Confirmation that this version of the module specification has been approved by the School Learning and Teaching Committee:

………11th March 2015………………………………………….

**MODULE SPECIFICATION**

1. Title of the module

*PH604 Relativity Optics and Maxwell’s Equations*

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

*School of Physical Sciences*

1. Start date of the module

*Existing module, next running in 2015-16*

1. The number of students expected to take the module

*100*

1. Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal

*None.*

1. The level of the module (e.g. Certificate [C], Intermediate [I], Honours [H] or Postgraduate [M])

*H*

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

*15 (7.5 ECTS)*

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

*Term 1*

1. Prerequisite and co-requisite modules

*Prerequisite and co-requisites: PH301 (or replacement modules PH321, PH322, PH323) and PH504.*

1. The programmes of study to which the module contributes

*Physics (BSc, BSc with Foundation Year, MPhys)*

*Physics with Astrophysics (BSc, MPhys)*

*Astronomy Space Science and Astrophysics (BSc, MPhys)*

*This is not available as a wild module*

1. The intended subject specific learning outcomes
   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)*
2. The intended generic learning outcomes
   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. Indicative Reading List

*Introduction to Electrodynamics; Griffiths, D. (1999)*

*Optics; Hecht, E. (2002)*

*Optoelectronics: An Introduction; Wilson, J. & Hawkes, J.F.B. (1998)*

*Optical Electronics; Yariv, A. (1991)*

*Introduction to the Relativity Principle; Barton, G. (1999)*

1. Learning and Teaching Methods, including the nature and number of contact hours and the total study hours which will be expected of students, and how these relate to achievement of the intended module learning outcomes

*Contact hours: lectures (30 hours) including class tests.*

*In addition, 120 hours of directed reading, problem solving and self-study are required.*

*Total number of study hours 150 hrs*

*The lectures address learning outcomes 11.1-11.5 and 12.1-12.2. Directed reading addresses 11.1, 11.2 and 11.6 and 12.1-12.2. Directed problem solving addresses 11.3, 11.4 and 11.5*

1. Assessment methods and how these relate to testing achievement of the intended module learning outcomes

*Coursework 30% including class tests*

*Final (written, unseen, length 2 hours) exam 70%*

*The class tests and examinations test students’ knowledge and understanding of laws and principles (11.1, 11.2, 12.2) and application of techniques to model behaviour and solve problems (11.3-11.5, 12.1). In preparing for the assessments, students will need to manage their own revision using reference materials (11.6, 12.2)*

1. Implications for learning resources, including staff, library, IT and space

*None.*

1. The School recognises and has embedded the expectations of current disability equality legislation, and supports students with a declared disability or special educational need in its teaching. Within this module we will make reasonable adjustments wherever necessary, including additional or substitute materials, teaching modes or assessment methods for students who have declared and discussed their learning support needs. Arrangements for students with declared disabilities will be made on an individual basis, in consultation with the University’s disability/dyslexia support service, and specialist support will be provided where needed.
2. Campus where module will be delivered:

*Canterbury*