

## Programme Specification: Post Graduate Taught

### Academic Year 2021/22

#### 1. Course Summary

<b>Names of programme and award title(s)</b>	MSc Smart Energy Management Postgraduate Diploma Smart Energy Management Postgraduate Certificate Smart Energy Management
<b>Award type</b>	Taught Masters
<b>Mode of study</b>	Full-time
<b>Framework of Higher Education Qualification (FHEQ) level of final award</b>	Level 7
<b>Normal length of the programme</b>	1 year
<b>Maximum period of registration</b>	The normal length as specified above plus 3 years
<b>Location of study</b>	Keele Campus
<b>Accreditation (if applicable)</b>	n/a
<b>Regulator</b>	Office for Students (OfS)
<b>Tuition Fees</b>	<p><b>UK students:</b></p> <p>Full-time fee for 2021/22 is £9,000</p> <p>Part-time fee for 2021/22 is £4,950*</p> <p><b>International students:</b></p> <p>Full-time fee for 2021/22 is £16,500</p>

**How this information might change:** Please read the important information at <http://www.keele.ac.uk/student-agreement/>. This explains how and why we may need to make changes to the information provided in this document and to help you understand how we will communicate with you if this happens.

\* We reserve the right to increase fees in subsequent years of study by an inflationary amount. Please refer to the accompanying Student Terms & Conditions for full details. Further information on fees can be found at <http://www.keele.ac.uk/studentfunding/tuitionfees/>

#### 2. Overview of the Programme

The UK Industrial Strategy identifies "affordable energy and clean growth" as one of the key pillars of its development. This is set against a backdrop of an ageing power grid, increasing demands from the electrification of transport, and the increasing penetration of renewables to address climate change. Tackling this challenge requires the human capital trained to develop the next generation of energy management technologies and ensure the energy infrastructure is resilient to environmental and man-made threats.

The programme is aimed at developing an advanced knowledge of underlying principles and concepts of smart grid, enabling technologies of smart energy such as the Internet of Things (IoT), Big Data Analytics and Artificial Intelligence (AI), as well as cross-disciplinary issues such as sustainability. The programme will also develop and extend the practical skills that are necessary for the designing, building, and evaluation of smart

energy systems such as strategy management and consultancy skills.

Graduates from this programme should be able to undertake both development and management roles. The programme recognises the wide variety of potential destinations for students after completion of their programme and as such uses compulsory modules to deliver key skills and enable students to obtain the required knowledge.

### 3. Aims of the programme

The broad aims of the programme are to:

- deliver to the students knowledge which allows them to fully participate in the design, development and evaluation of smart energy management systems and appreciate a wide range of cross-cutting issues in sustainability and smart energy;
- provide students with the research and scholarship skills to undertake independent research and to develop smart applications with enabling technologies such as IoT and data analytics;
- develop critical, analytical and problem based learning skills;
- improve student's communication, numeracy, time management, self-management and professional development skills;
- develop student - centred independent active learning;
- foster skills for team working needed in the creation of modern systems.

The programme will be delivered in conjunction with the £15M SEND (Smart Energy Network Demonstrator) at Keele University. SEND centres on strong collaborations between Keele, Siemens and local SMEs with the aim to create Europe's first 'at scale' Smart Energy Network Demonstrator on Keele campus - a living laboratory where new smart energy, data analytics, and IoT technologies can be researched, developed and tested. As a result, there are paid industrial placement opportunities available to the students on this MSc programme<sup>[1]</sup>.

<sup>[1]</sup> International students who require a Tier 4 visa must check with the Immigration Compliance Team prior to commencing any type of work placement.

### 4. What you will learn

The intended learning outcomes of the programme (what students should know, understand and be able to do at the end of the programme), can be described under the following headings:

- Subject knowledge and understanding
- Subject specific skills
- Key or transferable skills (including employability skills)

On completion of the Masters programme, a successful student will be able to demonstrate:

#### ***Computing subject knowledge and understanding***

LO 1.1 An ability to evaluate the technical, societal and management dimensions of computer systems.

LO 1.2 A knowledge and understanding of advanced aspects of computer systems and their use.

LO 1.3 A combination of theory and practice, with practice being guided by theoretical considerations.

LO 1.4 In depth knowledge of the underlying discipline and/or applications.

LO 1.5 Mastery of the practical methodology of the relevant areas of computing, whether for general application in software development or in specialised applications relating to the storing, processing and communication of information.

LO 1.6 An understanding of, and attention to, the many and varied aspects of quality and security.

LO 1.7 An understanding of professional, legal, social, cultural and ethical issues related to computing and an awareness of societal and environmental impact.

#### ***Computing subject-specific skills***

LO 2.1 An ability to engage in a peer review process that involves the critical review of papers, software and proposals, coupled with positive advice for improvement and innovation.

LO 2.2 The ability to assess systems (which may include software, devices, people, and so on), to recognise the individual components and to understand their interaction, to improve systems, to replace them and to create them; this includes socio-technical systems such as those relevant to aspects of healthcare and also computing systems used in specialised applications such as bioinformatics, e-science, virtual environments,

financial services, and transport.

LO 2.3 Familiarity with codes of ethics and codes of practice specific to the specialism of the degree programme, relevant industrial standards and principles underpinning the development of high integrity systems (for safety, security, trust, privacy, and so on), while keeping in focus the benefits of, approaches to and opportunities offered by innovation.

LO 2.4 Entrepreneurship, which tends to involve acquiring resources to ensure the success of some technically sound endeavour.

LO 2.5 Translational skills which involve the necessary communication between technical and non-technical audiences.

### ***Smart Energy, Sustainability and Management Skills***

LO 3.1 An understanding of multi-vector smart energy systems.

LO 3.2 The ability to describe the engineering challenges associated with renewable energy and energy transition.

LO 3.3 An understanding of the role of ethical, economic and policy and political issues at the forefront of sustainable professional practice relevant to energy planning, waste management and environmental protection.

LO 3.4 The skill to evaluate and relate aspects of data related to climate change including resolution, feedbacks and uncertainties.

LO 3.5 Proficiency in communicating and explaining highly complex information related to climate change science effectively to both technical and lay audiences.

LO 3.6 The ability to critically evaluate the crucial relationship between information and strategy, for both formulation and implementation, and formulate strategic decisions that are crucial in particular situations.

LO 3.7 The ability to make practical use of the mainstream strategy concepts in simulated business situations, using relevant information.

### ***Generic (transferable) skills of the programme***

LO 4.1 The ability to set goals and identify resources for the purpose of learning.

LO 4.2 An ability to critically review the literature, which includes identifying all of the key developments in a particular area of study, critically analysing them and identifying limitations and avenues for further development or explanation.

LO 4.3 An ability to recognise and respond to opportunities for innovation.

LO 4.4 Leadership skills, which tend to be characterised by acquiring a vision (based on sound technical insights) coupled with the ability to encourage others to share in that vision and to ensure that this will not be to their detriment.

## **Keele Graduate attributes**

Engagement with this programme will enable you to develop your intellectual, personal and professional capabilities. At Keele, we call these our ten Graduate Attributes and they include independent thinking, synthesizing information, creative problem solving, communicating clearly, and appreciating the social, environmental and global implications of your studies and activities. Our educational programme and learning environment is designed to help you to become a well-rounded graduate who is capable of making a positive and valued contribution in a complex and rapidly changing world, whichever spheres of life you engage in after your studies are completed.

Further information about the Keele Graduate Attributes can be found here: <http://www.keele.ac.uk/journey/>

## **5. How is the programme taught?**

You will use a variety of learning tools in studying for this programme. The principal method for you to acquire knowledge is the use of formal lectures. These are supplemented by smaller group tutorials and practical sessions dependent on the topics being covered in the module. The formal learning opportunities are supplemented by self-study, using both provided material and also that which you research for yourself.

Formal lectures and self-study materials are used to introduce concepts. The smaller group tutorials and

practicals enable both consolidation of this material and an understanding of the practicalities of its application in a modern business environment. The tutorials and practicals achieve this aim by having the students apply the taught concepts to real world problems in a situation where individual progress can be monitored.

All first semester 15-credit taught modules, with the exception of one module delivered over two semesters, will normally be delivered in block mode, i.e. each of these modules will normally be delivered over a period of six consecutive weeks. In any week at most two block mode modules will be scheduled for delivery during the first semester. All taught modules in the second semester are currently delivered along the whole semester.

## 6. Teaching Staff

More information about the staff in the Schools teaching on the programme is available at:

School of Computing and Mathematics: <http://www.keele.ac.uk/scm/staff/>

School of Geography, Geology and the Environment: <https://www.keele.ac.uk/gge/ourpeople/>

Keele Business School: <https://www.keele.ac.uk/kbs/staff/>

The University will attempt to minimise changes to our core teaching teams, however, delivery of the programme depends on having a sufficient number of staff with the relevant expertise to ensure that the programme is taught to the appropriate academic standard.

Staff turnover, for example where key members of staff leave, fall ill or go on research leave, may result in changes to the programme's content. The University will endeavour to ensure that any impact on students is limited if such changes occur.

## 7. What is the structure of the programme?

An outline of the structure of the MSc Smart Energy Management Programme is given in the tables below.

Year	Compulsory	Optional		Electives	
		Min	Max	Min	Max
Level 7	105	75	75	0	0

## Module Lists

### *Level 7*

Compulsory modules	Module Code	Credits	Period
System Design & Programming	CSC-40044	15	Semester 1
The Internet of Things	CSC-40056	15	Semester 1
Smart Grid and the Energy Transition	ESC-40061	15	Semester 1
Research and Consultancy Skills	CSC-40050	15	Semester 2
Case Studies in Sustainability	ESC-40030	15	Semester 2
Climate Change Science	ESC-40060	15	Semester 2
Strategy and Information Management	MAN-40036	15	Semester 2

<b>Optional modules</b>	<b>Module Code</b>	<b>Credits</b>	<b>Period</b>
Distributed Intelligent Systems	CSC-40045	15	Semester 1
Data Analytics and Databases	CSC-40054	15	Semester 1
Industrial Placement	CSC-40035	60	Semester 3
MSc Project	CSC-40040	60	Semester 3

**Optional Modules:** Students must choose one of the two optional modules in Semester 1.

**MSc Project or Industrial Placement:**

Students either do a project or an industrial placement. Students wishing to do an industrial placement will have to apply for this and satisfy the selection criteria of the relevant industrial placement.

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**Learning Outcomes**

The table below sets out what students learn in the programme and the modules in which that learning takes place. Details of how learning outcomes are assessed through these modules can be found in module specifications.

***Level 7***

<b>Subject Knowledge and Understanding</b>	
<b>Learning Outcome</b>	<b>Module in which this is delivered</b>
An ability to evaluate the technical, societal and management dimensions of computer systems.	All modules
A knowledge and understanding of advanced aspects of computer systems and their use.	The Internet of Things - CSC-40056 Industrial Placement - CSC-40035 Smart Grid and the Energy Transition - ESC-40061 System Design & Programming - CSC-40044 MSc Project - CSC-40040
A combination of theory and practice, with practice being guided by theoretical considerations.	Industrial Placement - CSC-40035 MSc Project - CSC-40040 Smart Grid and the Energy Transition - ESC-40061 System Design & Programming - CSC-40044 The Internet of Things - CSC-40056
In-depth knowledge of the underlying discipline and/or applications.	Smart Grid and the Energy Transition - ESC-40061 Industrial Placement - CSC-40035 The Internet of Things - CSC-40056 System Design & Programming - CSC-40044 MSc Project - CSC-40040
Mastery of the practical methodology of the relevant area of computing, whether for general application in software development or in specialised applications relating to the storing, processing and communication of information.	Research and Consultancy Skills - CSC-40050 Smart Grid and the Energy Transition - ESC-40061 The Internet of Things - CSC-40056 Industrial Placement - CSC-40035 System Design & Programming - CSC-40044 MSc Project - CSC-40040
An understanding of, and attention to, the many and varied aspects of quality and security.	All modules
An understanding of professional, legal, social, cultural and ethical issues related to computing and an awareness of societal and environmental impact.	MSc Project - CSC-40040 Industrial Placement - CSC-40035 Strategy and Information Management - MAN-40036 Research and Consultancy Skills - CSC-40050 Case Studies in Sustainability - ESC-40030
An understanding of multi-vector smart energy systems	Smart Grid and the Energy Transition - ESC-40061
The ability to describe the engineering challenges associated with renewable energy and energy transition	Smart Grid and the Energy Transition - ESC-40061
An understanding of the role of ethical, economic and policy and political issues at the forefront of sustainable professional practice relevant to energy planning, waste management and environmental protection	Case Studies in Sustainability - ESC-40030

<b>Subject Specific Skills</b>	
<b>Learning Outcome</b>	<b>Module in which this is delivered</b>
An ability to engage in a peer review process that involves the critical review of papers, software and proposals, coupled with positive advice for improvement and innovation.	MSc Project - CSC-40040 Research and Consultancy Skills - CSC-40050 Industrial Placement - CSC-40035
The ability to assess systems (which may include software, devices, people, and so on), to recognise the individual components and to understand their interaction, to improve systems, to replace them and to create them; this includes socio-technical systems such as those relevant to aspects of healthcare and also computing systems used in specialised applications such as bioinformatics, e-science, virtual environments, financial services, and transport.	All modules
Familiarity with codes of ethics and codes of practice specific to the specialism of the degree programme, relevant industrial standards and principles underpinning the development of high integrity systems (for safety, security, trust, privacy, and so on), while keeping in focus the benefits of, approaches to and opportunities offered by innovation.	All modules
Entrepreneurship, which tends to involve acquiring resources to ensure the success of some technically sound endeavour.	Strategy and Information Management - MAN-40036 Research and Consultancy Skills - CSC-40050
Translational skills which involve the necessary communication between technical and non-technical audiences.	All modules
The skill to evaluate and relate aspects of data related to climate change including resolution, feedbacks and uncertainties	Climate Change Science - ESC-40060
Proficiency in communicating and explaining highly complex information related to climate change science effectively to both technical and lay audiences	Climate Change Science - ESC-40060
The ability to critically evaluate the crucial relationship between information and strategy, for both formulation and implementation, and formulate strategic decisions that are crucial in particular situations	Strategy and Information Management - MAN-40036
The ability to make practical use of the mainstream strategy concepts in simulated business situations, using relevant information.	Strategy and Information Management - MAN-40036

Key or Transferable Skills (graduate attributes)	
Learning Outcome	Module in which this is delivered
The ability to set goals and identify resources for the purpose of learning.	Research and Consultancy Skills - CSC-40050 MSc Project - CSC-40040 Strategy and Information Management - MAN-40036 Industrial Placement - CSC-40035
An ability to critically review the literature, which includes identifying all of the key developments in a particular area of study, critically analysing them and identifying limitations and avenues for further development or explanation.	MSc Project - CSC-40040 Research and Consultancy Skills - CSC-40050 Industrial Placement - CSC-40035
An ability to recognise and respond to opportunities for innovation.	All modules
Leadership skills, which tend to be characterised by acquiring a vision (based on sound technical insights) coupled with the ability to encourage others to share in that vision and to ensure that this will not be to their detriment.	Industrial Placement - CSC-40035 MSc Project - CSC-40040 Research and Consultancy Skills - CSC-40050

## 8. Final and intermediate awards

<b>Master's Degree</b>	180 credits	You will require 180 credits at Level 7. This must include credits in the modules CSC-40056, ESC-40061, ESC-40060 and MAN-40036 and either the MSc Project or Industrial Placement. The award of the Master's Degree may be at merit or distinction level based on the marks achieved.
<b>Postgraduate Diploma</b>	120 credits	You will require 120 credits at Level 7. This must include credits in the modules CSC-40056, ESC-40061, ESC-40060 and MAN-40036.
<b>Postgraduate Certificate</b>	60 credits	You will require 60 credits at Level 7. This must include credits in the modules CSC-40056, ESC-40061, ESC-40060 and MAN-40036.

## 9. How is the Programme Assessed?

The wide variety of assessment methods used on this programme at Keele reflects the broad range of knowledge and skills that are developed as you progress through the degree programme. Teaching staff pay particular attention to specifying clear assessment criteria and providing timely, regular and constructive feedback that helps to clarify things you did not understand and helps you to improve your performance. The following list is representative of the variety of assessment methods used on your programme:

- **Unseen examinations:** test a student's knowledge and understanding of computer science topics. Such examinations are of two hours in length and contain compulsory and possibly also optional questions.
- **Class tests:** these are taken during the course of a module, usually in a lecture slot. They are intended to assess a student's current understanding and subject knowledge in that module in a structured and focused manner. Some taught compulsory modules may have class tests as part of the assessment profile.
- **Coursework:** normally consists of regular short assignments designed to assess, in more depth than class tests, a student's knowledge and understanding of the programme material. Some of these assignments may be computer based; others take the form of individual reports, essays or group projects.
- **Short reports:** for which students are required to write up their own account of small group studies and discussions on particular topics.
- **Tutorial Participation,** whereby students may be asked to make contributions based on the subject material, either orally or as a written solution, sometimes in consultation with their peers.



- **Dissertations** are formal reports of work carried out by students undertaking a project. Projects involve the integration and application of theoretical knowledge and problem-solving skills to an identified programming need and/or research problem within the discipline. Dissertations describe product and process in extended detail.
- **Oral presentations and reports** assess a student's ability to communicate their knowledge and understanding, both visually and orally, to both general and academic audiences.

Marks are awarded for summative assessments designed to assess your achievement of learning outcomes. You will also be assessed formatively to enable you to monitor your own progress and to assist staff in identifying and addressing any specific learning needs. Feedback, including guidance on how you can improve the quality of your work, is also provided on all summative assessments within three working weeks of submission, unless there are compelling circumstances that make this impossible, and more informally in the course of tutorial and seminar discussions.

## 10. Accreditation

This programme does not have accreditation from an external body.

## 11. University Regulations

The University Regulations form the framework for learning, teaching and assessment and other aspects of the student experience. Further information about the University Regulations can be found at:

<http://www.keele.ac.uk/student-agreement/>

If this programme has any exemptions, variations or additions to the University Regulations these will be detailed in an Annex at the end of this document titled 'Programme-specific regulations'.

## 12. What are the typical admission requirements for the Programme?

See the relevant course page on the website for the admission requirements relevant to this programme:

<https://www.keele.ac.uk/study/>

## 13. How are students supported on the programme?

Support for student learning and welfare is provided in a number of ways.

- Module leaders and demonstrators are responsible for providing learning support on the individual modules. They also give feedback on all summative and formative assessment, from individual feedback on coursework to more general feedback on examinations.
- The members of academic staff in Computer Science and the School of Geography, Geology and the Environment operate an open-door policy whereby lecturers and tutors are happy to see and advise students at any reasonable time or by mutually convenient appointment. The Keele Business School operate on a student consulting hours policy and there are two hours per week when staff are available to see students without prior appointment. Meetings with KBS staff at other times are by prior arrangement via email.
- Every student enrolled on the Programme will be allocated a Personal Tutor who is responsible for reviewing and advising on the student's academic progress throughout their time on the Programme. Students should approach their personal Tutor, in the first instance, if they are experiencing issues with any part of the Programme.
- Personal Tutors also act as a first point of contact on any non-academic issues that may be affecting their learning and can also refer students to a range of specialist health, welfare and financial services coordinated by the Student and Support Development Services.
- There is an Independent Support Tutor from the School of Computing and Mathematics who is independent of the lecturing team delivering the modules and available to all students on the Programme. The role of the Independent Support Tutor is to provide general support for students, though they will deal specifically with attendance monitoring and the exceptional circumstances procedure.

## 14. Learning Resources

- There is a specialist teaching laboratory and associated workroom with equivalent configuration of machines, both of which are reserved for access by those studying postgraduate taught programmes in the School. All the systems available have software appropriate to the modules included in this programme, in addition to those provided as standard by the University.
- The relevant Programme Handbook will provide you with key information and guidance on structure, content and assessment.
- You may contact the Course Director and the MSc Administrator, or their substitutes, via e-mail at all times on weekdays and you may expect a response to your communications within 3 working days.

- You will have access to the Course Director and tutors by appointment.
- You will have access to material in the programmes' on-line learning resources.
- You will have access to Keele's Library Information Services on campus and via the Internet.

## 15. Other Learning Opportunities

Individual taught modules can be accessed as CPD (Continuing Professional Development) modules. These modules are open to people to attend who are not members of the student cohort studying on the programme.

## 16. Additional Costs

As to be expected there will be additional costs for inter-library loans and potential overdue library fines, print and graduation. We do not anticipate any further costs for this programme.

## 17. Quality management and enhancement

The quality and standards of learning in this programme are subject to a continuous process of monitoring, review and enhancement.

- The School Education Committee is responsible for reviewing and monitoring quality management and enhancement procedures and activities across the School.
- Individual modules and the programme as a whole are reviewed and enhanced every year in the annual programme review which takes place at the end of the academic year.
- The programmes are run in accordance with the University's Quality Assurance procedures and are subject to periodic reviews under the Internal Quality Audit (IQA) process.

Student evaluation of, and feedback on, the quality of learning on every module takes place every year using a variety of different methods:

- The results of student evaluations of all modules are reported to module leaders and reviewed by the Programme Committee as part of annual programme review.
- Findings related to the programme from the annual Postgraduate Taught Experience Survey (PTES), and from regular surveys of the student experience conducted by the University, are subjected to careful analysis and a planned response at programme and School level.
- Feedback received from representatives of students on the programme is considered and acted on at regular meetings of the Student Staff Voice Committee.

The University appoints senior members of academic staff from other universities to act as external examiners on all programmes. They are responsible for:

- Approving examination questions
- Confirming all marks which contribute to a student's degree
- Reviewing and giving advice on the structure and content of the programme and assessment procedures

Information about current external examiner(s) can be found here:

<http://www.keele.ac.uk/qa/externalexaminers/currentexternalexaminers/>

## 18. The principles of programme design

The programme described in this document has been drawn up with reference to, and in accordance with the guidance set out in, the following documents:

a. UK Quality Code for Higher Education, Quality Assurance Agency for Higher Education:

<http://www.qaa.ac.uk/quality-code>

b. QAA Subject Benchmark Statement for Master's Degrees in Computing, Quality Assurance Agency for Higher Education, 2019. [https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-computing-\(masters\).pdf](https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/subject-benchmark-statement-computing-(masters).pdf)

c. Keele University Regulations and Guidance for Students and Staff: <http://www.keele.ac.uk/regulations>

## Version History

### This document

**Date Approved:** 22 September 2021

### Previous documents

<b>Version No</b>	<b>Year</b>	<b>Owner</b>	<b>Date Approved</b>	<b>Summary of and rationale for changes</b>
1	2020/21	CLAIRE EVANS	08 June 2020	