1. **Title of the module**

PHYS6040 (PH604) - Relativity Optics and Maxwell’s Equations

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)**

Autumn

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

PHYS3010 Physics

Or replacement modules

PHYS3210 Mechanics

PHYS3220 Electricity and Light

PHYS3230 Thermodynamics and Matter

And

PHYS5040 Electromagnetism and Optics

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

BSc/BSc with Foundation Year/MPhys Physics

BSc/MPhys Physics with Astrophysics

BSc/MPhys 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. Knowledge and understanding of electromagnetic and relativistic laws and principles, and their application to diverse areas of physics. (A1)
2. An ability to identify relevant principles and laws when dealing with problems in electromagnetism and relativity, and to make approximations necessary to obtain solutions. (B1)
3. An ability to solve problems in electromagnetism and relativity using appropriate mathematical tools. (B2)
4. An ability to use mathematical techniques and analysis to model physical behaviour in electromagnetism and relativity. (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; 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**

Special Relativity: Limits of Newtonian Mechanics, Inertial frames of reference, the Galilean and Lorentz transformations, time dilation and length contraction, invariant quantities under Lorentz transformation, energy momentum 4-vector.

Maxwell's equations: operators of vector calculus, Gauss law of electrostatics and magnetostatics, Faraday's law and Ampere's law, physical meanings and integral and differential forms, dielectrics, the wave equation and solutions, Poynting vector, the Fresnel relations, transmission and reflection at dielectric boundaries.

Modern Optics: Resonant cavities and the laser, optical modes, Polarisation and Jones vector formulation.

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

• D.J. Griffiths, Introduction to Electrodynamics, 3rd Ed. (1999), Prentice Hall

• E. Hecht, Optics 3rd Edn., Addison Wesley, [QC375.2]

• J. Wilson and J.F.B. Hawks, Optoelectronics: An Introduction, Prentice-Hall International, 1983. [QC 447]

• A.Yariv, Optical electronics, Holt-Saunders International, 1985. [QC 447]

• G. Barton, Introduction to the Relativity Principle, J. Wiley & Sons, 1999

• Edwin F. Taylor and John Archibald Wheeler,

Spacetime Physics: Introduction to Special Relativity, 2nd ed.

W. H. Freeman & Company, 1992.

1. **Learning and teaching methods**

Total contact hours: 30

Private study hours: 120

Total study hours: 150

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

Take-home Test 1 (45 mins, 15 %)

Take-home Test 2 (45 mins, 15 %)

Examination (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** |  |  |  |  |  |  |  |  |
| Private Study | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| Lectures | **x** | **x** | **x** | **x** | **x** | **x** | **x** | **x** |
| **Assessment method** |  |  |  |  |  |  |  |  |
| Take-home Tests | **x** | **x** | **x** | **x** | **x** | **x** | **X** | **x** |
| Examination | **x** | **x** | **x** | **x** | **x** | **x** | **X** |  |

1. **Inclusive module design**

The School/Collaborative Partner *(delete as applicable)* 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 internationalisation focus of this module is achieved by utilising techniques and information

beyond the UK theories or skills being tested which are grounded in universal principles with broad

international application

**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) |
| 10/07/2019 | Minor | September 2019 | 11, 13 |  |
|  |  |  |  |  |