UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Elements of Environmental and Medical Physics

2526-3-E3001Q067

Aims

Provide the basic knowledge and tools needed to evaluate and protect from the harmful effects caused by the exposure to ionizing radiation present in the external environment, in the working places and in the medical practices.
By the end of the course, the student will have acquired:

- Knowledge and understanding of the physical phenomena underlying the interaction between ionizing radiation and matter, as well as of the main measurement and protection methods;
- Ability to apply knowledge and understanding to the qualitative and quantitative assessment of radiological risks in environmental, occupational, and medical contexts;
- Independent judgment in identifying risk situations and proposing appropriate prevention measures;
- Communication skills in reporting results and assessments to both specialist and non-specialist audiences;
- Learning skills necessary to independently deepen their understanding of topics related to radiation protection.

Contents

- Ionizing radiation
- Radiation protection
- Sources of ionizing radiation.
- Interactions of radiation with matter.
- Biological effects of ionizing radiation.
- Dosimetry and radiation protection.
- Cavity theory and dosimetry instrumentation.
- Production of X-rays and artificial isotopes for medical and industrial applications.
- Radiation shielding.

Detailed program

- Ionizing radiation: discovery and early history, radiation protection principles, biological and health effects, epidemiology.
- Introduction to radioactive decay.
- Sources of ionizing radiation: cosmic and cosmogenic radiation, natural and artificial radioactivity.
- Interactions of radiation with matter: electrons and heavy charged particles, photons, neutrons.
- Biological effects of ionizing radiation.
- Dosimetry: radiometric quantities, dosimetric quantities (kerma, dose, exposure)
- Radiation protection: radiation protection quantities (external and internal exposure), operational quantities, limiting quantities for workers and the population and Italian regulation.
- Internal and external dose calculation examples. Radon and cosmic rays doses.
- Cavity theory and dose measurement methods.
- Neutron dosimetry: neutron kerma, dosimetry instrumentation.
- X-ray production, X-ray imaging in medical and industrial applications.
- Production and use of artificial isotopes: medical and industrial applications, Tecnetium-99m.
- Radiation shielding: beta, gamma and neutron shielding, practical dimensioning of protective barriers in medical X-ray installations and for gamma sources.

Prerequisites

Physics and laboratory courses of the first two years

Teaching form

24 2-hour lectures conducted in person and in *delivery* mode (6 cfu).

Textbook and teaching resource

- Course slides on elearning
- M. Eisenbud e T. Gesell, "Environmental Radioactivity", Academic Press, 1997
- N. J. Carron, “An Introduction to the Passage of Energetic Particles through Matter”, Taylor and Francis, 2007
- U. Amaldi, "Fisica delle radiazioni ad uso di radiologi, radiobiologi e protezionisti", Bollati Boringhieri, 1971
- Landolt-Börnstein; vol 4, "Radiological Protection", Springer 2005
- J. E. Martin, “Physics for Radiation Protection”, Wiley, 2013
- F. H. Attix, “Introduction to Radiological Physics and Radiation Dosimetry”, Wiley, 2005
- J.R. Greening, “Fundamentals of Radiation Dosimetry”, Taylor & Francis, 1985
- H.E. Johns e J. Cunningham, “The Physics of Radiology”, Charles Thomas Publisher, 1983
- M. Pelliccioni, "Fondamenti fisici della radioprotezione", Bologna Pitagora, 1993
- A. Webb, "Introduction to biomedical imaging", Wiley, 2003

Semester

3rd year, 2nd semester

Assessment method

Oral examination on the topics presented during the course.

The colloquium starts with the student exposing a topic he has chosen from the course program.
The exam aims to ascertain a general understanding of radioprotection in the areas discussed in class and its fundamental principles. The ability to use the techniques presented in the course for estimating exposures in particularly simple irradiation conditions will also be evaluated.

Any further studies, for example through the numerous texts suggested during the course, and presentation skills will also be considered.

Exam grade 18-30/30

No intermediate test is planned.

Office hours

On appointment by email.

Sustainable Development Goals

GOOD HEALTH AND WELL-BEING