BSc Mathematics and Physics

UCAS code: GF13

For students entering Part 1 in 2003

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: 3 years
Date of specification: 18-Mar-05
Programme Director: Dr P. A. Mulheran
Programme Adviser: Dr J. A. Leach (Mathematics), Dr P. A. Hatherly (Physics)
Board of Studies: Mathematics, Meteorology and Physics
Accreditation: This degree programme is 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 BSc 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, and career 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
MA24H	*General Skills 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
MA37B	*Topics in Applied Mathematics*	20	H
PH3701	*Relativity*	10	H
PH3702	*Condensed Matter*	10	H
PH3703	*Atomic & Molecular Physics*	10	H
PH3801	*Particle Physics*	10	H

Optional modules:

(i) *20 credits from:*

MA37E	*Numerical Analysis and Dynamical Systems 1*	20	H
MA3E7	*Boundary Value Problems and Fluid Dynamics* †	20	H
MA3V7	*Control Systems and Fluid Dynamics* †	20	H
MA38D	*History of Mathematics*	10	H
MA3D8	*Asymptotic Methods* †	10	H
MA3N7	*Reaction-Diffusion Theory* †	20	M

(† a selection of these will be available in any given year.)

(ii) *20 credits from:*

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

Progression requirements

To proceed to Part 2 it is sufficient to obtain an average of at least 40% in the Part 1 Mathematics modules averaged together, at least 40% in the Physics modules averaged together and have no module mark under 30%. Marks of less than 30% in a total of 20 credits, except for MA11A, MA11B, MA11C, PH1001, PH1002, PH104, will be condoned provided that the candidate has pursued the course for the module with reasonable diligence and has not been absent from the examination without reasonable cause.

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.

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 one third of the final assessment and Part 3 the remaining two thirds.

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: 300 points including grades 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 two Bs and a C in three other subjects.
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

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 contributing 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, management services and teaching. In recent years graduates who have followed this programme have gone into jobs as scientists (e.g. in DERA), to postgraduate study and as production assistant in a media company.

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 BSc 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 selection of more specialist optional topics.	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. 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:

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. conduct independent study of a chosen topic and report on the results.

Teaching/learning methods and strategies

Logic is an essential part of the understanding and construction of mathematical proofs and is embedded throughout the mathematics programme. The quality of a solution to 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 group project and the report produced as part of the module *Topics in Applied Mathematics*.

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. write and present orally a report on a chosen topic.

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 side of the course, 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 final year project. Time management is essential for the timely and effective completion of the programme. Library resources are required for the project in the final year project, and contribute to the best performances throughout.

Assessment

1 and 2 are assessed through coursework. 4 contributes towards modules in Parts 1 and 2. 5 is assessed in the project element of *Topics in Applied Mathematics*. 7 contributes to one Part 2 module. The effective of 6 will enhance performance in 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 expect 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 module and programme handbooks.