**MSc/PGDip in Mathematics of Scientific and Industrial Computation**
**For students entering Part 1 in 2011/2**

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|---|---|
| Awarding Institution: | University of Reading |
| Teaching Institution: | University of Reading |
| Relevant QAA subject Benchmarking group(s): | |
| Faculty: | Science Faculty |
| Programme length: | 1 years |
| Date of specification: | 01/Sep/2011 |
| Programme Director: | Dr Peter Sweby |
| Programme Advisor: | |
| Board of Studies: | School of MPS PG taught programmes |
| Accreditation: | |

**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 practise and experience in written and oral presentations and in literature searches).

**Programme content**
*Compulsory modules:*

| *Code* | *Module title* | *Credits* | *Level* |
|---|---|---|---|
| *Autumn Term* | | | |
| MAMI0 | Elements of Numerical and Functional Analysis (introductory module) | 0 | 7 |
| MAMA1 | Numerical Methods for Intitial 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 |
| *Spring Term* | | | |
| 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 |
| MAMB6 | Industrial Modelling | 0 | 7 |
| *Summer Term* | | | |
| MAMC6 | Modelling Week | 10 | 7 |
| *Either* | | | |
| MAMC2 | Dissertation (MSc) | 60 | 7 |
| *or* | | | |
| MAMC3 | Extended Essay (PG Diploma) | 20 | 7 |

*Optional modules such as the following:*

*Autumn Term*

| | | | |
|---|---|---|---|
| MAMA10* | Reading Course | 10 | 7 |
| MAMA13 | Aymptotic Methods | 10 | 7 |
| MAMA14 | Applied Stochastic Processes | 10 | 7 |
| MAMB10 | Theory and Techniques of Data Assimilation | 10 | 7 |
| MTMG02 | Atmospheric Physics | 10 | 7 |
| *Spring Term* | | | |
| MAMB8 | Integral Equations | 10 | 7 |
| MAMB11 | Mathematical Biology | 10 | 7 |
| MTMW14 | Numerical Modelling of the Atmosphere and Oceans | 10 | 7 |
| *Summer Term* | | | |
| SEMS03 | Parallel Algorithms | 10 | 7 |
| SEMS04 | Algorithms and Programming Techniques for Advanced Architectures | 10 | 7 |

*Denotes a module which continues into the following Term(s).

**Part-time or 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.

**Progression requirements**

**MSc (180 credits)**

Autumn, Spring and Summer Terms: In addition to the compulsory modules, students must choose a total of TWO modules from the list of options.
Remainder of the programme: There is the literature seminar (which forms part of the Communication and Research Skills module MAMB5) plus one compulsory module during the Summer Term; students must also complete a dissertation (60 credits) by the fourth week of August.

**Postgraduate 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 compulsory, students must choose a total of TWO modules from a list of options (each worth 10 credits).
Summer Term: There is the literature seminar (which forms part of the Communication and Research Skills module MAMB5) plus one compulsory module.
OR:
Autumn and Spring Terms: Students take only the compulsory modules.
Summer Term: There is the literature seminar (which forms part of the Communication and Research Skills module MAMB5) plus one compulsory module. In addition, students complete an extended essay (worth 20 credits) by the end of June.

For both the MSc and PG Diploma, there are some non-assessed elements in the programme. These include introductory material and attendance at the weekly seminar series.

**Assessment and classification**

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 is provided by a wide array of services across the University, including: the University Library, the Student Employment, Experience and Careers Centre (SEECC), In-sessional English Support Programme, the Study Advice and Mathematics Support Centre teams, IT Services and 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 advisers in the Student Services Centre. The Student Services Centre is housed in the Carrington Building and offers advice on accommodation, careers, disability, finance, and wellbeing. Students can get key information and guidance from the team of Helpdesk Advisers, or make an appointment with a specialist adviser; Student Services also offer drop-in sessions and runs workshops and seminars on a range of topics. For more information see 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.

**Programme Outcomes**

**Knowledge and Understanding**

**A. Knowledge and understanding of:**

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.

**Teaching/learning methods and strategies**

- 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:*

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.

**Teaching/learning methods and strategies**

- 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:*

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.

**Teaching/learning methods and strategies**

- 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:*

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.

**Teaching/learning methods and strategies**

- 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 process or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.**