BSc Environmental Physics **UCAS code: F330**
For students entering Part 1 in 2015/6

Awarding Institution:	University of Reading
Teaching Institution:	University of Reading
Relevant QAA subject Benchmarking group(s):	Physics, Astronomy and Astrophysics; Earth Sciences, Environmental Sciences and Environmental Studies
Faculty:	Science Faculty
Programme length:	3 years
Date of specification:	24/May/2016
Programme Director:	Dr Matt Owens
Programme Advisor:	Dr Peter Inness
Board of Studies: Undergraduate	School of Mathematical and Physical Sciences
Accreditation:	Institute of Physics (to be sought)
Optional placement variation(s):	with Year Abroad

Summary of programme aims
The programme aims to provide a thorough degree-level education in the fundamental physics central to environmental physical science and its application to a number of atmospheric, oceanographic, Earth-system and solar-terrestrial situations. It aims to provide graduates with degree level knowledge of applied physics, along with the requisite scientific, mathematical and transferable skills, to enable them to pursue a career in a wide range of scientific, technical and numerate fields, including air pollution, environmental consultancy, adaptation to climate change, energy supply and insurance, as well as varied careers in terrestrial and space-weather forecasting and general environmental research.
Optional modules allow the student to pursue specialisations within the field of Environmental Physics, such as Climate Change, Dynamical Meteorology, Oceanography, Earth System Modelling, Atmospheric Spectroscopy and Solar-Terrestrial Physics.
Part 1 provides the student with a strong foundation in the core methods and approaches of Environmental Physics, with compulsory modules covering the required fundamental physical principles, mathematical tools and laboratory techniques. Part 2 has compulsory modules which further advance these core skills, as well as a range of optional modules which focus on particular areas of Environmental Physics in greater detail. Optional modules in Part 3 allow for specialisation in one or more Environmental Physics disciplines. Part 3 also features an extended project which develops skills in research and analysis, as well as scientific communication.

Transferable skills
During the course of their studies at Reading, all students will be expected to enhance their academic and personal transferable skills. In following this programme, students will have had the opportunity to develop such skills, in particular relating to communication, interpersonal skills, learning skills, numeracy, self-management, use of IT and problem-solving and will have been encouraged to further develop and enhance the full set of skills through a variety of opportunities available outside their curriculum.
A defining aspect of an education in physics is the ability to deliver cogent scientific arguments, understand and apply the scientific method and undertake quantitative problem solving. As part of this programme students are expected to have gained experience and show competence in the following transferable skills: IT (word-processing, using spreadsheet and graphical applications programs, scientific programming, internet), scientific writing, oral presentation, experimental methods, team-working, use of library resources, project planning, career planning and management, and business awareness.

Programme content
The profile that 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 optional modules). Students must choose such additional modules as they wish, in consultation with the Director of Studies, to make 120 credits in each Part. The number of credits for each module is shown after its title.

Part 1 (three terms)
Compulsory modules

Code	Title	Credits	Level
MA1CA	Calculus	20	4
MA1LA	Linear Algebra	20	4
MT11D	Weather and Climate Fundamentals	20	4
MT12C	Skills for Environmental Science	20	4
PH101	Physics of the Natural World	20	4
PH102	Atomic and Nuclear Physics	10	4
PH103	Global Environmental Chemistry	10	4

Part 2 (three terms)
Compulsory modules

Code	Title	Credits	Level
MA2VC	Vector Calculus	10	5
MA2MPH	Mathematical Physics	10	5
MT24C	Numerical Methods for Environmental Science	10	5
MT25D	Skills for Graduates	10	5
MT2SWC	Statistics for Weather and Climate Science	10	5
MT26E	Surface Energy Exchange	10	5
MT2IEM	Instrumentation for Environmental Measurements	10	5
MT24B	Atmospheric Physics	20	5
MT2ACT	Atmospheric Chemistry and Transport	10	5

Optional Modules
Optional Modules subject to pre-requisites stated in the Module Descriptions Students must select one or more Level 5 modules to the value of 20 credits, subject to pre-requisites in some cases. Alternatively, students may select a Level 4 module (for 20 credits) in a foreign language offered by the Institutional Wide Language Programme (IWLP). Choice is subject to timetable constraints and discussion with personal tutor and programme director.

Code	*Title*	*Credits*	*Level*
BI2EH4	Intro to the History and Philosophy of Science	10	5
GV2D5	Sustainable Resource Management	10	5
GV2H4	Transport Processes in the Environment	10	5
GV2M5	Global Quaternary Climate Change	10	5
GV2MES	Monitoring the Earth from Space	20	5
IWLP	Practical French/ German/ Italian/ Spanish	20	4
MM270	Practise of Entrepreneurship	20	5
MT24A	Atmosphere and Ocean Dynamics	20	5

Part 3 (three terms)
Compulsory modules

Code	Title	Credits	Level
MT37A	Part 3 Project	30	6
MT37B	General Studies	10	6

Optional Modules
Students must select level 6 modules from the following list to the value of 80 credits, subject to pre-requisites in some cases. Alternatively, students may select a level 7 module in Hydrology. Choice is subject to timetable constraints and discussion with personal tutor and programme director.

Code	*Title*	*Credits*	*Level*
GV342	Environmental Modelling	20	6
MM254	Organisational Behaviour	20	5
MT3AS	Atmospheric Spectroscopy	10	6

MT3SW	Space Weather	10	6
MT37D	Remote Sensing Methods and Applications	10	6
MT37F	Oceanography	10	6
MT37H	Atmospheric Science Field Course (Arran)	10	6
MT37J	Boundary Layer Meteorology	20	6
MT38B	Climate Change	10	6
MT38N	Atmospheric Electricity	10	6
MTMG44	Hydrology and Global Environmental Change	10	7

Progression requirements
To gain a threshold performance at Part 1 a student shall normally be required to achieve an overall average of at least 40% over 120 credits taken in Part 1, 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 additionally obtain at least 40% in the Environmental modules (MT11D, MT12C) averaged together, 40% in the Physics modules averaged together (PH101, PH102, PH103) and not less than 30% in each of the modules MT11D, MT12C and PH101.

To gain a threshold performance at Part 2, a student shall normally be required to achieve a weighted average of 40% over 120 credits taken at Part 2 AND marks of at least 40% in individual modules amounting to not less than 80 credits AND marks of at least 30% in individual modules amounting to not less than 120 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.
Part 2 contributes one third of the overall assessment and Part 3 the remaining two thirds.

Students are required to pass the professional/placement year in order to progress on the programme which incorporates the professional/placement year. Students who fail the professional/placement year transfer to the non-placement year version of the programme.

The University's honours classification scheme is:
Mark Interpretation
70% - 100% First class
60% - 69% Upper Second class
50% - 59% Lower Second class
40% - 49% Third class
35% - 39% Below Honours Standard
0% - 34% Fail

For the University-wide framework for classification, which includes details of the classification method, please see: www.reading.ac.uk/internal/exams/Policies/exa-class.aspx.

The weighting of the Parts/Years in the calculation of the degree classification is Three-year programmes
Part 2 one-third
Part 3 two-thirds

Summary of Teaching and Assessment
Teaching is organised in modules that typically involve lectures, problem solving classes, and practical classes. The assessment is carried out within the University's degree classification scheme, details of which are provided elsewhere. The pass mark in each module is 40%. Modules in parts 1 and 2 are normally assessed through a mixture of coursework and formal examination. Exceptions may occur for practicals or skills-based modules, and are detailed in the module specifications. In Part 3 there are some modules that are assessed wholly by coursework and others wholly by examination: the details are given in the module descriptions. The Part 3 project involves a substantial component of independent learning, under the supervision and guidance of a Project Supervisor. The project is assessed on the basis of formal reports, oral and poster presentations and the development of independent learning skills.
Please note that the University reserves the right to retain samples of coursework for the purposes of internal and external programme review.

You will be required to undertake a substantial independent piece of work (MT37A, the research project) during Part 3 that will involve settling on a topic and supervisor during the Summer Term of Part 2. Guidance notes on the preparation and submission of such a dissertation will be given to you at that time by the Programme Director. You will also have an introductory lecture at the start of the Autumn Term of Part 3 describing how to set about tackling the work.
Your Programme Handbook offers general advice relevant to your subject. If you have any queries or require further information, you should consult the relevant lecturers or your tutor.

Admission requirements
Entrants to this programme are normally required to have obtained:
Grade C or better in English, Science and Mathematics at GCSE;
Either A/AS level: ABB with an A/B grade in Mathematics and Physics (A2)
or International Baccalaureat: 33 points including 6 in Physics and 6 in Mathematics;
or Scottish Advanced Highers: 320 points with an AB combination in Physics and Mathematics plus the remainder from another Advanced Higher or other Highers;
or Irish Leaving Certificate: two grade As (in Maths and Physics) and three grade Bs in any other subjects;
or equivalent qualifications from other national exam systems etc.

Vocational international students without the above qualifications may be admitted via a 1-year International Foundation Programme, provided by the Department of Continuing Education.

Entry into Part 2 or Part 3 may be allowed under special circumstances, and would be considered on a case-by-case basis. It would be necessary to have successfully undertaken relevant studies at another institute.

Admissions Tutor: Dr Peter Inness

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

Within the providing Department additional support is given through practical classes and problem solving classes. The Department of Meteorology Library holds all textbooks used in connection with the programme, and also contains a Learning Resource Centre containing additional material such as course notes, reprints of important papers, and past examination papers. There is a Course Adviser to offer advice on the choice of modules within the programme.

Career learning
In addition to University of Reading Career and Professional Development services, advice on career planning is given in the Part 2 module, 'Skills for Graduates'. In addition to the development of transferable skills, it aims to provide students with the opportunity to develop self-awareness in the context of career decision making and knowledge of career opportunities

Career prospects
Graduates gaining a good honours degree are well-equipped for a wide range of physical science based careers or environmental research, such as with the British Antarctic Survey, the Centre for Ecology and Hydrology, the Environment Agency or the Met Office. Opportunities also exist in the general area of environmental consultancy, both with local authorities (in the UK) and private companies as well as for town and regional planning, environmental health assessment and the nuclear industry. A Physics and the Environment graduate is

also qualified to follow a career involving more general applications of physical science and mathematics, as in teaching (primary or secondary level), the scientific civil service, and industry.

Opportunities for study abroad
A version of this programme to include a maxi placement is available. Students undertaking a maxi placement spend a year in industry or year abroad between the second and third taught year. This year does not contribute to the final degree classification.

Placement opportunities
Placements can be arranged on an individual basis through a dedicated placements officer, who will aid in identifying and securing a suitable placement with an industrial partner. The placement will enhance the achievement of many of learning outcomes, the balance between outcomes depending on the character of the particular placement. It will also provide practical experience of working alongside suitable practitioners in a scientific, regulatory or commercial environment.

Programme Outcomes
The programme provides opportunities for students to develop and demonstrate knowledge and understanding, skills, qualities and other attributes in the following areas. The programme outcomes have been formulated with reference to the QAA benchmarking statements for Physics, Astronomy and Astrophysics and for Earth Sciences, Environmental Sciences and Environmental Studies. Given the cross-cutting nature of the programme, neither of these statements is applicable in its totality, but appropriate elements of both have been drawn upon. The Framework for Higher Education Qualifications in England, Wales and Northern Ireland (2008) has also been used.

Knowledge and Understanding

A. Knowledge and understanding of:	**Teaching/learning methods and strategies**
1. Fundamental physical concepts and laws, such as energy and momentum conservation, gravitational and electromagnetic forces, etc., particularly in relation to the Earth system. 2. Statistical physics and thermodynamics, in particular in relation to the atmosphere and oceans 3. Physical processes and phenomena operating in the atmosphere and oceans 4. The use of mathematical and numerical models to describe environmental systems 5. Impacts of environmental change on society. 6. Specialist topics relating to the Earth system and space environment, of current research interest.	The knowledge required for the fundamental topics is primarily delineated in Parts 1 and 2 through formal lectures supported by problem sets for students to tackle with support from the lecturer. This is further supported by illustrative laboratory work and computing practicals in Parts 1 and 2, and the extended research project in Part 3. The knowledge required for more specialist topics in Part 3 is enhanced through self-learning based on guided reading, problem solving and project work. The knowledge required for 5 and 6 is gained from weekly discussion classes during part 3. Feedback on 1-4 is provided through both formative and assessed work. *Assessment* Most knowledge is tested through a combination of coursework and unseen formal examinations. A research dissertation and oral presentations also contribute, most prominently in Part 3.

Skills and other attributes

B. Intellectual skills - *able to:*	**Teaching/learning methods and strategies**
1. Recognise and apply physical laws and principles to a range of diverse areas of environmental physics. 2. Make scientific arguments, understand and apply the scientific method and undertake quantitative problem solving. 3. Analyse, synthesise and summarise information critically	All modules are designed to teach 1 and 2, to varying degrees. 3 is embedded in all modules throughout the programme. 4 and 5 are primarily addressed by the laboratory-based modules in Parts 1 and 2, and the extended research project in Part 3. The skills required for 6 are gained from weekly discussion classes during part 3

4. Make suitable approximations necessary to obtain solutions and be able to evaluate uncertainty and significance of results.
5. Analyse and interpret environmental data and instrumentation.
6. Identify and interpret moral and ethical issues relating to the subject area

Assessment
1 and 2 are assessed directly by all modules in the programme. 3 is assessed indirectly in most parts of the programme. 4 and 5 are assessed by Part 1 and 2 laboratory reports, while 3, 4 and 5 are assessed by the Part 3 project. 4, 5 and 6 are directly assessed by a General Paper.

C. Practical skills - *able to:*

Teaching/learning methods and strategies

1. Plan, conduct, and report on scientific investigations, including the use of secondary data
2. Collect, record and analyse scientific data using appropriate techniques in experimental and laboratory settings
3. Undertake experimental and laboratory investigations in a responsible and safe manner
4. Make use of appropriate scientific texts and research materials, referencing work in an appropriate manner.

Laboratory, IT, and examples classes are designed to enhance skills 1 and 2. 3 is emphasised through guidelines and advice given to students in connection with practical work. 4 is emphasised through guidelines issued to students in connection with project work.

Assessment
1 and 2 are tested in coursework connected with laboratory and examples classes. 3 is not formally assessed, although teaching staff will individually satisfy themselves of it before allowing certain work to proceed. 4 is assessed as part of the part 3 project report.

D. Transferable skills - *able to:*

Teaching/learning methods and strategies

1. Communicate scientific knowledge clearly, professionally and effectively through both written and oral presentations.
2. Effectively use numerical computing and IT for data analysis and visualisation.
3. Appreciate and identify issues relating to the selection and reliability of experimental and laboratory data and equipment.
4. Work with others as part of a team, sharing knowledge effectively and recognising and respecting the views and opinions of other team members
5. Effectively manage their time and learning in an independent manner. Identify professional and development needs for personal, academic and career development
6.. Effectively use library resources.

Skills 1, 2 and 3 are developed throughout most of the programme, but particularly through practical work, examples classes and project work. 4 is encouraged through team-working within laboratory and examples classes. 5 is enhanced partly through the provision of a Career Development Skills module during Part 2, and partly through the tutorial system. 6 is covered by a study skills module.

Assessment
1 and 3 are assessed directly as an outcome of project work, and contribute to the coursework assessment of practical work. 2 is assessed indirectly, mainly in connection with laboratory and examples classes, as well as more directly in a numerical methods module. Skills 4, 5 and 6 are also indirectly assessed and their effective use will enhance performance in level 6 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 process or external sources, such as professional bodies, requires a change to be made. In such circumstances, a revised specification will be issued.