PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MSc
4	**Programme Title**	Sustainable Chemical Engineering
5	**UCAS/Programme Code**	5031 F
6	**Programme Accreditation**	N/A
7	**QAA Subject Benchmark(s)**	Engineering
8	**FHEQ Level**	Level 7
9	**Date written/revised**	May 2023

10 Programme Aims

The MSc and Diploma in Sustainable Chemical Engineering was set up in 2002 to address the needs of industry in recruiting students of Chemical Science and Engineering with a broad based understanding of sustainable engineering practices. The course has been designed to meet the growing need for engineers and scientists skilled in materials and process engineering and process intensification. The programme aims:-

- To train graduates who understand industrial processes to be aware of the potential of process intensification in sustainable engineering and possess the ability to develop, research and implement the methodologies in an effective manner.

- To allow disciplinary conversion of engineers or pure or applied scientists into sustainable engineering, where the students have an understanding of the environmental, economic and social issues associated with the operation of industrial processes and the need for, an application of sustainable technologies.

- To develop and improve the student's key skills alongside their academic and technical abilities. These include the ability to communicate and present effectively both orally and in writing, to work alone or as part of a team.

The programme offers the opportunity to work with leading edge researchers in the fields of new energy technologies such as fuel cells and gasification, process intensification and new advanced materials.

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 Understanding of advanced process engineering and process intensification
A2 Understanding of modern approaches to pollution detection, control and remediation
A3 Advanced knowledge and understanding of the techniques that may used to minimise waste
A4 Understanding of the principles of clean energy production as well as knowledge of cleaner technologies.
A5 Advanced knowledge of new materials manufacture.
A6 An awareness of the environmental, economic and social pressures put upon industry and demonstration of the means to achieve a more sustainable business

Learning and Teaching Methods

Teaching Strategy

Specialist knowledge and understanding is primarily imparted via lectures classes and seminars. This is supplemented by the use of industrially based case studies and workshops, and lectures from industrialists and environmental consultants. Students are also strongly encouraged to attend locally arranged seminars and conferences such as those offered by the School of Chemical Engineering and Advanced Materials and by the Energy Institute and IChemE.

Learning Strategy

Students are expected to carry out directed reading and appropriate reading lists are given on all module outline forms.

Active involvement in case studies and workshops increases the student's awareness of the issues and concerns of both industry and the public. Discussion and participation in lectures given by outside speakers, and attendance at local conferences, give students an appreciation of the real issues facing industry today as well as the requirement for an effective communication strategy.

Assessment Strategy

Knowledge and understanding are assessed by formal and class examinations and coursework and preparation of a Dissertation (for MSc students only). Written unseen examinations include essays, short answer questions, equations and calculations. Assessed coursework comprises scientific/technical reports, design study calculations, essays, oral and video presentations and poster presentations.

The project element of the degree (MSc students only) is assessed by Dissertation together with a poster presentation to which all examiners and lecturers are invited. The external examiner will have the opportunity to view these and talk to some of the students.

Intellectual Skills

On completing the programme students should be able to apply:

B1 Analysis and problem solving skills in process intensification
B2 Experimental, research and design skills through original laboratory research in new energy systems, materials and process intensification.
B3 Creative and design skills in methods and planning of research.
B4 The ability to measure and monitor utilities, raw materials and waste arising during industrial processing and target strategies for reduction, reuse and recycle.
B5 The ability to appraise and assess data from a wide variety of sources and apply appropriate statistical techniques.

Teaching and Learning Methods

Teaching Strategy

An understanding of the requirements and implementation of process intensification and sustainable engineering practice are taught within the on process intensification, clean technology and sustainable engineering and more extensively through the student's time spent on their methodology and planning of research module and a precursor to their individual research projects. In addition the various approaches taken by industry and commerce in addressing issues of sustainable development in a business context are widely demonstrated by the visiting lecturers.
Energy Auditing, Monitoring and Targeting and data management skills are taught in the module Energy Management.

Learning Strategy

Students are given the opportunity to apply their acquired practical skills through class exercises and during their research projects (MSc students only).

Assessment Strategy

Specific understanding and application of the key skills is assessed through formal written examination, write ups of auditing exercises and the outcomes from the student research methodology and planning and research dissertation (MSc students only).

Practical Skills

On completing the programme students should be able to:

C1 critically assess the value and limitations of process intensification, cleaner technologies and waste minimisation options
C2 solve problems and to be aware of alternative solutions which will ensure a more sustainable future based on environmental protection, economic viability and social acceptance
C3 process data, seeing trends and patterns and relate this to other variables.

Learning and Teaching Methods

Teaching Strategy
Approaches to process intensification strategies are taught through the modules on Process Intensification.

Approaches to Advanced Process Engineering are taught through the Process Intensification.

Approaches to waste minimisation and the potential applications and limitations of cleaner technologies are taught in the modules: Sustainable Engineering, Sustainable design and manufacture, Stability and Sustainability of Materials.

The ability to solve problems and evaluate sustainable solutions, is addressed in a number of modules where case studies are used such as, Sustainable Engineering, Sustainable design and manufacture
Data processing skills are taught in Energy Management.

Learning Strategy
Problem solving skills are employed across all elements of the course.
Students learn to handle and process data through practical exercises involving energy auditing. Their projects give them many instances where they have to collect, collate and handle data from a variety of sources and apply appropriate statistical techniques.

Assessment Strategy

Assessment is by formal calculation/problem solving and essay style examinations, and coursework where the practical exercises and designs are written up. The ability to solve problems is a key element of case studies that form a large part of the course.

Transferable/Key Skills

On completing the programme students should be able to:
D1 communicate effectively and at all levels via written reports and oral presentations
D2 use library facilities and other sources of reference material
D3 organise their workload and meet deadlines.
D4 work efficiently and effectively either individually or in a team and where necessary to delegate or receive instruction.
D5 analyse and understand a problem.
D6 realise that there may be more than one solution to a problem and to select the most appropriate to meet sustainability requirements.

Learning and Teaching Methods

Teaching Strategy
The course can be taken by both science graduates and engineering graduates. For the former the programme offers a training module in fundamental process engineering in the first

semester to provide sufficient process engineering skills to meet the demands of the programme.

Students are given dedicated seminars during induction week and later in the course prior to starting their projects on report writing, use of library facilities and working effectively both alone and as part of a team. This is also detailed in the course handbook. Particular attention to the handling of group working and oral presentations is given during the modules Sustainable Engineering and Sustainable Design and Manufacture I.
The abilities to solve problems is covered in all case study based workshops and many coursework assignments and also using specific tools such as decision matrixes in Sustainable design and manufacture I The course handbook goes into detail on the requirements of Dissertation writing, group working, and avoidance of plagiarism.

Team work skills are discussed prior to the initiation of each workshop and through participation in modules involving group presentations. Students are also given a seminar organised specifically for them by the Careers Service on presentation and interview skills and another on writing CVs.

Learning Strategy
Communication skills are assessed throughout the course when students are required to give oral presentations both alone or as part of a team. Feedback on these is given to the students. Problem solving individually or working as part of team is covered in workshops and case studies. The ability to see another person's point of view and communicate effectively is addressed during the workshops where students are required to role play.

Assessment Strategy

Key skills are assessed for individual and groups presentations and joint and individual written reports. Presentations are marked on their content, style and overall oral skills.

12 Programme Curriculum, Structure and Features
Basic structure of the programme

The full-time programme of study begins annually at the start of Semester 1.

MSc candidates shall take modules to the value of 180 credits.

The programme of study begins annually in mid-September and the taught element of the course ends in May. Students then carry out a research project, submitted in mid-August which is usually based in the School and write a Dissertation of credit value of 60.

Diploma candidates shall take modules to the value of 120 credits. There are two optional modules which can be selected, with the approval of the Degree Programme Director and depending upon the academic background of the candidate.

Subject to satisfactory performance and with the approval of the degree examination board diploma candidates may transfer to the MSc after Semester 1.

Module CME8097 (Dissertation) is not taken by diploma candidates.

The basic premise of the course is that it puts sustainable development in a chemical and process engineering context. So topics such as sustainability, resource use and especially energy, are common threads which run throughout the course although there is more detail in specific modules. Several modules includes workshops where group investigative work is undertaken and the students can develop their groupwork, communication and presentations skills. All MSc students are offered a range of research projects, experimental, and theoretical from which they select a preferred field of study to investigate. Some of these may be based in industry. The project is written up as a dissertation. A curriculum map which showing the fit between modules and learning outcomes is shown in Table 1.

Programme regulations (link to on-line version)
5031F: -R5031F

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 learning and Teaching

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

Accreditation reports
Not applicable

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.