General Course Information

MDPH 406
Medical Imaging

0.125 EFTS
Second Semester 19 Jul 2021 - 22 Oct 2021

Course Coordinator
Dr Konstantin Pavlov
Lecturers:
Dr Konstantin Pavlov (konstantin.pavlov@canterbury.ac.nz) (R. 409 BT)
Dr Darin O'Keeffe (darin.okeeffe@canterbury.ac.nz)
Office appointments by arrangement

Lectures:
Check the timetable for any room/time changes.

Description
An introduction to radiographic practice and terminology, image perception, x-ray, fluoroscopy, CT, MRI, ultrasound, digital radiographic image measurement, patient dosimetry, occupational radiation dose factors, quality assurance.

Assessment

Assignment 1	10%
Mid-course test	15%
Assignment 2	10%
Assignment 3	10%
Final exam☝	55%

☝Note that a 50% pass in the final exam is required to pass the course, unless there are exceptional circumstances.

Pre-requisites
Subject to approval of the director of the programme

Recommended Textbooks
Diagnostic Radiology Physics – A Handbook for Teachers and Students, D.R. Dance et al. IAEA 2014. A free PDF copy is available here (http://www-pub.iaea.org/books/IAEABooks/8841/Diagnostic-Radiology-Physics-A-Handbook-for-Teachers-and-Students).

The Essential Physics of Medical Imaging, Third Edition. J.T. Bushberg et al. Lippincott Williams and Wilkins 2012. Mostly Sections I and II. (available electronically via the Library website

MRI from Picture to Proton, D.W. McRobbie. Cambridge University Press, 3rd edition, 2017. (available electronically via the Library website and via a link from the MDPH 406 Learn page)

Other useful reading is listed below.

Goal of the Course
This course will provide a background to the physical principles and practical aspects of medical imaging. The main imaging modalities considered are x-ray (including radiography,

mammography, fluoroscopy, digital subtraction angiography and computed tomography), ultrasound, and magnetic resonance imaging.

Summary of Course Content
The general topics covered by this course are:

- Image science and image perception – an introduction
- PACS and an introduction to the DICOM standard
- Introduction to image processing
- Radiography – screen-film and digital radiography
- Fluoroscopy
- Digital subtraction angiography
- Mammography
- Computed tomography
- Magnetic resonance imaging
- Ultrasound imaging

Learning Outcomes
On completing this course you should be able to

- Describe basic principles underlying imaging methods
- Discuss principles of operation of medical imaging equipment
- Recognise safety aspects of imaging with ionising and non-ionising radiation
- Understand basic quality control of medical imaging equipment
- Recognise potential sources of artefacts or inaccuracy
- Discuss a range of clinical applications of imaging modalities
- Discuss radiation doses associated with medical imaging methods
- Discuss image processing used in medical imaging
- Discuss perception in relation to image display methods

Other Useful and Reference Texts

- Medical imaging physics, Fourth Edition. W.R. Hendee, E.R. Ritenour. Wiley 2002. (available electronically via the Library website)
- Magnetic resonance imaging: physical principles and sequence design. 2nd edition, Robert W. Brown, et al., 2014. (available electronically via the Library website)
- Modern diagnostic X-ray sources: technology, manufacturing, reliability. R. Behling. 2016. (available electronically via the Library website)
- Computed Tomography: Fundamentals, System Technology, Image Quality, Applications. Willi A. Kalender. 2011 (available electronically via the Library website)

Hendee's book provides alternative explanations to the main reference texts and some interesting anecdotes, but is generally more qualitative. The MRI section of Bushberg is somewhat lacking for medical physics education (this is not the target audience), mainly because it avoids any mathematical formalism relating to Fourier transforms. McRobbie's book on MRI is aimed at a more suitable level, with many practical examples with only the minimum required mathematics. However, if you want some more in-depth theory on MRI imaging, you can't go past the book by Brown et al. The book by Behling is very recent and contains some useful material if you want to learn more about x-ray tubes. For this course, it is the go-to book for x-ray sources.

Learn
All important course information can be accessed through the UC *Learn* system available at http://learn.canterbury.ac.nz/. You need to login with your UC login and password and then select the course code on the left hand side. Make sure you check the *Learn* page regularly for relevant information and course updates. Note that all course related emails will be sent to your UC email address. It is your responsibility to check your UC email regularly or forward it to your usual email address.

General Physics and Astronomy Information
Please consult the document General Information for Physics and Astronomy Students on the Physics and Astronomy Web Page:

https://apps.canterbury.ac.nz/1/science/phys-chem/PHYS%20-%20Course%20Outlines/General.PDF

Late work

Late work will be accepted. However, to be fair on the efforts of other students, unless the course coordinator considers the reason for the late submission valid the work will be penalised through the deduction of marks, usually at 20% per day or part thereof.