PROGRAMME SPECIFICATION (Taught Postgraduate)	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MSc
4	**Programme Title**	Embedded Systems and Internet of Things Electronic Engineering (exit award)
5	**Programme Code**	5134F 5468F (exit award)
6	**Programme Accreditation**	IET
7	**QAA Subject Benchmark(s)**	N/A
8	**FHEQ Level**	7
9	**Last updated**	May 2023

10 Programme Aims

The programme aims to:

- Provide an understanding of the concept and theories of interconnected Embedded Systems within a paradigm of Internet of Things (ES-IoT).
- Equip graduates with knowledge and experience of the enabling technologies, including the fundamental techniques required for an engineer, scientist or manager working in this field.
- Develop skills in the application of these techniques in the development of their constituent parts and the system as a whole.
- Promote sound scientific and engineering principles in the graduates' approach to professional work, and an understanding of the ethical and social dimensions of such work.
- Cover understanding and knowledge in both high-level architectural concepts and low-level implementation techniques, and both software and hardware systems. Graduates will have experience of the current state of the art of ES-IoT and will have demonstrated the ability to apply the principles and practices in tackling a significant technical problem; the solution typically demonstrates a soundly based vision of the direction of developments within ES-IoT field.
- Provide a good knowledge and practical experience of up to date tools and techniques related to the enabling technologies of ES-IoT. Graduates will be able to critically evaluate and test the embedded components, machine-to-machine networks and interconnected systems forming an application. They are expected to go on to employment in technical positions with ES-IoT related supplier industries and large-scale users; some graduates will pursue research careers.
- The programme aims to meet the descriptors, for a qualification at Masters (M) level, published by the Framework for Higher Education Qualifications in England, Wales and Northern Ireland

11 Learning Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, qualities, skills and other attributes in the following areas. .

Knowledge and Understanding

On completing the programme students should:

A1 The basis of Embedded Systems interconnected by means of an IoT framework and their enabling technologies.

A2 The scientific and engineering principles related to the enabling technologies.
A3 Embedded computer systems architecture and organization for mobile, real-time and distributed applications.
A4 Networking and communication systems theory and practice (inc. important issues such as security).
A5. Computer programming specific to Embedded Systems and IoT
A6. Important hardware issues related to Embedded Systems and IoT

Teaching and Learning Methods

Lectures are the main way of imparting knowledge and understanding (A1-A6). Practical classes feature prominently, which enhance understanding of hardware and programming (A3-A6). Students are expected to contribute to their own learning experience by independent study. They are provided with references to books which are categorised as *essential*, *recommended*, and *background* reading, as well as scientific papers and other learning materials including appropriate web URLs.

Assessment Strategy

Knowledge and understanding are assessed by means of closed and open book written examinations and coursework, including group and individual project reports (A1-A6).

Intellectual Skills

On completing the programme students should be able to:

B1. Conduct investigations using the technical and professional literature.
B2. Use and evaluate appropriate tools and techniques.
B3. Undertake critical evaluation (both theoretical and empirical) of alternative solutions.
B4. Formulate problems and identify suitable approaches to solving them.
B5. Reason abstractly about the structure and behaviour of Embedded Systems and networking solutions included in and forming the Internet of Things.

Teaching and Learning Methods

Most modules involve coursework and/or practicals, much of which involves problem solving skills (B4). This is especially so in the group and individual projects where students need to select, evaluate and apply appropriate tools and techniques (B2). Here and elsewhere students will need to investigate possible alternatives in the technical and professional literature (B1, B3), and to reason about computer systems (B5).

Assessment Strategy

Cognitive skills are assessed by a range of coursework (reports, design documents, etc.) (B1- B5).

Practical Skills

On completing the programme students should be able to:

C1. The design of Embedded Systems, machine to machine networks and IoT applications.
C2. The use of hardware and software systems and tools including CAD tools.
C3. The use of continuous and discrete mathematical tools.
C4. The use and provision of network information services.
C5. The use of programming languages.
C6. Analysis of system requirements and the production of system specifications.

Teaching and Learning Methods

All listed practical skills (C1-C6) feature prominently in all modules. In particular, two group projects (Reconfigurable Hardware Design, and Internet of Things and Sensor Networks) provide students experience of working within teams to engineer complex products (C1-C6). Practical mini-projects are included in Real-Time Embedded systems and Machine-to-Machine Technology IoT modules. An individual project requires students to develop a large product to a customer's

requirements (C1-C6). In all other modules, practicals and coursework are used to develop these skills (C1-C6).

Assessment Strategy

Subject-specific and professional skills are assessed by coursework (C1-C6).

Transferable/Key Skills

A successful student will be proficient in:

D1. Written communication.
D2. Problem solving.
D3. Interpersonal communication.
D4. Initiative.
D5. Oral presentation.
D6. Adaptability.
D7. Teamwork.
D8. Planning, organisation, and prompt delivery of results.
D9. Computer literacy and information literacy

The above covers the generic knowledge and understanding, subject/specific/professional skills, cognitive skills and key (transferable) skills of a 'typical' Masters level graduate, although for each individual student there will be variations depending on the dissertation.

Teaching and Learning Methods

Key skills feature throughout the programme; teamwork in the group projects (D7); oral presentation, interpersonal communication, and planning and organisation in the individual project module, as well as the group projects (D3, D5, D8); written communication in all modules, but especially in the individual project (D1); problem solving, initiative and adaptability are necessarily covered throughout the programme (D2, D4, D6, D9).

The strategy of the degree programme is to give a broad coverage of the subject of Embedded Systems and Internet of Things in taught modules, and then to provide specialisation in the individual project.

Assessment Strategy

Key (transferable) skills are assessed by both written and oral presentations (D1-D9). Teamwork in the group projects is assessed both by the module leader at team oral presentations and by group monitors (members of teaching staff) who attends group formal meetings (D5, D7).

12 Programme Curriculum, Structure and Features

Basic structure of the programme

The Programme is aimed at the award of MSc degree upon successful completion of all taught modules and the Individual Project.

This is a one year Programme, which starts in September and the students normally complete the last assignment by the end of August. The taught part of the programme takes place from September to June. The Programme has 180 credits, 160 credits of compulsory modules and 20 credits of optional modules. The optional modules are available in Semester 2; they use the compulsory modules as the baseline and expand either in the direction of reconfigurable hardware design (e.g. FPGA-based interfaces and accelerators) or in the field of wireless applications/features (biometrics and multimedia devices).

There are three modules in semester one with 60 total credits and three modules in semester two with 60 total credits. The project (60 credits) takes place in semesters 2 and 3, 10 credits in semester 2 and 50 credits in semester 3.

Key features of the programme (including what makes the programme distinctive)

The MPC Degree Programme includes only the full-time mode of studies and is normally completed within one year. This is an advanced programme with a strong emphasis on project work and self-directed learning. None of the material is taught at the undergraduate level.

A unique feature of this Programme is that it combines the subjects normally attributed to electronic design, networking and software engineering. Such a wide coverage reinforced with skills developed in the coursework and the Individual Project creates specialists capable to merge into a commercial design group with reduced in-house training. Relevance of this Degree Programme to the needs of modern industry is extremely high.

The optional modules add flexibility to the programme, catering to the needs of the engineers either in the field of hardware or software/system-level wireless embedded design.

The Programme combines leading research and teaching expertise in mobile communications and distributed computing from the School. The School is equipped with teaching and research facilities to deliver a high quality programme in this new multidisciplinary field. Large, state of the art teaching laboratories provide an opportunity for the next generation of technology and computing specialists to be educated using the latest ideas in interactive instruction. The course is delivered by staff from internationally recognised research groups with active projects in the relevant fields.

Programme regulations (link to on-line version)

-R5134F.pdf (ncl.ac.uk)

13 Support for Student Learning

Generic information regarding University provision is available at the following link.
Generic Information

14 Methods for evaluating and improving the quality and standards of teaching and learning

Generic information regarding University provision is available at the following link.
Generic Information

Accreditation reports
This programme is accredited by the Institute of Engineering and Technology until 2017-18; to be reapplied for accreditation in 2018-19.

Additional mechanisms

15 Regulation of assessment

Generic information regarding University provision is available at the following link.

Generic Information

In addition, information relating to the programme is provided in:
The University Prospectus: https://www.ncl.ac.uk/postgraduate/ Degree Programme and University Regulations: http://www.ncl.ac.uk/regulations/docs/

Please note. This specification provides a concise summary of the main features of the programme and of the learning outcomes that a typical student might reasonably be expected to achieve if she/he takes full advantage of the learning opportunities provided.