UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

# COURSE SYLLABUS

# Elements of Environmental and Medical Physics

**2425-3-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.

## 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.

Exam grade 18-30/30

No intermediate test is planned.

## Office hours

On appointment by email.

## Sustainable Development Goals

GOOD HEALTH AND WELL-BEING