1. **Title of the module**

PHYS3700 (PH370) - Laboratory and Computing Skills for Physicists

1. **School or partner institution which will be responsible for management of the module**

Physical Sciences

1. **The level of the module (Level 4, Level 5, Level 6 or Level 7)**

Level 4

1. **The number of credits and the ECTS value which the module represents**

30 credits (15 ECTS)

1. **Which term(s) the module is to be taught in (or other teaching pattern)**

Autumn and Spring

1. **Prerequisite and co-requisite modules**

UK A Level Physics Examinations with a normal minimum attainment of a Grade C on the main Physics A Level. Any generally accepted equivalent of this content and attainment is regarded as an acceptable prerequisite.

Co-requisites:

PHYS3110 Mathematics I

PHYS3120 Mathematics II

PHYS3040 Introduction to Special Relativity, Astronomy, Astrophysics and Cosmology

PHYS3210 Mechanics

PHYS3220 Electricity and Light

PHYS3230 Thermodynamics and Matter

1. **The programmes of study to which the module contributes**

BSc/BSc with Foundation Year/BSc with Year in Industry/MPhys/MPhys with Year Abroad Physics

BSc/BSc with Year in Industry/MPhys/MPhys with Year Abroad Physics with Astrophysics

BSc/BSc with Year in Industry/MPhys/MPhys with Year Abroad Astronomy, Space Science and Astrophysics

This is not available as a wild module.

1. **The intended subject specific learning outcomes.
On successfully completing the module students will be able to:**

8.1 Demonstrate an ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions.

8.2 Demonstrate an ability to execute and analyse critically the results of an experiment or investigation and draw valid conclusions. To evaluate the level of uncertainty in these results and compare them with expected outcomes, theoretical predictions or with published data; thereby to evaluate the significance of their results in this context.

8.3 Demonstrate an ability to communicate scientific information, in particular to produce clear and accurate scientific reports.

8.4 Show a familiarity with laboratory apparatus and techniques, including relevant aspects of Health & Safety.

8.5 Demonstrate the ability to systematically and reliably record experimental data.

8.6 Demonstrate an ability to make use of appropriate texts, research-based materials or other learning resources as part of managing their own learning.

8.7 Show a systematic understanding of how computers work according to human’s instructions.

8.8 Demonstrate knowledge and understanding of computer programming principles, and their application to diverse problems.

8.9 Demonstrate an ability to solve problems in physics/mathematics using appropriate mathematical tools. Ability to use computational methods for the practical application of theory and to use information technology and data-processing skills to search for, assess and interpret data.

8.10 Demonstrate an ability to use mathematical techniques and analysis to model physical behaviour including the use of computer programming along with development of simple algorithms.

8.11 Show competence in the use of appropriate C&IT packages/systems for the analysis of data and the retrieval of appropriate information.

8.12 Demonstrate an ability to present and interpret information graphically including the use of computer programming.

1. **The intended generic learning outcomes.
On successfully completing the module students will be able to:**

9.1 Demonstrate problem-solving and programming skills, in the context of both problems with well-defined solutions and open-ended problems; an ability to formulate problems in precise terms and to identify key issues, and the confidence to try different approaches in order to make progress on challenging problems. Numeracy is subsumed within this area.

9.2 Demonstrate investigative skills in the context of independent investigation including the use of textbooks and other available literature, databases, and the interaction with colleagues to extract important information.

9.3 Demonstrate communication skills when dealing with surprising ideas and difficult concepts, including listening carefully, reading demanding texts and presenting complex information in a clear and concise manner. C&IT skills are an important element to this.

9.4 Demonstrate analytical skills – associated with the need to pay attention to detail and to develop an ability to manipulate precise and intricate ideas, to construct logical arguments and to use technical language correctly.

9.5 Show personal and interpersonal skills – the ability to work independently, to use initiative, to organise oneself to meet deadlines and to interact constructively with other people within a professional environment. Including the ability to communicate and interact with professionals from other disciplines.

1. **A synopsis of the curriculum**

This module guides students through a series of experiments giving them experience in using laboratory apparatus and equipment. Students will also learn how to accurately record and analyse data in laboratory notebooks and write scientific laboratory reports. The experiments cover subjects found in the Physics degree program and are run parallel with Computing Skills workshops in which students are introduced to the concept of using programming/scripting languages to analyse and report data from their experiments.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**
* Experimental methods, Kirkup, L., 1994
* An Introduction to Error Analysis, Taylor, J., 1997
* C. Jackson: Learning to program using Python, Jackson, C., 2011
1. **Learning and teaching methods**

Total contact hours: 90

Private study hours: 210

Total study hours: 300

1. **Assessment methods**
	1. Main assessment methods

Assignment 1 (2 hr lab session, 6%)

Assignment 2 (2 hr lab session, 6%)

Assignment 3 (2 hr lab session, 6%)

Assignment 4 (2 hr lab session, 6%)

Assignment 5 (2 hr lab session, 6%)

C1 Python Assignment (1 hr workshop, 5%)

C2 Python Assignment (1 hr workshop, 10%)

C3 Python Assignment (1 hr workshop, 10%)

C4 Python Assignment (1 hr workshop, 10%)

E1 LAB REPORT (4hr lab session, 5%)

E2 LAB REPORT (4hr lab session, 10%)

E3 LAB REPORT (4hr lab session, 10%)

E4 LAB REPORT (4hr lab session, 10%)

13.2 Reassessment methods

Like-for-like

1. **Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section12) and methods of assessment (section 13)**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 8.5 | 8.6 | 8.7 | 8.8 | 8.9 | 8.10 | 8.11 | 8.12 |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |  |
| Lectures | **x** | **x** |  |  |  | **x** |  | **x** |  | **x** |  |  |
| Laboratory Sessions | **x** | **x** | **x** | **x** | **x** | **x** | **x** |  | **x** | **x** | **x** | **x** |
| Console Sessions | **x** | **x** |  |  |  | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Self-studies |  |  | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |  |
| Library quiz |  |  |  |  |  | **x** |  |  |  |  |  |  |
| Short Lab reports | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Long Lab reports | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Computing Assignments | **x** | **x** |  |  |  | **x** | **x** | **x** | **x** | **x** | **x** | **x** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Module learning outcome** | 9.1 | 9.2 | 9.3 | 9.4 | 9.5 |
| **Learning/ teaching method** |  |  |  |  |  |
| Lectures |  |  |  |  |  |
| Laboratory Sessions | **x** | **x** | **x** | **x** | **x** |
| Console Sessions | **x** | **x** | **x** | **x** | **x** |
| Self-studies | **x** | **x** | **x** | **x** | **x** |
| **Assessment method** |  |  |  |  |  |
| Library quiz |  | **x** |  |  | **x** |
| Short Lab reports | **x** | **x** | **x** | **x** | **x** |
| Long Lab reports | **x** | **x** | **x** | **x** | **x** |
| Computing Assignments | **x** | **x** | **x** | **x** | **x** |

1. **Inclusive module design**

The School recognises and has embedded the expectations of current equality legislation, by ensuring that the module is as accessible as possible by design. Additional alternative arrangements for students with Inclusive Learning Plans (ILPs)/declared disabilities will be made on an individual basis, in consultation with the relevant policies and support services.

The inclusive practices in the guidance (see Annex B Appendix A) have been considered in order to support all students in the following areas:

a) Accessible resources and curriculum

b) Learning, teaching and assessment methods

1. **Campus(es) or centre(s) where module will be delivered**

Canterbury

1. **Internationalisation**

Physics is an international subject with laws of physical sciences discovered and techniques developed and refined by physical scientists across the globe. Mastery of the subject-specific learning outcomes in this module will equip students to apply the learned theories and techniques in a wide range of international contexts. In compiling the reading list, consideration has been given to the range of texts that are available internationally. The support SPS provides to its students is also attuned to our international student body.

**FACULTIES SUPPORT OFFICE USE ONLY**

**Revision record – all revisions must be recorded in the grid and full details of the change retained in the appropriate committee records.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 01/05/2020 | Minor | September 2020 | 10, 13 | Yes |
|  |  |  |  |  |

Revised FSO Jan 2018