Programme Title: BSc Computer Science and Mathematics with Industrial Experience

Programme Specification (UG)

Awarding body / institution:	Queen Mary University of London
Teaching institution:	Queen Mary University of London
Name of final award and programme title:	Bachelor of Science (BSc) Computer Science and Mathematics with Industrial Experience
Name of interim award(s):	Cert HE, DipHE,BSc
Duration of study / period of registration:	4 years FT
QMUL programme code / UCAS code(s):	IG41
QAA Benchmark Group:	Computer Science, Mathematics
FHEQ Level of Award :	Level 6
Programme accredited by:	
Date Programme Specification approved:	
Responsible School / Institute:	School of Electronic Engineering & Computer Science

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

School of Mathematical Sciences

Institution(s) other than QMUL that will provide some teaching for the programme:

N/A

Programme outline

This programme aims to equip students with a sound, reflective understanding of both computer science and mathematics and of how they are related, together with the skills necessary to apply these skills in conjunction to analyse and solve real-world problems and to develop, on the basis of these solutions, effective computer systems

The programme includes a year in industry between the second and final years of study.

Aims of the programme

Practically, the program equips the students with the ability to use a modern programming language ¬ currently Java ¬ and a modern symbolic computation system -currently Maple. Students will also acquire skills in the construction of computer programs, in calculation (both by hand and aided by computers) and will have a grounding in the analysis and application of

algorithms, both numerical and non-numerical. They will also have enough perspective to be able to choose between different programming and analytical paradigms to find an appropriate one for the solution of a given problem.

This program incorporates, on the computing side, a solid grounding in programming, computer systems, and in the formal tools of computer science; on the mathematical side, it has a basis of both discrete and continuous mathematics. There are many possible combinations of this palette of disciplines, and the programme is flexible enough to allow a certain degree of choice: for example, students could specialise in the logic and formal analysis of computer programmes, or in machine learning, or could apply computational techniques to mathematical problems in combinatorics or in dynamical systems. Equally, they could use dynamical systems theory to analyse the computational techniques that are used in modern banking. All of these combinations will give the students a good understanding of the theory and application of both mathematics and computer science in the modern world.

Students will, throughout their development, learn practical skills, both computational and mathematical, in a laboratory environment: students will gain experience of solving problems, and applying their skills, in a series of progressively more demanding applications.

Alongside this, the programme pays attention to the wider context of both mathematics and computing and the development of transferable skills such as writing, presentation and team work. The programme is under continual revision to ensure it matches the needs of both students and their future employers.

The year in industry supports the students in learning about the application of computer science in an organisational context. The aims of the placement year are to:
• Ground the taught components of the programme in practical experience at a scale not possible within the College;
• Improve career preparation, giving students a better understanding of future career options and enhancing their career prospects.

What will you be expected to achieve?

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills and other attributes in the following areas. The programme outcomes are referenced to the relevant QAA benchmark statement(s) (see above) and the Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008), and relate to the typical student. Additionally, the SEEC Credit Level Descriptors for Further and Higher Education 2003 and Queen Mary Statement of Graduate Attributes have been used as a guiding framework for curriculum design.

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QMUL Model

The QMUL Model is an innovative teaching and learning initiative that will broaden opportunities for Queen Mary undergraduates within and beyond higher education, supporting them to plan and manage their ongoing professional development. The Model is firmly grounded in the core QMUL values of respect for, and engagement with, the local area and communities, with a distinctive focus on enabling students to make a positive societal impact through leadership in their chosen field. The Model is organised around the key themes of:

- networking
- multi- and inter-disciplinarity
- international perspectives
- enterprising perspectives.

Students are required to study QMUL Model modules to the value of at least 10 credits at each year of undergraduate study. Model modules may be 5, 10 or 15 credits. Model modules are indicated within this programme specification.

In your first year of study, the Model module will be core or compulsory and will be situated within your home School or Institute. In subsequent years, students will be strongly encouraged to study at least one Model module beyond their home discipline(s), which could, for example, be in another School / Institute or area of QMUL or undertaken as a module outside of QMUL.

If Model module information is not provided on this programme specification for all subsequent years of study, this will be identified as your studies continue.

Where a Model module elective can be selected from an approved group of Model modules, no guarantee can be provided that your first choice of Model module will be available.

Academic Content:	
A1	computer system components and architecture
A2	the principles of operating systems and networks and the techniques required for their implementation
A3	specific operating systems
A4	the common protocols used in networks
A5	major application areas in the sciences, medicine, industry and commerce
A6	the mathematical, scientific and engineering elements of computer science
A7	the historical, social and professional context of computer science

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Disciplinary Skills - able to:	
B 1	recognise and appreciate the presence of risk in engineering practice
B 2	solve problems
B 3	appreciate common protocols used in networks

Attributes:	
C 1	manage projects effectively
C 2	produce well-written technical documentation
C 3	implement parts of an operating system
C 4	work effectively as a member of a design and development team
C 5	apply usability principles

QMUL Model Learning Outcomes - Level 4:	
D 1	**(Networking) Identify and discuss their own career aspirations or relevant skills and knowledge and how they i**
D 2	**(Networking) Identify and discuss what their own role in their programme and/or subject discipline might mea**
D 3	**(International Perspectives) Consider the role of their discipline in diverse cultural and global contexts**

QMUL Model Learning Outcomes - Level 5:	
E 1	(Enterprising Perspectives) Demonstrate and evaluate how they have enhanced their own learning through engaging
E 2	(Networking) Evaluate and demonstrate their own attitudes, values and skills in the workplace and/or in the wider wo
E 3	(Networking) Evaluate and demonstrate evidence of their skills to support networking and how these have influencec

QMUL Model Learning Outcomes - Level 6:	
F 1	

F2	
F3	

QMUL Model Learning Outcomes - Level 7:	
G1	
G2	
G3	

How will you learn?

Each non-project-based module involves lectures, problem solving coursework and practical sessions. Lectures are used to introduce principles and methods and also to illustrate how they can be applied in practice. Coursework allows students to develop their skills in problem solving and to gain practical experience. Practical sessions provide students with guidance and help while solving a problem. These lessons take the form of exercise classes and programming laboratories that allow the students to learn-by-doing in order to complement the lectures.

Individual projects are undertaken throughout the year under the supervision of an academic member of staff with whom there are weekly consultancy meetings. These are used for students to report on their progress, discuss research and design issues and plan their future work. This develops and reinforces students' ability to communicate technical ideas clearly and effectively. GG41 students will be encouraged to choose a project topic which is relevant for their mathematical studies as well as for computer science. The Projects Coordinator also runs a thread of taught sessions to support the project module.

How will you be assessed?

The assessment of taught modules normally consists of a combination of written examination and coursework.

Project modules are normally examined on the basis of a written report, a formal oral presentation, and, where applicable, a demonstration of any software and/or hardware developed.

The industrial placement is assessed by a combination of written report, viva, learning journal and 2 employer evaluations. The first employer evaluation takes place a few months into the placement and the second takes places shortly before the end of the placement. Each evaluation involves employer and student jointly setting appropriate objectives within a structured framework of categories; progress is later measured against these objectives using set marking criteria.

How is the programme structured?

Please specify the full time and part time programme diets (if applicable). Please also outline the QMUL Model arrangements for each year of study. The description should be sufficiently detailed to fully define the structure of the diet.

Year 1 Modules
Semester 1
ECS401U Procedural Programming (15 credits)
ECS427U Professional and Research Practice (15 credits)
MTH4100 Calculus I (15 credits)
MTH4113 Numbers, Sets and Functions (15 credits)
Semester 2
ECS414U Object Oriented Programming (15 credits)
ECS421U Automata and Formal Languages (15 credits)

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MTH4101 Calculus II (15 credits)
MTH4116 Vectors and Matrices (15 credits)
Year 2 Modules
Semester 3
ECS505U Software Engineering (15 credits) (pre requisite for ECS506U)
MTH4107 Introduction to Probability (15 credits)
MTH5112 Linear Algebra I (15 credits)
Plus one module from:
ECS519U Database Systems (15 credits) (pre requisite for ECS650U)
ECS529U Algorithms and Data Structures (15 credits)
Semester 4
ECS506U Software Engineering Project (15 credits) (pre requisite ECS505U)
Plus one module from:
MTH4104 Introduction to Algebra (15 credits)
MTH4116 Probability and Statistics I (15 credits) (pre requisite for MTH5129)
Plus one module from:
ECS518U Operating Systems (15 credits)
ECS522U Graphical User Interfaces (15 credits)
ECS524U Internet Protocols and Applications (15 credits
Plus one module from:
MTH5100 Algebraic Structures I (15 credits)
MTH5103 Complex Variables (15 credits)
Third Year Modules
Semester 1 and 2
ECS550U Industrial Placement Project (30 credits)
Final Year Modules
Semester 5
ECS635U Project (30 credits)
ECS651U Computability, Complexity and Algorithms (15 credits)
Plus two modules from:
ECS610U Computer Graphics (15 credits)
ECS639U Web Programming (15 credits)
ECS640U Big Data Processing (15 credits)
ECS650U Semi-Structured Data and Advanced Data Modelling (15 credits) (pre requisite ECS519U)
MTH5123 Differential Equations (15 credits)
MTH5129 Probability and Statistics II (15 credits) (pre requisite MTH4116)
MTH6109 Combinatorics (15 credits)
MTH6140 Linear Algebra II (15 credits)
Semester 6
ECS635U Project (30 credits cont'd)
Plus two or three modules from:
ECS605U Image Processing (15 credits)
ECS612U Interaction Design (15 credits)
ECS629U Artificial Intelligence (15 credits)
ECS637U Digital Media and Social Networks (15 credits)
ECS641U Communicating and Teaching Computing (UAS) (15 credits)
ECS647U Bayesian Decision and Risk Analysis (15 credits)
ECS655U Security Engineering (15 credits)
ECS656U Distributed Systems (15 credits)
MTH6108 Coding Theory (15 credits)
MTH6128 Number Theory (15 credits)
If selecting two from above may also take one module from (if not taken Year 2)
MTH5100 Algebraic Structures I (15 credits)
MTH5103 Complex Variables (15 credits)

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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	QMUL Model
Procedural Programming	ECS401U	15	4	Compulsory	1	Semester 1	
Professional and Research Practice	ECS427U	15	4	Compulsory	1	Semester 1	Yes
Calculus I	MTH4100	15	4	Compulsory	1	Semester 1	
Numbers, Sets and Functions	MTH4113	15	4	Compulsory	1	Semester 1	
Object Oriented Programming	ECS414U	15	4	Compulsory	1	Semester 2	
Automata and Formal Languages	ECS421U	15	4	Compulsory	1	Semester 2	
Calculus II	MTH4101	15	4	Compulsory	1	Semester 2	
Vectors and Matrices	MTH4115	15	3	Compulsory	1	Semester 2	

Academic Year of Study FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Software Engineering	ECS505U	15	5	Compulsory	2	Semester 1	
Introduction to Probability	MTH4107	15	4	Compulsory	2	Semester 1	
Linear Algebra I	MTH5112	15	5	Compulsory	2	Semester 1	
Database Systems	ECS519U	15	5	Elective	2	Semester 1	
Algorithms and Data Structures	ECS529U	15	5	Elective	2	Semester 1	

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Software Engineering Project	ECS506U	15	5	Compulsory	2	Semester 2	Yes
Introduction to Algebra	MTH4104	15	4	Elective	2	Semester 2	
Probability and Statistics I	MTH4116	15	4	Elective	2	Semester 2	
Operating Systems	ECS518U	15	5	Elective	2	Semester 2	
Graphical User Interfaces	ECS522U	15	5	Elective	2	Semester 2	
Internet Protocols and Applications	ECS524U	15	5	Elective	2	Semester 2	
Algebraic Structures I	MTH5100	15	5	Elective	2	Semester 2	
Complex Variables	MTH5103	15	5	Elective	2	Semester 2	

Academic Year of Study FT - Year 3

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Industrial Placement Project	ECS550U	30	5	Core	3	Semesters 1 & 2	

Academic Year of Study FT - Year 4

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Project	ECS635U	30	6	Core	4	Semesters 1 & 2	
Computability, Complexity and Algorithms	ECS651U	15	6	Compulsory	4	Semester 1	
Computer Graphics	ECS610U	15	6	Elective	4	Semester 1	

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Web Programming	ECS639U	15	6	Elective	4	Semester 1	
Big Data Processing	ECS640U	15	6	Elective	4	Semester 1	
Semi-Structured Data and Advanced Data Modelling	ECS650U	15	6	Elective	4	Semester 1	
Differential Equations	MTH5123	15	5	Elective	4	Semester 1	
Probability and Statistics II	MTH5129	15	5	Elective	4	Semester 1	
Combinatorics	MTH6109	15	6	Elective	4	Semester 1	
Linear Algebra II	MTH6140	15	6	Elective	4	Semester 1	
Image Processing	ECS605U	15	6	Elective	4	Semester 2	
Interaction Design	ECS612U	15	6	Elective	4	Semester 2	
Artificial Intelligence	ECS629U	15	6	Elective	4	Semester 2	
Digital Media and Social Networks	ECS637U	15	6	Elective	4	Semester 2	
Communicating and Teaching Computing (UAS)	ECS641U	15	6	Elective	4	Semester 2	
Bayesian Decision and Risk Analysis	ECS647U	15	6	Elective	4	Semester 2	
Security Engineering	ECS655U	15	6	Elective	4	Semester 2	
Distributed Systems	ECS656U	15	6	Elective	4	Semester 2	
Coding Theory	MTH6108	15	6	Elective	4	Semester 2	
Number Theory	MTH6128	15	6	Elective	4	Semester 2	
Algebraic Structures I	MTH5100	15	5	Elective	4		

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Complex Variables (15 credits	MTH5103	15	5	Elective	4	Semester 2	

What are the entry requirements?

Further information about the entry requirements for this programme can be found at:

http://www.eecs.qmul.ac.uk/undergraduates/entry-requirements/

How will the quality of the programme be managed and enhanced?

EECS has a Student Experience Teaching Learning and Assessment (SELTA) structure which enables programmes to be both managed and enhanced.

The Structure allows for subject level teaching groups and programme coordinators to regularly evaluate the content and delivery of each programme. Feedback from module evaluations and SSLC meetings are fed into these groups and this provides an opportunity for student feedback to be incorporated into the programmes.

Additionally, programme coordinators work with the Director of Taught Programmes to ensure each programme is current and can be delivered effectively.

How do we listen to and act on your feedback?

The Student-Staff Liaison Committee provides a formal means of communication and discussion between the School and its students. The committee consists of student representatives from each cohort, together with appropriate representation from School staff. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Student-Staff Liaison Committees meet four times a year, twice in each teaching semester.

Each semester, students are invited to complete a web-based module questionnaire for each of their taught modules, and the results are fed back through the SSLC meetings. The results are also made available on the student intranet, as are the minutes of the SSLC meetings. Any actions necessary are taken forward by the relevant Senior Tutor, who chairs the SSLC, and general issues are discussed and actioned through the School's Student Experience Learning Teaching And Assessment (SETLA) Committee .

The School's SETLA Committee advises the Director of Taught Programmes 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, including through student membership and consideration of student surveys and module questionnaires.

The School participates in the College's Annual Programme Review process, which supports strategic planning and operational issues for all undergraduate and taught postgraduate programmes. The APR includes consideration of the School's Taught Programmes Action Plan, which records progress on learning and teaching related actions on a rolling basis. Students' views are considered in the APR process through analysis of the NSS and module questionnaires, among other data.

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What academic support is available?

All students are assigned an academic adviser during induction week. The adviser's role is to guide advisees in their academic development including module selection and to provide first-line pastoral support.

In addition, the School has a Senior Tutor for undergraduate students who provides second-line guidance and pastoral support as well as advising staff on related matters.

The School also has a Student Support Officer who is the first point of contact regarding all matters.

Every member of Teaching Staff holds 2 open office hours per week during term time.

The year in industry is supported by a dedicated Industrial Placements Manager.

Programme-specific rules and facts

Further information on the Academic Regulations can be found at http://www.arcs.qmul.ac.uk/media/arcs/policyzone/academic/Academic-Regulations-2017-18.pdf

In addition to this the programme does have special regulations (further details are available in the Academic Regulations):
1. There is a requirement for students to achieve a minimum mark of 30.0 in every module, and to pass the project outright (in addition to the standard award rules) in order to achieve the intended, accredited, award.
2. The exit award and the field of study of the exit award will be dictated by the specific modules passed and failed by a student.

Specific support for disabled students

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 School has a wide range of industrial contacts secured through research projects and consultancy, our Industrial Experience programme and our Industrial Advisory Panel.

The Industrial Advisory Panel works to ensure that our programmes are state-of-the-art and match the changing requirements of this fast-moving industry. The Panel includes representatives from a variety of Computer Science oriented companies ranging from SMEs to major blue-chips. These include: Microsoft Research, IBM, The National Physical Laboratory, National Instruments, PA Consulting, Rohde and Schwarz, O2, Cisco Systems, ARM, Selex and BAE Systems.

Recent graduates have found employment as IT consultants, specialist engineers, web developers, systems analysts, software designers and network engineers in a wide variety of industries and sectors. A number of students also go on to undertake PhDs in electronic engineering and computer science. Merril Lynch, Microsoft, Nokia, Barclays Capital, Logica,, Credit Suisse, KPMG,

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Transport for London, Sky and Selex ES are among the organizations that have recently employed graduates of EECS programmes. Transferable skills are developed through a variety of means, including embedding of QM Graduate Attributes in taught modules and the project, together with the opportunity to participate in extra-curricular activities, e.g. the School's E++ Society, the School's Annual Programming Competition and external competitions with support from the School.

Programme Specification Approval

Person completing Programme Specification:	Rupal Vaja
Person responsible for management of programme:	Tassos Tombros
Date Programme Specification produced / amended by School / Institute Learning and Teaching Committee:	29 Jan 2018
Date Programme Specification approved by Taught Programmes Board:	

Queen Mary University of London