Engineering Tripos Part IIB, 4I8: Medical Physics, 2017-18

Module Leader

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Lecturer

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Timing and Structure

Lent Term. Assessment: 100% exam

Prerequisites

3G4 useful

Aims

The aims of the course are to:

- Describe the importance of physics in medicine
- Understand the general principles of medical image reconstruction and registration
- Compare and contrast the medical imaging techniques that are available in a hospital setting and explain their relative merits
- Explain the difference between imaging with ionising and non-ionising radiation in the context of radiation dosimetry and risk
- Describe sensing and therapeutic applications of physics in medicine

Content

The material should be accessible to all Part IIA Bioengineering and Part III Physics students. The course is divided into two parts: the first 6 lectures concentrate on the basic physics of biomedical imaging, while the second 6 lectures (given by Addenbrookes hospital staff) provide a broad insight into the applications of physics in medicine. The latter half of the course should be accessible to all those with an interest in medical physics

Introduction

Historical background; radiation interactions; general imaging concepts; and contrast mechanisms.

Medical Imaging Methodology

For all clinically applicable imaging techniques, a detailed description of contrast mechanisms, data acquisition hardware and image reconstruction will be provided. This will cover: imaging with ionising radiation, including X-ray, CT, nuclear medicine, SPECT and PET; imaging with non-ionising radiation, including MRI and ultrasound; and general principles of image reconstruction and registration of images over time and between modalities.

Clinical Applications of Physics

Clinical examples of the utility of medical imaging in diagnosis and treatment of disease. Sensing applications of physics in hospitals, including patient monitoring. Therapeutic applications of physics, particularly radiotherapy in cancer patients.

Booklists

Please see the Booklist for Group I Courses [2] for references for this module.

Examination Guidelines

Please refer to Form & conduct of the examinations [3].

UK-SPEC

This syllabus contributes to the following areas of the UK-SPEC [4] standard:

Toggle display of UK-SPEC areas.

GT1

Develop transferable skills that will be of value in a wide range of situations. These are exemplified by the Qualifications and Curriculum Authority Higher Level Key Skills and include problem solving, communication, and working with others, as well as the effective use of general IT facilities and information retrieval skills. They also include planning self-learning and improving performance, as the foundation for lifelong learning/CPD.

IA1

Apply appropriate quantitative science and engineering tools to the analysis of problems.

IA2

Demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs.

KU1

Demonstrate knowledge and understanding of essential facts, concepts, theories and principles of their engineering discipline, and its underpinning science and mathematics.

KU2

Have an appreciation of the wider multidisciplinary engineering context and its underlying principles.

S4

Awareness of the framework of relevant legal requirements governing engineering activities, including personnel, health, safety, and risk (including environmental risk) issues.

E1

Ability to use fundamental knowledge to investigate new and emerging technologies.

E2

Ability to extract data pertinent to an unfamiliar problem, and apply its solution using computer based engineering

tools when appropriate.

P1

A thorough understanding of current practice and its limitations and some appreciation of likely new developments.

P3

Understanding of contexts in which engineering knowledge can be applied (e.g. operations and management, technology, development, etc).

US1

A comprehensive understanding of the scientific principles of own specialisation and related disciplines.

US3

An understanding of concepts from a range of areas including some outside engineering, and the ability to apply them effectively in engineering projects.

US4

An awareness of developing technologies related to own specialisation.

Last modified: 31/05/2017 10:02

Links
[1] mailto:gmt11@cam.ac.uk
[2] https://www.vle.cam.ac.uk/mod/book/view.php?id=364101&chapterid=56151
[3] http://teaching.eng.cam.ac.uk/content/form-conduct-examinations
[4] http://teaching.eng.cam.ac.uk/content/uk-spec