PHYS-450

Radiation biology, protection and applications

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Cursus	Sem.	Type
Ing.-phys	MA1, MA3	Opt.
Nuclear engineering	MA1	Obl.
Physicien	MA1, MA3	Opt.

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

Summary

An introductory course in the basic concepts of radiation detection and interactions and energy deposition by ionizing radiation in matter, radioisotope production and its applications in medicine, industry and research. The course includes presentations, lecture notes, problem sets and seminars.

Content

- Basics: radiation sources and interaction with matter, radioisotope production using reactors and accelerators, radiation protection and shielding.
- Medical applications: diagnostic tools, radiopharmaceuticals, cancer treatment methodologies such as brachytherapy, neutron capture therapy and proton therapy.
- Industrial applications: radiation gauges, radiochemistry, tracer techniques, radioisotope batteries, sterilization, etc.
- Applications in research: dating by nuclear methods, applications in environmental and life sciences, etc.

Learning Outcomes

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

- Explain the basic physics principles that underpin radiotherapy, e.g. types of radiation, atomic structure, etc.
- Explain the interaction mechanisms of ionizing radiation at keV and MeV energies with matter.
- Explain the principles of radiation dosimetry.
- Explain the principles of therapeutic radiation physics including X-rays, electron beam physics, radioactive sources, use of unsealed sources and Brachytherapy.
- Describe how to use radiotherapy equipment both for tumour localisation, planning and treatment.
- Define quality assurance and quality control, in the context of radiotherapy and the legal requirements.
- Explain the principles and practice of radiation protection, dose limits, screening and protection mechanisms.
- Explain the use of radiation in industrial and research applications.

Resources

Bibliography

Handouts will be distributed

- James E. Martin, "Physics for Radiation Protection", Wiley-VCH (2nd edition, 2006)

• F.M. Khan, "The Physics of Radiation Therapy", Lippincott, Williams & Wilkins, (4th edition, 2010)
• G.C. Lowenthal, P.L. Airey, "Practical Applications of Radioactivity and Nuclear Reactions", Cambridge University Press (2001)
• K.H. Lieser, "Nuclear and Radiochemistry", Wiley-VCH (2nd edition, 2001)

Ressources en bibliothèque

• Physics for Radiation Protection / Martin
• The Physics of Radiation Therapy / Khan
• Practical Applications of Radioactivity and Nuclear Reactions / Lowenthal
• Nuclear and Radiochemistry / Lieser