

## Introduction

BNEN, the Belgian Nuclear higher Education Network organizes a interuniversity program for Master of Science in Nuclear Engineering. This program is organized in a highly modular way and taught in English to facilitate and enhance participation of foreign students in the frame of the European Master of Science in Nuclear Engineering within the ENEN-association. The BNEN program makes full use of the laboratory facilities and infrastructure of the Belgian Nuclear Research, the SCK•CEN.

The course on "Radiation Protection and Nuclear Measurements" is free of charge for university registered students. Travel, lodging and other incurring cost are at own expenses. Participants from industry should contact the registration office.

## Students

The course is open for graduate and post-graduate students. Knowledge of Physics and higher Mathematics are a prerequisite.

## Application

Applicants should fill in the annexed Application Form and provide it with the requested additional information to the registration.

The number of participants is limited to 20. The applications are subject to a selection procedure.

## Application deadline

The application deadline is January 13, 2005.

## Venue

The course will take place at the SCK•CEN Club-House, Boeretang 200, B-2400 Mol, Belgium.

## Registration & Information

### Technical programme

Frans Moons

☎ +32 14 33 25 96

☎ +32 14 31 89 36

✉ [frans.moons@sckcen.be](mailto:frans.moons@sckcen.be)

### Registration

Ingrid Van Regenmortel

☎ +32 14 33 25 72

☎ +32 14 31 91 81

✉ [ingrid.van.regenmortel@sckcen.be](mailto:ingrid.van.regenmortel@sckcen.be)

## Travel Information

SCK•CEN is in Mol, Belgium, about 100 km northeast of Brussels and about 50 km east of Antwerp.

For a roadmap and itinerary: [www.sckcen.be](http://www.sckcen.be)

By taxi from Brussels Airport to Mol: 1,5 h drive (*indicative rate* € 150)

By public transport from Brussels Airport:

Take the intercity train to Brussels North Station. Change to Antwerp Station. Change to Mol railway Station. (*indicative rate*: € 15) (app. 2h total travel time)

For more information please check the website of the Belgian Railways: [www.b-rail.be](http://www.b-rail.be)

## Accommodation

The course is organised in residential form. Dormitories or hotelrooms on SCK•CEN domain are available.

- Dormitories without hotel service (only sheets, no cleaning) € 76,95 for 2 weeks
- Dormitories with hotel service: towels, soap, cleaning € 263,47 for 2 weeks
- Club-House hotel (breakfast included)  
single: € 50 /night double: € 70 /night

SCK•CEN guarantees 10 dormitories on a "first come, first served" base. Deadline for registration is December 13, 2004.

For all reservations of dormitories, a cash warranty of € 135 must be payed upon arrival.

## Meals

Meals can be taken at the

- cafeteria (self service) (lunch from € 4)
- the Club-House restaurant (lunch/dinner from € 10)
- the pub of the sportsclub (snack from € 2)
- the dormitory building has a communal kitchen



## Course on Radiation Protection and Nuclear Measurements

Mol, Belgium, March, 8 – 19, 2005

Organised by BNEN:



BNEN is a consortium of the Belgian universities

- Katholieke Universiteit Leuven,
- Université Catholique de Louvain,
- Université de Liège,
- Universiteit Gent,
- Vrije Universiteit Brussel,

in collaboration with SCK•CEN, the Belgian Nuclear Research Centre

[www.sckcen.be/BNEN](http://www.sckcen.be/BNEN)



BNEN courses are proffered within the ENEN association. ENEN is a non-profit organisation to preserve and develop higher nuclear education and expertise

[www.enen-assoc.org](http://www.enen-assoc.org)

## Introduction – Scope of the Course

The main objectives of the Radiation protection and nuclear measurements are:

- To get familiarised with biological effects of radiation, radiation shielding and radiation detection and measurements (also called "nuclear metrology").
- To provide general review of radiation measurement techniques relevant to nuclear engineering.

## Organisation of the Course

The course will be held in a modular way in a two week period and includes

- 7 lectures of 3h,
- 3 lectures of 4h
- lecture of 6h.
- 3 laboratory sessions & demonstrations of 8 hours

The course starts on Tuesday March 8 at 2.00 p.m. and will be concluded on Saturday March 19 at 5.00 p.m.

## Course credit

The course is rated 6 ECTS within the Belgian interuniversity programme for Master of Science in Nuclear Engineering (BNEN)

## Programme

### Theoretical course

The theoretical course is based on

1. G.F. Knoll "Radiation detection and measurement", J. Wiley, 1989.
2. N.M. Schaeffer, "Reactor Shielding for Nuclear Engineering", Atomic Energy Commission, USA, 1973.
3. A.E. Profio, "Radiation Shielding and Dosimetry", Wiley, NY, 1979.
4. J. Wood, "Computational Methods in Reactor Shielding", Pergamon Press, Oxford, 1982.

Following topics will be covered by this course:

- Interaction of ionising radiation with matter
- Basic quantities and units used in dosimetry
- Dosimetry in external radiation fields
- Internal Dosimetry
- Biological effects of ionising radiation
- Dispersion of effluents from nuclear facilities
- Shielding
- Legislation with respect to radiological protection
- Detection and identification of ionizing radiation
- Measurement techniques in radiation dosimetry

### Laboratory sessions & demonstrations

Three days of laboratory sessions are included in the module, covering:

- Gamma spectrometry
- Alpha spectrometry
- Liquid scintillation counting
- Internal dose assessment
- Thermoluminescent dosimetry
- Practical measurements

## Examination

On Wednesday, June 8, 2005 there will be a written examination in two parts:

- Closed book (=theory): 50%
- Open book (=exercises): 50%

## Lecturers

Hubert Thierens is full professor at the Universiteit Gent and radiation protection department head. His research activities concentrate on dosimetry and radiation protection issues in applications of radiation in industry and medicine.

Stefaan Tavernier is full professor at the Vrije Universiteit Brussel. His research concentrates on elementary particle physics and medical instrumentation based on X- and gamma ray detection.

Klaus Bacher lectures at the Universiteit Gent. His research is in the fields of patient dosimetry and of radio-isotopes for medical applications.

The teaching assistants are research fellows and doctoral students of the SCK•CEN.