Programme Specification

Mathematics with Computer Science (2020-21)

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	None
Final award	Bachelor of Science with Honours (BSc (Hons))
Name of Award	Mathematics with Computer Science
Interim Exit awards	Certificate of Higher Education (CertHE)
	Diploma of Higher Education (DipHE)

FHEQ level of final award	Level 6
UCAS code	G1G4
Programme Code	4705
QAA Subject Benchmark or other external reference	Mathematics, Statistics And Operational Research 2007
Programme Lead	James Renshaw

Programme Overview

Brief outline of the programme

Graduate mathematicians are in high demand in commerce and in industry. The computing industry has a special need for mathematicians with a background in computing, and this programme is designed to meet that need, allowing those with a primary interest in mathematics to maintain and develop their interest in computing. This degree may lead to possible exemption from some Core Technical professional actuarial examinations depending on option choices made.

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
The Mathematical Sciences School uses a wide variety of modern learning and teaching methods including problem classes, workshops and computer based learning that builds on what you learn in lectures.

Assessment
We use a variety of assessment methods enabling students to demonstrate their strengths and show what they have learnt. Most modules will include a written examination, but many will also use weekly portfolios of problems, class tests and mini-projects as part of the assessment. Assessment is varied enabling you to demonstrate your strengths and show what you have learnt. Students are provided with access to relevant software that they can use on their own personal computers to assist their studies.

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 mathematical and physical models;
·   Introduce you to advanced programming languages such as Java and develop your basic programming skills;
·   Introduce you to the development and evaluation of information systems used in business and organisations;
·   Develop your knowledge and understanding of current and future information and computing technologies;
·   Develop your subject specific and transferable skills including an analytical approach to problem solving, logical argument and deductive reasoning, abstraction and generalisation, and written communication skills in mathematics;
·   Provide some of the basic IT skills necessary for further study and employment, including word processing and use of the internet;
·   Help you to develop key skills: personal organisation, teamwork, problem solving and analysis, finding and using information, and written and oral presentation

Programme Learning Outcomes

Knowledge and Understanding

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

A1.   The fundamentals of calculus, linear algebra, and statistics;
A2.   The fundamentals of ordinary 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 variable;
A5.   The role of programming in the wider context of software development.

Teaching and Learning Methods

Acquisition of knowledge and understanding of A1 through A5 is through structured exposition based on lectures, tutorial classes, workshops, private study, and computer laboratories, all of which are equally important. Increasing independence of learning is required as the programme progresses.

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

Assessment Methods

Assessment is undertaken in the first year by a mixture of unseen examinations, regular marked coursework, class tests and computer-based work, together with a small component of project and laboratory work. This variety of assessment relates to A1 through A3, and also to some of the skills described below. This varied approach to assessment continues in the remainder of the programme, with the relative emphasis depending on the options chosen (A4 - A5).

Subject Specific Intellectual and Research Skills

On successful completion of this programme you will be able to:

B1.   Mathematical problem-solving skills for certain types of problems and their variants in a variety of mathematical contexts;
B2.   The ability to undertake algebraic calculations accurately and with understanding;
B3.   The ability to use computer packages (for example, R) as vehicles for mathematical exploration and understanding;
B4.   The ability to understand and to construct mathematical proofs;
B5.   The ability to appreciate, construct and analyse mathematical models of practical situations;
B6.   The ability to write, test and debug advanced computer programs;
B7.   Write programs to run in an event driven WIMP (windows, icons, menus and pointers) environment;
B8.   Design large programs in an appropriate modular fashion;
B9.   Define user-defined data structures, both static and dynamic, using Java

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.

Assessment Methods

The various methods of assessment described in section 2 involve problem-solving (F1) in addition to the assessment of knowledge and understanding (F2, F4 through F9). Fluency in computer packages (F3, F6 through F9) is assessed by coursework.

Transferable and Generic Skills

On successful completion of this programme you will be able to:

C1.   Communicate mathematical and computing ideas in written form;
C2.   Undertake oral presentations;
C3.   Demonstrate group-working skills
C4.   Use email, spreadsheets and show basic word-processing skills;
C5.   Use and obtain information from a variety of different sources including the internet, books and other printed material;
C6.   Use the skills you have 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. The first year lecturers will set problems for which one of a range of computing packages, such as Excel, or 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. Extensive electronic resources on study skills are available through the Mathematics and University websites.

Further development of IT skills, written communication and general skills such as organisation and time- management is associated to optional second and third year modules which may an element of coursework in their assessment. The second and third year project-based modules develop your portfolio of skills to include internet and library research, group working, and presentation skills.

Assessment Methods

Throughout the programme the clear communication of Mathematics is part of the assessment criteria, either explicitly or implicitly. For project work, and for those modules which involve coursework assignments, a proportion of the assessment is allocated to communication (C1, C2, C4). Project work and coursework assessment also relate to C5, and where appropriate, C3. The skills referred to in C6 refer to problem-solving, an integral component of all mathematical work, and other learning skills are implicit.

Programme Structure

The programme structure table is below:

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

Where optional modules have been specified, the following is an indicative list of available optional modules, which are subject to change each academic year. Please note in some instances modules have limited spaces available.

Pathway

Part I
The structure of the programme and the modules currently offered are set out below. Of the modules shown against each year of your programme, some are compulsory (i.e. enrolment is automatic) and others are optional. Against 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 complete list of optional modules currently available on your programme can be found via the Student Record Self-Service system (https://studentrecords.soton.ac.uk/BNNRPROD/bwkkspgr.showpage?page=ESC_PROGCAT_FINDPR).

The programme comprises three parts, each corresponding to one year of full-time study. You will normally have 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 credit can be considered as the equivalent of approximately ten hours of study. All the modules offered in this programme (except MATH1056) 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 producing assignments and preparing and taking examinations.

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
COMP1202	Programming I	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

Code	Module Title	ECTS	Type
COMP1201	Algorithmics	7.5	Optional
COMP1206	Programming 2	7.5	Optional

Part II

Part II Compulsory

Code	Module Title	ECTS	Type
MATH2039	Analysis	7.5	Compulsory

Part II Core

Code	Module Title	ECTS	Type
MATH2038	Partial Differential Equations	7.5	Core

Part II Optional Rule 1
Select 2 modules (30 credits) comprising one of the following 3 groups:-
Please Note:- Each group contains a pair of modules that must be selected together, so you are choosing to take 1 of the 3 groups.

Part II Optional Group 1
Select up to 2 modules (30 credits). Select both modules if you wish to study the Pure Mathematics pair as your 2 Optional Modules.

Code	Module Title	ECTS	Type

Code	Module Title	ECTS	Type
MATH2049	Geometry and Topology	7.5	Optional
MATH2003	Group Theory	7.5	Optional

Part II Optional Group 2
Select up to 2 modules (30 credits). Select both modules if you wish to study the Applied Mathematics pair as your 2 Optional Modules.

Code	Module Title	ECTS	Type
MATH2044	Fields and Fluids	7.5	Optional
MATH2045	Vector Calculus and Complex Variable	7.5	Optional

Part II Optional Group 3
Select up to 2 modules (30 credits). Select both modules if you wish to study the Statistics pair as your 2 Optional Modules.

Code	Module Title	ECTS	Type
MATH2011	Statistical Distribution Theory	7.5	Optional
MATH2010	Statistical Modelling I	7.5	Optional

Part II Optional Rule 2
Select 2 modules (30 credits) from the following:-
Please ensure that you select an even split of credits overall by Semester including your compulsory/core modules.

If you do not, you will be contacted by your Student Office and asked to amend your choices.

Code	Module Title	ECTS	Type
MATH2014	Algorithms	7.5	Optional
MATH2044	Fields and Fluids	7.5	Optional
MATH2040	Financial Mathematics	7.5	Optional
MATH2049	Geometry and Topology	7.5	Optional
MATH2003	Group Theory	7.5	Optional
MATH3087	Maths and your Future	7.5	Optional
MATH2013	Operational Research II	7.5	Optional
MATH2011	Statistical Distribution Theory	7.5	Optional
MATH2010	Statistical Modelling I	7.5	Optional
MATH2012	Stochastic Processes	7.5	Optional
MATH2045	Vector Calculus and Complex Variable	7.5	Optional

Part III

Part III Optional Rule 0
You must take have taken at least one of MATH3023, MATH3031, MATH3032 or MATH3087 during their programme

Code	Module Title	ECTS	Type
MATH3023	Communicating and Teaching Mathematics	7.5	Optional
MATH3032	Mathematical Investigation and Communication	7.5	Optional
MATH3031	Mathematics Project	7.5	Optional
MATH3087	Maths and your Future	7.5	Optional

Part III Optional Rule 2
Select 3 modules (45 credits) from the following or 4 modules (60 credits) if you have taken MATH3087 in part 2 and elected not to select a module from Rule 0.

Please ensure that you select an even split of credits overall by Semester including your core module. If you do not, you will be contacted by your Student Office and asked to amend your choices.

Code	Module Title	ECTS	Type
MATH3063	Actuarial Mathematics I	7.5	Optional
MATH3066	Actuarial Mathematics II	7.5	Optional
MATH3072	Advanced Fluid Dynamics	7.5	Optional
MATH3083	Advanced Partial Differential Equations	7.5	Optional
MATH3080	Algebraic Topology	7.5	Optional
MATH3023	Communicating and Teaching Mathematics	7.5	Optional
MATH3088	Complex Analysis	7.5	Optional
MATH3014	Design and Analysis of Experiments	7.5	Optional
MATH3078	Further Number Theory	7.5	Optional
MATH3033	Graph Theory	7.5	Optional
MATH3076	Hilbert Spaces	7.5	Optional
MATH3084	Integral Transform Methods	7.5	Optional
MATH3052	Mathematical Biology	7.5	Optional
MATH3022	Mathematical Finance	7.5	Optional
MATH3032	Mathematical Investigation and Communication	7.5	Optional
MATH3017	Mathematical Programming	7.5	Optional
MATH3089	Mathematics for the Modern World	7.5	Optional
MATH3031	Mathematics Project	7.5	Optional
MATH3087	Maths and your Future	7.5	Optional
MATH3018	Numerical Methods	7.5	Optional
MATH3016	Optimization	7.5	Optional
MATH3006	Relativity, Black Holes and Cosmology	7.5	Optional
MATH3013	Simulation & Queues	7.5	Optional
MATH3044	Statistical Inference	7.5	Optional
MATH3091	Statistical Modelling II	7.5	Optional
MATH3090	Structure and Dynamics of Networks	7.5	Optional
MATH3085	Survival Models	7.5	Optional

Progression Requirements

The programme follows the University's regulations for *Progression, Determination and Classification of Results : Undergraduate and Integrated Masters Programmes* or *Progression, Determination and Classification of Results: Postgraduate Master's Programmes.* Any exemptions or variations to the University regulations, approved by AQSC are located in *section VI of the University Calendar*.

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.
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·   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.
·   Computing facilities. In addition to the computing facilities provided by iSolutions, access will be given to those provided by ECS to their single honours students.

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 evaluation questionnaires for each module of the programme.
- Acting as a student representative on various committees, e.g. Staff/Student Liaison Committees, School 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.

Further details on the University's quality assurance processes are given in the ***Quality handbook***.

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.

Major technology organisations have a special need for mathematicians with a background in computing. You could end up as part of the team writing the next version of Windows, devising a computer based stock control system for an automotive manufacturer, or writing a secure web-based customer interface for a US music distributor.

External Examiner(s) for the programme

Name: Professor Miguel Anjos – University of Edinburgh

Name: Professor Andrey Lazarev – Lancaster University

Name: Dr Thomas Mohaupt – University of Liverpool

Name: Professor Jeremy Oakley – University of Sheffield

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 they take 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
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.
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.

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*.