1. **Title of the module**

PHYS6060 (PH606) - Solid State Physics

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:

PHYS3210 Mechanics

PHYS3230 Thermodynamics and Matter

PHYS5020 Quantum Physics

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 & Physics with 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. Knowledge and understanding of physical laws and principles in Solid State Physics, and their application to diverse areas of physics. (A1)
2. An ability to identify relevant principles and laws when dealing with problems in Solid State Physics, and to make approximations necessary to obtain solutions. (B1)
3. An ability to solve problems in Solid State Physics using appropriate mathematical tools. (B2)
4. An ability to use mathematical techniques and analysis to model physical behaviour in Solid State Physics. (B4)
5. An ability to present and interpret information graphically. (C2)
6. An ability to make use of appropriate texts, research-based materials or other learning resources as part of managing their own learning. (C6)
7. **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. 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**

To provide an introduction to solid state physics. To provide foundations for the further study of materials and condensed matter, and details of solid state electronic and opto-electronic devices.

Structure:

* Interaction potential for atoms and ions. Definitions, crystal types. Miller indices. Reciprocal lattice. Diffraction methods.
* Dynamics of Vibrations.
* Lattice dynamics, phonon dispersion curves, experimental techniques.
* Electrons in k-space: metals.
* Free electron theory of metals. Density of states. Fermi-Dirac distribution. Band theory of solids - Bloch's theorem. Distinction between metals and insulators. Electrical conductivity according to classical and quantum theory. Hall effect.
* Semiconductors.
* Band structure of ideal semiconductor. Density of states and electronic/hole densities in conduction/valence band. Intrinsic carrier density. Doped semiconductors.
* Magnetism.
* Definitions of dia, para, ferromagnetism. Magnetic moments. General treatment of paramagnetism, Curie's law. Introduction to ferromagnetism.

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

Recommended Text:

Hook & Hall, Solid State Physics, Wiley [QC176]

Additional texts:

Kittel, Solid State Physics (7th Ed), Wiley, 1996 [QC176]

Ashcroft & Mermin, Solid State Physics, Holt-Saunders [QC176]

1. **Learning and teaching methods**

Total contact hours: 27

Private study hours: 123

Total study hours: 150

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

Assignment 1: (10hours, 15%)

Assignment 2: (10hours, 15%)

Examination (2 hour, 70%)

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** |  |  |  |  |  |  |  |  |  |  |
| Lectures | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |  |  |
| Private Study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |
| *Assignments* | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |  |  |
| *Examination* | **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 physical laws discovered and techniques developed and refined by Physicists 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 and a selection of texts has been identified to complement the delivery of the material. The support SPS provides to its students is also internationally attuned given 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.**

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| --- | --- | --- | --- | --- |
| Date approved | Major/minor revision | Start date of the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 10/07/2019 | Minor | January 2020 | 6, 13, 14 |  |
|  |  |  |  |  |