School of Physics & Astronomy

Important Degree Information:

Students who are aiming for a degree in Physics or Astrophysics and who enter with good Advanced Highers or A-levels or equivalent in Physics and Mathematics may apply to take an accelerated entry route to the programme, which can reduce the length of the BSc honours programme to three years and the MPhys programme to four years.

B.Sc./M.A. Honours
The general requirements are 480 credits over a period of normally 4 years (and not more than 5 years) or part-time equivalent; the final two years being an approved Honours programme of 240 credits, of which 90 credits are at 4000 level and at least a further 120 credits at 3000 and/or 4000 levels. Refer to the appropriate Faculty regulations for lists of subjects recognised as qualifying towards either a B.Sc. or M.A. degree.

B.Sc./M.A. Honours with Integrated Year Abroad
The general requirements are 540 credits over a period of normally 5 years (and not more than 6 years) or part-time equivalent; the final three years being an approved Honours programme of 300 credits, of which 60 credits are gained during the integrated year abroad, 90 credits are at 4000 level and at least a further 120 credits at 3000 and/or 4000 levels. Refer to the appropriate Faculty regulations for lists of subjects recognised as qualifying towards either a B.Sc. or M.A. degree.

M.Phys. Honours
The general requirements are 600 credits over a period of normally 5 years (and not more than 6 years) or part-time equivalent; the final three years being an approved Honours programme of 360 credits, of which 120 credits are at 5000 level and a further 210 credits (minimum) at 3000 and 4000 levels.

M.Sci. Honours
The general requirements are 600 credits over a period of normally 5 years (and not more than 6 years) or part-time equivalent; the final three years being an approved Honours programme of 360 credits, of which 120 credits are at 5000 level and a further 210 credits (minimum) at 3000 and 4000 levels.

Other Information: In the case of students who spend part of the Honours programme abroad on a recognised Exchange Scheme, the Programme Requirements will be amended to take into account courses taken while abroad.

Degree Programmes	Programme Requirements at:
(B.Sc. Honours): **Astrophysics**	**Single Honours Astrophysics (B.Sc.) Degree:** **Level 1:** 80 credits comprising**:** PH1011, PH1012, MT1002 and AS1001. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 120 credits comprising: 11 or better in AS2001, PH2011, PH2012, and in MT2001. Those on the accelerated-entry route have the same PH and MT requirements for entry to Honours Astrophysics, but normally take AS1001 in their year of entry .AS2101 is then taken in the first semester of JH. **Level 3:** 105 credits comprising: AS3011, AS3013, PH3007, PH3012, PH3014, PH3061, PH3062 PH3066 and PH3075 (except for students who have taken MT2003). **Level 4:** At least 60 credits comprising: AS4103, PH4022 and at least two of AS3015, AS4021 - AS4025, and PH4031.

Degree Programmes	Programme Requirements at:
(M.Phys. Honours): **Astrophysics** **(for students entering Honours before 2010)**	**Single Honours Astrophysics (M.Phys) Degree:** **Level 1:** 80 credits comprising: PH1011, PH1012, MT1002 and AS1001. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 120 credits comprising: grade 15 or better in AS2001, PH2011 and PH2012, and grade 11 or better in MT2001. Those on the accelerated-entry route have the same PH and MT requirements for entry to Honours Astrophysics, but normally take AS1001 in their year of entry. AS2101 is then taken in the first semester of JH. **Level 3:** 110 credits comprising: AS3011, AS3013, AS3015, PH3007, PH3012, PH3014, PH3061, PH3062, PH3066 and PH3075 (except for students who have taken MT2003). **Level 4:** At least 55 credits comprising: AS4022, AS4023, PH4022 and at least two of AS4021, AS4024, AS4025 and PH4031. **Level 5:** At least 90 credits comprising: AS5101 and at least two of AS5001, AS5002, AS5003.
(M.Phys. Honours): **Astrophysics** **(for students entering Honours in 2010 or later)**	**Single Honours Astrophysics (M.Phys) Degree:** **Level 1:** 80 credits comprising: PH1011, PH1012, MT1002 and AS1001. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 120 credits comprising: grade 15 or better in AS2001, PH2011, PH2012, and in MT2001. Those on the accelerated-entry route have the same PH and MT requirements for entry to Honours Astrophysics, but normally take AS1001 in their year of entry. AS2101 is then taken in the first semester of JH. **Level 3:** 110 credits comprising: AS3011, AS3013, AS3015, PH3007, PH3012, PH3014, PH3061, PH3062, PH3066 and PH3075 (except for students who have taken MT2003). **Level 4:** At least 55 credits comprising: AS4022, AS4023, PH4022 and at least two of AS4021, AS4024, AS4025 and PH4031. **Level 5:** At least 90 credits comprising: AS5101 and at least two of AS5001, AS5002, AS5003.
(B.Sc. Honours): **Physics**	**Single Honours Physics (B.Sc.) Degree:** **Level 1:** 60 credits comprising: PH1011, PH1012, and MT1002. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 90 credits comprising: grade 11 or better in PH2011, PH2012, and in MT2001. **Level 3:** 105 credits comprising: PH3002, PH3007, PH3012, PH3014, PH3061, PH3062, PH3066, PH3075 (except for students who have taken MT2003) and PH3101. **Level 4:** 70 credits comprising: PH4021, PH4022, PH4105 and PH4111.

Degree Programmes	Programme Requirements at:
(B.Sc. Honours): **Physics and one of:** **Computer Science,** **Logic & Philosophy of Science,** **Mathematics.**	**Physics element of Joint B.Sc. Honours Degree:** **Level 1:** 60 credits comprising: PH1011, PH1012, and MT1002. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 90 credits comprising: grade 11 or better in PH2011, PH2012, and in MT2001 **Level 3:** 60 credits comprising: PH3007, PH3012, PH3061, PH3062, PH3066 and PH3075 (except for students who have taken MT2003). **Level 4:** 10 credits comprising PH4022. **Other information:** In total (between the two Schools) 240 credits are required at 3000 level and 4000 level of which at least 90 credits must be achieved at 4000 level.
(M.Phys. Honours): **Physics** **(for students entering Honours before 2010)**	**Single Honours Physics (M.Phys.) Degree:** **Level 1:** 60 credits comprising PH1011, PH1012, and MT1002. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 90 credits comprising: grade 15 or better in PH2011 and PH2012, and 11 or better in MT2001 **Level 3:** 135 credits comprising: PH3002, PH3004 or PH3074, PH3007, PH3012, PH3014, PH3061, PH3062, PH3066, PH3073, PH3075 (except for students who have taken MT2003) and PH3101. **Level 4:** 60 credits comprising: PH4021, PH4022, PH4028, PH4030 and PH4105. **Level 5:** 60 credits comprising: PH5101.
(M.Phys. Honours): **Physics** **(for students entering Honours in 2010 or later)**	**Single Honours Physics (M.Phys.) Degree:** **Level 1:** 60 credits comprising PH1011, PH1012, and MT1002. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 90 credits comprising: grade 15 or better in PH2011, PH2012 and in MT2001 **Level 3:** 135 credits comprising: PH3002, PH3074, PH3007, PH3012, PH3014, PH3061, PH3062, PH3066, PH3073, PH3075 (except for students who have taken MT2003) and PH3101. **Level 4:** 60 credits comprising: PH4021, PH4022, PH4028, PH4030 and PH4105. **Level 5:** 60 credits comprising: PH5101.
(M.Phys. Honours): **Physics with Photonics** **(for students entering Honours before 2010)**	**Physics with Photonics (M.Phys.) Degree:** **Level 1:** 60 credits comprising: PH1011, PH1012, and MT1002. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 90 credits comprising: grade 15 or better in PH2011 and PH2012, and 11 or better in MT2001 **Level 3:** 165 credits comprising: PH3002, PH3007, PH3010 or PH4035, PH3012, PH3014, PH3061, PH3062, PH3066, PH3073, PH3074, PH3075 (except for students who have taken MT2003) and PH3101. **Level 4:** 60 credits comprising: PH4021, PH4022, PH4027, PH4028, PH4030, PH4034, and PH4105. **Level 5:** 90 credits comprising: PH5005, PH5008 and PH5101.

Degree Programmes	Programme Requirements at:
(M.Phys. Honours): **Physics with Photonics** **(for students entering Honours in 2010 or later)**	**Physics with Photonics (M.Phys.) Degree:** **Level 1:** 60 credits comprising: PH1011, PH1012, and MT1002. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 90 credits comprising: grade 15 or better in PH2011, PH2012, and in MT2001 **Level 3:** 165 credits comprising: PH3002, PH3007, PH4035, PH3012, PH3014, PH3061, PH3062, PH3066, PH3073, PH3074, PH3075 (except for students who have taken MT2003) and PH3101. **Level 4:** 60 credits comprising: PH4021, PH4022, PH4027, PH4028, PH4030, PH4034, and PH4105. **Level 5:** 90 credits comprising: PH5005, PH5008 and PH5101.
(M.Sci. Honours): **Physics and Chemistry** **(M.Sci. Honours) 5 year Degree** **(for students entering Honours before 2010)**	**Physics element of Physics-Chemistry M.Sci. Honours Degree:** **Level 1:** 60 credits comprising: PH1011, PH1012, MT1002 **Level 2:** At least 90 credits comprising: grade 15 or better in PH2011 and PH2012, and 11 or better in MT2001 **Level 3:** At least 90 credits comprising: PH3002, PH3007, PH3012, PH3061, PH3062, PH3066, PH3075 (except for students who have taken MT2003) and at least one of PH3101, PH4105 **Level 4:** 25 credits comprising: PH4021 and PH4022 **Level 5:** 60 credits from PH5101 plus at least one 15-credit 5000-level module in Physics plus at least 30 credits at 5000 level in Chemistry OR 40 credits from CH5441 plus at least 30 credits at 5000 level in Chemistry plus at least 30 credits in 5000-level modules in Physics.
(M.Sci. Honours): **Physics and Chemistry** **(M.Sci. Honours) 5 year Degree** **(for students entering Honours in 2010 or later)**	**Physics element of Physics-Chemistry M.Sci. Honours Degree:** **Level 1:** 60 credits comprising: PH1011, PH1012, MT1002 **Level 2:** At least 90 credits comprising: grade 15 or better in PH201, PH2012, and in MT2001 **Level 3:** At least 90 credits comprising: PH3002, PH3007, PH3012, PH3061, PH3062, PH3066, PH3075 (except for students who have taken MT2003) and at least one of PH3101, PH4105 **Level 4:** 25 credits comprising: PH4021 and PH4022 **Level 5:** 60 credits from PH5101 plus at least one 15-credit 5000-level module in Physics plus at least 30 credits at 5000 level in Chemistry OR 40 credits from CH5441 plus at least 30 credits at 5000 level in Chemistry plus at least 30 credits in 5000-level modules in Physics.

Degree Programmes	Programme Requirements at:
(M.Phys. Honours): **Theoretical Physics**	**Single Honours Theoretical Physics (M.Phys.) Degree:** **Level 1:** 60 credits comprising: PH1011, PH1012, and MT1002. For those who enter at Second level, the PH modules are not required. **Level 2:** At least 90 credits comprising: grade 15 or better in PH2011 and PH2012, and in MT2001 **Level 3:** 120 credits comprising: MT3501, PH3002, PH3007, PH3012, PH3014, PH3061, PH3062, PH3066, PH3073 and PH3075 (except for students who have taken MT2003). **Level 4:** 60 credits comprising: PH4021, PH4022, PH4028, PH4030, PH4032. **Level 5:** At least 90 credits comprising: PH5002, PH5004, PH5102 and at least one of PH5003, PH5011 and PH5012.
(M.Phys. Honours): **Theoretical Physics and Mathematics**	**Theoretical Physics element of Joint M.Phys. Honours Degree:** **Level 1:** 40 credits comprising: PH1011, PH1012. For those who enter at Second level, these PH modules are not required. **Level 2:** 60 credits comprising: grade 15 or better in PH2011 and PH2012. **Level 3:** At least 65 credits comprising: PH3007, PH3012**,** PH3061, PH3062, PH3075 (except for students who have taken MT2003). and (PH3073 or MT4507) **Level 4:** 35 credits comprising: PH4022, PH4028 and PH4032. **Level 5:** At least 85 credits comprising: PH5002, PH5004, PH5102 or MT5999, and at least one of PH5003, PH5011 and PH5012.

Modules
InterDisciplinary (ID) Modules

This School contributes to inter-disciplinary modules **ID1003 Great Ideas 1, ID1004 Great Ideas 2** and **ID2004 Science Ethics (Section 23).**

Astronomy (AS) Modules

AS1001 Astronomy and Astrophysics 1

Credits: 20 Semester: 1

Prerequisites: SQA Higher or A-Level Physics and Mathematics, at grade B or better.

Anti-requisite: AS1002

Description: This module surveys our present state of knowledge of the orbits, surfaces and atmospheres of the planets in our solar system; the structure and evolution of the Sun and other stars, including extra-solar planetary systems; the bizarre menagerie of star-forming regions, violent stellar objects and supermassive black holes found within our own Milky Way Galaxy and in other galaxies; and the large-scale structure and ultimate fate of the expanding Universe. Throughout the module, fundamental observations are interpreted using simple but powerful geometric methods to show how distances and other properties of astronomical objects throughout the Universe have been measured, from the time of Copernicus to the era of the Hubble Telescope and beyond.

Class Hour: 11.00 am

Teaching: 4 or 5 lectures, 1 tutorial and 1 laboratory.

Assessment: Laboratory work = 25%, Other Continuous Assessment = 15%, 2-hour Examination = 60%

Re-Assessment: Laboratory work = 25%, 2-hour Examination = 75%

AS1002 The Physical Universe

Credits: 20 Semester: 2

Anti-requisites: AS1001 and PH1011 and PH1012

Description: This module presents a descriptive, non-mathematical account of the physical universe. It is aimed at students from across the University. It is divided into two components: concepts in astronomy, dealing with our understandings of the properties and ages of planets, stars, galaxies, and their distributions in space, cosmology and the origin of the Universe; and concepts in physics, dealing with our understandings of the nature of light and matter, the structure of atoms, fundamental particles and their links to cosmology.

Class Hour: 11.00 am

Teaching: 4 lectures, 1 tutorial/seminar.

Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

Re-Assessment: 2-hour Examination = 100%

AS2001 Astronomy and Astrophysics 2

Credits: 30 Semester: 1

Prerequisites: AS1001, PH1011, PH1012 and MT1002.

Anti-requisite: AS2101

Description: This module comprises four lecture courses which extend knowledge gained in the first level module AS1001, and discuss recent developments in the subject: (i) observational techniques - modern telescopes, instruments and detectors for gamma-, X-, uv, optical, IR and radio radiation; spherical astronomy and essential coordinate systems; (ii) the structure and evolution of stars - nucleosynthesis, stellar properties as a function of age, a complete understanding of the HR diagram; (iii) the chemical evolution of the Universe - abundances from the Big Bang to the present; (iv) galactic astronomy - the distribution and motion of stars, gas, dust, and dark matter in our Milky Way and other galaxies.

Class Hour: 11.00 am

Teaching: 4 lectures, 1 tutorial and 1 laboratory.

Assessment: Laboratory work = 25%, Other Continuous Assessment = 15%, 3-hour Examination = 60%

Re-Assessment: Laboratory work = 25%, 3-hour Examination = 75%

AS2101 Astrophysics 2

Credits: 15 Semester: 1

Prerequisites: AS1001, and Admission into an Honours programme in the School of Physics and Astronomy

Anti-requisite: AS2001

Description: This module is designed to extend the knowledge gained in the first level AS1001 module and to prepare the way for more advanced material appearing in the honours astrophysics modules. The module has three basic components dealing with the physics of stellar structure and evolution, the components and dynamics of galaxies and the chemical evolution of the Universe including the synthesis of the elements.

The module is based on the physical principles and mathematical techniques acquired earlier, and applied to the astrophysical concepts covered in AS1001.

Class Hour: 11.00 am

Teaching: 3/4lectures and 1 tutorial.

Assessment: Continuous Assessment = 20%, 2-hour Examination = 80%

Re-Assessment: 2-hour Examination = 100%

Physics (PH) Modules

PH1011 Physics 1A

Credits: 20 Semester: 1

Prerequisite(s): SQA Higher or A-Level Physics and Mathematics, at grade B or better.

Anti-requisite: AS1002

Description: This module covers the core subjects of mechanics, waves and optics, and also provides an overview of the physical properties of matter. It is suitable for those who have studied physics to the level of Higher Physics or equivalent. It includes lectures on Newton's laws, gravitation, simple harmonic motion, the different types of wave motion, geometrical and wave optics, and the nature and composition of nuclei, atoms, molecules and solids, and their interactions. Relevant laboratory work is an important part of the module.

Class Hour: 12.00 noon

Teaching: 4 lectures, 1 workshop, 1 tutorial and 1 laboratory.

Assessment: Continuous Assessment = 40%, 2-hour Examination = 60%

Re-Assessment: Continuous Assessment = 40%, 2-hour Examination = 60%

PH1012 Physics 1B

Credits: 20 Semester: 2

Prerequisite(s): PH1011

Anti-requisite: AS1002

Description: This module covers an introduction to quantum mechanics, the mechanics of motion and an introduction to lasers. The module is suitable for those who have studied physics to the level of Higher Physics or equivalent. It includes lectures on the origins of quantum theory, its application to atoms and other small-scale systems; the principles of lasers, and some aspects of optical communication. The module also includes a set of group-based activities associated with the use of physics ideas to solve an interesting problem. Relevant laboratory work is an important part of the module.

Class Hour: 12.00 noon

Teaching: 4 lectures, 1 workshop, 1 tutorial and 1 laboratory.

Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

Re-Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

PH2011 Physics 2A

Credits: 30 Semester: 1

Prerequisite(s): PH1011, PH1012 and MT1002; alternatively passes in Advanced Higher Physics and Mathematics or A-Level Physics and Mathematics, both normally at grade A.

Description: This module covers the subjects of mechanics, relativity, oscillations, and thermal physics. It is suitable for those who have taken the specified first year modules in physics and mathematics, or have good Advanced Higher or A-level passes or equivalent in physics and mathematics. It includes lectures on the dynamics of particles and rigid bodies, Einstein's special theory of relativity, free, forced and damped harmonic motion, and lectures on thermal physics including elementary thermodynamics and the notion of entropy.

Class Hour: 10.00 am

Teaching: 4 or 5 lectures, 1 workshop, 1 tutorial and 1 laboratory.

Assessment: Continuous Assessment = 40%, 3-hour Examination = 60%

Re-Assessment: Continuous Assessment = 40%, 3-hour Examination = 60%

PH2012 Physics 2B

Credits: 30 Semester: 2

Prerequisite(s): PH1011, PH1012 and MT1002; alternatively passes in Advanced Higher Physics and Mathematics or A-Level Physics and Mathematics, both normally at grade A.

Description: This module covers the subjects of quantum physics, electricity and magnetism and classical waves. It is suitable for those who have taken the specified first year modules in physics and mathematics, or have good Advanced Higher or A-Level passes or equivalent in physics and mathematics. It includes lectures on the origin of Schrodinger's equation in quantum mechanics and its solution for simple one-dimensional potentials; an elementary introduction to the electromagnetic field comprising electrostatics, magnetostatics, electromagnetic induction and circuit theory; and lectures on waves, acoustics, polarisation of light, and interference.

Class Hour: 10.00 am

Teaching: 4 or 5 lectures, 1 workshop, 1 tutorial and 1 laboratory.

Assessment: Continuous Assessment = 40%, 3-hour Examination = 60%

Re-Assessment: Continuous Assessment = 40%, 3-hour Examination = 60%

Gateway to Physics and Engineering (PH) Modules

PH1501 Mathematics for Physicists 1A

Credits: 20 Semester: 1

Prerequisite(s): Entry to Gateway to Physics and Engineering Programme

Anti-requisite: MT1001

Co-requisites: PH1011, PH1502

Description: This module is designed to give physics students a secure base in elementary calculus and other mathematical tools to enable them to access the mathematics modules needed for progression into physics and engineering degrees. Participants will learn to use this mathematics effectively and efficiently in the context of work in physics. Some of the work is a revision and practice of material that will normally have been seen in the Scottish Higher and some A-Level maths syllabi.

Class Hour: To be arranged.

Teaching: 5 lectures and 3 tutorials.

Assessment: Continuous Assessment = 50%, 2-hour Examination = 50%

Re-Assessment: 2-hour Examination = 100%

PH1502 Physics Skills 1A

Credits: 20 Semester: 1

Prerequisite(s): Entry to Gateway to Physics and Engineering Programme

Co-requisites: PH1011, PH1501

Description: This module develops academic and transferable skills in problem-solving, team-working, information retrieval and analysis, and study skills. It is a core module of the level one programme "Gateway to Physics and Engineering".

Class Hour: To be arranged.

Teaching: 1 lecture and 5 tutorials.

Assessment: Continuous Assessment = 100%

PH1503 Physics Skills 1B

Credits: 20 Semester: 2

Prerequisite(s): Entry to Gateway to Physics and Engineering Programme

Anti-Requisite: MT1001

Co-requisites: PH1012

Description: This module develops academic and transferable skills in problem solving in physics, in mathematical modelling of physical systems, in numerical/computational work applied to physics, and in study skills. It is a core module for the level one programme "Gateway to Physics and Engineering".

Class Hour: To be arranged.

Teaching: 1 lecture and 5 tutorials.

Assessment: Continuous Assessment = 100%

The details of the Honours modules – that is 3000-level, 4000-level and 5000-level modules – which relate to the programmes listed in this section, are available in the Honours Course Catalogue.