Programme Specification (UG)

Awarding body / institution:	Queen Mary University of London + Beijing University of Posts and Telec
Teaching institution:	QMUL + BUPT
Name of final award and programme title:	BSc Information and Computational Science
Name of interim award(s):	
Duration of study / period of registration:	4 years
QMUL programme code / UCAS code(s):	I4EE
QAA Benchmark Group:	Computing
FHEQ Level of Award :	Level 6
Programme accredited by:	
Date Programme Specification approved:	17 July 2024
Responsible School / Institute:	Faculty of Science and Engineering

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

School of Electronic Engineering & Computer Science

School of Mathematical Sciences

School of Physical and Chemical Sciences

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

BUPT

Programme outline

The Information and Computational Science programme is intended to respond to a rapidly growing demand in the industry for graduates with a high level of training in the mathematics and computational background of dealing with data. The programme aims to achieve an in-depth integration of mathematics, information science, computer science and data science, enabling graduates to engage in industrial developments and research in these areas.

Students on this programme benefit from the combined expertise from BUPT and QMUL in the core areas of information and computational science. This allows graduates to negotiate a rapidly evolving world, and address problems from the perspective of designers and makers, not merely users, of information and computational technologies. The programme incorporates research informed teaching in which students will be involved with the latest and future technologies in computational and information science. In addition, the programme will also include the key skills aspects already incorporated into the other

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QMUL-BUPT JEI programmes that were specifically commended by the QAA.

Aims of the programme

Information and computational science is the driving force behind today's most successful businesses. In our data-driven economy, companies are seeking highly numerate information experts who can use computational and statistical techniques and the latest technologies to extract information from data to inform every aspect of their strategy and operations. The aim of this programme is to allow students to gain expertise and experience in these areas with a particular emphasis on data science. The proposed programme will provide a thorough grounding in the core mathematical principles of information and data science, along with real world applications, including some more specialised topics.

These skills will open a host of career opportunities to students in the research sector, public service, industry and commerce that require or seek out specialist knowledge and skills.

Overall, the programme is a mixture of applied fundamental and specialised modules. The programme will provide students with:
- an understanding of the major theories, principles and concepts of information and computational science
- a familiarity with some of the routine materials, techniques and practices of current data analytics as practiced in industry and research
- the required skills for the gathering, basic and advanced analysis, and presentation of analysis of data, ideas, concepts and conclusions, including the use of standard tools in data analytics.
- the ability to apply their skills to real-world problems in a wide range of different contexts .

What will you be expected to achieve?

In this degree programme we place strong emphasis not only on the technical content of our modules, such as mathematics, coding and software engineering, but also on cross disciplinary skills vital for a computational scientist to be effective in the workplace. We embed these skills in the technical modules on the programme, to ensure that the technical knowledge and understanding works as you progress through your degree, and to allow you to graduate with skills you can apply to a range of future careers or higher-level study. We have mapped our programme to a range of graduate attributes that we would like you to develop, within the areas of creativity, resilience, communication, technical and professional practice in order to produce well-rounded, interested and highly employable graduates.

The programme will develop concepts and disciplinary skills related to the academic content and Graduate Attributes, which are listed below in the Attributes section. Over the duration of your programme you will develop the tools to recognise and record your development in these areas.

The programme's Graduate Attributes were developed in consultation with industrial partners, and are divided into five areas as follows.

Resilience (R1-R3)
In your studies and career there may be times where things do not go exactly how you planned. Being resilient is all about your ability to cope with setbacks and criticism, motivate yourself to overcome obstacles, and stay calm under pressure. You might explore your resilience when reflecting on how you have adapted to a problem-based learning exercise as part of your programme or attend workshops that explore the importance of this skill for your personal and professional development.

Creativity (Cr1 – Cr4)
As a computational scientist you will need to identify real-world problems and design creative approaches to solve them. You may develop your critical thinking abilities when reviewing complex, and sometimes controversial information from sources, or showcase your creativity by developing innovative design approaches in (computer) laboratory and practical work.

Communication (Co1 – Co4)
Good communication skills are important not only for helping you to express your own ideas but to listen and provide feedback

to others. You will be asked to show your ability to communicate information both verbally, in writing and using other digital technologies to a range of audiences, in both individual and group situations.

Professional Practice (P1 – P5)
From learning about effective ways to manage projects to considering the commercial aspects of developing a new product, you will need a range of knowledge and tools for future success in industry and research. You will be able to practise project management approaches through practical work in your modules. You will also be introduced to topics such as intellectual property and research ethics.

Technical (T1 – T4)
The fundamental practical attributes important for scientific/engineering careers from computational techniques to the analysis and risk assessment of systems and approaches are included in this area. Design projects will test your ability to analyse a complex problem, select appropriate computational techniques to help solve your specific challenge, and use statistics to understand the risks and uncertainty associated with your planned design. You will be introduced to computer programming software through taught modules and use your knowledge to interpret and model large amounts of data as part of practical assignments and projects.

We have further mapped the programme learning outcomes onto the Engineering Council's outcomes, which are indicated by the "EngC" labels below.

Please note that the following information is only applicable to students who commenced their Level 4 studies in 2017/18, or 2018/19

In each year of undergraduate study, students are required to study modules to the value of at least 10 credits, which align to one or more of the following themes:

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

These modules will be identified through the Module Directory, and / or by your School or Institute as your studies progress.

Academic Content:	
A 1	Apply knowledge of mathematics, statistics, natural science, computer science and engineering principles to the solution of complex problems. Some of the knowledge will be at the forefront of the particular subject of study. [EngC1]
A 2	Select and apply appropriate computational and analytical techniques to model complex problems, recognising the limitations of the techniques employed. [EngC3]
A 3	Select and evaluate technical literature and other sources of information to address complex problems. [EngC4]
A 4	Design solutions for complex problems that meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards. [EngC5]
A 5	Apply an integrated or systems approach to the solution of complex problems. [EngC6]

A 6	Evaluate the environmental and societal impact of solutions to complex problems and minimise adverse impacts. [EngC7]
A 7	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct. [EngC8]

Disciplinary Skills - able to:	
B 1	Adopt a holistic and proportionate approach to the mitigation of security risks. [EngC10]
B 2	Adopt an inclusive approach to science and engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion. [EngC11]
B 3	Select and apply appropriate technologies and processes, recognising their limitations. [EngC13]
B 4	Discuss the role of quality management systems and continuous improvement in the context of complex problems. [EngC14]

Attributes:	
C 1	Adapt to changes in the face of adversity and an appreciation of how this feeds into lifelong learning. [R1/EngC18]
C 2	Identify and appreciate the skills for personal and professional self-development. [R2/EngC18]
C 3	Persevere and sustain interest in long-term goals. [R3]
C 4	Evaluate complex or contradictory information, data and processes in order to make judgements and decisions. [Cr1/ EngC2]
C 5	Identify and solve real world problems, developing creative solutions with a full awareness of sustainability. [Cr2]
C 6	Apply creativity in product and systems design, incorporating different disciplinary and cultural perspectives. [Cr3]
C 7	Evaluate, model and improve a range of multifaceted systems. [Cr4]
C 8	Be effective in verbal communication, develop speaking and listening skills, and provide and receive constructive feedback. [Co1]
C 9	Convey complex technical, professional and other information in written form to suit a range of audiences. [Co2]
C 10	Use a range of digital technologies to facilitate effective verbal, graphical and visual communication of technical ideas with engineers, scientists, technicians and a lay audience. [Co3/EngC17]
C 11	Work effectively in a team, appreciating different team roles including leadership. [Co4/EngC16]
C 12	Use project management tools and develop skills to deliver projects in industry, research and elsewhere. [P1/EngC15]
C 13	Understand and comply with professional scientific ethics and codes of conduct. [P2]
C 14	Understand the importance of health and safety (H&S) from personal, professional and corporate responsibility viewpoints. [P3]

C 15	Have a working knowledge of intellectual property (IP) considerations and other commercial aspects of product development. [P4/EngC15]
C 16	Have a working knowledge and ability to comply with relevant regulatory frameworks and quality assurance processes. [P5/EngC15]
C 17	Plan, use and record data from laboratory techniques pertinent to the discipline of study. [T1/EngC12]
C 18	Evaluate risk and uncertainty using appropriate statistical methods applied to scientific and engineering problems and other evaluation methods. [T2/EngC9]

How will you learn?

All taught modules involve lectures, problem solving coursework, case studies and independent study. Many also have laboratory work, which for this degree includes coding, engineering/technical practical exercises as well as e.g. drawing and prototyping. 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. Laboratory work provides students with the guidance and help while solving a problem using a wide range of tools and techniques. This allows students to learn-by-doing in order to complement the lectures. QMUL Science and Engineering Graduate Attributes are available for all JEI students to identify students' attributes and develop students' knowledge, skills and behaviour that employers value.

How will you be assessed?

The assessment of most of the taught modules takes place through a written examination and practical coursework. Some modules also include in-class tests as a component in assessment, while others will be assessed entirely through project work.

The final year project is examined on the basis of a written report, a formal oral presentation, and a demonstration of the piece of software or hardware developed by the student. In addition to the final year project, other modules introduce project and critical group working skills necessary for working in industry after graduation.

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.

Most modules are shown with a value of 15 credits. This is to simplify the procedure to fit the QM system. The exception is Personal Development Plan (PDP) which is 1.8. Engineering Environment is a mix of QM and BUPT modules that does not have any specific credits but counts 5% towards the award of Honours and exists in all JEI programmes, with a slightly different mix depending on programme; PDP counts towards Engineering Environment but does not have any real credits by itself, although it is shown on the transcript.

In addition there are more modules than in a degree in London in order to satisfy Chinese requirements - the module load is not symmetrical across semesters as the technical modules are balanced with the Chinese compulsory modules not shown.
All modules are taught in English and every module must be passed for a degree to be awarded (Chinese regulations) - so are all shown as core.

The JEI programme has two parts: technical content and compulsory modules. The degree is awarded on the basis of the technical content, but the compulsory part must be passed to get a degree to comply with Chinese MoE requirements.

Only modules shown on the QM transcript counting towards the award of Honours are included; Chinese compulsory courses are not shown in detail, nor are short summer semester modules, but these must all be passed for the award of the degree so a pass/ fail module is included to allow that to be handled at QM.

Note that each module is assigned credits based on contact time; again these are Chinese requirements.

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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
Personal Development Plan & Entrepreneurial Skills 1	QHF3001	0	3	Core	1	Semester 2
Technical Language and Academic Study Skills I	QHF3004	15	3	Core	1	Semester 1
Advanced Algebra I	BHU3001	15	3	Core	1	Semester 1
Mathematical Analysis I	BHU3002	15	3	Core	1	Semester 1
Introduction to Computing and Programming	BHU3003	15	3	Core	1	Semester 1
Technical Language and Academic Study Skills II	QHF3005	15	3	Core	1	Semester 2
Mathematical Analysis II	BHU3004	15	3	Core	1	Semester 2
Advanced Algebra II	BHU3005	15	3	Core	1	Semester 2
Introduction to Data Science Programming	QHP4701	15	4	Core	1	Semester 2

Academic Year of Study FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Personal Development Plan & Entrepreneurial Skills 2	QHF4001	0	4	Core	2	Semester 1
Probability Theory and Mathematical Statistics	BHU4001	15	4	Core	2	Semester 1
Algorithms and Data Structures	BHU4002	15	4	Core	2	Semester 1
Ordinary Differential Equations	BHU4003	15	4	Core	2	Semester 1
Exploratory Data Analysis	QHP5701	15	5	Core	2	Semester 1

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Introduction to Artificial Intelligence	QHE4102	15	4	Core	2	Semester 2
Numerical Analysis	BHU4004	15	4	Core	2	Semester 2
Computer Networks	QHE4703	15	4	Core	2	Semester 2
Mathematical Modelling	BHU4005	15	4	Core	2	Semester 2
Matrix Theory and Method	BHU4007	15	4	Elective	2	Semester 2
Mathematical Foundations of Data Science	BHU4008	15	4	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
Personal Development Plan & Entrepreneurial Skills 3	QHF5001	0	5	Core	3	Semester 1
Principles of Machine Learning	QHM5703	15	5	Core	3	Semester 1
Fundamentals of DSP	QHE5107	15	5	Core	3	Semester 1
Database Systems	QHE5701	15	5	Core	3	Semester 1
Linear Programming and Games	QHM5701	15	5	Core	3	Semester 1
Blockchain	BHU5001	15	5	Core	3	Semester 2
Digital Image and Video Processing	QHEXXXX	15	5	Core	3	Semester 2
Deep Learning with Neural Networks	QHM6702	15	6	Core	3	Semester 2
Bayesian Statistics	QHM6703	15	6	Core	3	Semester 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Algorithmic Graph Theory	QHM6704	15	6	Core	3	Semester 2

Academic Year of Study FT - Year 4

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Project	QHM6706	30	6	Core	4	Semesters 1 & 2
Computability and Complexity	QHE6705	15	6	Core	4	Semester 1
Internet Finance	BHU6001	15	6	Elective	4	Semester 1
Big Data Modelling and Application	BHU6002	15	6	Elective	4	Semester 1
Data Mining	BHU6003	15	6	Elective	4	Semester 1
NoSQL Database Technology	BHU6004	15	6	Elective	4	Semester 1
Fundamentals of Information Theory	BHU6005	15	6	Elective	4	Semester 1
Mobile Internet	BHU6006	15	6	Elective	4	Semester 1
Mobile Communications	BHU6007	15	6	Elective	4	Semester 1
Network Storage Technology	BHU6008	15	6	Elective	4	Semester 1
Engineering Environment (Information and Computational Science)	BHU6009	15	6	Core	4	Semester 2
Chinese Compulsory Topics	BHU6010	15	6	Core	4	Semester 2

What are the entry requirements?

Pass the minimum entry requirements for BUPT. As a national key university, all entrants to BUPT must score above the top line in the Chinese national entrance examinations. In addition, BUPT's requirement is much higher than that and the level is approximately equivalent to the top 2-3% of the population in China of that age group.

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

The JEI operates an Academic Committee which is responsible under the contract and MoE licence for 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.

The JEI operates an Annual Programme Review and a tri-annual Extended Programme Review of the taught undergraduate provision. The process is normally organised with the Director and Co-Director of the JEI who responsible for the completion of the school's Annual Programme Reviews. Schools/institutes are required to produce a separate Annual Programme Review for undergraduate programmes using the relevant Undergraduate Annual Programme Review process. Students' views are considered in this process through analysis of the module evaluations and SSLC comments. In addition BUPT conducts a biannual review of all programmes.

The Student-Staff Liaison Committee (SSLC) provides a formal means of communication and discussion between QM and BUPT and JEI students. The committee consists of student representatives from each year in the JEI together with appropriate representation from staff within QM and BUPT. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. SSCLs meet twice a semester.

What academic support is available?

Induction and pastoral support is provided through BUPT. Students are organised into "classes" of 30 as in the usual Chinese model. Each class has a tutor who provides pastoral support. One male and one female tutor sleep on campus every night so there is 24/7 access to pastoral support.
Feedback mechanisms from students are: (i) directly to the lecturers (ii) to their tutor (as described above) and (iii) through an SSLC that meets twice a semester. Because of the large numbers of students, a separate SSLC is held for each cohort.
For every module, whether taught by QM or BUPT, formal office hour or tutorial slots are provided. In addition QM staff can give advice and supervision remotely using a variety of techniques including MS Teams, WeChat and Tencent Conference .

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

A specific disabled students support that complies with Chinese law is applied to this programme since the students are physically in China.

Programme-specific rules and facts

The Special Regulations for the JEI apply to this programme.

In Years 2 and 4 students will need to select one 15 credit elective module:
- Year 2 elective modules: BHU4006, BHU4007 and BHU4008. Students will select one of the 3 elective modules.
- Year 4 elective modules: BHU6001, BHU6002, BHU6003, BHU6004, BHU6005, BHU6006, BHU6007 and BHU6008. Students will select one of the 8 elective modules.

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Links with employers, placement opportunities and transferable skills

There is an Industrial Advisory Committee consisting of senior staff from the Chinese Industry. A dedicated Industrial Liaison Manager is part of the JEI team to develop links with industry and industrial projects, to ensure that projects are appropriate and to monitor their progress. A good industrial project provides excellent experience for an engineering undergraduate. There is a compulsory internship for all year 3 summer students and frequent invited industry lectures to year 3 and 4 students.

To date the JEI has a record of 100% employment or PG education. Most JEI graduates (>80%) continue to PG education, including directly PhD research.

Programme Specification Approval

Person completing Programme Specification:	Dr Jesus Requena Carrion
Person responsible for management of programme:	Dr Sebastian del Bano Rollin
Date Programme Specification produced / amended by School / Institute Learning and Teaching Committee:	14 June 2024
Date Programme Specification approved by Taught Programmes Board:	17 July 2024

Queen Mary University of London