1. **Title of the module**

Advanced Quantum Mechanics

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

School of Physical Sciences

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

Level 7

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

15 (ECTS 7.5)

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

Autumn

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

PH502, PH503

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

Physics (MPhys, MPhys with Year Abroad and M.Phys with Year in Industry)

Physics with Astrophysics (MPhys, MPhys with Year Abroad and M.Phys with Year in Industry)

Astronomy Space Science and Astrophysics (MPhys, MPhys with Year Abroad and M.Phys with Year in Industry)

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 Display knowledge and understanding of physical laws and principles in Quantum Physics, and their application to diverse areas of physics at an advanced level.

8.2 Display an ability to identify relevant principles and laws when dealing with problems in Quantum Physics, and to make approximations necessary to obtain solutions at an advanced level.

8.3 Display an ability to solve problems in Quantum Physics using appropriate mathematical tools at an advanced level

8.4 Display an ability to use mathematical techniques and analysis to model physical behaviour in Quantum Physics at an advanced level.

8.5 Display 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.

8.5 Display an ability to present and interpret information graphically at an advanced level.

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

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

9.1 Display problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems. Numeracy is subsumed within this area.

9.2 Display 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.

1. **A synopsis of the curriculum**

Quantum mechanics is the theoretical basis of much of modern physics. Building on the introductory quantum theory studied in earlier stages, this module will review some key foundational ideas before developing more advanced topics of quantum mechanics and quantum field theory.

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

C. Auletta, M. Fortunato, G. Parisi, Quantum Mechanics, Cambridge University Press, (2009).

S McMurry, Quantum Mechanics, Prentice-Hall (1993)

F. Mandl Quantum Mechanics, John Wiley. (2012)

P. Strange: Relativistic Quantum Mechanics, Cambridge University Press, (1998).

F. Mandl: Quantum Field Theory, John Wiley, (2010)

L. H. Ryder, Quantum Field Theory, Cambridge University Press, (1998).

1. **Learning and teaching methods**

Contact hours: 30

Private study hours 120

Total study time 150 hrs

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

Assignment 1, 15% (2 hours)

Assignment 2, 15% (2 hours)

Final exam, 70% (2 hours)

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* | *9.1* | *9.2* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |
| Private Study | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Lectures | **X** | **X** | **X** | **X** | **X** |  | **X** | **X** |
| **Assessment method** |  |  |  |  |  |  |  |  |
| Examination | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| Assignments | **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**

The topics to be covered in this module were develop collaboratively by scientists in several countries (mostly Germany and Great Britain but also France, Denmark, USA) during the period between 1905 and 1960. Throughout the teaching of this module emphasis will be made on how contributions from different countries, each having their own approach to Physics, interacted to create the theory we have today which is an objective gift to humanity without any cultural or national biases (a trait shared by all the established physical theories, which should be described as universal, rather than international).

**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 delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 01/05/2020 | Minor | September 2021 | 13,14 |  |
|  |  |  |  |  |