Programme Specification[1]

1. Programme Title(s) and Code(s):

Programme Title	*UCAS Code*	*GU Code*
MSci (Combined) in Physics (and another subject)		F301-2207H

2. Academic Session:

2016-17

3. SCQF Level (see Scottish Credit and Qualifications Framework Levels):

11

4. Credits:

600

5. Entrance Requirements:

Please refer to the current undergraduate prospectus at:
http://www.gla.ac.uk/undergraduate/degrees/physics/

6. ATAS Certificate Requirement (see Academic Technology Approval Scheme):

ATAS Certificate not required

7. Attendance Type:

Full Time

8. Programme Aims:

Physics involves the experimental and theoretical study of matter and energy and their interactions, ranging from the domain of elementary particles, through nuclear and atomic physics to the physics of solids, and ultimately to the development of the universe itself. The laws of physics form the basis of most branches of science and engineering and are the foundation of

[1] 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 full advantage is taken of the learning opportunities that are provided. More detailed information on the learning outcomes, content and teaching, learning and assessment methods of each course can be found in course handbooks and other programme documentation and online at www.gla.ac.uk
The accuracy of the information in this document is reviewed periodically by the University and may be checked by the Quality Assurance Agency for Higher Education.

modern technology. In this MSci half-programme we aim to give the student an in depth understanding of the principles and methods of modern physics, and the skills to analyse and solve a range of theoretical and experimental problems. In order to illustrate this programme, we draw on a wide variety of research and applications, including work performed in the School of Physics & Astronomy.

Specific Aims of the Programme

(1) To present an integrated course of study which describes, analyses and relates the principles of modern physics at a level appropriate for a professional physicist;

(2) To provide the opportunity to study in depth a choice of advanced treatments and applications of aspects of modern physics and astronomy;

(3) To provide training and experience in the principles and practice of physical measurement techniques, using advanced instrumentation where appropriate, and in the critical analysis of experimental data;

(4) To develop problem solving abilities, critical assessment and communication skills, to a level appropriate for a career of leadership in academia or industry, and to give students the experience of group work;

(5) To offer the opportunity to apply measurement, problem solving and critical assessment, and communication skills in performing and writing a report on an extended and demanding project;

(6) To encourage students to work effectively, to develop a professional attitude to what they do and to take full responsibility for their own learning.

9. Intended Learning Outcomes of Programme:

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

On completion of the programme the student will be able to:

- Understand and apply a range of basic mathematical methods which are useful in solving quantitative problems in physics;
- Understand and describe the key concepts which underpin current knowledge in wave phenomena, quantum mechanics, thermal physics, circuits and systems, electromagnetism, solid state physics and nuclear and particle physics, applying these concepts to analyse and solve quantitative problems;
- Understand and describe the key physical concepts which underpin current knowledge across a subset of more specialist (H-level) topics drawn from: numerical methods, modern optics, medical imaging, semiconductor physics, magnetism and superconductivity, electronic signals transmission, particle physics, nuclear physics, stellar structure and evolution, high energy astrophysics, galaxies and cosmology, circumstellar matter, astronomical instrumentation and data analysis. Apply these concepts to analyse and solve quantitative problems;
- Demonstrate a deeper understanding of more advanced physical concepts across a subset of more specialist (M-level) topics drawn from: advanced quantum mechanics, electromagnetism, statistical mechanics, imaging and microanalysis, dynamics and relativity, detectors for nuclear and particle physics, general relativity and gravitation, plasma theory and diagnostics.

Skills and Other Attributes

Subject-specific/practical skills

On completion of the programme students will be able to

- Programme straightforward procedures in a high level computer language and use computers to solve physical problems;
- Plan and carry out experimental investigations, using standard and complex or advanced experimental equipment and apparatus, of complex physical systems or processes, demonstrating logic, initiative, planning and decision making skills in solving problems encountered;
- Analyse, interpret and critically evaluate experimental data, make a quantitative evaluation of the errors inherent in the experimental measurements and draw valid conclusions from the results of experimental investigations;
- Apply computer software to analyse experimental data and to write scientific reports;
- Recover, evaluate and summarise the professional literature and material from other sources concerned with a chosen area of physics or astronomy, and prepare a written analysis of the current position in the chosen area, which should include a critical comparison of the material and a discussion of likely future developments;
- Plan the course of action required to achieve self-defined goals in an open-ended physics project;
- Make appropriate safety assessments for experimental procedures.

Intellectual skills

On completion of the programme students will be able to:

- Describe and analyse quantitatively processes, relationships and techniques related to the areas covered in the contributory courses;
- Write down, and where appropriate either prove or discuss the underlying basis of, physical laws related to topics in these areas;
- Analyse critically, and solve using appropriate mathematical tools, advanced or complex problems, which may include unseen elements, related to topics included in the course component outlines;
- Demonstrate a critical awareness of the significance and importance of the topics, methods and techniques discussed in the lectures and their relationship to other concepts in courses which have been taken.

Transferable/key skills

On completion of the programme students will be able to:

- Give an oral account of experimental work performed and conclusions drawn from it;
- Prepare a detailed written report on an experimental investigation;
- Apply logical analysis to problem solving;
- Make a preliminary definition of goals to be achieved during open-ended project work and revise these goals and strategies for completion of the work in the light of results achieved and difficulties encountered;
- Write a report on an extended piece of project work, which should include a critical evaluation of the significance of the work, and how it compares with earlier work done in the same area;
- Prepare an abstract of experimental or project work performed in the accepted scientific format;
- Prepare and present audio-visual presentations and posters summarising the results of a project;
- Appreciate open problems typical of business situations;
- Interact positively with colleagues in a group context;

- Apply team-working skills to address a complex physics problem and contribute significantly to the work of a group tackling such a problem, combining their own work constructively with the work of others;
- Contribute to the management of a group engaged in project work;
- Combine with colleagues to prepare and deliver a presentation and report of group work.

10. Typical Learning and Teaching Approaches:

Knowledge and Understanding:

Lectures and class tutorials
Small group supervisions
Laboratory and project work
Private study

Intellectual skills:

Lectures and class tutorials
Small group supervisions
Laboratory work, including IT laboratory
Private study

Subject-specific/practical skills:

Laboratory work, including IT laboratory
Individual project work

Transferable/key skills:

Skills workshop
Extended project
Small group supervisions

11. Typical Assessment Methods:

Knowledge and understanding:

Written examinations
Verbal and written reports of laboratory and IT work
Multiple choice questions

Intellectual skills:

Written examinations
Verbal and written reports of laboratory and IT work
Multiple choice questions

Subject-specific/practical skills:

Verbal and written reports of laboratory and IT work
Verbal, written and poster presentations of project work

Transferable/key skills:

Verbal and written reports of laboratory and IT work
Oral and written presentations of Group project work, and assessments by supervisors
Written and poster presentations of project work, and assessment by supervisors

12. Programme Structure and Features:

The MSci programme in Physics and another *subject* lasts 5 years and contains a minimum of 600 credits, as required by the regulations of the College of Science and Engineering, set out in the University Calendar, for an integrated masters degree. This figure includes a minimum of 120 credits at M-level and a further 240 credits at either H-level or M-level, all of which must be taken in years 3, 4 or 5.

A minimum of 120 credits must be taken in Years 1 to 4. In year 5 the minimum number of credits is the number required to complete the degree programme. The maximum number of credits which may be taken in any year is 160.

The courses which can be taken in years 3, 4 and 5 are subject to timetabling constraints and to students having taken prerequisite courses in an earlier semester or year. In the sample degree programme listed below, all compulsory courses are taken as soon as possible.

Year 1
Physics 1 [PHYS1001] (40 credits)
Mathematics 1R [MATHS1001] or 1X [MATHS1004] and Mathematics 1S [MATHS1002], or 1Y [MATHS1005] (20 credits each)
Additional classes (40 credits, and which should satisfy the requirements of *subject*).

Year 2
Physics 2 [PHYS2001] (60 credits)
Mathematics 2A, 2B and 2D [MATHS2001, 2004 AND 2006] (10 credits each)
Additional classes (A minimum of 30 credits, and which should satisfy the requirements of *subject*).

Year 3
60 credits of compulsory courses as listed:

P301H Mathematical Methods 1 [PHYS4011] (10 credits),
P302H Waves & Diffraction [PHYS4031] (10 credits),
P304H Quantum Mechanics [PHYS4025] (10 credits),
P305H Thermal Physics [PHYS4030] (10 credits),
P3LABH Honours Physics Laboratory [PHYS4009] (20 credits).

Plus 60 credits of courses from *subject*

Year 4
60 credits of compulsory courses as listed:

P306H Electromagnetic Theory 1 [PHYS4004] (10 credits),
P401H Solid State Physics [PHYS4028] (10 credits),
P402H Nuclear & Particle Physics [PHYS4015] (10 credits),
P403H Atomic Systems [PHYS4002] (10 credits),
P409H Mathematical Methods 2 [PHYS4012] (10 credits),

P4GPWH General Physics Workshop [PHYS4007] (10 credits),

Plus 60 credits of courses from *subject*

Year 5

P4PR40M Physics M-Project [PHYS5009P] (40 M-credits). This will constitute a substantial component of independent research at an advanced level, as required by the MSci regulations.

P4PSWM Problem Solving Workshop [PHYS5012] (10 M-credits).

Plus at least 30 credits of elective courses from the following list, to give a total of at least 360 credits at H-level or M-level and including at least 120 credits at M-level. Students may not retake any elective courses previously taken in 3rd or 4th year.

P410M Relativistic Quantum Fields [PHYS5014] (10 M-credits),
P411M Electromagnetic Theory 2 [PHYS5005] (10 M-credits),
P412M Statistical Mechanics [PHYS5016] (10 M-credits)
P413M Imaging & Detectors [PHYS5035] (10 M-credits),
P414M Dynamics, Electrodynamics & Relativity [PHYS5004] (10 M-credits)
P416H Energy and the Environment [PHYS4006] (10 credits)
P417H Physics Education & Communication [PHYS4034] (10 credits)
P420M Groups & Symmetries [PHYS5007] (10 M-credits)
P421M Frontiers of Optics [PHYS5002] (10 M-credits)
P422H Peer to Peer Teaching & Learning in Physics [PHYS4045] (10 credits)
P423M Detection & Analysis of Ionising Radiation [PHYS5036] (10 credits)
P424M Nuclear Power Reactors [PHYS5038] (10 credits)
P425M Environmental Radioactivity [PHYS5037] (10 credits)
P426M Quantum Information [PHYS5039] (10 credits)
P427M Fundamentals of Sensing & Imaging [PHYS5040] (10 credits)
P431M Fundamentals of Sensing & Monitoring [PHYS5044] (10 credits)

Plus 40 credits of courses from *subject*

Assessment

The programme is assessed on the basis of performance in compulsory and elective courses taken in years 3, 4 and 5. If a greater number of elective courses is taken than required, the performance in elective courses will be based on the best combination of elective courses meeting the minimum requirement.

The classification of marks for each course is made according to the University Code of Assessment and the programme assessment is based on the average mark of all contributing courses, weighted according to the number of credits for each course.

Lecture Course assessment: 60 minute written paper for each 10-credit lecture course; 90 minute written paper for each 15-credit lecture course.

The P4GPWH General Physics Workshop and the P4PSWM Problem Solving Workshop courses: 60 minute written paper, weighted 2/3, and continuous assessment, weighted 1/3.

P3LABH Honours Physics Laboratory and P4PR40M Physics M-Project: continuous assessment. In each case, this will include assessment of a written report on each experiment or project carried out.

For P4PR40M the weighting will also include an explicit component of 45 % assessment of the project work, by the project supervisor(s). For P4PR40M an additional 15 % of the assessment weighting will derive from an oral and poster presentation, assessed by a panel of three staff members (including the project co-ordinators).

Progress Requirements

In addition to Science general progress requirements :

Year 1 to Year 2: Physics 1, Mathematics 1R or 1X and Mathematics 1S, or 1Y normally all at grade D3 or better. Requirements of other subject;

Year 2 to Year 3: Physics 2 at B3 or better, plus Mathematics 2A and 2B and 2D at an average of B3 or better, all normally at first diet of examination. Requirements of other subject;

Year 3 to Year 4: An average grade of C3 or better over all 3rd year courses. Requirements of other subject;

Year 4 to Year 5: An average grade of C3 or better over all 3rd and 4th year courses. Requirements of other subject.

Marks defining progression are awarded in accordance with the University Code of Assessment.

Exit Awards and programme changes

At the end of Year 3, students who satisfy the University requirements, may graduate with a Designated B.Sc. Joint Degree in Physics and *subject*.

At the end of year 3, students may also move to the B.Sc. Joint Honours programme in Physics and *subject*.

At the end of year 4 students who satisfy the relevant University requirements may, at the discretion of the Dean(s), graduate immediately with an Honours B.Sc. Degree in Physics.

13. Programme Accredited By:

Institute of Physics

14. Location(s):

Glasgow

15. College:

College of Science and Engineering

16. Lead School/Institute:

Physics and Astronomy [REG30600000]

17. Is this programme collaborative with another institution:

Select...

18. Awarding Institution(s):

University of Glasgow

19. Teaching Institution(s):

20. Language of Instruction:

English

21. Language of Assessment:

English

22. Relevant QAA Subject Benchmark Statements (see Quality Assurance Agency for Higher Education) and Other External or Internal Reference Points:

This Programme Specification is informed by the QAA Benchmark Statement for Physics, Astronomy and Astrophysics which can be found at:

http://www.qaa.ac.uk/Publications/InformationAndGuidance/Documents/Physics08.pdf

The Programme Specification also addresses the requirements of the "Core of Physics" programme identified by the Institute of Physics (IoP).

23. Additional Relevant Information (if applicable):

Support for students is provided by the Postgraduate/Undergraduate Adviser(s) of Studies supported by University resources such as the Student Learning Service (www.gla.ac.uk/services/sls/), Counselling & Psychological Services (www.gla.ac.uk/services/counselling/), the Disability Service (www.gla.ac.uk/services/studentdisability/) and the Careers Service (www.gla.ac.uk/services/careers/).
Further information for intending students is available on the School of Physics and Astronomy Website at http://www.gla.ac.uk/schools/physics/

24. Date of approval:	