1. **Title of the module**

PHYS5130 (PH513) - Medical 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 5

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**

PHYS3210 Mechanics

PHYS3220 Electricity and Light

PHYS3230 Thermodynamics and Matter

PHYS5040 Electromagnetism and Optics

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

BSc/BSc with Foundation Year/MPhys/MPhys with Year Abroad Physics

BSc/MPhys/MPhys with Year Abroad 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:

8.1 Knowledge and understanding of physical laws and principles, and their applications in medical physics.

8.2 Knowledge and understanding of ionising radiations, with special reference to adverse health effects, to principles relating to radiation dose, and to measures necessary to protect people from the effects of ionising radiations.

8.3 Knowledge of medical imaging principles, techniques and applications using X-rays, radionuclides, ultrasound and optical radiation.

8.4 Knowledge of therapeutic principles using unsealed sources of radiation in vivo and external radiation sources.

8.5 An ability to identify relevant principles and laws when dealing with problems involving measurements or tasks medical physics, with the ability to make assumptions or approximations in order to obtain solutions.

8.6 An ability to solve problems in medical physics using appropriate mathematical tools.

8.7 An ability to use mathematical techniques and analysis to model physical behaviour.

8.8 An ability to present and interpret information graphically within a medical physics context.

8.9 An ability to make use of appropriate texts, research-based materials or other learning resources as part of managing their own learning.

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

Have a knowledge and understanding of:

9.1 Problem-solving skills, in the context of both problems with well-defined solutions and open-ended problems of applications of physics laws to health sciences, 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.

9.2 Analytical skills - associated with the need to pay attention to detail, to construct logical arguments and to use technical language correctly and to develop an ability to manipulate precise and intricate ideas, to construct logical arguments and to use technical language correctly.

1. **A synopsis of the curriculum**

The aim of the module in Medical Physics is to provide a primer into this important physics specialisation. The range of subjects covered is intended to give a balanced introduction to Medical Physics, with emphasis on the core principles of medical imaging, radiation therapy and radiation safety. A small number of lectures is also allocated to the growing field of optical techniques. The module involves a major contribution from the professional medical physicist.

Syllabus:

Radiation protection (radiology, generic); Radiation hazards and dosimetry, radiation protection science and standards, doses and risks in radiology; Radiology; (Fundamental radiological science, general radiology, fluoroscopy and special procedures); Mammography (Imaging techniques and applications to health screening); Computed Tomography (Principles, system design and physical assessment); Diagnostic ultrasound (Pulse echo principles, ultrasound imaging, Doppler techniques); Tissue optics (Absorption, scattering of light in the tissue); The eye (The eye as an optical instrument); Confocal Microscopy (Principles and resolutions); Optical Coherence Tomography (OCT) and applications; Nuclear Medicine (Radionuclide production, radiochemistry, imaging techniques, radiation detectors); In vitro techniques (Radiation counting techniques and applications); Positron Emission Tomography (Principles, imaging and clinical applications); Radiation therapies (Fundamentals of beam therapy, brachytherapy, and 131I thyroid therapy); Radiation Protection (unsealed sources); Dose from in-vivo radionuclides, contamination, safety considerations.

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

* Physics for Medical Imaging, R.F. Farr and P.J. Allisy-Roberts; with contributions from J. Weir, London: Saunders, 1998 (repr. 2006), ID: 705044; R 895
* Hendee, William R., Medical Imaging Physics, William R. Hendee, E. Russell Ritenour, 4th ed., New York: Wiley-Liss, 2002, ID: 633023, q RC 78.7.D53
* Physics in Nuclear Medicine, Simon R. Cherry, James A. Sorenson, Michael E. Phelps., 3rd ed, Philadelphia, Pa: Saunders, c2003, ID 690435, R 895
* A Practical Approach to Medical Image Processing [with cd-rom] / Elizabeth Berry, New York; London: Taylor & Francis, 2008, Series in medical physics and biomedical engineering, ID 723882, R 857.O6
* Confocal Microscopy, edited by T. Wilson, London: Academic Press, 1990. ID 8092, QH 224
* Handbook of Biological Confocal Microscopy/edited by James B. Pawley, New York; London: Plenum Press, 1990, Based on papers given at the Confocal Microscopy Workshop held at the Electron Microscopy Society of America Meeting, August 8-9, 1989, in San Antonio, Texas, ID 308784, qQH 224
* Handbook of Optical Coherence Tomography, edited by Brett E. Bouma, Guillermo J. Tearney, New York: Marcel Dekker, 2002, ID 649237, R 857.O6
* Optical Coherence Tomography, Technology and Applications, Wolfgang Drexler, James G. Fujimoto, (eds.), Berlin; London: Springer, c2008, Biological and medical physics, biomedical engineering, ID 737786, E-Book

1. **Learning and teaching methods**

Total contact hours: 36

Private study hours: 114

Total study hours: 150

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

Assignment 1 (25%) on non optics techniques in two stages: a Moodle quiz of 20 minutes (10%), and a Moodle quiz of 30 minutes (15%), with access to the lecture notes;

Assignment 2 on optics techniques (5%), Moodle quiz, 10 minutes, access to the lecture notes

Examination (70%), 2 hours

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* | *8.7* | *8.8* | *8.9* | *9.1* | *9.2* |
| **Learning/ teaching method** |  |  |  |  |  |  |  |  |  |  |  |
| **Private Study** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| *example classes* | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| *Lectures* | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| **Assessment method** |  |  |  |  |  |  |  |  |  |  |  |
| *Assignments* | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** | **X** |
| *Examination* | **X** | **X** | **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**

The topics to be covered in this module were developed collaboratively by scientists in several countries (European, USA, including the U.K.) and continues to be developed today by several groups in the world. Throughout the teaching of this module emphasis will be made on how contributions from different countries, each having their own approach to Medical Physics problems, interacted to create the armamentarium of tool we have today, which like all established technologies transcends national boundaries.

**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 the delivery of revised version | Section revised | Impacts PLOs (Q6&7 cover sheet) |
| 10/07/2019 | Minor | September 2019 |  |  |
|  |  |  |  |  |