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

*PH504 Electromagnetism and Optics*

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 AY 2014-15.*

1. The number of students expected to take the module

*140*

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 Modules to be withdrawn on the introduction of this proposed module and consultation with other relevant Schools and Faculties regarding the withdrawal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

I

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: PH301 (or replacement modules PH321, PH322, PH323).*

1. The programmes of study to which the module contributes

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

*Physics with Astrophysics (BSc, MPhys, MPhys with Year Abroad)*

*Astronomy, Space Science and Astrophysics (BSc, MPhys, MPhys with Year Abroad)*

*This is not available as a wild module*

1. The intended subject specific learning outcomes
   1. *Knowledge and understanding of physical laws and principles in Electromagnetism and Optics, 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 Optics, and to make approximations necessary to obtain solutions. (B1)*
   3. *An ability to solve problems in Electromagnetism and Optics using appropriate mathematical tools. (B2)*
   4. *An ability to use mathematical techniques and analysis to model physical behaviour in Electromagnetism and Optics. (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

*SYLLABUS  
  
Electromagnetism   
Vectors: Review of Grad, Div & Curl; and other operations  
Electrostatics: Coulomb's Law, electric field and potential, Gauss's Law in integral and differential form; the electric dipole, forces and torques.  
Isotropic dielectrics: Polarization; Gauss's Law in dielectrics; electric displacement and susceptibility; capacitors; energy of systems of charges; energy density of an electrostatic field; stresses; boundary conditions on field vectors.  
Poisson and Laplace equations.  
Electrostatic images: Point charge and plane; point and sphere, line charges.  
Magnetic field: Field of current element or moving charge; Div B; magnetic dipole moment, forces and torques; Ampere's circuital law.  
Magnetization: Susceptibility and permeability; boundary conditions on field vectors; fields of simple circuits.  
Electromagnetic induction: Lenz’s law, inductance, magnetic energy and energy density;   
  
Optics   
Field equations: Maxwell's equations; the E.M. wave equation in free space.  
Irradiance: E.M. waves in complex notation.  
Polarisation: mathematical description of linear, circular and elliptical states; unpolarised and partially polarised light; production of polarised light; the Jones vector.   
Interference: Classes of interferometers – wavefront splitting, amplitude splitting. Basic concepts including coherence.  
Diffraction: Introduction to scalar diffraction theory: diffraction at a single slit, diffraction grating.*

1. Indicative Reading List

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

*Physics for scientists and engineers, 6th Edition; Tipler, P.A. & Mosca, G. (2008)*

*Optics, 4th Edition; Hecht, E. (2002)*

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); workshop sessions (3 hours); class tests (2 hours)*

*Total study hours 150 hrs*

*Achievement of module learning outcomes:*

* *Specific learning outcomes* *11.1, 11.2, 11.3, 11.4, 11.5, 11.6 will be achieved by lectures and revision classes;*
* *Generic learning outcomes* *12.1, 12.2 will be achieved by revision classes and class tests;*

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

*Written (unseen) examination, 2 hours, 70%. Class tests: 30%.*

*The above assessments 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, 11.4, 11.5, 12.1, 12.2). 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*