Programme Title: BSc(Eng) Internet of Things Engineering

Programme Specification (UG)

Awarding body / institution:	QMUL and Beijing University of Posts and Telecoms (BUPT)
Teaching institution:	QMUL and BUPT
Name of award and field of study:	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:

School of Electronic Engineering & Computer Science

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

Beijing University of Post and Telecommunications (BUPT)

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.

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Aims of the programme

The programme sets out 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 programming 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 apply AI techniques and data analytics techniques on IoT related 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, smart infrastructures, 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.

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	The theory, principles, concepts and methodologies that are fundamental to Internet of Things engineering. This LO is covered in many modules including programming and network related modules as well as IoT specific modules such as Introduction to IoT, Sensors and RFID, wireless Sensor Networks, and Cloud Computing etc, where students are introduced with different aspects of Internet of Things engineering.
A 2	The role of business processes in Internet of Things engineering and how that impact the technical development. This LO is covered in various modules like PDP and Entrepreneurial Skills and Innovation and Technology for Engineering. Students will be able to apply business process in the creation of IoT engineering content.
A 3	The knowledge and skills to design and development applications in the context of Internet of Things engineering, including understanding of some major examples in the society. This LO is covered in various modules including IoT Engineering Practice, and Smart Infrastructure and Data Analytics, where students apply knowledge and skills for Internet of Things systems, in different application areas.

Disciplinary Skills - able to:	
B 1	Analyse and solve technical problems effectively, both individually and as part of a team. This LO is covered in various modules, including Database Systems, Embedded system Design, Software Engineering, and Smart Infrastructure and Data Analytics, where student practice and refine their skills to analyse and resolve complex technical problems across diverse IoT engineering contexts.
B 2	Understand and apply technical project management techniques and skills. This learning outcome is covered in modules like Communication Skills, Personal Development Plan & Entrepreneurial Skills, Innovation and Technology for Engineering and Object-Oriented Programming.
B 3	Demonstrate awareness and understanding of the historical, social, professional, industrial and ethical context of Internet of Things engineering. This LO is covered in modules like Database Systems, Software Engineering, Embedded Systems Design and Smart Infrastructure and Data Analytics.

B 4	Operate a wide range of development hardwares and softwares, as well as testing and analytical equipment. This LO is covered in many modules that uses hardwares and softwares, including Object-Oriented Programming, Cloud Computing, Machine Learning, Embedded System Design, and Software Engineering etc.

Attributes:	
C 1	Connect information and ideas within the broader context of the discipline of Internet of Things engineering. This LO is covered in modules like Internet of Things Engineering Practice and Smart Infrastructure and Data Analytics, where students apply interdisciplinary knowledge to draw connections across IoT concepts, enhancing their ability to understand and address real-world challenges in the field.
C 2	Communicate technical details effectively to a variety of audiences, both through production of well-written technical reports and through oral presentation and/or demonstration. This LO is covered in modules like Communication Skills, Computer Fundamentals and Programming, Personal Development Plan & Entrepreneurial Skills, and Project, where students are expected to demonstrate their design or project findings to technical and non-technical audiences.
C 3	Engage critically with knowledge, taking responsibility for both personal and professional development. This LO is covered in modules like Personal Development Plan & Entrepreneurial Skills, and Project.
C 4	Manage time and prioritize tasks by working to strict deadlines while achieving clarity of communication, both with peers and with academic staff. This LO is covered in many modules that project type of assessment are involved, including Database Systems, Software Engineering, and Smart Infrastructure and Data Analytics.
C 5	Competent in the use of information/computer-based technology, and in the manipulation and analysis of quantitative data. This LO is covered in computer/programming related modules as well as data science related modules, including Computer Fundamentals and Programming, Object-Oriented Programming, AI Foundations and Applications, Machine Learning, and Smart Infrastructure and Data Analytics.

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 works 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/JEI students to identify students' attributes and develop students' knowledge, skills and behaviour that employers value.

How will you be assessed?

The assessment of the taught course units takes place through written examination papers and continuous assessment, in line with IET accreditation standard practice. Continuous assessment include practical coursework, group based projects and in-class tests.

The final year project is examined on the basis of a written report, a formal viva and project management performance throughout the project period. In addition to the final year project, various other modules include project and team-work.

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. EBx modules are normally 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. CBx modules are co-delivered by QM and BUPT. Personal Development Plan & Entrepreneurial Skills is

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marked as a Core module with no credits as it forms part of Engineering Environment which is a mix of QM and BUPT modules. Engineering Environment is worth 15 credits and counts 5% towards the award of Honours.

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 the core.

The 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.

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	EBC3002	0	3	Core	1	Semesters 1 & 2
New Horizons English 1	BBC4031	15	4	Core	1	Semester 1
Advanced Mathematics 1	BBC4911	15	4	Core	1	Semester 1
Linear Algebra	BBC4913	15	4	Core	1	Semester 1
Computer Fundamentals and Programming	BBC3502	15	3	Core	1	Semester 1
New Horizons English 2	BBC4032	15	4	Core	1	Semester 2
Introduction to Electronic Systems	BBC4102	15	4	Core	1	Semester 2
Advanced Mathematics 2	BBC4921	15	4	Core	1	Semester 2
Physics C	BBC4924	15	4	Core	1	Semester 2

Academic Year of Study FT - Year 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Personal Development Plan & Entrepreneurial Skills 2	EBC4002	0	4	Core	2	Semesters 1 & 2
Data Structures	BBC4108	15	4	Core	2	Semester 1
Discrete Mathematics	BBC4114	15	4	Core	2	Semester 1
AI Foundations and Applications	EBU4213	15	4	Core	2	Semester 1
Introduction to Internet of Things	BBC4200	15	4	Core	2	Semester 1
Digital Circuit Design	EBU4202	15	4	Core	2	Semester 2
Object-Oriented Programming	EBU4211	15	4	Core	2	Semester 2
Probability Theory and Stochastic Processes	BBC4941	15	4	Core	2	Semester 2
Database Systems	EBU5503	15	5	Core	2	Semester 2
Communication and Networks	EBU5212	15	5	Core	2	Semester 2
Communication Skills	BBC4104	15	4	Core	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	EBC5002	0	5	Core	3	Semesters 1 & 2
Operating systems	BBC5204	15	5	Core	3	Semester 1
Cryptography and Cyber Security	EBU6010	15	6	Core	3	Semester 1
Cloud Computing	EBU6502	15	6	Core	3	Semester 1

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Machine Learning	CBU5201	15	5	Core	3	Semester 1
Embedded System Design	EBU6470	15	6	Core	3	Semester 1
Sensors and Radio Frequency Identification	EBU6408	15	6	Core	3	Semester 2
Software Engineering	EBU5314	15	5	Core	3	Semester 2
Wireless Sensor Networks	BBC5416	15	5	Core	3	Semester 2
Innovation and Technology for Engineering	EBU5610	15	5	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
Smart Infrastructure and Data Analytics	EBU6504	15	6	Core	4	Semester 1
Internet of Things Engineering Practice	BBC6201	15	6	Core	4	Semester 1
Engineering Environment (IoT)	EBC6012	15	6	Core	4	Semester 1
Chinese Compulsory Topics	BBF6000	0	6	Core	4	Semester 1
Project	BBC6521	30	6	Core	4	Semesters 1 & 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 JP/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. All proposals for module and programme amendments are also reviewed by the TNE Education Committee before submission to Taught Programmes Board.

The JP/JEI conducts an Annual Programme Review of the taught undergraduate provision. The process is normally organised with the Director and co-Director of JP/JEI who submit to the JP/JEI Academic Committee and JP/JEI Steering Committee. The review report will also feed to the School's Annual Programme Review process. Students' views are considered in this process through analysis of the module evaluations and comments on SSLC meetings and student focus group meetings. In addition BUPT conducts a biannual review of all programmes.

The Staff-Student Liaison Committee (SSLC) provides a formal means of communication and discussion between QM and BUPT and JP/JEI students. The committee consists of student representatives from each year in JP/JEI 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 once a semester.

Two student focus group meetings are held each semester to collect and discuss students' concerns, problems, and suggestions. QM staff including JP/JEI Director, Director of Education, Director of Assessment, Directors of Programmes, Lecturers, Student Support Officer, Administrators attend the meeting and make sure each question raised by students is answered by the specific responsible department or staff. Regarding students' suggestions, if they are not fully discussed during the meeting, the relevant department/staff will explore further and respond back to students.

Minutes from SSLC and focus groups are circulated to all staff and students by the JP/JEI Student Support Officer.

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.

Feedback mechanisms from students are: (i) directly to the lecturers (ii) to their tutor (as described above), (iii) through an SSLC that meets once a semester and (iv) via Student Focus Group meetings held twice per 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, a formal office hour is provided during each teaching week. In addition QM staff give advice and supervision remotely using a variety of techniques, mainly using MS Teams.

From 2024/25, JP/JEI has launched a new Fresher to Thriver (F2T) Programme. It is designed to support first-year students in their smooth transition to university life. It takes a student-centered approach, integrating various elements to enrich the student experience. The primary focus is on providing tailored support that meets the specific needs of students.

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

Modules will be delivered to BUPT JP/JEI students at BUPT campuses. The learning outcomes for the module are clearly stated in the module descriptor. The teaching is normally delivered in person at BUPT campus. The lectures are not recorded but all electronic materials will be available on QMPlus, including the reading list. Tools such as SensusAccess will be used if necessary.

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 JP/JEI apply to this programme.

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Links with employers, placement opportunities and transferable skills

There are two Industrial Advisory Boards (IABs) ; One based in the UK and another one based in China. The IABs meet every year either in person, online or via correspondence. The meeting minutes of the two boards are available to each board.

We also have a dedicated Industrial Liaison Manager as part of the JP/JEI team to develop links with industry. There is a compulsory internship for all year 3 students to ZTE telecom centre. All JP/JEI students spend 2 weeks at a ZTE telecom training centre where they have access to a wide range of equipment including a variety of modern base stations, soft switches and a linking Synchronous Digital Hierarchy networks. The Queen Mary-BUPT Summer School is available mainly for second-year (Year 2) students taking place in London every year during the summer term. This optional two- to three-week programme features strong industry connections with Amazon Web Services (AWS). The programme is developed in collaboration between QMUL academic staff and input from AWS; the programme is led and taught by AWS accredited academic staff. Students in this Summer School will have access to AWS resources and training necessary for certification, which will be recorded on their QMUL transcripts, enhancing their employability and career prospects.

There are various other opportunities for students to enhance transferable skills such as the Year-2 Design and Build project, Design and Build Winter Hack (in London), JP/JEI Innovation Projects and competitions organised by BUPT in a variety of subjects. In addition, there will be frequent invited industry lectures to year 3and 4 students, primarily organised the JP/JEI Student Innovation Centre.

To date the JP/JEI has a record of nearly 100% employment or PG education. In fact, most JP/JEI graduates (>70%) go on to PG education.

Programme Specification Approval

Person completing Programme Specification:	Na Yao
Person responsible for management of programme:	Michael Chai
Date Programme Specification produced / amended by School / Institute Education Committee:	
Date Programme Specification approved by Taught Programmes Board:	

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