PROGRAMME SPECIFICATION	

1 Awarding Institution	Newcastle University
2 Teaching Institution	Newcastle University
3 Final Award	MSc
4 Programme Title	Master of Science in Mathematical Modelling in Engineering and Industry
5 UCAS/ Programme Code	5133
6 Programme Accreditation	IMechE, IET (2006):
7 QAA Subject Benchmark(s)	Engineering Benchmark(http://www.qaa.ac.uk/ academicinfrastructure/benchmark/statements/Engineering06.pdf) UK Spec (http://www.engc.org.uk/UKSPEC/default.aspx)
8 FHEQ Level	~~M~~7
9 Date written/revised	May 2005 Revised: July 2006, August 2007, January 2009

10 Programme Aims

The programme aims to enable suitably qualified graduates from a range of engineering, mathematical and physical science backgrounds to:

1. Develop their knowledge, skills (including transferable skills) and understanding, as well as awareness and "know how", in the fields of mechanical engineering with mathematical modelling and its related disciplines (continuum solid and fluid mechanics) so that as graduates they will be equipped to enter employment as professional engineers (progressing on to Chartered Engineer or equivalent status) or a wide range of other professional careers.
2. Prepare them to engage in life-long learning (eg professional CPD or further Higher Education) and critical enquiry with skills in research and knowledge acquisition and an appreciation of the value of education to the wider community.
3. Provide them with internationally recognised qualifications which meet the requirements of the Framework for Higher Education Qualifications at Level M and of the subject Benchmark Statement for Engineering (Applicability of Output Standards to MEng Degrees) and of the Engineering Council UK, UKSpec for CEng accredited Integrated Masters Degrees.
4. Provide the engineering industry and profession, in the UK and elsewhere, with employable and enterprising graduates prepared for the assumption of technical, managerial and financial responsibilities.
5. Achieve the above in the contexts of the School, SAgE Faculty and University business plans, following the University's policies and procedures and conforming to the relevant sections of the QAA Code of Practice

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 for Engineering and to UKSpec Learning Outcomes.

Knowledge and Understanding

On completing the programme students should be able to demonstrate:

A1 An advanced knowledge of the general principles and underlying physical science of a broad range of modelling methodologies, commonly used in the development and analysis of engineering systems. (UKSpec US1, US1m, US2, US2m, US3m, E1)

A2 Knowledge of fundamental modelling issues relevant to the study of engineering systems, and an understanding of how to formulate and analyse mathematical models in various engineering contexts. (UKSpec US1, US1m, US2, US2m, US3m, E1m)

A3 Working knowledge of a range of modern mathematical methods and computational tools used in the analysis of models for engineering and industrial systems. (UKSpec US2, US2m)

A4 In-depth knowledge of specific engineering systems, and related modelling techniques and mathematical and/or numerical techniques (depending of selection of option modules and project area). (UKSpec US3m, E1, D1m, S2, P1, P1m, E1m)

A5 Knowledge of basic research and development principles and practices relevant to mainstream engineering industry. (UKSpec US3m, E1, S3, P1m)

A6 Knowledge of key professional, safety and ethical issues arising in modern engineering industry.(UKSpec S2m, S3, P1m)

A7 Knowledge of time-management and work planning issues related to the organization, implementation and successful completion, including reporting, of an individual, Masters level, engineering based project. (UKSpec S2)

Teaching Methods

The main mechanism for imparting the above knowledge and understanding in A1-A6 is lectures, combined with tutorials, examples classes, activities and coursework. Computer labs form part of the teaching methods for some of the numerically orientated modules (A3, A4). In-depth knowledge outcomes in A4 are also achieved via project work, as is outcome A7. Outcome A6 is affected through material covered on the module *Methods in Industrial Research & Development*, and in many cases will also be supported through project based experience.

Learning Methods

Students are required to support and reinforce lecture based knowledge transfer through private study, making use of recommended texts and web-based material. Tutorials allow lecture material to be discussed and supplemented, and provide a mechanism for detailed feedback to the student on coursework. Supervised project work provides the student with the opportunity to develop knowledge and understanding in an area of interest to a greater depth, and further reinforces material from the taught component of the programme.

Assessment Strategy

Formative assessment of student progress on taught modules is affected through the use tutorial exercises and coursework in the form of written answers to set exercises and/or case-study reports. The primary, summative means of assessing knowledge and understanding is the closed book examination. The balance between coursework assessment and examination varies as appropriate to each module. In-depth learning and understanding acquired during work of the main project is assessed by dissertation. Interview of candidates by the external examiner is also used, where appropriate, to assess student learning.

Intellectual Skills

On completing the programme students should be able to:

B1 Identify and adapt mathematical models appropriate to the study of a wide-range of different engineering type systems, and industrial processes. (UKSpec US2, E2)

B2 Apply standard scientific principles to develop novel mathematical models for tackling a range of practical engineering based problems. (UKSpec US1, 3m, E2, E1m)

B3 Select and apply appropriate mathematical and/or numerical methods for analysing relevant problems, and to critically assess and interpret results obtained from these methods. (UKSpec US2, E2m, E3m)

B4 Propose, formulate and present suitable modelling strategies, and related analytical and/or numerical methods, enabling the study of a range of engineering based problems. (UKSpec US2, US3, E2, E3m)

Teaching Methods

Skills B1-B4 are introduced, illustrated and explained in lectures and examples classes. Subsequent work in tutorials and computer labs reinforces these skills. More in-depth exposure to skills B1-B4 is provided during work on the main project.

Learning Methods

Skills B1-B4 are developed through work on exercises provided in lectures, example classes, tutorials and computer labs. Regular student attendance and participation at all formal classes is expected and required. Acquisition of B1-B4 is also through application and extension of taught material to project work.

Assessment Strategy

Satisfactory acquisition of skills B1-B4 is formally assessed through coursework (written solutions to set problems and mini-project reports) and written examination. In-course assessed work provides an important mechanism for monitoring student development through the course. Written examinations test skill acquisition and the ability to apply such skills under time constraints.

Practical Skills

On completing the programme students should be able to:

C1 The interpretation and critical assessment of existing theories, models, methods and results, both qualitative and quantitative, within a broad engineering and physical science framework. (UKSpec E3m)

C2 The recognition and appreciation of problems inherent in a given engineering system or approach, and the ability to synthesis, and propose models for, alternative solution strategies. (UKSpec E3)

C3 Ability to work with technical uncertainty (UK Spec P8)

C4 Ability to apply engineering techniques taking account of a range of commercial and industrial constraints (UK Spec P8m)

Teaching Methods

The inculcation of skills C1 – C4 takes place throughout the entire degree programme, and draws on teaching, learning and assessment strategies (as employed in lectures, tutorials, labs and project work) described in A and B above. Project work provides an important mechanism not only for consolidating the technical information and learning outcomes

introduced and developed in the taught modules, but also for developing more generic, cognitive skills by drawing on the body of these experiences and learning outcomes. Supervision of project work is structured to assist students develop their learning skills.

Learning Methods

Students are encouraged to adopt a critical and logical approach when interpreting the methods and ideas presented and discussed in the programme. Emphasis is given to the requirement of submitting work that exhibits clear and logical presentation, with rational explanations of methods employed. In this respect the planning, execution and reporting of work undertaken during the project plays and important role in the development of practical skills.

Assessment Strategy

Primary assessment is via evaluation of student performance on submitted coursework (problem-solving exercises, mini-project and lab reports) and the final project, the later being assessed through the written dissertation together with formal feedback from the project supervisor. Written examinations for the taught modules also provide a mechanism for assessing the development of these.

Transferable/Key Skills

On completing the programme students should be able to:

D1 Communicate ideas clearly, by means of both written documentation and oral presentation.

D2 Effectively utilize modern information resources and technologies. (UKSpec 4m))

D3 Prioritize, organize and schedule work activities effectively. (UKSpec S5)

D4 A comprehensive knowledge and understanding of the role and limitations of ICT, and an awareness of developing technologies in ICT (UK Spec US4m)

D5 Understanding of the need for a high level of professional and ethical conduct in engineering (UK Spec S5)

Teaching Methods

Proficiency in D1-D5 is addressed directly by taught material forming part of the module *Methods in Industrial Research & Development,* which is aimed at teaching generic skills and methods commonly used in industrial R&D. Further, students will undertake both individual and group problem-solving activities within this module. Students who are not native speakers of English usually receive additional instruction by registering for the Language Centre module *Writing Dissertations in Science & Engineering*. In addition to the key-skill-specific taught material, students will develop these skills through participation in other aspects of the programme. In particular project based work is central in this teaching strategy.

Learning Methods

Key skills are formally taught, and feedback on student performance assists the learning process. These skills are also required in other, subject specific modules, and active participation in these modules will further aid key skill development. Successful completion of the final project will require that a student is developing and applying these skills.

Assessment Strategy

Key-skill development is formally assessed in the module *Methods In Industrial Research and Development.* Assessment is through performance demonstrated by written work and by oral presentations. The key skills are also indirectly assessed through performance on coursework for other modules and on the final project.

12 Programme Curriculum, Structure and Features

Basic structure of the programme

This is a full-time, one year (three semesters) programme, starting in September, leading to the award of the degree of Master of Science (MSc).

The taught component of the programme consists of a total of 120 credits (1 credit ≡10 study hours, including timetabled contact hours and private study) studied during Semesters 1 and 2 (September to June). Students begin preliminary work (eg literature review etc) on their 60 credit major project in Semester 1, with work continuing throughout the year and being completed in Semester 3 (June – September). Project work must be submitted for assessment before 1 October.

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

The degree covers a range of topics in mathematical modelling and related applied mathematical and numerical techniques relevant to applications in engineering and continuum mechanics with the opportunity to apply these in the major project.

All students will normally follow a compulsory 10 credit module on Methods in Industrial Research and Development. Non-native speakers of English will normally also follow a compulsory 10 credit module on Writing Dissertations in Science and Engineering. All students will undertake a major (60 credit) industrial project, which usually involves laboratory based work and/or modelling and numerical studies and/or design (with considerable scope for industrial involvement in projects).

Programme regulations (link to on-line version)

http://www.ncl.ac.uk/regulations/

13 Criteria for admission

Entry qualifications
Applicants for this MSc should have a good Honours level first degree or equivalent in a relevant engineering, mathematical or physical science discipline. Applicants who hold non-standard qualifications and/or have relevant professional experience requiring the regular exercise of Level H engineering knowledge, skills and understanding, may be considered on an individual basis and may be required to attend for interview if practical.

Admissions policy/selection tools
All applicants should apply through the University Enquiries to Registration portal.
https://pgadmissions.ncl.ac.uk/irj/portal

Non-standard Entry Requirements
Non-standard applications are directed via the University Enquiries to Registration portal to the Degree Programme Director to evaluate. Evidence of extensive and recent work based experience is acceptable.

Additional Requirements

Level of English Language capability
Applicants who are non-native speakers of English will usually be required to provide evidence of English language proficiency equivalent to IELTS 6.5 or better.

14 Support for Student Learning

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 eg. 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 teaching and learning

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 Teaching and Learning 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 Teaching and Learning Committee.

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

External Examiner reports
External Examiner reports are considered by the Board of Studies. The Board responds to these reports through Faculty Teaching and Learning 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 Teaching and Learning Committee on whether the programmes reviewed should be re-approved for a further five year period.

Accreditation reports
Accreditation was given by IMechE and IET (formerly the Institution of Electrical Engineers) in October 2006. Accreditation is for 5 years and the next re-accreditation visit is due in 2011

Additional mechanisms
Previous QAA Reports
The University underwent Institutional Audit in March 2005
(http://www.qaa.ac.uk/reviews/reports/institutional/Newcastle05/main.asp)

Internal Subject Review
The School underwent Internal Subject Review in November 2005

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		

Role of the External Examiner
An External Examiner, a distinguished member of the subject community, is appointed by Faculty Teaching and Learning 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 School Brochure (contact enquiries@ncl.ac.uk)

The University Regulations (see http://www.ncl.ac.uk/calendar/university.regs/)

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

Either

Intended Learning Outcome	Module codes (Compulsory in Bold)
A1	**ENG8001, ENG8009, ENG8007, MEC8008**, **MEC8095,** MEC8007, MEC8017, CIV8201, CME4001, MAR8084
A2	**ENG8001, ENG8009, ENG8007**, **MEC8095,** MEC8003, CIV8201, MAS3111, MAR8084
A3	**ENG8003, ENG8004, ENG3003, ENG8007, MEC8095,** MAS3110, MAS3111
A4	**ENG8001, ENG8002, ENG8009, MEC8008, MEC8095,** MEC8007, MEC8017, MEC8003, CIV8201, CME4001, MAS3110, MAR8084, ENG8002
A5	**MEC8011**, **MEC8095,**
A6	**MEC8011**, **MEC8095,**
A7	**MEC8011**, **MEC8095,**
B1	**ENG8001, ENG8007**, **MEC8095,** MAS3111
B2	**ENG8001, ENG8009, ENG8007, MEC8095,** MEC8017, MEC8003, MAS3111
B3	**ENG8001, ENG8002, ENG8003, ENG8004, ENG8009, ENG3003, ENG8007, MEC8008, MEC8095,** MAS3110, MAS3111, MAR8084, ENG8002
B4	**ENG8001, ENG8007**, **MEC8095,** MAS3111
C1	**ENG8001, ENG8009, ENG8007, MEC8011, MEC8095,**
C2	**ENG8001, ENG8007, MEC8011, MEC8095,**
C3	**MEC8011, MEC8095,**
C4	**MEC8011, MEC8095,**
D1	**MEC8011, MEC8095,** LCE8014
D2	**ENG8001**, **MEC8095,**
D3	**MEC8011**, **MEC8095,**
D4	**ENG8002, MEC8008, MEC8011, MEC8095,**
D5	**MEC8011**, **MEC8095,**