MSc in Applicable and Numerical Mathematics (full-time)
For students entering in 2013/4

Awarding Institution:	University of Reading
Teaching Institution:	University of Reading
Relevant QAA subject Benchmarking group(s):	
Faculty:	Science Faculty
Programme length:	12 months
Date of specification:	16/Aug/2013
Programme Director:	Dr Peter Sweby
Programme Advisor:	
Board of Studies:	School of MPS PG taught programmes
Accreditation:	N/A

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

- allow specialisation in one of the areas of *Mathematical and Numerical Modelling of the Atmosphere and Oceans (MNMAO), Mathematics of Scientific and Industrial Computation (MoSaIC), Applied and Numerical Analysis (ANA)* or a broad overview of all of these areas
- introduce students to a range of topics and technical skills in the chosen area, leading to a variety of potential applications and career opportunities
- provide 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.

Transferable skills
The programmes will provide a range of transferable skills, including generic training in IT (operating systems, programming, computer graphics and mathematical 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 and Spring Terms: In addition to the modules listed as compulsory, students must choose modules from the list of options to the total of 50 credits.
Remainder of course: All students must complete a dissertation (worth 60 credits) by the fourth week of August. An Oral examination is held in mid-September.

PG Diploma (120 credits)
Autumn, Spring and Summer Terms: In addition to the modules listed as compulsory, excluding the dissertation, students must choose modules from the list of options to the total of 50 credits.

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

Compulsory

Mod Code	*Module Title*	*Credits*	*Level*
MAMI0	Elements of Numerical and Functional Analysis	0	
MAMA3	Theory of Differential Equations	10	7
MAMNSO	Numerical Solution of Ordinary Differential Equations	10	7
MAMNSP	Numerical Solution of Partial Differential Equations	10	7
MAMA5	Computing Techniques and Projects	20	7
MAMB5	Communication and Research Skills	10	7
MAMB6	Industrial Mathematics	0	
MAMC6	Modelling Week	10	7
MAMC2	Dissertation (MSc only)	60	7

Optional

Mod Code	*Module Title*	*Credits*	*Level*
MAMA10	Reading Course	10	7
MAMA13	Asymptotic Methods	10	7
MAMA14	Applied Stochastic Processes	10	7
MAMB4	Numerical Techniques for Conservation Laws	10	7
MAMB8	Integral Equations	10	7
MAMB10	Theory and Techniques of Data Assimilation	10	7
MAMB11	Mathematical Biology	10	7
MAMANS1	Advanced Numerical Solution of Ordinary Differential Equations	10	7
MAMANS2	Advanced Numerical Solution of Partial Differential Equations	10	7
MAMST	Spectral Theory	10	7
MAMTLA	Topology and Linear Analysis	10	7
MAMMTI	Measure Theory and Integration	10	7
MAMPT	Probability Theory	10	7
MAMANT	Analytic Number Theory	10	7
MAMFA1	Functional Analysis I	10	7
MAMFA2	Functional Analysis II	10	7
MAMSMA	Statistical Mechanics and Applications	10	7
MTMG01	Introduction to Weather Systems	10	7
MTMG02	Atmospheric Physics	10	7
MTMW99	Fluid Dynamics of the Atmosphere and Oceans	10	7
MTMW14	Numerical Modelling of the Atmosphere and Oceans	10	7
MTMW15	Extra-tropical Weather Systems	10	7
MTMG16	Climate Change	10	7
MTMG19	Tropical Weather Systems	10	7
MTMG21	Oceanography	10	7
MTMW20	Global Circulation of the Atmosphere and Oceans	10	7
MTMG44	Hydrology and Global Change	10	7
MTMG38	Remote Sensing	10	7
MTMG04	Current Weather Discussions	0	7
MTMG48	Forecasting Course	0	7
MTMG41	Applications of Meteorology	0	7

Strands

Whilst a free choice of options is available (subject to pre-requisites and timetable) the following choices can be identified with the indicated strands.
MNMAO: Compulsory plus MTMG01, MTMG02, MTMW99 and MTMW14, plus one other 10 credit option together with non-assessed modules MTMG48, MTMG04 and MTMG41.
MoSaIC: Compulsory plus MAMANS1, MAMANS2 and MAMB4, plus two other 10 credit options.
ANA: Compulsory plus 50 credits from MAMTLA, MAMMTI, MAMANT, MAMFA1, MAMFA2, MAMST, MAMB8

Summary of Teaching and Assessment

Assessment is by a mixture of open-note examination, closed book examination, coursework and presentation. Where assessment is by examination this takes place in the vacation following the term in which the module is delivered for core modules and for options during the Easter vacation. All assessed modules contribute to the final mark.
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
Further information on the classification conventions, including borderline criteria, are available at http://www.reading.ac.uk/web/FILES/exams/PGclassification-post-2008.pdf.

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. 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. 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, a joint degree with a substantial mathematical content, or a degree in the physical or environmental sciences with a strong mathematical content.

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 Careers, Placement and Experience Centre (CPEC), 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, academic issues (eg problems with module selection) and exam related queries. 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

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Career prospects
The majority of graduates from the course will pursue careers in the mathematical and/or environmental sciences. Depending on the strand followed, the course will provide the skills and knowledge base for a wide range of careers including:
- Research and technical posts in mathematical and/or environmental science institutes
- Research posts in mathematical and/or environmental science consultancy firms
- Forecasting and analysis in meteorological consultancies

- Research and forecasting posts in national meteorological services
- Companies involved in scientific computing or data analysis, e.g. geosciences, software, aerospace, engineering, pharmaceuticals, finance
- Research work and technical posts in universities

Opportunities for study abroad or for placements
This is not usual within the programme but occasionally it may be possible for the dissertation component of the programme to be completed whilst on a suitable placement.

Programme Outcomes

Knowledge and Understanding

A. Knowledge and understanding of:	**Teaching/learning methods and strategies**
1. Fundamental rigorous concepts of mathematical analysis and basic functional analysis 2. basic theory of differential equations. Illustrative physical scenarios which the equations may model 3. classical finite difference, finite element and finite volume schemes for numerical solution of initial and boundary value problems 4. modern adaptive numerical methods for the solution of differential equations 5. types of problems encountered in industry and techniques for their solution 6. high level programming languages 7. mathematical word-processing software. 8. the physical processes which drive the atmospheric system giving rise to weather and climate 9. the feedback between the earth's surface and the atmosphere and the impact of these feedback processes on weather and climate 10. the theoretical framework for developing robust numerical methods and prove their accuracy and stability	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). *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. Abstract problem solving 2. apply knowledge and understanding gained to a variety of familiar and unfamiliar situations 3. rigorously analyse numerical methods and results 4. show independence and initiative in approaches to problem solving 5. present material clearly to expert and non-expert audiences in written and oral forms 6. critically review, synthesise and evaluate published research 7. conduct independent study of a chosen topic and report on the results.	1, 2, 3 and 4 are developed by a combination of problem sheets, worked examples, coursework assignments, computing project work and dissertation. 5 and 6 are addressed by lectures, practice presentations and the literature seminar in the Communication and Research Skills module, and also by the dissertation. 7 is covered by the dissertation. *Assessment* 1, 2, 3 and 4 (in part) are assessed by coursework and examination. 5 and 6 are mainly assessed through the literature seminar and dissertation. 4 and 7 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 and Modelling Week

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.