



## Programme Specification (PG)

Awarding body / institution:	Queen Mary University of London
Teaching institution:	Queen Mary University of London
Name of final award and title:	Actuarial Science and Data Analytics MSc
Name of interim award(s):	PG Cert and PG Dip
Duration of study / period of registration:	1 year full time, 2 years part time
Queen Mary programme code(s):	PFQM-G13B-09, PPQM-G13F-09
QAA Benchmark Group:	Mathematics, Statistics and Operational Research
FHEQ Level of Award:	Level 7
Programme accredited by:	Institute and Faculty of Actuaries (IFoA)
Date Programme Specification approved:	11.10.2023
Responsible School / Institute:	School of Mathematical Sciences

Schools / Institutes which will also be involved in teaching part of the programme:

Collaborative institution(s) / organisation(s) involved in delivering the programme:

### Programme outline

The programme is designed to provide students with a large number of accreditations by the Institute and Faculty of Actuaries (IFoA), which are highly valued by employers. No postgraduate programme currently on offer has such a wide coverage for accreditations. The programme includes courses on actuarial risk management, actuarial mathematics, actuarial statistics, machine learning and data analytics. Once accreditations are approved by the IFoA for this programme, students will be able to gain the exemptions automatically for Core Principles (CM2 and CS2) IFoA accreditation and Core Practices (CP1, CP2 and CP3) of the IFoA on completion of the programme.

Students are also trained using statistical software such as Excel/VBA, R and Python to analyse and visualise data. In the Dissertation module, students will work in areas such as general and life insurance, pensions, healthcare, risk and investment depending on the students' interests. Our actuarial training has a perfect mix of theory and professional practice and students will have the opportunity to work on real industry challenges, on occasions directly with an industry partner.

In the first semester, students study two compulsory modules: Actuarial Risk Management 1 and Machine Learning with Python. They also choose two electives from our actuarial science and data analytics courses. Actuarial Risk Management 1 covers fundamental topics such as insurance products, regulatory regimes, investment markets, and risk governance. Students learn risk analysis, scenario analysis, and stochastic modeling. The module also includes rigorous training in Python for machine

learning and real-life case analysis.

In the second semester, students study two compulsory modules: Actuarial Risk Management 2 and Time Series for Business. They also choose two electives from our actuarial science and data analytics courses. Actuarial Risk Management 2 focuses on identifying actuarial problems and developing practical solutions. Topics include profitability, reporting results, insolvency, closure, and options and guarantees. Students also learn the actuarial control cycle for financial planning. In Time Series, students analyze historical business data, extract trends and cyclic components, calculate autocorrelation, and study autoregressive and moving average models. Realistic examples and solutions are provided using SAS or Excel/VBA. Elective modules cover financial engineering, asset and liability modeling, advanced machine learning, financial data analytics, neural networks, deep learning, and computational statistics with R.

The summer semester is the culmination of a year of learning, where students participate in field-related projects. The project consists of two parts: modelling and communication. The modelling part focuses on critical analysis and modelling of common actuarial data using analytical and statistical methods, generating innovative outputs while maintaining an audit trail. The communication part emphasizes effective written communication of innovative research and actuarial/financial solutions to both actuarial and non-actuarial audiences. The MSc project prepares students for actuarial work or pursuing a PhD.

## Aims of the programme

As the actuarial profession has moved beyond its traditional roles and has expanded into a wide variety of data science roles, the MSc in Actuarial Science and Data Analytics provides a clear offering in line with the evolution of the actuarial profession. The programme will be of interest to students with quantitative backgrounds and aims to equip students with advanced knowledge and practical skills in the field of both actuarial science and data science, i.e, actuarial methods in mathematics and statistics, actuarial risk management, the application of statistical methods and computer programming for providing advanced actuarial solutions.

The programme will provide students with a large number of accreditations by the Institute and Faculty of Actuaries (IFoA) and will give students the knowledge and skills necessary to obtain employment in a wide variety of roles in the field of general or life insurance, pension funds, healthcare, regulatory bodies, or corporations.

The primary aim of this programme is to provide students with a solid foundation in actuarial risk management, actuarial mathematical, actuarial statistics and methodologies, and techniques for data analysis. The students will be encouraged to apply this knowledge to real-world situations. Students will develop a deep understanding of risk management techniques, data analysis, and interpretation, allowing them to extract meaningful insights from large and complex datasets such financial data or mortality and morbidity data.

The programme also focuses on enhancing students' proficiency in various technologies, such as Excel/VBA, R, Python. Students will gain hands-on experience with cutting-edge software and programming languages, enabling them to effectively manipulate, analyse, and visualize data using real world scenarios in the actuarial practice.

Furthermore, the programme aims to foster critical thinking and problem-solving abilities in students. They will learn to design and execute research projects with a clear applicability in the actuarial profession, formulate questions, and select appropriate methodologies, learn how to provide actuarial and financial solutions, integrate them and monitor them for future financial strategies. Through practical exercises and projects, students will develop the ability to apply techniques to solve real-world challenges.

In addition to academic content, the programme places emphasis on developing essential disciplinary skills and abilities. Students will learn to collaborate effectively in interdisciplinary teams. They will also cultivate strong communication skills, enabling them to present complex concepts and findings to both technical and non-technical audiences in a clear and concise manner.

## What will you be expected to achieve?

You will have strong analytical skills needed to perform efficiently and competitively in a variety of actuarial roles. Furthermore you will be able to gain exemptions for Core Principles and Core Practices subjects of IFoA accreditations which will result in Associate-level accreditation (subject to 2 years' work experience).

You will be able to understand and manage various types of actuarial risks. You will be able to adapt and evolve your data

analytic skills to new challenges in the field both in terms of new and large data available but also constant need for development of financial and actuarial products for a constant and fast changing market for risk. You will also be a successful communicator capable to transmit technical information in a accessible way to non-actuarial audiences.

Academic Content:	
A 1	Apply appropriate analytical methods such as actuarial risk management techniques to problems faced by insurance firms, pension funds, and financial institutions, and also more widely in healthcare, technology and climate change.
A 2	Demonstrate a comprehensive understanding of fundamental actuarial risk management including: accounting and disclosure; surplus and surplus management; sources of risks; risks in benefit schemes; pricing and insurance risks; the risk management process; risk management tools; capital management and monitoring experience.
A 3	Critically evaluate case studies in actuarial practice, including scenario analysis, stress-testing and stochastic modeling of risks.

Disciplinary Skills - able to:	
B 1	Proficiently use the actuarial risk management techniques to perform analysis, generate results and provide actuarial advice.
B 2	Design investigation studies in actuarial practice with appropriate techniques to address risk management issues faced by stakeholders in both public and private institutions.
B 3	Effectively communicate actuarial concepts, analyses, and results to both technical and non-technical audiences through written reports and oral presentations.

Attributes:	
C 1	Develop critical thinking skills to assess the validity and reliability of risk management techniques in actuarial practice
C 2	Cultivate a strong attention to detail, accuracy, and professionalism when working with financial data and offering actuarial advice.
C 3	Enhance problem-solving abilities by applying appropriate techniques to real-world scenarios in actuarial risk management.
C 4	Appreciate how erroneous assumptions in mathematical modelling may have significant negative consequences.

### How will you learn?

In the Actuarial Science and Data Analytics MSc programme, your learning experience will be comprehensive and supported by various methods. Here's how you will learn:

1. **Formal Lessons:** You will attend structured formal lessons delivered by experienced lecturers who are experts in their respective fields. These lessons will provide you with the necessary theoretical foundations, concepts, and methodologies in the field. The curriculum is designed to cover a wide range of topics, ensuring a well-rounded understanding of the subject matter.
2. **Tutorials:** Alongside formal lessons, you will have the opportunity to participate in tutorials. Tutorials offer a smaller group setting where you can engage in interactive discussions, ask questions, and receive further clarification on complex topics. Tutorials provide a supportive environment for deeper exploration of course materials and facilitate peer-to-peer learning.
3. **Assignments:** Throughout the programme, you will be assigned various coursework and assignments. These assignments will

challenge you to apply the knowledge and techniques learned in the classroom. They will involve hands-on tasks, problem-solving exercises, and applications to real-world datasets.

4. MSc Dissertation Project: As part of your MSc journey, you will undertake a summer dissertation project. This project will be a culmination of your learning, where you will have the opportunity to demonstrate your ability to conduct independent research, apply state-of-the-art methodologies, and generate valuable insights. You will work closely with a supervisor who will guide and support you throughout the project.

5. Access to State-of-the-Art Software and Hardware: The programme ensures that you have access to cutting-edge software and hardware resources. You will have the opportunity to work with industry-standard statistical software packages, programming languages, and data analysis and visualisation tools. Access to advanced hardware and computing resources will enable you to handle large datasets and perform computationally intensive analyses effectively.

6. Personal Academic Advisor: Each student will be assigned a personal academic advisor who will serve as a mentor and guide throughout your academic journey. Your advisor will provide support and advice on course selection, academic progress, and career development. They will assist you in navigating the programme requirements and help you make informed decisions regarding your academic and professional goals.

7. Office Hours: Lecturers and teaching staff will hold regular office hours, during which you can schedule one-on-one meetings to seek clarification, discuss coursework, receive feedback, and address any questions or concerns. Office hours provide an opportunity for personalized interaction, allowing you to receive individualized attention and guidance from faculty members.

Overall, the learning experience in the Actuarial Science and Data Analytics MSc will combine formal lessons, interactive tutorials, practical assignments, independent research, access to advanced technology, and personal support from academic advisors and lecturers. This holistic approach will foster a dynamic and engaging learning environment, enabling you to develop a strong foundation in actuarial science and prepare you for successful careers in this field.

### How will you be assessed?

You will be assessed by a combination of in-term class tests (some of which are computer-based) and written examinations. Some modules may also have in-term assessed coursework assignments or projects.

For the in-term class tests and assignments (but excluding those that are the final element of assessment for a module) we generally aim to release provisional marks, and to give detailed feedback, within two weeks.

The MSc dissertation project represents a significant component of your assessment. This independent research project allows you to investigate a specific research question or problem in depth. You will design and execute a research study, analyze data, and present your findings in a formal written dissertation. The dissertation will be assessed based on the quality of research design, data analysis, interpretation, and the clarity and coherence of your written work.

The combination of assignments, exams, projects, and the MSc dissertation ensures a comprehensive evaluation of your knowledge and practical skills in applied statistics and data science.

Throughout the programme, you will receive feedback and guidance from faculty members, allowing you to identify areas of improvement and enhance your learning experience. The assessments are designed to not only evaluate your progress but also to promote active engagement with the subject matter and to prepare you for future challenges.

### How is the programme structured?

Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

The programme consists of four compulsory taught modules (two in Semester A and two in semester B) and four elective modules (two in Semester A and two in Semester B), as well as a summer dissertation project. Full-time students are expected to complete eight taught modules and the project dissertation in one academic year.

The programme provides a wide range of electives in order to consider the needs of students that already have some knowledge in the field or have already obtained accreditations associated with some of the modules we offer, such as the case of our own BSc in Actuarial Science students.

## Programme Title: Actuarial Science and Data Analytics

Students choose their elective modules according to their academic background and interests, in consultation with the Programme Director and other staff as needed. The programme will incorporate a robust advising process to support students in choosing the relevant pathway leading to the desired level of accreditations gained.

Assessment dates will be coordinated by the Director of Education, Programme Director and Module Organisers to ensure no undue pressure is placed on students.

NOTE: codes in parenthesis such as "CP1" beside the module name refer to the IFoA accreditation corresponding to that module.

### Semester A

#### - Compulsory:

NEW [7] Actuarial Risk Management 1 (CP1)  
MTH786P [7] Machine Learning with Python

#### - Electives:

NEW [7] Survival Models (CS2)  
NEW [7] Foundations of Mathematics and Statistics for Actuaries (CS2)  
MTH765P [7] Storing, Manipulating and Visualising Data  
MTH739P [7] Topics in Scientific Computing

### Semester B

#### - Compulsory:

NEW [7] Actuarial Risk Management 2 (CP1)  
MTH783P [7] Time Series for Business (CS2)

#### - Electives:

NEW [7] Financial Engineering (CM2)  
NEW [7] Mathematical Tools for Asset and Liability Management (CM2)  
MTH793P [7] Advanced Machine Learning  
MTH792P [7] Financial Data Analytics  
MTH767P [7] Neural Networks and Deep Learning  
MTH791P [7] Computational Statistics with R

### Semester C:

Core (60 credits) NEW [7] Actuarial Science and Data Analytics Dissertation (CP2 and CP3)

Note: students with no prior accreditation and QM Students with an undergraduate degree from SMS without the modules that cover CS2 and CM2 can choose the elective modules covering CS2 and CM2. If a student already has accreditations for either CS2 or CM2, or graduated from QM SMS with an undergraduate degree with modules covering CS2 or CM2, their choice of electives on this MSc will exclude CM2 or CS2 modules.

### Part Time Diet:

#### Semester A, Year 1

##### - Compulsory:

NEW [7] Actuarial Risk Management 1 (CP1)  
MTH786P [7] Machine Learning with Python

#### Semester B, Year 1

##### - Compulsory:

NEW [7] Actuarial Risk Management 2 (CP1)  
MTH783P [7] Time Series for Business (CS2)

#### Semester A, Year 2

##### - Electives (choose 2 from the list below)

NEW [7] Survival Models (CS2)  
NEW [7] Foundations of Mathematics and Statistics (CS2)  
MTH765P [7] Storing, Manipulating and Visualising Data

Programme Title: Actuarial Science and Data Analytics

<p>MTH739P [7] Topics in Scientific Computing</p> <p>Semester B, Year 2</p> <p>- Electives (choose 2 from the list below)</p> <p>NEW [7] Financial Engineering (CM2)</p> <p>NEW [7] Mathematical Tools for Asset and Liability Management (CM2)</p> <p>MTH793P [7] Advanced Machine Learning</p> <p>MTH792P [7] Financial Data Analytics</p> <p>MTH767P [7] Neural Networks and Deep Learning</p> <p>MTH791P [7] Computational Statistics with R</p> <p>Semester C, Year 2</p> <p>Core (60 credits)</p> <p>NEW [7] Actuarial Science and Data Analytics Dissertation (CP2 and CP3)</p>
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Academic Year of Study FT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Actuarial Risk Management 1	MTH7013P	15	7	Compulsory	1	Semester 1
Machine Learning with Python	MTH786P	15	7	Compulsory	1	Semester 1
Actuarial Risk Management 2	MTH7014P	15	7	Compulsory	1	Semester 2
Time Series for Business	MTH783P	15	7	Compulsory	1	Semester 2
Survival Models	MTH7025P	15	7	Elective	1	Semester 1
Foundations of Mathematics and Statistics for Actuaries	MTH7026P	15	7	Elective	1	Semester 1
Storing, Manipulating and Visualising Data	MTH765P	15	7	Elective	1	Semester 1
Topics in Scientific Computing	MTH739P	15	7	Elective	1	Semester 1
Financial Engineering	MTH7027P	15	7	Elective	1	Semester 2
Mathematical Tools for Asset and Liability Management	MTH7028P	15	7	Elective	1	Semester 2
Advanced Machine Learning	MTH793P	15	7	Elective	1	Semester 2
Financial Data Analytics	MTH792P	15	7	Elective	1	Semester 2

Programme Title: Actuarial Science and Data Analytics

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Computational Statistics with R	MTH791P	15	7	Elective	1	Semester 2
Neural Networks and Deep Learning	MTH767P	15	7	Elective	1	Semester 2
Actuarial Science and Data Analytics Dissertation	MTH7029P	60	7	Core	1	Semester 3

Academic Year of Study PT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Actuarial Risk Management 1	MTH7013P	15	7	Compulsory	1	Semester 1
Machine Learning with Python	MTH786P	15	7	Compulsory	1	Semester 1
Actuarial Risk Management 2	MTH7014P	15	7	Compulsory	1	Semester 2
Time Series for Business	MTH783P	15	7	Compulsory	1	Semester 2

Academic Year of Study PT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Survival Models	MTH7025P	15	7	Elective	2	Semester 1
Foundations of Mathematics and Statistics	MTH7015P	15	7	Elective	2	Semester 1
Storing, Manipulating and Visualising Data	MTH765P	15	7	Elective	2	Semester 1
Topics in Scientific Computing	MTH739P	15	7	Elective	2	Semester 1
Financial Engineering	MTH7027P	15	7	Elective	2	Semester 2

Programme Title: Actuarial Science and Data Analytics

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Mathematical Tools for Asset and Liability Management	MTH7028P	15	7	Elective	2	Semester 2
Advanced Machine Learning	MTH793P	15	7	Elective	2	Semester 2
Financial Data Analytics	MTH792P	15	7	Elective	2	Semester 2
Neural Networks and Deep Learning	MTH767P	15	7	Elective	2	Semester 2
Computational Statistics with R	MTH791P	15	7	Elective	2	Semester 2
Actuarial Science and Data Analytics Dissertation	MTH7029P	60	7	Core	2	Semester 3

### What are the entry requirements?

An upper second BSc degree in actuarial science, mathematics, statistics, econometrics, mathematical economics, finance, or engineering. Applicants with unrelated degrees will be considered if there is evidence of equivalent content in their academic or professional background. For international students we require English language qualifications IELTS 6.5.

### How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?

The Staff-Student Liaison Committee provides a formal means of communication and discussion between Schools and its students. The committee consists of student representatives from each year in the school/institute together with appropriate representation from staff within the school/institute. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

Each school operates a School Education Committee, or equivalent, which advises the School/Institute Director of Education on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in this Committee's work in a number of ways, such as through student membership, or consideration of student surveys.

### What academic support is available?

All students will be assigned an Academic Advisor with whom they will have regular meetings. In addition the students will have all the standard induction, advice and supervisory arrangements normally offered to students within SMS.

The programme will incorporate a robust advising process to support students in choosing the relevant pathway leading to the desired level of accreditations gained.

The school handbook will be provided (and made accessible at all times) to students, where all the channels of support will be outlined. These include the support channels within the school and also those available at College level.



## Programme-specific rules and facts

N/A

## How inclusive is the programme for all students, including those with disabilities?

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:

- Finding out if you have a specific learning difficulty like dyslexia
- Applying for funding through the Disabled Students' Allowance (DSA)
- Arranging DSA assessments of need
- Special arrangements in examinations
- Accessing loaned equipment (e.g. digital recorders)
- Specialist one-to-one "study skills" tuition
- Ensuring access to course materials in alternative formats (e.g. Braille)
- Providing educational support workers (e.g. note-takers, readers, library assistants)
- Mentoring support for students with mental health issues and conditions on the autistic spectrum.

## Links with employers, placement opportunities and transferable skills

The staff involved in the MSc in Actuarial Science and Data Analytics have strong links with the actuarial profession and a range of international academic institutions. Some of our faculty members are Fellows and Independent Examiners with the IFoA, one of whom received recognition via a Frank Redington Prize from the IFoA in 2022. Companies are involved in some of the teaching activities, as well as business use cases, such as SAS.

Many of the skills taught in this programme are highly transferable. For example, the programming skills (especially in Python) are widely sought by employers in the actuarial profession.

## Programme Specification Approval

**Person completing Programme Specification:**

Sebastian del Bano Rollin, DDoE; amended S. Beheshti, DDoE

**Person responsible for management of programme:**

Shabnam Beheshti, DDoE

**Date Programme Specification produced / amended by School / Institute Education Committee:**

03 Jul 23, amended 26 Sep 23

**Date Programme Specification approved by Taught Programmes Board:**

11.10.2023