MSc/Postgraduate Diploma Mathematics of Scientific and Industrial Computation
For students entering in 2009

Awarding Institution:	The University of Reading
Teaching Institution:	The University of Reading Faculty of Science
Programme length:	12 months
Date of specification:	July 2009
Programme Director:	Dr P.K. Sweby
Board of Studies:	MMP MSc BoS
Accreditation:	Not applicable

Summary of programme aims
Both the MSc and PG Diploma programmes aim to

- introduce students to a range of topics and technical skills in the chosen area, leading to a variety of potential applications and career opportunities;
- inculcate an insight into current practice in the chosen area, particularly techniques relevant to professional practice;
- enhance students' communication skills;
- provide an appreciation of the link between theory and application in the chosen area of study.

A PG Cert is also available suitable for those interested in taking elements of the programme towards Continued Professional Development (CPD).

Transferable skills
The programmes will provide a range of transferable skills, including generic training in IT (operating systems, programming, computer graphics and word-processing) and in Communication and Research Skills (including good practice and experience in written and oral presentations and in literature searches).

Programme content

MSc (180 credits)

Autumn, Spring and Summer Terms: In addition to the modules listed as core, students must choose a total of TWO modules from the list of options.

Remainder of course: There is the literature seminar (which forms part of the Communication and Research Skill module MAMB5) plus one core module (MAMC6) in the Summer Term and students must complete a dissertation (worth 60 credits) by the fourth week of August.

PG Diploma (120 credits)

There are two possible routes to the PG Diploma

EITHER:

Autumn, Spring and Summer Terms: In addition to the modules listed as core, students must choose a total of TWO modules from the list of options (each worth 10 credits).

Summer Term: There is the literature seminar (which forms part of the Communication and Research Skill module MAMB5) plus one core module (MAMC6).

OR:

Autumn and Spring Terms: Students only take the core modules.

Summer Term: There is the literature seminar (which forms part of the Communication and Research Skills module MAMB5) plus one core module (MAMC6). In addition students complete an extended essay (worth 20 credits) by the end of June.

MSc and Diploma

There are also some non-assessed elements in the programme. These include introductory material and attendance at the weekly seminar series.

Mod Code	***Module Title***	***Credits***	***Level***
Autumn Term (introductory modules)			
MAMI0	Elements of Numerical and Functional Analysis		7
Autumn Term (core modules)			
MAMA1	Numerical Methods for Initial Value Problems	10	7
MAMA3	Theory of Differential Equations	10	7
MAMA5†	Computing Techniques and Projects	20	7
MAMA11†	Advanced Numerical Solution of Differential Equations	10	7
Autumn Term (optional modules such as)			
MAMA10†	Reading Course	10	7
MAMA13	Asymptotic Methods	10	7
MAMA14	Stochastic Processes	10	7
MTMG02	Atmospheric Physics	10	7
Spring Term (core modules)			
MAMB1	Numerical Methods for Boundary Value Problems	10	7
MAMB3	Finite Element Methods	10	7
MAMB4	Numerical Techniques for Conservation Laws	10	7
MAMB5 †	Communication and Research Skills	10	7
Spring Term (core non-assessed module)			
MAMB6	Industrial Modelling		7
Spring Term (optional modules such as)			

MAMB8	Integral Equations	10	7
MAMB10	Theory and Techniques of Data Assimilation	10	7
MAMB11	Mathematical Biology	10	7
MTMW14	Numerical Modelling of the Atmosphere and Oceans	10	7

Summer Term (core module)

MAMC6	Modelling Week	10	7

Summer Term (optional modules such as)

SEMS03	Parallel Algorithms	10	7
SEMS04	Algorithms & Programming Techniques for Advanced Architectures	10	7

Summer Term (dissertation/extended essay)

MAMC2	Dissertation	60	7
MAMC3	Extended Essay	20	7

† denotes a module which continues into the following term(s)

Part-time/Modular arrangements

The programme may be taken over two years on a part-time basis. The minimum requirements are the equivalent of two days a week in the first term with the equivalent of 1 day a week for the five subsequent terms. The project will require the equivalent of 30 days and access to suitable facilities to carry out the work.

Summary of teaching and assessment

The programme consists of two terms taught modules, with the Modelling Week and the literature seminar in the first four weeks of the third term. Teaching is by lectures, supplemented by guided reading and, where appropriate, practical computations. With the exception of the Computing Techniques and Project module (MAMA5) and the Communication Skills module (MAMB5) assessment is by examination, usually in the vacation following the term in which the module is delivered. All assessed modules contribute to the final mark.

The University's taught postgraduate marks classification is as follows:

Mark	Interpretation
70 – 100%	Distinction
60 – 69%	Merit
50 – 59%	Good standard (Pass)
Failing categories:	
40 – 49%	Work below threshold standard
0 – 39%	Unsatisfactory Work

For Masters Degrees

To pass the MSc students must gain an average mark of 50 or more overall including a mark of 50 or more for the dissertation and a mark of 40 or more in MAMA5. In

addition, the total credit value of all modules marked below 40 must not exceed 30 credits and for all modules marked below 50 must not exceed 55 credits.*

Students who gain an average mark of 70 or more overall including a mark of 60 or more for the dissertation and have no mark below 40 will be eligible for a Distinction. Those gaining an average mark of 60 or more overall including a mark of 50 or more for the dissertation and have no mark below 40 will be eligible for a Merit.

For PG Diplomas

To pass the Postgraduate Diploma students must gain an average mark of 50 or more and a mark of 40 or more in MAMA5. In addition, the total credit value of all modules marked below 40 must not exceed 30 credits and for all modules marked below 50 must not exceed 55 credits.*

Students who gain an average mark of 70 or more and have no mark below 40 will be eligible for the award of a Distinction. Those gaining an average mark of 60 or more and have no mark below 40 will be eligible for a Merit.

Admission requirements

Entrants to this programme are normally required to have obtained an upper second or higher Mathematics BSc or MMath, or a joint degree with a substantial mathematical content, although a good lower second may be sufficient.

Admissions Tutor: Dr P.K. Sweby

Support for students and their learning

University support for students and their learning falls into two categories. Learning support includes IT Services, which has several hundred computers and the University Library, which across its three sites holds over a million volumes, subscribes to around 4,000 current periodicals, has a range of electronic sources of information and houses the Student Access to Independent Learning (S@IL) computer-based teaching and learning facilities. There are language laboratory facilities both for those students studying on a language degree and for those taking modules offered by the Institution-wide Language Programme.

Student guidance and welfare support is provided by Personal Tutors, School Senior Tutors, the Students' Union, the Medical Practice and the Student Services Centre. The Student Services Centre is housed in the Carrington Building and includes the Careers Advisory Service, the Disability Advisory Service, Accommodation Advisory Team, Student Financial Support, Counselling and Study Advisors. Student Services has a Helpdesk available for enquiries made in person or online (www.risisweb.reading.ac.uk), or by calling the central enquiry number on (0118) 378 5555. Students can get key information and guidance from the team of Helpdesk

* The provision to permit a candidate to be passed overall with a profile containing marks below 40 is made subject to the condition that there is evidence that the candidate applied his or herself to the work of those modules with reasonable diligence and has not been absent from the examination without reasonable cause.

Advisers, or make an appointment with a specialist adviser; Student Services also offer drop-in sessions on everything from accommodation to finance. The Carrington Building is open between 8:30 and 17:30 Monday to Thursday (17:00 Friday and during vacation periods). Further information can be found in the Student Diary (given to students at enrolment) or on the Student website (www.reading.ac.uk/student).

Career prospects
The programmes will provide the basic mathematical tools required for the development and analysis of modern numerical techniques for the solution of differential equations and will provide experience in implementing and applying the numerical procedures to industrial models. Graduates will therefore possess the skills required for development and effective use of specialist, application based, computer packages. The programmes will enable mathematicians, scientists and engineers with a wide variety of backgrounds and specific subject interests to obtain the mathematical foundations and practical skills needed for computational modelling in modern industry.

Opportunities for study abroad or for placements
Industrial internships will be offered, where possible, on a competitive basis, as part of the summer project and dissertation.

Educational aims of the programme
The Mathematics of Scientific and Industrial Computation programme covers a wide variety of mathematical topics and technical skills, with a variety of potential applications and career opportunities. The general aim of the programme is to convert new graduates from first degree programmes containing a significant amount of Mathematics into postgraduates possessing a deeper insight into numerical analysis and modelling of direct use to Industry. The programme gives a secure foundation in the subject which is invaluable for the effective and intelligent use of numerical techniques.

Another important aim is to give students practical competence in the numerical solution of various types of differential equations. This is essential if the objective is to enter industry at the end of the Course, but it is equally important for anyone aiming for a higher degree in even the most theoretical aspects of the subject.

Programme Outcomes:

Knowledge and Understanding

A. Knowledge and understanding of:	**Teaching/learning methods and strategies**
1. basic theory of differential equations, including well-posedness. Illustrative physical scenarios which the equations may model; 2. Classical finite difference schemes for numerical solution of initial and boundary value problems; 3. dynamics of numerics; 4. finite element and finite volume methods for numerical solution of differential equations; 5. solvers and acceleration techniques; 6. aspects of computational grids and their generation; 7. modern adaptive numerical methods for the solution of conservation laws; 8. types of problems encountered in industry and techniques for their solution; 9. high level programming languages.	The knowledge is delineated through formal lectures supported by guided reading and problem sheets. Model solutions are provided and feedback given. Feedback on the programming is given initially via non-assessed programming exercises, and later assessed projects. The industrial expertise is delivered in a series of lectures by outside industrial speakers (MAMB6) and in the Modelling Week (MAMC6) as well as through the use of Internships where possible. *Assessment* Understanding is tested through open note examinations and course work.

Skills and other attributes

B. Intellectual skills – able to:	**Teaching/learning methods and strategies**
1. apply knowledge and understanding gained to a variety of familiar and unfamiliar situations; 2. critically analyse numerical results; 3. show independence and initiative in approaches to problem solving; 4. present material clearly to expert and non-expert audiences in written and oral forms; 5. critically review, synthesise and evaluate published research; 6. conduct independent study of a chosen topic and report on the results.	1,2 and 3 are developed by a combination of problem sheets, worked examples, coursework assignments, computing project work and dissertation. 4 and 5 are addressed by lectures, practice presentations and the literature seminar in the Communication and Research Skills module, and also by the dissertation. 6 is covered by the dissertation. *Assessment* 1, 2 and 3 (in part) are assessed by coursework and examination. 4 and 5 are mainly assessed through the literature seminar and dissertation. 3 and 6 are assessed by the dissertation.

C. Practical skills – able to:	**Teaching/learning methods and strategies**
1. program a computer in a structured and effective way; 2. analyse numerical methods and respond to the issues of accuracy, stability and convergence; 3. plan, conduct and report on investigations; 4. reference work in an appropriate manner.	1 is achieved via the Computing Techniques and Projects module. Most modules enhance skill 2. Skills 3 and 4 are addressed through guidance on the project/ dissertation work and Modelling Week. *Assessment* 1 and 2 are tested by computing projects and examinations. 3 and 4 are assessed by the project /dissertation.

D. Transferable skills – able to:	**Teaching/learning methods and strategies**
1. communication: the ability to communicate knowledge effectively through written and oral presentations; 2. computation and IT: use of the computer to solve numerical problems and to analyse and present results using standard and mathematical software; 3. self management and professional development: study skills, independent learning, time management; 4. library skills: effective use of library resources.	Skills 1 and 2 are developed throughout most of the programme, but especially in the Computing Techniques and Projects and Communication and Research Skills modules. 3 is encourage throughout the programme. 4 is covered by the Communication and Research Skills module and the dissertation. *Assessment* 1 and 2 are assessed through coursework, examinations, literature seminar and dissertation. 3 is indirectly assessed throughout the programme by its influence on performance. 4 is indirectly assessed in the dissertation.

Please note - This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each module can be found in the module description and in the programme handbook. The University reserves the right to modify this specification in unforeseen circumstances, or where the process of academic development and feedback from students, quality assurance processes or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.