

PHYS-455

Introduction to medical radiation physics

Bochud François

Cursus	Sem.	Type
Nuclear engineering	MA1	Opt.

Language of teaching	English
Credits	4
Session	Winter
Semester	Fall
Exam	Written
Workload	120h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

This course covers the physical principles underlying medical diagnostic imaging (radiography, fluoroscopy, CT, SPECT, PET, MRI), radiation therapy and radiopharmacy. The focus is not only on risk and dose to the patient and staff, but also on an objective description of the image quality.

Content

Medical applications of ionizing radiations
 Physics of medical imaging
 Risk and radiation
 Radiography & Mammography
 Computer tomography (CT)
 Radioscopy
 Receiver operating characteristics (ROC)
 Planification of a radiotherapy treatment
 Radiotherapy treatment devices
 Imaging in radiotherapy and advanced treatment techniques
 Radiopharmaceutical products
 Physics of single-photon emission computed tomography (SPECT)
 Physics of positron emission tomography (PET)

Keywords

medical imaging, radiation therapy, risk, radiopharmacy

Learning Prerequisites**Recommended courses**

This course has many synergies with the Radiation biology, protection and applications course where the basics of radiation physics and some aspects of radiation protection are very useful to follow the present course.

Learning Outcomes

By the end of the course, the student must be able to:

- Describe the main parts of an x-ray device from a physical point of view
- Describe the main differences between the radiography units and the fluoroscopy units

- Explain the principle of CT image acquisition

Teaching methods

Ex-cathedra with integrated individual exercises

Assessment methods

Written, Multiple Choice Question exam

Resources

Bibliography

Course in general

- William R. Hendee and E. Russell Ritenour, "Medical Imaging Physics", Wiley-Liss, 4th edition, 2002
- The Essential Physics of Medical Imaging, Third Edition, Jerrold T. Bushberg, J. Anthony Seibert, Edwin M. Leidholdt Jr., John M. Boone, Lippincott 2012

Radiopharmaceutical products

- Philip Elsinga, Sergio Todde, Ivan Penuelas, Geerd Meyer, Brit Farstad, Alain Faivre-Chauvet, Renata Mikolajczak, Gerrit Westera, Tanja Gmeiner-Stopar, Clemens Decristoforo, Radiopharmacy Committee of the EANM, "Guidance on current good radiopharmacy practice (cGRPP) for the small-scale preparation of radiopharmaceuticals", Eur J Nucl Med Mol Imaging 2010, DOI 10.1007/s00259-010-1407-3

Physics of single-photon emission computed tomography (SPECT)

- SPECT in the Year 2000: Basic Principles MarkW. Groch and William D. Erwin, J Nucl Med Technol 2000; 28:233-244
- Physics in nuclear medicine, S.R. Cherry, J.A. Sorenson, M.E. Phelps, Saunders Elsevier 2012 (forth edition)

Physics of positron emission tomography (PET)

- Positron Emission Tomography: A Review of Basic Principles, Scanner Design and Performance, and Current Systems Pat Zanzonico, Seminars in Nuclear Medicine, Vol XXXIV, No 2 (April), 2004: pp 87-111
- Physics in nuclear medicine, S.R. Cherry, J.A. Sorenson, M.E. Phelps, Saunders Elsevier 2012 (forth edition)

Dose to the patient

- Effective Doses in Radiology and Diagnostic Nuclear Medicine: A Catalog, Fred A. Mettler et al. Radiology: Volume 248: Number 1 July 2008

Risk and radiation

- T. Rob Goodman, Maxwell Amurao, "Medical Imaging Radiation Safety for the Female Patient: Rationale and Implementation", RadioGraphics 2012; 32:1829-1837
- Francis R. Verdun, François Bochud, François Gudinchet, Abbas Aroua, Pierre Schnyder, Reto Meuli, "Radiation Risk: What You Should Know to Tell Your Patient", Radiographics 2008; 28:1807-1816

Receiver operating characteristics (ROC) and hypothesis testing

- Anvari A, Halpern EF, Samir AE. Statistics 101 for Radiologists. RadioGraphics 35:1789-1801 (2015)

Radiation therapy

- E. Podgorsak, Radiation Oncology Physics: a handbook for teachers and students, IAEA, 2005, https://www-pub.iaea.org/MTCD/Publications/PDF/Pub1196_web.pdf

Ressources en bibliothèque

- [Medical Imaging Physics / Hendee & Ritenour](#)
- [The Essential Physics of Medical Imaging / Bushberg](#)
- [Physics in nuclear medicine / Cherry](#)

Références suggérées par la bibliothèque

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Moodle Link

- <https://go.epfl.ch/PHYS-455>