1. KentVision Code and title of the module

PHS7520 – Magnetism and Superconductivity

## Division and School/Department or partner institution which will be responsible for management of the module

Division of Natural Sciences (Physics & ASSA)

## The level of the module (Level 4, Level 5, Level 6 or Level 7)

Level 7

## The number of credits and the ECTS value which the module represents

15 Credits (7.5 ECTS)

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

Spring

## Prerequisite and co-requisite modules and/or any module restrictions

None

## The course(s) of study to which the module contributes

Compulsory for the following courses:

MPhys Physics

MPhys Physics with Astrophysics

Not available as an elective module

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

8.1 Demonstrate a comprehensive understanding of the underlying physics of magnets and superconductors.

8.2 Demonstrate a broad appreciation of the rich variety of physics dependent correlated electrons.

8.3 Demonstrate the ability to solve problems in the science of magnetism and superconductivity.

8.4 Demonstrate a broad appreciation of the role of magnets and superconductors in devices and industry.

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

9.1 Demonstrate the ability to solve problems, particularly mathematical approaches to problem solving, confidently and accurately.

9.2 Use appropriate sources as part of directed self-learning.

9.3 Demonstrate an ability to interpret theory accurately.

9.4 Demonstrate a deeper appreciation of the connection of the role played by fundamental science in society generally.

## A synopsis of the curriculum

Introduction. Magnetism, magnetometry and measuring techniques, Localised magnetic moments, spin and orbital moments, magnetic moments in solids. Paramagnetism. Exchange interactions, direct, indirect and superexchange, Magnetic structures, ferro, ferri, antiferromagnetism. Neutron and X-ray scattering. Spin waves, magnons. Magnetic phase transitions. Superconductivity: Introduction to properties of superconductors, Thermodynamics and electrodynamics of superconductors, Type I and Type II superconductors, the flux lattice Superconducting phase transitions. Microscopic superconductivity, correlations lengths, isotope effect, Cooper pairs, Froehlich Interaction, BCS theory. High Tc superconductors, superfluids, liquid helium.

## Reading list

## The University is committed to ensuring that core reading materials are in accessible electronic format in line with the Kent Inclusive Practices.

## The most up to date reading list for each module can be found on the university's [reading list pages](https://kent.rl.talis.com/index.html).

## Contact Hours

Private Study: 120

Contact Hours: 30

Total: 150

## Assessment methods

13.1 Main assessment methods

* Assignment 1 (2 hours) – 15%
* Assignment 2 (2 hours) – 15%
* Examination (2 hours, in-person) – 70%

13.2 Reassessment methods

* Like-for-like

## Map of module learning outcomes (sections 8 & 9) to learning and teaching methods (section 12) and methods of assessment (section 13)

**Module learning outcomes against learning and teaching methods:**

| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 9.1 | 9.2 | 9.3 | 9.4 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Private Study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Lectures | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Workshops |  |  | **x** |  | **x** |  |  |  |

**Module learning outcomes against assessment methods:**

| **Module learning outcome** | 8.1 | 8.2 | 8.3 | 8.4 | 9.1 | 9.2 | 9.3 | 9.4 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Assignment 1 | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Assignment 2 | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Examination | **x** | **x** | **x** | **x** | **x** |  | **x** | **x** |

## Inclusive module design

The Division 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

## Campus(es) or centre(s) where module will be delivered

Canterbury

## Internationalisation

Science is an international discipline with widely applicable international resonance. This module presents subject-specific knowledge generated, developed, and refined by scientists around the world. Mastery of the learning outcomes will equip students to apply the knowledge in a wide range of international contexts and these will be addressed in making the content relevant to current global issues. The Division of Natural Sciences is an international community of students and staff and group activities and teaching will provide a platform for internationally-focussed discussion.

**DIVISIONAL USE ONLY**

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

| Date approved | New/Major/minor revision | Start date of delivery of (revised) version | Section revised  (if applicable) | Impacts PLOs (Q6&7 cover sheet) |
| --- | --- | --- | --- | --- |
| 10 Jul 2019 | Minor | Sept 2019 | 13 | No |
|  |  |  |  |  |