PROGRAMME SPECIFICATION	

1	**Awarding Institution**	Newcastle University
2	**Teaching Institution**	Newcastle University
3	**Final Award**	MSc / Postgraduate Diploma
4	**Programme Title**	Sustainable Chemical Engineering
5	**UCAS/Programme Code**	5031 / 3405
6	**Programme Accreditation**	N/A
7	**QAA Subject Benchmark(s)**	Engineering
8	**FHEQ Level**	Level 7
9	**Date written/revised**	May 2013

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 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.

- 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. The programme outcomes have references to the benchmark statements.

Knowledge and Understanding

On completing the programme students should:

1 Understanding of advanced process engineering and process intensification
2 Understanding of modern approaches to pollution detection, control and remediation
3 Advanced knowledge and understanding of the techniques that may used to minimise waste
4 Understanding of the principles of clean energy production as well as knowledge of cleaner technologies.
5 Advanced knowledge of new materials manufacture.
6 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 and where the external has the opportunity to talk to all of the students.

Intellectual Skills

On completing the programme students should be able to apply:

1. Analysis and problem solving skills in process intensification
2. Experimental, research and design skills through original laboratory research in new energy systems, materials and process intensification.
3. Creative and design skills in methods and planning of research.
4. Auditing skills for auditing.
5. The ability to measure and monitor utilities, raw materials and waste arising during industrial processing and target strategies for reduction, reuse and recycle.
6. 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:

1. critically assess the value and limitations of process intensification, cleaner technologies and waste minimisation options
2. 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
3. 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, Sustainable Processing Energy and Materials Technology.

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, e 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:

1 communicate effectively and at all levels via written reports and oral presentations
2 use library facilities and other sources of reference material
3 organise their workload and meet deadlines.
4 work efficiently and effectively either individually or in a team and where necessary to delegate or receive instruction.
5 analyse and understand a problem.
6 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. There are several optional modules which can be selected, with the approval of the Degree Programme Director and depending upon the academic background of the candidate.

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.

Candidates shall take the following compulsory modules:

(a) Chemical Engineers

CME8002	Sustainable Processing Energy and Materials Technology	10
CME8017	Modelling & Simulation	5
CME8019	Energy Management	10
CME8034	Nanomaterials	15
CME8037	Sustainable Design and Manufacture I	10
CME8038	Sustainable Industry	10
CME8043	Fuel Cells System I	10
CME8044	Fuel Cells System II	10
CME8097	Chemical Engineering for Sustainable Engineering Dissertation	60
CME8107	Process Intensification	10
SPG8007	Renewable Energy: Hydrogen and Fuel Cell Technology	10
SPG8008	Renewable Energy: Biomass and Waste Technology	10

All candidates shall take a further optional module to a value of 10 credits from the following:

CME8001	Occupational and Environmental Monitoring	5
CME8010	Pollution Monitoring	10
CME8012	Business and Environmental Management	10
CME8018	Air Pollution	5

(b) Non-Chemical Engineers

Candidates shall take the following compulsory modules:

CME8011	Basic Chemical Engineering	10
CME8017	Modelling and Simulation	5
CME8019	Energy Management	10
CME8034	Nanomaterials	15
CME8037	Sustainable Design and Manufacture I	10
CME8038	Sustainable Industry	10
CME8043	Fuel Cells System I	10

CME8044	Fuel Cells System II	10
CME8097	Chemical Engineering for Sustainable Engineering Dissertation	60
SPG8007	Renewable Energy: Hydrogen and Fuel Cell Technology	10
SPG8008	Renewable Energy: Biomass and Waste Technology	10

All candidates shall take further optional modules to a value of 20 credits from the following:

CME8001	Occupational and Environmental Monitoring	5
CME8010	Pollution Monitoring	10
CME8012	Business and Environmental Management	10
CME8002	Sustainable Processing Energy and Materials Technology	10
CME8018	Air Pollution	5
CME8009	Matlab Computing & Research Methodology	10
CME8035	Sustainable Design and Manufacture II	10

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 include s 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.

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

Programme regulations (link to on-line version)

MSc: http://www.ncl.ac.uk/regulations/programme/
Diploma: http://www.ncl.ac.uk/regulations/programme/

13 Criteria for admission

Criteria for Admission:
The programme is suitable for students with a good degree, (2:2 minimum or equivalent), in engineering or a pure or applied science subject. Students must also fulfil language requirements and provide satisfactory references.

Alternative entry qualifications
Students with a lesser qualification but relevant industrial experience may exceptionally be accepted on merit.

Admissions policy
On enquiry to the Course Director, or on receipt of application, a letter or email is sent with full details of the programme and a copy of the current year's handbook. Applicants are invited to visit the school and / or enter into correspondence with the Course Director should they need more information.

14 Support for Student Learning

The Student Services portal provides links to key services and other information is available at: http://www.ncl.ac.uk/students/

Induction
During the first week of the first semester students attend an induction programme. New students will be given a general introduction to University life and the University's principle support services and general information about the School and their programme, as described in the Degree Programme Handbook. New and continuing students will be given detailed programme information and the timetable of lectures/practicals/labs/ tutorials/etc. The International Office offers an additional induction programme for overseas students.

Study skills support
Students will learn a range of Personal Transferable Skills, including Study Skills, as outlined in the Programme Specification. Some of this material, e.g. time management is covered in the appropriate Induction Programme. Students are explicitly tutored on their approach to both group and individual projects.

Numeracy support is available through Maths Aid.

Help with academic writing is available from the Writing Centre.

Academic support
The initial point of contact for a student is with a lecturer or module leader, or their tutor (see below) for more generic issues. Thereafter the Degree Programme Director or Head of School may be consulted. Issues relating to the programme may be raised at the Staff-Student Committee, and/or at the Board of Studies.

Pastoral support
All students are assigned a personal tutor whose responsibility is to monitor the academic performance and overall well-being of their tutees. In addition the University offers a range of support services, including one-to-one counselling and guidance or group sessions/workshops on a range of topics, such as emotional issues e.g. Stress and anxiety, student finance and budgeting, disability matters etc. There is specialist support available for students with dyslexia and mental health issues. Furthermore, the Union Society operates a Student Advice Centre, which can provide advocacy and support to students on a range of topics including housing, debt, legal issues etc.

Support for students with disabilities
The University's Disability Support Service provides help and advice for disabled students at the University - and those thinking of coming to Newcastle. It provides individuals with: advice about the University's facilities, services and the accessibility of campus; details about the technical support available; guidance in study skills and advice on financial support arrangements; a resources room with equipment and software to assist students in their studies.

Learning resources
The University's main learning resources are provided by the Robinson and Walton Libraries (for books, journals, online resources), and Information Systems and Services, which supports campus-wide computing facilities.

All new students whose first language is not English are required to take an English Language Proficiency Test. This is administered by INTO Newcastle University Centre on behalf of Newcastle University. Where appropriate, in-sessional language training can be provided. The INTO Newcastle University Centre houses a range of resources which may be particularly appropriate for those interested in an Erasmus exchange.

15 Methods for evaluating and improving the quality and standards of learning and Teaching

Module reviews
All modules are subject to review by questionnaires which are considered by the Board of Studies. Changes to, or the introduction of new, modules are considered at the School Learning and Teaching Committee and at the Board of Studies. Student opinion is sought at the Staff-Student Committee and/or the Board of Studies. New modules and major changes to existing modules are subject to approval by the Faculty Learning, Teaching and Student Experience Committee.

Programme reviews
The Board of Studies conducts an Annual Monitoring and Review of the degree programme and reports to Faculty Learning, Teaching and Student Experience Committee.

External Examiner reports
External Examiner reports are considered by the Board of Studies. The Board responds to these reports through Faculty Learning, Teaching and Student Experience Committee. External Examiner reports are shared with institutional student representatives, through the Staff-Student Committee.

Student evaluations
All modules, and the degree programme, are subject to review by student questionnaires. Informal student evaluation is also obtained at the Staff-Student Committee, and the Board of Studies. The National Student Survey is sent out every year to final-year undergraduate students, and consists of a set of questions seeking the students' views on the quality of the learning and teaching in their HEIs. With reference to the outcomes of the NSS and institutional student satisfaction surveys actions are taken at all appropriate levels by the institution.

Mechanisms for gaining student feedback
Feedback is channelled via the Staff-Student Committee and the Board of Studies.

Faculty and University Review Mechanisms
The programme is subject to the University's Internal Subject Review process. Every five years degree programmes in each subject area are subject to periodic review. This involves both the detailed consideration of a range of documentation, and a two-day review visit by a review team which includes an external subject specialist in addition to University and Faculty representatives. Following the review a report is produced, which forms the basis for a decision by University Learning, Teaching and Student Experience Committee on whether the programmes reviewed should be re-approved for a further five year period.

Accreditation reports
Not applicable

Additional mechanisms

16 Regulation of assessment

Pass mark
The pass mark is 50 (Postgraduate programmes)

Course requirements

Progression is subject to the University's Masters Degree Progress Regulations, Taught and Research and Examination Conventions for Taught Masters Degrees. Limited compensation up to 40 credits of the taught element and down to a mark of 40 is possible and there are reassessment opportunities, with certain restrictions.

Common Marking Scheme
The University employs a common marking scheme, which is specified in the Taught Postgraduate Examination Conventions, namely:

Summary description applicable to postgraduate Masters programmes		**Summary description applicable to postgraduate Certificate and Diploma programmes**	
<50	Fail	<50	Fail
50-59	Pass	50 or above	Pass
60-69	Pass with Merit		
70 or above	Pass with Distinction		

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

Role of the External Examiner
An External Examiner, a distinguished member of the subject community, is appointed by Faculty Learning, Teaching and Student Experience Committee, after recommendation from the Board of Studies. The External Examiner is expected to:

- See and approve examination papers
- Moderate examination and coursework marking
- Attend the Board of Examiners
- Report to the University on the standards of the programme

In addition, information relating to the programme is provided in:

The University Prospectus (see http://www.ncl.ac.uk/undergraduate/ or http://www.ncl.ac.uk/postgraduate/

The University Regulations http://www.ncl.ac.uk/regulations/docs/)

The Degree Programme Handbook

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. The accuracy of the information contained is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Annex

Mapping of Intended Learning Outcomes onto Curriculum/Modules

Module	Codes	**Type**	**A1**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**B1**	**B2**	**B3**	**B4**	**B5**	**C1**	**C2**	**C3**	**D1**	**D2**	**D3**	**D4**	**D5**
Sustainable Processing Energy and Materials Technology	CME8002						X	X	X									X		X		
Matlab Computing & Research Methodology	CME8009										X								X	X	X	
Modelling & Simulation	CME8017				X					X				X			X	X		X	X	
Energy Management	CME8019				X		X				X	X	X				X	X	X	X		
Nanomaterials	CME8034				x			x	x			x	x				x	x	x			
Sustainable Design and manufacture 1	CME8037				X	X		X		X					X	X		X	X	X	X	X
Sustainable Industry	CME8038				X	X		X				X			X	X		X	X	X	X	X
Fuel Cell Systems I	CME8043						X	X	X	X	X	X	X	X		X	X	X		X		
Fuel Cell Systems II	CME8044																					
Basic Chemical Engineering	CME8011			X		X			X				X				X					
Dissertation	CME8097																					
Process Intensification	CME8107		X						X	X	X	X	X	X		X			X	X		
Renewable Energy: Hydrogen and Fuel Cell Technology	SPG8007				X		X	X	X	X	X				X	X		X		X		
Renewable Energy Biomass and Waste Technology	SPG8008				x		x	x	x	x	x	x	x	x		x	x	x		x		
Sustainable Design and manufacture 2	CME8035				X	X		X		X					X	X		X	X	X	X	X
Occupational and Environmental Monitoring	CME8001				X		X				X	X	X				X	X	X	X		
Pollution Monitoring	CME8010				X		X				X	X	X				X	X	X	X		
Business and Environmental Management	CME8012				X	X		X		X					X	X		X	X	X	X	X
Air Pollution	CME8018				X		X				X	X	X				X	X	X	X		