1. **Title of the module**

PHYS6110 (PH611) - Numerical and Computational Methods

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 6

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

15 credits (7.5 ECTS)

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

Spring

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

Prerequisites:

PHYS3000 Mathematics

PHYS3020 Computing Skills

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

BSc & MPhys in Physics & 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:**

Have:

1. An ability to identify relevant principles and laws when dealing with problems, and to make approximations necessary to obtain solutions. (B1)
2. An ability to solve problems in physics using appropriate mathematical tools. (B2)
3. An ability to use mathematical techniques and analysis to model physical behaviour. (B4)
4. An ability to solve advanced problems in physics using appropriate mathematical tools, to translate problems into mathematical statements and apply their knowledge to obtain order of magnitude or more precise solutions as appropriate. (B6)
5. An ability to interpret mathematical descriptions of physical phenomena. (B7)
6. A working knowledge of a variety of mathematical and/or computational techniques applicable to current research within physics. (B8)
7. Competent use of appropriate C&IT packages/systems for the analysis of data and the retrieval of appropriate information. (C1)
8. An ability to present and interpret information graphically. (C2)
9. An ability to make use of appropriate texts, or other learning resources as part of managing their own learning. (C6)
10. **The intended generic learning outcomes.  
    On successfully completing the module students will be able to:**

Have a knowledge and understanding of:

1. Problem-solving 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. (D1)
2. 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. (D4)
3. **A synopsis of the curriculum**

In Stage 1 and Stage 2, students frequently apply analytical methods to physical problem solving. This module provides a foundation in numerical approximations to analytical methods – these techniques are essential for solving problems by computer. An indicative list of methods is: Linear equations, zeros and roots, least squares & linear regression, eigenvalues and eigenvectors, errors and finite differences, linear programming, interpolation and plotting functions, numerical integration, numerical differentiation, solutions to ordinary differential equations using numerical methods.

1. **Reading list (Indicative list, current at time of publication. Reading lists will be published annually)**

Core text:

* S. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill, 2008. ISBN: 978-0-07-313290-7

Additional reading:

* C. Moler, Numerical Computing with MATLAB, Society for Industrial and Applied Mathematics, SIAM, 2004 ISBN 978-0-898715-60-6

1. **Learning and teaching methods**

Total contact hours: 32

Private study hours: 118

Total study hours: 150

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

Assignment 1 (3 hrs, 6.66%)

Assignment 2 (3 hrs, 6.66%)

Assignment 3 (3 hrs, 6.66%)

Assignment 4 (3 hrs, 6.66%)

Assignment 5 (3 hrs, 6.66%)

Assignment 6 (3 hrs, 6.66%)

Examination 2 hr (60%)

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* | *9.1* | *9.2* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |
| **Private Study** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| *Console session* | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| *Lectures* | **x** | **x** | **x** | **x** | **x** | **x** |  |  |  | **x** | **x** |
|  |  |  |  |  |  |  |  |  |  |  |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |
| *Problem sheets* | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| *Examination* | **x** | **x** | **x** | **x** | **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, will equip students to apply the theories and techniques of this module in a wide range of international contexts. The module team is drawn from the School of Physical Sciences, which includes many members of staff with international experience of teaching and research collaboration. 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) |
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Revised FSO Jan 2018