MMath/MPhys Mathematics and Physics

UCAS code: FG31

For students entering Part 1 in 2005

Awarding Institution:	The University of Reading
Teaching Institution:	The University of Reading
Relevant QAA subject benchmarking group(s):	Mathematics, Statistics and Operational Research, Physics and Astronomy
Faculty of Science	Programme length: 4 years

Date of specification: 12-Apr-08
Programme Director: Dr N.R.T. Biggs
Programme Adviser: Dr T.W. Hilberdink (Mathematics), Dr R.J. Stewart (Physics)
Board of Studies: Mathematics, Meteorology and Physics
Accreditation: This programme is provisionally accredited with the Institute of Physics. Approved by the Institute of Mathematics and its Applications as an appropriate academic training for mathematicians seeking the qualification *Chartered Mathematician*.

Summary of programme aims

The MMath/MPhys programme in Mathematics and Physics aims to provide a good grounding in both subjects, necessary for the understanding of the interaction between these two fundamental disciplines along with a range of appropriate subject-specific and transferable skills. (For a full statement of the programme aims and learning outcomes see below.)

Transferable skills

The University's Strategy for Teaching and Learning has identified a number of generic transferable skills which all students are expected to have developed by the end of their degree programme. In following this programme, students will have had the opportunity to enhance their skills relating to career management, communication (both written and oral), information handling, numeracy, problem-solving, team working and use of information technology.

By the end of the programme students are expected to have gained experience and show competence in the following transferable skills: IT (word-processing, using standard and mathematics software), scientific writing, oral presentation, team-working, problem-solving, use of library resources, time-management, career and management and planning.

Programme content

The profile which follows states which modules must be taken (the compulsory part), together with one or more lists of modules from which the student must make a selection (the "selected" modules). Students must choose such additional modules as they wish, in consultation with their programme adviser, to make 120 credits in each Part. The number of modules credit for and the level of each module are shown after its title.

Part 1 (three terms)		*Credits*	*Level*
Compulsory modules			
MA11A	*Introduction to Analysis*	20	C
MA11B	*Calculus and Applications*	20	C
MA11C	*Matrices*, *Vectors and Applications*	20	C
PH1001	*Concepts in Physics*	20	C

PH1002	*Classical Physics*	20	C
PH1004	*Experimental Physics I*	20	C
Part 2 (three terms)		*Credits*	*Level*
Compulsory modules			
MA24A	*Analysis*	20	I
MA24B	*Differential Equations*	20	I
MA24C	*Vectors, Dynamics and Numerical Analysis*	20	I
PH2001	*Thermal Physics*	20	I
PH2002	*Quantum Physics*	20	I
PH2003	*Electromagnetism*	20	I
Part 3 (three terms)		*Credits*	*Level*
Compulsory modules			
MA37A	*Complex Analysis and Calculus of Variations*	20	H
PH3701	*Relativity*	10	H
PH3702	*Condensed Matter*	10	H
PH3703	*Atomic & Molecular Physics*	10	H
PH3801	*Particle Physics*	10	H
One of			
MA3G7	*Boundary Problems and Dynamics*	20	H
MA3F7	*Control Systems and Dynamics*	20	H
Optional modules: One module from Group A and 20 credits from Group B.			
Group A:			
MA37E	*Numerical Analysis and Dynamical Systems 1*	20	H
MA37L	*Analysis and Topology*	20	H
MA3S7	*Modelling of Soft Matter*	20	M
Group B:			
PH3706	*Physics of Music*	10	H
PH3708	*Medical Physics*	10	M
PH3709	*Optical & Electrical Semiconductor Devices*	10	M
PH2502	*Stellar physics*	10	H
PH3804	*Fractals & Chaos*	10	H
PH3805	*Liquid Crystals*	10	H
PH3806	*Molecular Physics*	10	H
PH3807	*Cosmology (Models of the Universe)*	10	H
PH3001	*Computational Physics*	20	H
Part 4 (three terms)		*Credits*	*Level*
Compulsory modules			
PH4A01	*Advanced Quantum Theory*	10	M
PH4A02	*Lagrangian Field Theory & Symmetry*	10	M
MA4XB	*Advanced Topics in Mathematics*	20	M

Optional modules

(i) ***Either***

MA4XA	*Fourth Year Mathematics Project*	40	M

or

PH4003	*Physics Research Project S*	40	M

(ii) *Additional modules to make a total of 120 credits in Part 4.*

(iii) *The selected modules must be chosen so that the programme as a whole, including compulsory modules, includes at least 100 credits at Level M of Mathematics or Physics, which must include at least 40 Level M credits from each of Mathematics and Physics.*

Progression requirements

To gain a threshold performance at Part 1 and qualify for the CertHE a student shall normally be required to achieve an overall average of 40% over 120 credits taken in Part 1, where all the credits are at C level or above, and a mark of at least 30% in individual modules amounting to not less than 100 credits. In order to progress from Part 1 to Part 2, a student shall normally be required to achieve a threshold performance at Part 1 and obtain an average of at least 40% in the Part 1 Mathematics modules taken together, and in the Part 1 Physics modules taken together, and have no module mark below 30%.

To gain a threshold performance at Part 2 and qualify for the DipHE a student shall normally be required to achieve an overall average of 40% over 120 credits taken in Part 2, and a mark of at least 30% in individual modules amounting to not less than 100 credits. In order to progress from Part 2 to Part 3, a student shall normally be required to achieve a threshold performance at Part 2 and achieve an overall average of 50% over 120 credits taken in Part 2 (of which not less than 100 credits should normally be at I level or above).

Title of Degree

Students who take PH4003 (*Physics Research Project S*) are eligible for the degree of MPhys, and those who choose MA4XA (*Fourth Year Mathematics Project*) are eligible for the degree of MMath.

Summary of teaching and assessment

Teaching is organised in modules that typically involve both lectures and problems. The assessment is carried out within the University's degree classification scheme, details of which are in the programme handbooks. A wider variety of teaching/learning methods are used in Physics; lectures; problem-solving workshops, independent-learning, practical laboratories, computational laboratories, projects. In a typical lecture-based module the teaching is supplemented by problem-solving workshops that provide interaction between student and lecturer. The pass mark in each module is 40%. Modules in Part 1 and 2 are assessed by a mixture of coursework and formal examination. There are some modules which are assessed wholly by coursework and others wholly by examination; the details are given in the module descriptions.

Part 2 contributes 20% of the final assessment, Part 3 30% and Part 4 the remaining 50%.

Admission requirements

Entrants to this programme are normally required to have obtained:

Grade C or better in English in GCSE; and achieved
UCAS Tariff: A Level: 320 points including grade B in A Level Mathematics and C in A-Level Physics; or
International Baccalaureat: 30 points including 6 in Higher Mathematics; or
Advanced GNVQ: Merit in one of the following subject areas: Engineering, Information Technology or Science, accompanied by A Level Mathematics Grade B or
Scottish Highers: Grade A in Mathematics and As in two other subjects and C in a third.
Irish Leaving Certificate: Grade A in Mathematics and three Bs and a C in four other subjects
Two AS grades are accepted in place of one A-Level except in Mathematics and Physics.

Admissions Tutor: Dr Graham Williams (Mathematics)

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, the Careers Advisory Service, the University's Special Needs Advisor, Study Advisors, Hall Wardens and the Students' Union.

Within the Mathematics and Physics Departments additional support is given though practical classes in Part 1. The development of problem-solving skills is assisted by extensive provision of model solutions to problems. There is a Course Adviser to offer advice on the choice of modules within the programme.

Career prospects
The skills of numeracy and problem-solving promoted by both of the subjects lead graduates in Mathematics and Physics to be eligible not only for the more obvious careers involving applications of science and mathematics, but also in the financial sector and management services and teaching. This programme is recent. The destinations are expected to be similar to those for the BSc programme in Mathematics and Physics, whose graduates in recent years entered into jobs as scientists (e.g. in DERA) or to postgraduate study.

Opportunities for study abroad or for placements
Although there are no formal arrangements for this programme, informal arrangements may be possible. There are other programmes in Physics in which students spend a year in mainland Europe.

Educational aims of the programme
The MMath/MPhys programme in Mathematics and Physics aims to provide a good grounding in both subjects, necessary for the understanding of the interaction between these two fundamental disciplines along with a range of appropriate subject-specific and transferable skills.

Programme Outcomes

The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills, qualities and other attributes in the following areas:

Knowledge and Understanding

A. Knowledge and understanding of:	**Teaching/learning methods and strategies**
1. the fundamental concepts and techniques of calculus, analysis, linear algebra, and numerical mathematics 2. the empirical nature of physics: that theories must be testable and must be tested quantitatively 3. the core topics of physics: classical and quantum mechanics; thermal and statistical physics; waves and electromagnetism; particle physics 4. the application of physical and mathematical methods to the description, modelling and prediction of physical phenomena 5. a deeper insight into specialist areas of mathematics and physics and their applications including topics influenced by current research 6. project work on an advanced topic, forming a substantial independent investigation.	The knowledge required for the basic topics is delineated in formal lectures supported by problem sets for students to tackle on their own. In Part 1 these are supported by tutorials, practical classes and problem-solving workshops. The knowledge required for more specialist topics is enhanced through self-learning based on guided reading, problem solving and project work. *Assessment* Most knowledge is tested through a combination of coursework and unseen formal examinations, although the project is assessed through its report and an oral presentation. Practical work is assessed by means of logbooks, reports and viva examinations. Dissertations and oral presentations also contribute in other parts of the programme.

Skills and other attributes

B. Intellectual skills – able to:	**Teaching/learning methods and strategies**
1. think logically 2. analyse and solve problems 3. organise tasks into a structured form 4. recognise and use subject-specific theories, paradigms, concepts and principles integrate theory and applications 5. apply knowledge and understanding to address familiar and unfamiliar problems 6. plan, conduct and write a report on a substantial independent project.	Logic is an essential part of the understanding and construction of mathematical proofs and structured computer programs and is embedded throughout the programme. The quality of a solution to a problem is substantially determined by the structure of that response; analysis, synthesis, problem solving, integration of theory and application, and knowledge transfer from one topic to another are intrinsic to high-level performance in the programme. *Assessment* 1- 3 are assessed indirectly in most parts of Mathematics, while 4 and 5 contribute to the more successful work. 6 is assessed in the project dissertation.

C. Practical skills – able to:

1. understand and construct mathematical proofs
2. formulate and solve mathematical problems
3. analyse numerical methods
4. plan, conduct, and report on experimental investigations
5. plan, execute and report on a substantial project, and defend the result.

Teaching/learning methods and strategies

Mathematical proof is taught in Part 1 lectures and reinforced in practical classes. Problem solving is introduced in lectures in Part 1 and forms a large part of subsequent Mathematics. Numerical analysis courses introduce and develop the ideas of accuracy, stability and convergence, illustrated by practical tasks. Laboratory work, projects and IT classes are designed to enhance 4.

Assessment

1 and 2 are tested both formatively in coursework and summatively in examinations. 3 is assessed practically through coursework and the principles through formal examination. 4 is tested in laboratory and project modules. 5 is assessed through the project dissertation and its oral presentation.

D. Transferable skills – able to:

1. use IT (word-processing, using standard and mathematical software)
2. communicate scientific ideas
3. give oral presentations
4. work as part of a team
5. use library and Internet resources
6. manage time and their own professional development
7. identify and work towards targets for personal, academic and career development

Teaching/learning methods and strategies

The use of IT is embedded throughout much of the Physics and in the package *Mathematica* taught in Part 1 mathematics. Team work and career planning are part of one Part 2 module, while team work also features in Part 1. Communication skills are introduced in Parts 1 and 2, and these are deployed in the reports for the project work. Time management is essential for the timely and effective completion of the programme. Library resources are required for the the final year project, and contribute to the best performances throughout.

Assessment

1 - 4 and 7 are assessed through coursework and 5 also in the project. 6 is not directly assessed but its effective use will enhance performance in the later modules.

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.