Programme Title: BSc(Eng) Internet of Things Engineering

Programme Specification (UG)

Awarding body / institution:	Queen Mary University of London and Beijing University of Posts and Tele
Teaching institution:	Queen Mary University of London and Beijing University of Posts and Tele
Name of final award and programme title:	BSc(Eng) Internet of Things Engineering
Name of interim award(s):	
Duration of study / period of registration:	4 years
QMUL programme code / UCAS code(s):	H6NI
QAA Benchmark Group:	Engineering, but benchmarks subsumed by UKSPEC
FHEQ Level of Award :	Level 6
Programme accredited by:	Institution of Engineering and Technology
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:

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

Beijing University of Post and Telecommunications

Programme outline

This programme comes as a response to the increasing research and commercial interest for autonomous and intelligent applications that are based on the principles of the Internet of Things (IoT). This is a comprehensive programme covering all four layer structure which is needed for building complete IoT applications, such as smart grid, smart city, smart home, industrial automation, telemetry, etc.

The programme focuses on computer science's foundation and support, combined with other disciplines, such as microelectronics, communication networks and economics management. It emphasises on the necessary fundamental and practical knowledge for creating, designing, implementing, maintaining, and managing IoT systems. At the same time, it will keep pace with information industry's development in terms of course construction, and constantly adapting to social changes.

In addition to the technology, the programme will also include the key skills aspects already incorporated into the other JP programmes that were specifically commended by the QAA.

Aims of the programme

The programme sets out to provide graduates with:

- a solid fundamental knowledge about telecommunication and computer sciences;
- an understanding of network design and network planning principles for IoT;
- a knowledge of theory, methodology and techniques for IoT network assessment and evaluation;
- a good overall understanding of computer and telecoms network development skills.

This new interdisciplinary programme will provide graduates with a broader employment scope, covering the field of telecoms, computer science and related management.

What will you be expected to achieve?

At the end of his/her degree, each student should be able to demonstrate the following abilities:
• the ability to recall factual knowledge and the ability to apply it in familiar and unfamiliar situations;
• the ability to apply scientific, mathematical and software 'tools' to a familiar or unfamiliar situation;
• the ability to use Information Technology as a key tool pervading all aspects of Internet of Things;
• the ability to understand practical issues concerning real systems (whether hardware or software);
• the ability to recognise insufficient existing knowledge and the ability to search for the necessary scientific, mathematical and software 'tools' relevant to that particular issue;
• the ability to work as part of a team;
• the ability to manage time effectively;
• the ability to appreciate the financial background against which decisions are made in industry;
• the ability to show a certain level of reflection on the role of engineering in society;
and the following skills:
• the perceptive skills needed to understand information presented in the form of technical circuit-diagrams, flow-charts and high-level languages;
• the practical skills needed to implement a piece of hardware or software and to use laboratory test equipment;
• the analytical skills needed to verify the correct behaviour of a hardware or software system or component and to be able to identify faults;
• the design skills needed to synthesise a design (in hardware and/or software) from a specification (including the choice of the best option from a range of alternatives), to implement the design and to evaluate the design against the original specification;
• the written and oral communication skills needed to present information, in particular written information, effectively;
• the critical reasoning skills needed to appraise a particular topic;
• the ability to research and troubleshoot complex issues in such system systematically and communicate their conclusions clearly to specialist and non-specialist audiences.

Context-based aims and objectives:

• To be able to identify and apply the key communications principles (e.g. Shannon equations, queuing theory and information theory) for communications between devices, sensors, actuators and machines at any time in anywhere;
• To be able to use mathematics and statistics to systematic analysis hardware and software IoT systems e.g. use of complex numbers, matrix algebra, differential equations and transform theory to analysis and design the medium access and network routing protocols;
• To be able to apply relevant signal and information processing techniques to analyse and extract sensor information into useful representation for IoT applications;
• To be able to develop, provide and maintain IoT services, infrastructure and products for society, within the constraints imposed by economic, legal, social, cultural and environmental considerations;
• To be able to discuss the current and emerging concept e.g. cloud computing, Web and services middleware, for development of interaction IoT application;
• To be able to identify issues and requirements in the practice of IoT engineering activities, such as ethical issues and safety (e.g. hearing damage prevention);
• To be able to demonstrate the use of appropriate design methodology, programming tools and techniques necessary for structuring IoT applications;
• To be able to apply essential business management skills for managerial careers in IoT industry and other technology-driven companies at the global level.

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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	Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies.
A 2	Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems.
A 3	Understanding of engineering principles and the ability to apply them to analyse key engineering processes.
A 4	Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action.
A 5	Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems.
A 6	Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics.
A 7	Understanding of appropriate codes of practice and industry standards.
A 8	Awareness of quality issues and their application to continuous improvement.

Disciplinary Skills - able to:	
B 1	Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline.
B 2	Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques.
B 3	Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards.

B 4	Plan and manage the design process, including cost drivers, and evaluate outcomes.
B 5	Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal.
B 6	Ability to apply relevant practical and laboratory skills.
B 7	Knowledge of characteristics of particular materials, equipment, processes, or products.
B 8	Ability to work with technical uncertainty.
B 9	Understanding of, and the ability to work in, different roles within an engineering team.
B 10	Work with information that may be incomplete or uncertain and quantify the effect of this on the design.
B 11	Communicate their work to technical and non-technical audiences.

Attributes:	
C 1	Knowledge and understanding of the commercial, economic and social context of engineering processes.
C 2	Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering objectives.
C 3	Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate.
C 4	Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques.
C 5	Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct.
C 6	Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc).
C 7	Understanding of the use of technical literature and other information sources.
C 8	Knowledge of relevant legal and contractual issues.
C 9	Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues.

How will you learn?

All taught courses involve lectures, problem solving coursework, laboratory work, case study and independent study. 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 provide 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. QM Graduate Attributes are available for all JP students to identify students' attributes and develop students' knowledge, skills and behaviour that employers' value.

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How will you be assessed?

The assessment of the taught course units takes place through a written examination and practical coursework. Some courses also include in-class tests as a component in assessment.

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 group working skills.

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. EBU modules are actually 44 contact hours instead of 33 so should count for more than 15 credits; BBx modules use Chinese credits that do not map exactly to QM credits. 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 JP modules, 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 awarded (Chinese regulations) - so are all shown as core.

JP programme has two parts: technical content and compulsory courses. 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 unit is assigned credits based on contact time; again these are Chinese requirements.

Academic Year of Study FT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
English 1	BBC3914	15	3	Core	0	Semester 1
Advanced Mathematics 1	BBC4911	15	4	Core	0	Semester 1
Linear Algebra	BBC4913	15	4	Core	0	Semester 1
Personal Development Plan 1	EBC3001	5	3	Core	0	Semesters 1 & 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Computer Fundamentals and Programming	BBC3502	15	3	Core	0	Semester 1
English 2	BBC3923	15	3	Core	0	Semester 2
Introduction to Electronic Systems	BBC4102	15	4	Core	0	Semester 2
Advanced Mathematics 2	BBC4921	15	4	Core	0	Semester 2
Physics C	BBC4924	15	4	Core	0	Semester 2

Academic Year of Study FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Data Structure	BBU4208	15	4	Core	1	Semester 1
Signals and Systems	EBU4375	15	4	Core	1	Semester 1
Discrete Mathematics	BBC4114	15	4	Core	1	Semester 1
Fundamental Communication Skills	BBC4105	15	4	Core	1	Semester 1
Digital Circuit Design	EBU4202	15	4	Core	1	Semester 2
Database	EBU5602	15	5	Core	1	Semester 2
Probability Theory + Stochastic Statistics	BBC4941	15	4	Core	1	Semester 2
Introductory Java Programming	EBU4201	15	4	Core	1	Semester 2
IoT Product Development and Management	EBU5607	15	5	Core	1	Semester 2
Personal Development Plan 2	EBC4001	5	4	Core	1	Semesters 1 & 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Introduction to Internet of Things	BBC5200	15	5	Core	1	Semester 1

Academic Year of Study FT - Year 3

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Personal Development Plan 3	EBC5001	5	5	Core	2	Semesters 1 & 2
Sensors and Radio Frequency Identification	BBC6408	15	6	Core	2	Semester 2
Networks and Protocols	EBU5504	15	5	Core	2	Semester 1
Control Theory	EBU6503	15	6	Core	2	Semester 1
Ad hoc Networks	EBU5211	15	5	Core	2	Semester 1
Wireless Sensor Networks	BBC6406	15	6	Core	2	Semester 2
Software Engineering	EBU6304	15	6	Core	2	Semester 2
Microprocessors for Embedded Computing	EBU5476	15	5	Core	2	Semester 2
Operating System	BBC5204	15	5	Core	2	Semester 1
Middleware	EBU6501	15	6	Core	2	Semester 1

Academic Year of Study FT - Year 4

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Project	BBC6521	30	6	Core	3	Semesters 1 & 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Engineering Environment (IoT)	EBC6012		6	Core	all years	Semesters 1-3
Chinese Compulsory Topics	BBF7000		7	Core	all years	Semesters 1-3
Cloud Computing	EBU7501	15	7	Core	3	Semester 1
Internet of Things Engineering Practice	BBC6201	15	6	Core	3	Semester 1
Security and Authentication	EBU7140	15	7	Core	3	Semester 1

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.

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

The Staff-Student Liaison Committee (SSLC) provides a formal means of communication and discussion between QM and BUPT and JP students. The committee consists of student representatives from each year in JP together with appropriate representation from staff within the 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.

The JP 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 JP operates an Annual Programme Review of the taught undergraduate provision. The process is normally organised with the Director and co-Director of JP 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.

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 Skype, MSN and the cloud-based Nefsis conferencing system.

Programme-specific rules and facts

The Special Regulations for the JP apply to this programme.

Specific support for disabled students

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

Links with employers, placement opportunities and transferable skills

There is an industrial advisory committee consisting of senior staff from the Chinese Telecommunications industry. A dedicated Industrial Liaison Manager is part of the JP 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 JP has a record of 100% employment or PG education.

In fact, most JP graduates (>80%) go on to PG education

Programme Specification Approval

Person completing Programme Specification:	Matthew Tang
Person responsible for management of programme:	Michael Chai
Date Programme Specification produced / amended by School / Institute Learning and Teaching Committee:	
Date Programme Specification approved by Taught Programmes Board:	