

Programme Specification

Mathematics with Actuarial Science (2017-18)

This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided.

Awarding Institution	University of Southampton
Teaching Institution	University of Southampton
Mode of Study	Full-time
Duration in years	3
Accreditation details	Institute and Faculty of Actuaries
Final award	Bachelor of Science with Honours (BSc (Hons))
Name of award	Mathematics with Actuarial Science
Interim Exit awards	Certificate of Higher Education (CertHE) Diploma of Higher Education (DipHE)
FHEQ level of final award	Level 6
UCAS code	G1N3
Programme code	4702
QAA Subject Benchmark or other external reference	Mathematics, Statistics And Operational Research 2007
Programme Lead	Gerard Kennedy (gkenedy)

Programme Overview

Brief outline of the programme

Actuaries are highly skilled quantitative professionals who are primarily concerned with the identification, quantification, analysis, and management of various types of risk, particularly those with long term financial consequences. They are problem solvers, tackling the uncertainties of future events using their skills in mathematics, probability and statistics. Their expertise is essential to the proper management of life, general, and health insurance companies, pension funds, and investment firms, and their skills are very highly regarded and valued throughout the financial services industry.

This degree programme provides you with the technical skills in mathematics and a professional level education in actuarial science sufficient to prepare you to embark on a professional career as an actuary. The University of Southampton is one of the few Universities in the country to be able to offer exemptions from the eight Core

Technical professional examinations of the Institute and Faculty of Actuaries, CT1- CT8.

Transfer to this programme at the end of the first semester is possible from a number of other programmes within Mathematical Sciences.

Your contact hours will vary depending on your module/option choices. Full information about contact hours is provided in individual module profiles.

Learning and teaching

Acquisition of knowledge and understanding is through structured exposition based on lectures, tutorials or problem classes, case studies, supervised project work, and private study, as appropriate.

Assessment

Every module is assessed, typically by a combination of unseen examinations and coursework, including class tests.

Special Features of the programme

N/A

Please note: As a research-led University, we undertake a continuous review of our programmes to ensure quality enhancement and to manage our resources. As a result, this programme may be revised during a student's period of registration; however, any revision will be balanced against the requirement that the student should receive the educational service expected. Please read our [Disclaimer](#) to see why, when and how changes may be made to a student's programme.

Programmes and major changes to programmes are approved through the University's [programme validation process](#) which is described in the University's [Quality handbook](#).

Educational Aims of the Programme

The aims of the programme are to:

- Introduce you to the main basic areas of mathematics;
- Develop your understanding of abstract mathematical concepts;
- Offer you the opportunity to study advanced mathematical concepts and techniques;
- Develop your modelling and problem solving skills;
- Offer you the opportunity to construct an individual programme of study within a coherent framework;
- Offer you the opportunity to study applications of mathematics in a variety of contexts which utilize physical and/or statistical models;
- Introduce you to the theoretical concepts, methods, and techniques of actuarial science;
- Develop your understanding of practical actuarial and statistical modelling and of the context in which such work is undertaken;
- Offer you the opportunity to study actuarial topics selected from a range of options, but within a coherent framework;
- Give you sufficient grounding in actuarial science for employment as an actuarial analyst;
- Offer you the opportunity to gain exemptions from the professional examinations of the Institute and Faculty of Actuaries;
- Provide you with the opportunity to gain practical experience of applying problem-solving and other skills learned by working on individual and group research projects;
- Help you to develop subject specific and key transferable skills: personal organisation, problem solving, logical argument, deductive reasoning and analysis, abstraction and generalisation; locating, retrieving, synthesising, and using information; and written and oral communication.

- Provide some of the basic IT skills necessary for further study and employment, including word processing and use of the internet.

Programme Learning Outcomes

Knowledge and Understanding

On successful completion of this programme a student will have knowledge and understanding of:

- A1. The fundamentals of calculus, linear algebra, and statistics;
- A2. The fundamentals of ordinary and partial differential equations and their applications;
- A3. The principles of mathematical proof and some of the techniques of proof;
- A4. The fundamental concepts of real analysis of functions of one or more variables;
- A5. Statistical and actuarial methods and the assumptions that underlie them;
- A6. The theoretical concepts, methods, and techniques of actuarial science;
- A7. Actuarial and statistical modelling, including practical limitations and assumptions;
- A8. The context in which actuarial work is undertaken;
- A9. The aspects of economics and accounting and finance of importance for actuarial science;
- A10. Techniques of risk management in an actuarial context;
- A11. Communication in mathematics, statistics, and actuarial contexts;
- A12. Research planning, information retrieval, data collection, methodology, and reporting.

Teaching and Learning Methods

Acquisition of knowledge and understanding is through structured exposition based on lectures, tutorials or problem classes, case studies, supervised project work, and private study, as appropriate. Increasing independence of learning is required as the programme progresses.

Throughout the programme, students are encouraged to use additional recommended reading material for private study to consolidate the formal learning process and to broaden and deepen their understanding.

Assessment Methods

Each module is assessed, typically by a combination of unseen examinations and coursework, including class tests. The varied approach to assessment reflects the nature and learning objectives of the module, and the methods, techniques, and skills developed.

Subject Specific Intellectual and Research Skills

On successful completion of this programme a student will be able to:

- B1. Demonstrate mathematical problem-solving skills for certain types of problems and their variants in a variety of mathematical contexts;
- B2. Undertake algebraic calculations accurately and with understanding;
- B3. Use computer packages as vehicles for mathematical exploration and understanding;
- B4. Understand and construct mathematical proofs;
- B5. Appreciate, construct and analyse mathematical models of practical situations;
- B6. Use statistical, mathematical and demographic techniques to analyse actuarial problems;
- B7. Apply statistical methods such as regression and analysis of variance to practical situations
- B8. Logically analyse and critically evaluate the appropriateness and applicability of the concepts, methods, and techniques of actuarial science;
- B9. Structure and analyse actuarial problems;
- B10. Construct, analyse, and interpret appropriate actuarial, statistical, and financial models in an actuarial context;
- B11. Assess the role and impact of economics and accounting and finance in an actuarial context;
- B12. Assess risk and apply an appropriate risk management strategy and associated techniques in an actuarial context;
- B13. Logically discuss and communicate actuarial concepts and analyses, both orally and in written form;
- B14. Plan and analyse a research project, both individually and as part of a team.

Teaching and Learning Methods

Problem-solving is at the heart of all mathematical activity, and so it is emphasised throughout the learning and teaching experience, as is the need for accurate calculation and logical argument. The use of specific mathematical and computational packages is a part of the curriculum, and the skills acquired there are used in later modules as appropriate.

The application, analysis, critical evaluation, and interpretation of actuarial, statistical, and financial models are fundamental to actuarial science, and are emphasised throughout the teaching and learning experience. The fundamental role played by risk and the need to assess and manage risk in an actuarial context is also emphasised throughout. Planning, analysis, and logical communication skills are further developed through the individual and group research projects.

Assessment Methods

Each module is assessed, typically by a combination of unseen examinations and coursework, including class tests.

The various methods of assessment involve analysis, problem solving, modelling, and critical evaluation, in addition to the assessment of knowledge and understanding. For the individual and group research projects, planning, analysis, and communication are assessed through the resulting reports and presentation.

Transferable and Generic Skills

On successful completion of this programme a student will be able to:

- C1. Communicate mathematical ideas in written form;
- C2. Undertake oral presentations;
- C3. Demonstrate group-working skills;
- C4. Use email and spreadsheets and show basic word-processing skills;
- C5. Develop personal organisation and time management skills;
- C6. Demonstrate skills in problem solving, logical argument, deductive reasoning and analysis, abstraction and generalisation;
- C7. Locate, retrieve, synthesise, and use information from a variety of different sources, particularly through use of the library and the web;
- C8. Demonstrate written and oral communication skills;
- C9. Develop independent learning ability;
- C10. Use the skills acquired (e.g. time-management, organisation, problem-solving, critical analysis, independent learning, etc.) for life-long learning.

Teaching and Learning Methods

The learning of transferable skills begins in the first year. In addition to the modules you take each semester, you will also be timetabled for weekly computer labs. The first year lecturers will set problems for which one of a range of computing packages, such as the statistics package R, will be useful, thereby developing transferable skills alongside subject specific skills. Other IT skills such as basic word processing are used alongside first year project work, particularly in statistics. Mathematics Workshop drop-in sessions are offered during the first year, and extensive electronic resources on study skills are available through the Mathematical Sciences and University websites.

Further development of IT skills, written communication and general skills such as organisation and time-management are associated with optional second and third year modules which may contain an element of coursework in their assessment. The third year core module Communicating and Researching Mathematics develops your portfolio of skills to include internet and library research, group working, report writing and presentation skills. The last will be of particular importance if you are undertaking a third year project, for which you give an oral presentation of your work.

Assessment Methods

Throughout the programme, problem solving, deductive reasoning and analysis, and communication form an essential part of the assessment criteria employed, either explicitly or implicitly. For some elements of coursework and for the individual and group research projects, a proportion of the assessment is related to communication, and, where appropriate, to the appropriate use of library and web research. Project work and coursework assessment also relate to the other transferable and generic skills listed above. Problem solving is an integral component of all mathematical work, and other learning skills are implicit in this work.

Programme Structure

The programme structure table is below:

Information about pre and co-requisites is included in individual module profiles.

Part I

Typical programme content

This degree programme provides a strong education in mathematics, statistics and actuarial science. We are one of the few universities to hold a substantial exemption recognition agreement with the Institute and Faculty of Actuaries, covering the Core Technical professional subjects, CT1- CT8, thereby reducing the average time taken to qualify as an actuary following completion of your degree.

In addition to this, our Curriculum Innovation Programme offers our students the chance to take optional modules outside their core disciplines. This allows you to personalise your education, and to develop new skills and knowledge for your future.

Programme details

The structure of the programme and the modules currently offered are set out below. Of the modules shown in each year of your programme, some are compulsory (i.e. enrolment is automatic) and others are optional. In each year, you are directed to which modules are compulsory and which are optional. The optional modules listed constitute an indicative list. There will always be choice but the options might vary between years. A list of optional modules will be available to you via the Student Record Self-Service system once you enrol at the University.

The programme comprises three parts, each corresponding to one year of full-time study. You will normally be required to take 4 modules (30 ECTS/60 CATS) each semester, i.e. 8 modules (60 ECTS/120 CATS) in each year of the programme. Each CAT credit can be considered as the equivalent of approximately ten hours of study. All the modules offered in this programme are 7.5 ECTS/15 CATS modules. This means that each module comprises around 150 hours of study divided into contact time (e.g. lectures, seminars, workshops) and non-contact time when you will be engaged in directed study (preparation for classes) and independent study when you will be involved in undertaking assignments and preparing for and taking examinations.

The option modules shown below constitute an indicative list; there will always be choice but the options might vary between years. A full list of modules and rules will be available to you via the Student Record Self-Service system once you enrol at the University

NOTE: Students must take at least five "named degree options" from the following modules:

MATH2012 Stochastic Processes
MANG2014 Accounting and Finance for Non-Specialists
MATH3063 Actuarial Mathematics I
MATH3022 Mathematical Finance
MATH3066 Actuarial Mathematics II
MATH3085 Survival Models
STAT3010 Statistical Methods in Insurance

NOTE: Students must take at least 16 MATH modules over the three years of full-time study, including at least 4 level 3 MATH (MATH3XXX) modules.

Part I Compulsory

Code	Module Title	ECTS	Type
MATH1024	Introduction to Probability and Statistics	7.5	Compulsory
MATH1049	Linear Algebra II	7.5	Compulsory
MATH1060	Multivariable Calculus	7.5	Compulsory
MATH1058	Operational Research I and Mathematical Computing	7.5	Compulsory

Part I Core

Code	Module Title	ECTS	Type
MATH1059	Calculus	7.5	Core
MATH1048	Linear Algebra I	7.5	Core

Part I Optional

You should choose EITHER ECON1001 (if you do not have A level Economics) OR ECON1003 (if you do have A level Economics).

Note: ECON1001/ECON1003 and ECON1002 are normally taken, and so these modules are automatically added to your student record. There is flexibility for students to elect to take alternative modules (e.g. Languages) but any such request must be discussed with and receive the prior approval of the Programme Lead.

Code	Module Title	ECTS	Type
MATH1057	Dynamics and Relativity	7.5	Optional
ECON1001	Foundations of Microeconomics	7.5	Optional
MATH1001	Number Theory	7.5	Optional
ECON1002	Principles of Macroeconomics	7.5	Optional
ECON1003	Principles of Microeconomics	7.5	Optional

Part II

Part II Compulsory

Code	Module Title	ECTS	Type
MATH2039	Analysis	7.5	Compulsory
MATH2040	Financial Mathematics	7.5	Compulsory
MATH2038	Partial Differential Equations	7.5	Compulsory
MATH2011	Statistical Distribution Theory	7.5	Compulsory
MATH2010	Statistical Methods I	7.5	Compulsory

Part II Optional

Code	Module Title	ECTS	Type
MANG2014	Accounting and Finance for Non-Specialists	7.5	Optional
MATH2014	Algorithms	7.5	Optional
MATH2044	Applications of Vector Calculus	7.5	Optional
UOSM2001	Business Skills for Employability	7.5	Optional
MATH2008	Introduction to Applied Mathematics	7.5	Optional
MATH2012	Stochastic Processes	7.5	Optional
UOSM2011	The Management of Risk and Uncertainty	7.5	Optional
MATH2045	Vector Calculus and Complex Variable	7.5	Optional

Part III

Part III Core

Code	Module Title	ECTS	Type
MATH3032	Communicating and Researching Mathematics	7.5	Core

Part III Optional

Code	Module Title	ECTS	Type
MATH3063	Actuarial Mathematics I	7.5	Optional
MATH3066	Actuarial Mathematics II	7.5	Optional
UOSM2001	Business Skills for Employability	7.5	Optional
MATH3023	Communicating and Teaching Mathematics	7.5	Optional
UOSM2020	Economics with Experiments	7.5	Optional
UOSM2004	Global Health	7.5	Optional
MATH3033	Graph Theory	7.5	Optional
MATH3022	Mathematical Finance	7.5	Optional
MATH3018	Numerical Methods	7.5	Optional
MATH3006	Relativity, Blackholes and Cosmology	7.5	Optional
MATH3044	Statistical Inference	7.5	Optional
STAT3010	Statistical Methods in Insurance	7.5	Optional
MATH3085	Survival Models	7.5	Optional
UOSM2011	The Management of Risk and Uncertainty	7.5	Optional

Progression Requirements

The programme will follow the University's regulations for [Progression, Determination and Classification of Results: Undergraduate and Integrated Masters Programmes](#) or the University's regulations for [Progression, Determination and Classification of Results: Standalone Masters Programmes](#) as set out in the General Academic Regulations in the University Calendar: <http://www.calendar.soton.ac.uk/sectionIV/sectIV-index.html>

Support for student learning

There are facilities and services to support your learning some of which are accessible to students across the University and some of which will be geared more particularly to students in your particular Faculty or discipline area.

The University provides:

- library resources, including e-books, on-line journals and databases, which are comprehensive and up-to-date; together with assistance from Library staff to enable you to make the best use of these resources
- high speed access to online electronic learning resources on the Internet from dedicated PC Workstations onsite and from your own devices; laptops, smartphones and tablet PCs via the Eduroam wireless network. There is a wide range of application software available from the Student Public Workstations.
- computer accounts which will connect you to a number of learning technologies for example, the Blackboard virtual learning environment (which facilitates online learning and access to specific learning resources)
- standard ICT tools such as Email, secure filestore and calendars.
- access to key information through the MySouthampton Student Mobile Portal which delivers timetables, Module information, Locations, Tutor details, Library account, bus timetables etc. while you are on the move.
- IT support through a comprehensive website, telephone and online ticketed support and a dedicated helpdesk in the Hartley Library.
- Enabling Services offering support services and resources via a triage model to access crisis management, mental health support and counselling. Support includes daily Drop In at Highfield campus at 13.00 – 15.00 (Monday, Wednesday and Friday out of term-time) or via on-line chat on weekdays from 14.00 – 16.00. Arrangements can also be made for meetings via Skype.
- assessment and support (including specialist IT support) facilities if you have a disability, long term health problem or Specific Learning Difficulty (e.g. dyslexia).
- the Student Services Centre (SSC) to assist you with a range of general enquiries including financial matters, accommodation, exams, graduation, student visas, ID cards
- Career and Employability services, advising on job search, applications, interviews, paid work, volunteering and internship opportunities and getting the most out of your extra-curricular activities alongside your degree programme when writing your CV
- Other support that includes health services (GPs), chaplaincy (for all faiths) and 'out of hours' support for students in Halls and in the local community, (18.00-08.00)
- A Centre for Language Study, providing assistance in the development of English language and study skills for non-native speakers.

The Students' Union provides

- an academic student representation system, consisting of Course Representatives, Academic Presidents, Faculty Officers and the Vice-President Education; SUSU provides training and support for all these representatives, whose role is to represent students' views to the University.
- opportunities for extracurricular activities and volunteering
- an Advice Centre offering free and confidential advice including support if you need to make an academic appeal
- Support for student peer-to-peer groups, such as Nightline.

Associated with your programme you will be able to access:

- Module co-ordinators support. Module co-ordinators will be available at designated times during the week to discuss issues related to the particular modules you are studying at the time. This will be in addition to class contact time.
- Academic/personal tutor. As soon as you register on this programme, you will be allocated a personal tutor. S/he is a member of the academic team and will be available to discuss general academic issues related to the programme as well as offer advice and support on any personal issues which may affect your studies.

- Senior Tutor. The Senior Tutor will also be available to offer such advice and support.
- Module handbooks/outlines. These will be available at the start of each module (often in online format). The handbook includes the aims and learning outcomes of the module, the methods of assessment, relevant background material to the module and a session-by-session breakdown of the module together with appropriate reading lists.
- Within the Faculty, administrative support is provided by your Student Office which deals with student records and related issues and with queries related to your specific degree programme.

Methods for evaluating the quality of teaching and learning

You will have the opportunity to have your say on the quality of the programme in the following ways:

- Completing student surveys for each module of the programme
- Acting as a student representative on various committees, e.g. Staff Student Liaison Committees, Faculty Programmes Committee OR providing comments to your student representative to feedback on your behalf.
- Serving as a student representative on Faculty Scrutiny Groups for programme validation
- Taking part in programme validation meetings by joining a panel of students to meet with the Faculty Scrutiny Group

The ways in which the quality of your programme is checked, both inside and outside the University, are:

- Regular module and programme reports which are monitored by the Faculty
- Programme validation, normally every five years.
- External examiners, who produce an annual report
- Professional body accreditation/inspection (by the Institute and Faculty of Actuaries)
- A national Research Excellence Framework (our research activity contributes directly to the quality of your learning experience)
- Institutional Review by the Quality Assurance Agency

Further details on the University's quality assurance processes are given in the [Quality Handbook](#).

Criteria for admission

The University's Admissions Policy applies equally to all programmes of study. The following are the typical entry criteria to be used for selecting candidates for admission. The University's approved equivalencies for the requirements listed below will also be acceptable.

Alternative qualifications

Cambridge Pre-U

Our normal requirements are for D3D3M1 in the three principal subjects including D3 in Mathematics.

In addition we welcome applications from candidates offering other suitable qualifications with an appropriate mathematical content.

Qualification	Grades	Subjects required	Subjects not accepted	EPQ Alternative offer (if applicable)	Contextual Alternative offer (if applicable)
International Baccalaureate	36 points, 18 at higher level	including 6 in higher level mathematics			

A Level	AAA (or AAB with Further Mathematics)	including grade A in A-level Mathematics			
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Recognition of Prior Learning (RPL)

The University has a [Recognition of Prior Learning Policy](#)

Students are accepted under the University's recognition of prior learning policy; however, each case will be reviewed on an individual basis.

English Language Proficiency

The table below sets out the English proficiency requirements for this programme in terms of the IELTS test. We accept a range of other English proficiency tests including TOEFL and Cambridge Advanced/Proficiency. For full details of the recognised tests and the equivalent requirements in those tests please see www.southampton.ac.uk/admissions-language.

Overall	Reading	Writing	Speaking	Listening
6.5	5.5	5.5	5.5	5.5

Career Opportunities

Employability is embedded into modules from the first year onwards and right from the first lecture. We explain the degree skills which are being taught throughout the modules and offer a number of optional employability modules.

Technical skills you will acquire are in great demand, as are the skills of understanding and analysing problems, together with communicating the results.

Our degrees are a passport to vocational and non-vocational careers alike, with recent graduates employed in roles ranging from actuaries and statisticians to accountants and medical researchers.

External Examiner(s) for the programme

Name: John Parker - University of Durham

Name: Lawrence Pettit - Queen Mary College University of London

Name: Dolores Romero Morales - Copenhagen Business School

Name: Malcolm Brown - University of Kent

Students must not contact External Examiner(s) directly, and external examiners have been advised to refer any such communications back to the University. Students should raise any general queries about the assessment and examination process for the programme with their Course Representative, for consideration through Staff: Student Liaison Committee in the first instance, and Student representatives on Staff: Student Liaison Committees will have the opportunity to consider external examiners' reports as part of the University's quality assurance process.

External examiners do not have a direct role in determining results for individual students, and students wishing to discuss their own performance in assessment should contact their Personal Academic Tutor in the first instance.

Please note: This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities that are provided. More detailed information can be found in the programme handbook.

Appendix 1:

Students are responsible for meeting the cost of essential textbooks, and of producing such essays, assignments, laboratory reports and dissertations as are required to fulfil the academic requirements for each programme of study. In addition to this, students registered for this programme also have to pay for:

Additional Costs

Type	Details
Software Licenses	The software required for the programme is available on all public workstations on campus, and accessible from your own computer via VPN.
Stationery	You will be expected to provide your own day-to-day stationery items, e.g. pens, pencils, notebooks, etc.). Any specialist stationery items will be specified under the Additional Costs tab of the relevant module profile.
Textbooks	Where a module specifies core texts these should generally be available on the reserve list in the library. However due to demand, students may prefer to buy their own copies. These can be purchased from any source. Some modules suggest reading texts as optional background reading. The library may hold copies of such texts, or alternatively you may wish to purchase your own copies. Although not essential reading, you may benefit from the additional reading materials for the module.
Approved Calculators	Candidates may use calculators in the examination room only as specified by the University and as permitted by the rubric of individual examination papers. The University approved models are Casio FX-570 and Casio FX-85GT Plus. These may be purchased from any source and no longer need to carry the University logo.
Printing and Photocopying Costs	In the majority of cases, coursework such as essays; projects; dissertations is likely to be submitted on line. However, there are some items where it is not possible to submit on line and students will be asked to provide a printed copy. A list of the University printing costs can be found here: http://www.southampton.ac.uk/isolutions/students/printing-for-students.page For students undertaking modules with a high mathematical content, some assessed work will be submitted in handwritten hard copy format. Students are advised that they will need to bear the costs of the required stationery.

In some cases you'll be able to choose modules (which may have different costs associated with that module) which will change the overall cost of a programme to you. Details of such costs will be listed in the Module Profile. Please also ensure you read the section on additional costs in the University's Fees, Charges and Expenses Regulations in the University Calendar available at www.calendar.soton.ac.uk.