements in advanced probability — at least 15 ECTS

4.4 Other applicants

The Faculty may also admit applicants who, after an individual academic assessment, are deemed to possess educational qualifications equivalent to those required in Subclauses 4.1-3.

4.5 Language requirements

Applicants must as a minimum document English language qualifications comparable to a Danish upper secondary school English B level or English proficiency corresponding to the tests and scores required. Accepted tests and required minimum scores are published online at www.science.ku.dk.

4.6 Supplementary subject elements

The qualifications of an applicant to the MSc program are assessed exclusively on the basis of the qualifying bachelor's degree. Supplementary subject elements passed between the completion of the bachelor's program and the admission to the MSc program cannot be included in the overall assessment.

However, subject elements passed before the completion of the bachelor's program may be included in the overall assessment. This includes subject elements completed as continuing education as well as subject elements completed as part of a former higher education program. A maximum of 30 ECTS supplementary subject elements can be included in the overall assessment.

Subject elements passed before completing the BSc programme which are to form part of the MSc programme to which the student has a legal right of admission (§9-courses) cannot be included in the overall assessment.

5 Prioritisation of applicants

If the number of qualified applicants to the programme exceeds the number of places available, applicants will be prioritised as follows:

1) Applicants with a Bachelor's degree in Actuarial Mathematics from the University of Copenhagen seeking admission by way of direct extension of their completed BSc programme.
2) Applicants with a Bachelor's degree in Actuarial Mathematics from the University of Copenhagen.
3) Applicants with a Bachelor's degree in Mathematics or Mathematics-Economics from the University of Copenhagen.
4) Other applicants.

If the number of qualified applicants within a category exceeds the number of places available, applicants will be prioritised according to the following criteria (listed below in prioritised order):

- Total number of ECTS within actuarial mathematics.

6 Structure of the programme

The compulsory subject elements, restricted elective subject elements and the thesis constitute the central parts of the programme (Section 21 of the Ministerial Order on Bachelor and Master's Programmes (Candidatus) at Universities).

6.1 Programme components

The programme is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 45 ECTS.
- Restricted elective subject elements, 15 ECTS
- Elective subject elements, 30 ECTS.
- Thesis, 30 ECTS.

6.1.1 Compulsory subject elements

All of the following subject elements are to be covered (45 ECTS):

• NMAA05115U	Stochastic Processes in Life Insurance (LivStok)	Block 1	7.5 ECTS
• NMAA05113U	Continuous Time Finance (FinKont)	Block 2	7.5 ECTS
• NMAA06052U	Topics in Life Insurance (Liv2)	Block 3	7.5 ECTS
• NMAA06068U	Topics in Non-Life Insurance (Skade2)	Block 4	7.5 ECTS
• NMAA05117U	Stochastic Processes in Non-Life Insurance (SkadeStok)	Block 1	7.5 ECTS
• NMAK10020U	Quantitative Risk Management (QRM)	Block 2	7.5 ECTS

6.1.2 Restricted elective subject elements

15 ECTS are to be covered by subject elements from the following list:

• NMAK18000U	An Introduction to Large Deviations*	Block 1	7.5 ECTS
• NMAK16015U	Optimal Stopping with Applications	Block 1	7.5 ECTS
• NMAK16004U	Computational Finance	Block 1	7.5 ECTS
• NMAK19003U	Applied Probability	Block 1	7.5 ECTS
• NMAK13005U	Introduction to Extreme Value Theory (IntroExtremValue)	Block 2	7.5 ECTS
• NMAK19005U	Advances in Life Insurance Mathematics	Block 2	7.5 ECTS
• NMAK17005U	Machine Learning Methods in Non-life Insurance	Block 3	7.5 ECTS
• NMAK16006U	Consumption-Investment-Insurance Problems*	Block 3	7.5 ECTS
• NMAK19004U	Advanced Topics in Modern Life Insurance	Block 4	7.5 ECTS

* The courses are not offered in the academic year 2019/20

6.1.3 Elective subject elements
30 ECTS are to be covered as elective subject elements.
All subject elements at MSc level may be included as elective subject elements in the MSc Programme.

BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.

Projects outside the course scope may be included in the elective section of the programme with up to 15 ECTS**.** The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum.

6.1.4 Thesis
The MSc Programme in Actuarial Mathematics includes a thesis corresponding to 30 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.1.5 Academic Mobility
For students admitted in September the academic mobility for the MSc Programme in Actuarial Mathematics is placed in block 1+2 of the 2nd year.

For students admitted in February the academic mobility for the MSc Programme in Actuarial Mathematics is placed in block 3+4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition the student has the possibility to arrange similar academic mobility in other parts of the programme.

7 Exemptions
In exceptional circumstances, the study board may grant exemptions from the rules in the curriculum specified solely by the Faculty of Science.

8 Commencement etc.
8.1 Validity
This subject specific section of the curriculum applies to all students enrolled in the programme – see however Appendix 2.

8.2 Transfer
Students enrolled on previous curricula may be transferred to the new one as per the applicable transfer regulations or according to an individual credit transfer by the study board.

8.3 Amendments
The curriculum may be amended once a year so that any changes enter into force on the start of the academic year. Amendments must be proposed by the study board and approved by the Dean.

Notification about amendments that tighten the admission requirements for the programme will be published online at www.science.ku.dk one year before they come into effect.

If amendments are made to this curriculum, an interim arrangement may be added if necessary to allow students to complete their MSc Programme according to the amended curriculum.

Appendix 1 Tables

Tables for students admitted to the programme in September (summer):

Table – MSc Programme in Actuarial Mathematics

	Block 1	Block 2	Block 3	Block 4
1st year	Stochastic Processes in Non-life Insurance	Quantitative Risk Management	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-life Insurance
2nd year	Restricted Elective	Restricted Elective	Thesis	
	Elective	Elective		

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Table for students admitted to the programme in February (winter):

Table – MSc Programme in Actuarial Mathematics*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management
	Elective	Topics in Non-Life Insurance	Stochastic Processes in Life Insurance	Continuous Time Finance
2nd year	Topics in Life Insurance	Elective	Restricted Elective	Restricted Elective
	Thesis			

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

*This table is only relevant for students who begin the MSc Programme in February (block 3).

Appendix 2 Interim arrangements

The Shared Section of the BSc and MSc Curricula for Study Programmes applies to all students.

The interim arrangements below only consist of parts where the current curriculum differs from the rules and regulations that were previously valid. Therefore, if information about relevant rules and regulations are missing, it can be found in the curriculum above.

1 General changes for students admitted in the academic year 2018/19

Students admitted to the MSc Programme in the academic year 2018/19 must finish the programme as listed in the curriculum above with the following exceptions.

Restricted elective subject elements

15 ECTS are to be covered by courses from the following list:

Restricted elective subject elements offered as part of this curriculum (see above).			
• NMAK18003U	Beyond the Classical Markov Chain Life Insurance Setting	Discontinued*	7.5 ECTS
• NMAK18010U	Topics in Stochastic Calculus	Discontinued*	7.5 ECTS
• NMAK18007U	Pension systems	Discontinued*	7.5 ECTS

* See course specific changes below

2 General changes for students admitted in the academic year 2017/18

Students admitted to the MSc Programme in the academic year 2017/18 must finish the programme as listed in the curriculum above with the following exceptions.

2.1 When Stochastic Processes 2 or Stochastic Processes 3 (or both) is passed as part of the BSc Programme

From the academic year 2015/16, the courses Stochastic Processes 2 and Stochastic Processes 3 were added as compulsory subject elements to the BSc Programme in Actuarial Mathematics (*forsikringsmatematik).* Stochastic Processes 2 and Stochastic Processes 3 are equivalent to the two compulsory subject elements Advanced Probability Theory 1 and Advanced Probability Theory 2 in the MSc Programme in Actuarial Mathematics.

From the academic year 2018/19, Advanced Probability Theory 1 (NMAK11003U) and Advanced Probability Theory 2 (NMAK11011U) are no longer official parts of the MSc Programme in Actuarial Mathematics. Those students, who have passed Stochastic Processes 2 and Stochastic Processes during their BSc Programme, are now required to pass 15 ECTS restricted elective subject elements instead.

Structure of the programme

Determined by whether students have passed one or both BSc courses, the structure of the programme will vary accordingly:

- If Stochastic Processes 2 is passed, students are required to complete Advanced Probability Theory 2 and 7.5 ECTS restricted elective subject elements

  The programme will consist of:
  - Compulsory 52.5 ECTS
  - Restricted Elective 7.5 ECTS
  - Elective subject elements, 30 ECTS.
  - Thesis, 30 ECTS

- If Stochastic Processes 3 is passed, students are required to complete Advanced Probability Theory 1 and 7.5 ECTS restricted elective subject elements

  The programme will consist of:
  - Compulsory 52.5 ECTS
  - Restricted Elective 7.5 ECTS
  - Elective subject elements, 30 ECTS.
  - Thesis, 30 ECTS

- If neither of the BSc courses are completed, students are required to complete both Advanced Probability Theory 1 and Advanced Probability Theory 2 as compulsory subject elements

  The programme will consist of:
  - Compulsory 60 ECTS
  - Elective subject elements, 30 ECTS.
  - Thesis, 30 ECTS

Table – MSc Programme in Actuarial Mathematics (if both are passed)

	Block 1	Block 2	Block 3	Block 4
1st year	Restricted elective	Restricted elective	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-Life Insurance
2nd year	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management	Thesis	
	Elective	Elective		

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Table – MSc Programme in Actuarial Mathematics (Stochastic Processes 2 is passed)

	Block 1	Block 2	Block 3	Block 4
1st year	Restricted elective	Advanced Probability Theory 2	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-Life Insurance
2nd year	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management	Thesis	
	Elective	Elective		

Compulsory | Restricted elective / Elective | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Table – MSc Programme in Actuarial Mathematics (Stochastic Processes 3 is passed)

	Block 1	Block 2	Block 3	Block 4
1st year	Advanced Probability Theory 1	Restricted elective	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-Life Insurance
2nd year	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management	Thesis	
	Elective	Elective		

Compulsory | Restricted elective | Elective

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Table – MSc Programme in Actuarial Mathematics (if none are passed)

	Block 1	Block 2	Block 3	Block 4
1st year	Advanced Probability Theory 1	Advanced Probability Theory 2	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-Life Insurance
2nd year	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management	Thesis	
	Elective	Elective		

Compulsory | Elective

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Restricted elective subject elements

15 ECTS are to be covered as restricted elective subject elements from the following list if both Stochastic Processes 2 and Stochastic Processes 3 are passed as part of the BSc programme.

7.5 ECTS are to be covered as restricted elective subject elements from the following list if either Stochastic Processes 2 or Stochastic Processes 3 is passed as part of the BSc programme

• Restricted elective subject elements offered as part of this curriculum (see above)			
• NMAK16004U	Computational Finance (AAM)	Block 1	7.5 ECTS
• NMAK17007U	Monte Carlo Methods in Insurance and Finance**	Block 1	7.5 ECTS
• NMAK18003U	Beyond the Classical Markov Chain Life Insurance Setting	Discontinued*	7.5 ECTS
• NMAK18010U	Topics in Stochastic Calculus	Discontinued*	7.5 ECTS
• NMAK18007U	Pension systems	Discontinued*	7.5 ECTS
• NMAK17003U	Inference, Market Consistent Valuation and Pricing in Life Insurance	Discontinued*	7.5 ECTS

* See course specific changes below

**The course is not offered in 2019/2020

3 General changes for students admitted in the academic year 2016/17 or 2015/16

Students admitted to the MSc Programme in the academic year 2015/16 and 2016/17 must finish the programme as listed in the curriculum above with the following exceptions.

The required amount of restricted elective subject elements has been reduced from 15 to 0 ECTS, and correspondingly, the amount of elective subject elements has been increased from 15 to 30 ECTS. All subject elements previously passed as restricted elective will count as elective.

3.1 When Stochastic Processes 2 or Stochastic Processes 3 (or both) is passed as part of the BSc Programme

From the academic year 2015/16, the courses Stochastic Processes 2 and Stochastic Processes 3 were added as compulsory subject elements to the BSc Programme in Actuarial Mathematics (*forsikringsmatematik).* Stochastic Processes 2 and Stochastic Processes 3 are equivalent to the two compulsory subject elements Advanced Probability Theory 1 and Advanced Probability Theory 2 in the MSc Programme in Actuarial Mathematics.

From the academic year 2018/19, Advanced Probability Theory 1 (NMAK11003U) and Advanced Probability Theory 2 (NMAK11011U) are no longer official parts of the MSc Programme in Actuarial Mathematics. Those students, who have passed Stochastic Processes 2 and Stochastic Processes during their BSc Programme, are now required to pass 15 ECTS restricted elective subject elements instead.

Structure of the programme

Determined by whether students have passed one or both BSc courses, the structure of the programme will vary accordingly:

- If Stochastic Processes 2 is passed, students are required to complete Advanced Probability Theory 2 and 7.5 ECTS restricted elective subject elements

  The programme will consist of:
  - Compulsory 52.5 ECTS
  - Restricted Elective 7.5 ECTS
  - Elective subject elements, 30 ECTS.
  - Thesis, 30 ECTS

- If Stochastic Processes 3 is passed, students are required to complete Advanced Probability Theory 1 and 7.5 ECTS restricted elective subject elements

  The programme will consist of:
  - Compulsory 52.5 ECTS
  - Restricted Elective 7.5 ECTS
  - Elective subject elements, 30 ECTS.
  - Thesis, 30 ECTS

- If neither of the BSc courses are completed, students are required to complete both Advanced Probability Theory 1 and Advanced Probability Theory 2 as compulsory subject elements

  The programme will consist of:
  - Compulsory 60 ECTS
  - Elective subject elements, 30 ECTS.
  - Thesis, 30 ECTS

Table – MSc Programme in Actuarial Mathematics (if both are passed)

	Block 1	Block 2	Block 3	Block 4
1st year	Restricted elective	Restricted elective	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-Life Insurance
2nd year	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management	Thesis	
	Elective	Elective		

Compulsory Restricted elective Elective

Table – MSc Programme in Actuarial Mathematics (Stochastic Processes 2 is passed)

	Block 1	Block 2	Block 3	Block 4
1st year	Restricted elective	Advanced Probability Theory 2	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-life Insurance
2nd year	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management	Thesis	
	Elective	Elective		

Compulsory Restricted elective Elective

Table – MSc Programme in Actuarial Mathematics (Stochastic Processes 3 is passed)

	Block 1	Block 2	Block 3	Block 4
1st year	Advanced Probability Theory 1	Restricted elective	Elective	Elective
	Stochastic Processes in Life Insurance	Continuous Time Finance	Topics in Life Insurance	Topics in Non-Life Insurance
2nd year	Stochastic Processes in Non-Life Insurance	Quantitative Risk Management	Thesis	
	Elective	Elective		

Compulsory Restricted elective Elective

Restricted elective subject elements

7.5 ECTS are to be covered as a restricted elective subject element from the following list if either Stochastic Processes 2 or Stochastic Processes 3 is passed as part of the BSc programme.

15 ECTS are to be covered as restricted elective subject elements from the following list if both Stochastic Processes 2 and Stochastic Processes 3 are passed as part of the BSc programme:

• Restricted elective subject elements offered as part of this curriculum (see above)			
• NMAK16004U	Computational Finance (AAM)	Block 1	7.5 ECTS
• NMAK17007U	Monte Carlo Methods in Insurance and Finance**	Block 1	7.5 ECTS
• NMAK16015U	Optimal Stopping with Applications	Blok 1	7.5 ECTS
• NMAK17003U	Inference, Market Consistent Valuation and Pricing in Life Insurance	Discontinued*	7.5 ECTS
• NMAK18003U	Beyond the Classical Markov Chain Life Insurance Setting	Discontinued*	7.5 ECTS
• NMAK18010U	Topics in Stochastic Calculus	Discontinued*	7.5 ECTS
• NMAK18007U	Pension systems	Discontinued*	7.5 ECTS
• NMAK16017U	Statistical Inference for Markov Processes	Discontinued*	7.5 ECTS
• NMAK16014U	Introduction to Multivariate Extreme Value Theory (AAM)	Discontinued*	7.5 ECTS
• NMAK14013U	Modelling Dependence in Discrete Time (AAM)	Discontinued*	7.5 ECTS

*See course specific change below.

**The courses are not offered in 2019/2020

4 Course specific changes

Discontinued course	Interim arrangement
Control Theory in Finance (NMAK15011U)	The course was a restricted elective subject element in the academic year 2015/16. The course was offered for the last time in the academic year 2015/16 and a third exam was offered in the academic year 2016/17.
Modelling Dependence in Discrete Time (AAM) (NMAK14013U), 7.5 ECTS	The course was a restricted elective subject element in the academic year 2016/17 or earlier. The course was offered for the last time in the academic year 2016/17 and a third exam was offered in the academic year 2017/18.
Modelling Dependence in Non-Life Insurance (NMAK15018U)	The course was a restricted elective subject element in the academic year 2015/16. The course was offered for the last time in the academic year 2015/16 and a third exam was offered in the academic year 2016/17.
Introduction to Multivariate Extreme Value Theory (AAM) (NMAK16014U), 7.5 ECTS	The course was a restricted elective subject element in the academic year 2016/17 or earlier. The course was offered for the last time in the academic year 2016/17 and a third exam was offered in the academic year 2017/18.
Statistical Inference for Markov Processes (NMAK16017U), 7.5 ECTS	The course was a restricted elective subject element in the academic year 2016/17 or earlier. The course was offered for the last time in the academic year 2016/17 and a third exam was offered in the academic year 2017/18.

Statistics for Non-Linear Time Series Models (NMAK14022U)	The course was a restricted elective subject element in the academic year 2015/16. The course was offered for the last time in the academic year 2015/16 and a third exam was offered in the academic year 2016/17.
Topics in Financial Risk Management (NMAK15024U)	The course was a restricted elective subject element in the academic year 2015/16. The course was offered for the last time in the academic year 2015/16 and a third exam was offered in the academic year 2016/17.
Pension Systems (NMAK18007U), 7,5 ECTS	The course was a restricted elective subject element in the academic year 2018/19 and earlier. The course was offered for the last time in the academic year 2018/19 and a third exam was offered in the academic year 2019/20.
Topics in Stochastic Calculus (NMAK18010U), 7,5 ECTS	The course was a restricted elective subject element in the academic year 2018/19 and earlier. The course was offered for the last time in the academic year 2018/19 and a third exam was offered in the academic year 2019/20.
Beyond the Classical Markov Chain Life Insurance Setting (NMAK18000U), 7,5 ECTS	The course was a restricted elective subject element in the academic year 2018/19 and earlier. The course was offered for the last time in the academic year 2018/19 and a third exam was offered in the academic year 2019/20.
Inference, Market Consistent Valuation and Pricing in Life Insurance (NMAK17003U)	The course was a restricted elective subject element in the academic year 2017/18 and earlier. The course was offered for the last time in the academic year 2018/19 and a third exam was offered in the academic year 2019/20.

Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:

- Scientific problems within the study programme's subject areas.
- A suitable combination of methodologies/theories based on international research for use in his/her work with the problem formulation.
- Theories/models on the basis of an organised value system and with a high degree of independence.

Skills in/to:

- Apply and critically evaluate theories/methodologies, including their applicability and limitations.
- Assess the extent to which the production and interpretation of findings/material depend on the theory/methodology chosen and the delimitation chosen.
- Discuss academic issues arising from the thesis.
- Draw conclusions in a clear and academic manner in relation to the problem formulation and, more generally, considering the topic and the subject area.
- Discuss and communicate the academic and social significance, if any, of the thesis based on ethical principles.

Competences in/to:

- Initiate and perform academic work in a research context.
- Solve complex problems and carry out development assignments in a work context.