

Polytechnic Institute of Porto  
High Institute for Allied Health Technologies

## **ERASMUS COURSE PROGRAMME**

- Portugal –



Nuclear Medicine Course

July 2010

The course programme for the ERASMUS students during the exchange programme will be composed by four of the following study units, in order to accomplish 20 ECTS.

Unit Title	Type	ECTS Credit Value	T/P	Assessment Mode
<b>1. Quality Control of Conventional Nuclear Medicine Equipments (SPECT)</b>	Opt	9	T+P	Written Report + Presentation
<b>2. Quality Control in Radiopharmacy</b>	Opt	9	T+P	Written Report + Presentation
<b>3. Radioprotection in Nuclear Medicine</b>	Opt	9	T+P	Written Report + Presentation
<b>4. Patient Care</b>	Opt	9	T+P	Written Report + Presentation
<b>5. Image Processing</b>	Opt	9	T+P	Written Report + Presentation
<b>6. Nuclear Medicine Methods and Technologies in Biomedical Research</b>	Opt	9	T+P	Written Report + Presentation
<b>7. Portuguese Language and Culture</b>	C	2	T+P	Presentation
<b>TOTAL Required (2 X Opt + Nº7)</b>		<b>20</b>		

Opt – Optional; C – Compulsory; T – Theoretical; P - Practical

In order to complete the Programme, the student must choose two from the six Optional Curricular Units and also the Unit “Portuguese Language and Culture”.

Each one of the Units will open only if there are a minimum number of registered students that is equal or superior to 4.

## Curricular Units Description

### 1. Quality Control of Conventional Nuclear Medicine Equipments

The reliability of the final diagnosis depends on the quality of the images produced and on the accuracy of the measurements performed, which can be ensured by a number of factors, including periodic testing.

In this sense, through the resolution of the Problems included in this Unit, it is intended that the students acquire knowledge of the Quality Control testing of equipment used in Conventional Nuclear Medicine, enabling them to perform all the related procedures.

#### Objectives and Skills

After completing this Unit, the student should be able to:

- Distinguish Quality Assurance and Quality Control;
- Identify the various factors and parameters that can be evaluated by methods of Quality Control of Conventional Nuclear Medicine Equipments;
- List the Quality Control procedures required for the Dose Calibration, how each of the procedures should be performed and the obtained results interpreted;
- List the Quality Control procedures required for the Gamma Camera, how each of the procedures should be performed and the obtained results interpreted;
- Evaluate Images qualitatively and quantitatively;
- Check energy window setting and spectrum display;
- Perform Quality Control tests such as COR - Center of Rotation, pixel size measurement, field of view uniformity analysis, determination of linearity, sensitivity and spatial resolution;
- Justify the importance of Quality Control methods in a routine Nuclear Medicine Department.

**Credit value:** 9 ECTS

**Type:** Optional

**Assessment mode:** Written Report + Presentation

## 2. Quality Control in Radiopharmacy

The reliability of the final diagnosis depends on the quality of the images produced and on the accuracy of the measurements performed, which can be ensured by a number of factors, including periodic testing.

In this sense, through the resolution of the Problems included in this Unit, it is intended that the students acquire knowledge of the Quality Control testing of equipment used in Conventional Nuclear Medicine, enabling them to perform all the related procedures.

### Objectives and Skills

After completing this Unit, the student should be able to:

- Distinguish Quality Assurance and Quality Control;
- Understand GMP and GLP concepts;
- Known how and when to use the European Pharmacopeia;
- Perform  $^{99}\text{Mo}$ - $^{99\text{m}}\text{Tc}$  Generator elution, assembly and maintenance;
- Reconstitute cold kits with the appropriate radionuclide;
- Employ aseptic techniques;
- Estimate total activity needed and appropriate activity concentration in reconstituted kit based on the number of patients, usual injected activity and study schedule;
- Identify the various factors and parameters that can be evaluated by methods of Quality Control in Radiopharmacy;
- Describe and explain the differences between Quality Control relative to radionuclide purity, radiochemical purity and chemical impurities;
- Describe how particle size is measured;
- Justify the importance of Quality Control methods in a routine Nuclear Medicine Department.

**Credit value:** 9 ECTS

**Type:** Optional

**Assessment mode:** Written Report + Presentation

### 3. Radiation Protection in Nuclear Medicine

According to International Atomic Energy Agency (IAEA) Safety Standards Series No. RS-G-1.5 (2002): “for the purposes of radiation protection, ionizing radiation exposures are divided into three types:

- Medical exposure, which is mainly the exposure of patients as part of their diagnosis or treatment;
- Occupational exposure, which is the exposure of workers incurred in the course of their work, with some specific exclusions; and
- Public exposure, which comprises all other exposures of members of the public that are susceptible to human control.”

The primary aim of radiation protection is to provide an appropriate standard of protection for humankind against the harmful effects of ionizing radiation, without unduly limiting the beneficial practices of such exposures. Nuclear Medicine Technologists have responsibilities with regard to the factors that affect the overall optimization of protection during medical exposures concerning him/herself, the patients and the remaining members of the staff.

#### Objectives and Skills

After completing this Unit, the student should be able to:

- Describe the several ways of radioactive transformation;
- Define and understand the concept of “decay constant”;
- Use the general form of the radioactive decay equation to calculate quantities of radioactivity;
- Describe the processes of interaction of radiation with matter (with special attention for those that relates more with Nuclear Medicine practice, both sides, diagnosis and therapy;
- Describe the effects of ionizing radiation;
- Define the term half-life (physical, biological and effective half-life);
- List and understand the respective scope/role for the main International Organizations concerned to the Medical Uses of Ionizing Radiation (International Atomic Energy Agency



- IAEA, Nuclear Regulatory Commission – NRC, International Commission on Radiological Protection – ICRP, International Radiation Protection Association – IRPA, etc.);

- Define units of radiation, absorbed dose and dose equivalent and apply these terms properly;
- Identify sources of radiation exposure to the general population;
- List the legal limits for radiation exposure;
- Define ALARA and detail a comprehensive ALARA program for Nuclear Medicine;
- Describe the operation principle of personnel monitoring devices;
- Recognize the importance of monitoring for contamination;
- Apply radiation protection rules in the routine clinical practice;
- Use Geiger Mueller Counters and scintillation detectors for laboratory surveys and decontamination procedures;
- Use your radiation monitor to survey dose levels;
- Measure dose rates throughout the workplace.

**Credit value:** 9 ECTS

**Type:** Optional

**Assessment mode:** Written Report + Presentation

## 4. Patient Care

It is the responsibility of the Nuclear Medicine Technologist to provide adequate Quality Care to the patient during all the procedures.

This Unit discusses the various responsibilities associated with the first encounter with the patient, including Patient Care and Patient Assessment.

### Objectives and Skills

After completing this Unit, the student should be able to:

- Distinguish the different routes of drug administration;
- Recognize the different material related to drug administration;
- Knowing and executing adequately the technique of hand washing;
- Demonstrate the proper techniques for transferring patients;
- Describe and demonstrate proper venipuncture technique, including the administration of intravenous medications with distinct techniques: using direct injection, abbocath, butterfly, three way trap, etc.;
- Knowing, understand and performing different techniques related to monitoring of the patient: measurement of temperature, blood pressure, glucose and oxygen levels, etc.;
- Identify and describe the actions to be taken in various medical emergencies;
- Check for correct patient preparation;
- Check for possible pregnancy or breastfeeding in women of reproductive capacity;
- Collect all relevant information concerning patient anamnesis and previous diagnostic procedures;
- Convey information at a level of understanding suitable to the patient;

**Credit value:** 9 ECTS

**Type:** Optional

**Assessment mode:** Written Report + Presentation

## 5. Image Processing

After acquisition, most often, an image must be processed in order to be prepared to obtain the most relevant information before to be sent to the reporting physician. Nuclear Medicine images present several particular problems such as lack of statistic, low contrast, high level of background noise, etc., that should be minimized for the purpose of allow an accurate diagnostic.

It is from the Nuclear Medicine Technologist the responsibility to perform this exigent task, applying distinct techniques to improve Image Quality.

### Objectives and Skills

After completing this Unit, the student should be able to:

- Define the concept of digital image;
- Discuss the principles of image formation in Nuclear Medicine;
- Discuss the level of adequateness, as well as the advantages and disadvantages of different image size matrices on different situations;
- Understand and explain the rationale behind the acquisition of gated cardiac data;
- Describe image processing operations;
- Apply image filtering techniques;
- Obtain quantitative information from an image;
- Perform image region of interest placement and curve generation;
- Describe frequency space representation of images;
- Apply SPECT and PET reconstruction techniques;

**Credit value:** 9 ECTS

**Type:** Optional

**Assessment mode:** Written Report + Presentation

## 6. Nuclear Medicine Methods and Technologies in Biomedical Research

Nuclear Medicine methods and techniques are a powerful tool in biomedical research. The basic work is normally carried out in the laboratory and using either cellular and/or animal models in order to study chemical, physiological and metabolic processes. Such investigations, for instance, are a key part on the process of the introduction of new diagnostic and therapeutic methods.

### Objectives and Skills

After completing this Unit, the student should be able to:

- Describe the different phases of the scientific method;
- Evaluate the validity and relevance of the sources used in gathering information and scientific data;
- Develop methodologies / strategies for search of scientific information;
- Recognize the basic concepts of imaging, its various types and basic principles and their application in terms of diagnostic methods and therapeutics;
- Distinguish functional and morphological imaging and their respective role in research;
- Recognize biodistribution studies as very important source of information;
- Describe the 3R's rules in biomedical research and correlate with Nuclear Medicine Techniques;
- Recognize the role and potential of Nuclear Medicine Techniques in solving problems in Health;
- Read a published scientific or medical paper and understand how conclusions can be drawn from presented data;
- Draw conclusions regarding the information presented;
- Compare different points of views from distinct authors/groups;
- Organize and write a scientific paper;

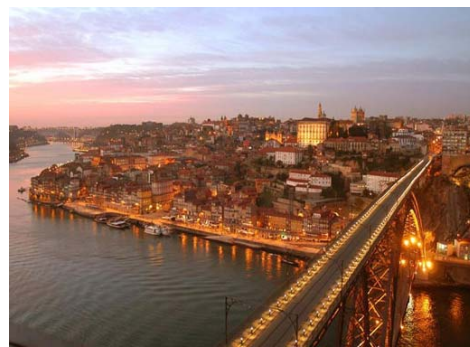
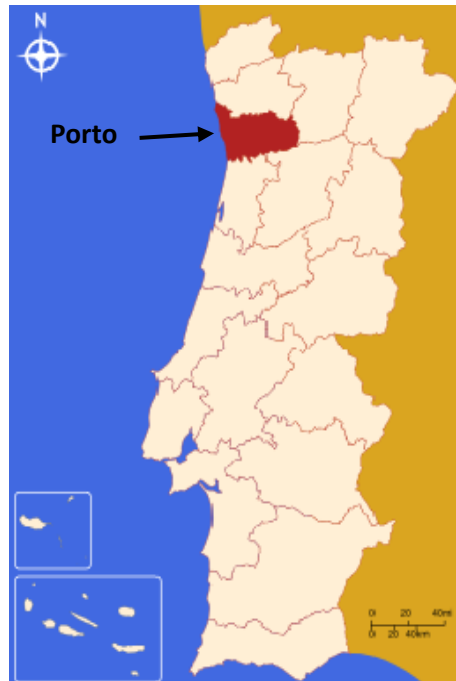
**Credit value:** 9 ECTS

**Type:** Optional

**Assessment mode:** Written Report + Presentation

## 7. Portuguese Language and Culture

Students will be given the opportunity to explore some of the beautiful attractions of Porto (visit the Port wine cellars, do cruises on the Douro River, etc.).



The inhabitants of Porto are known for their hospitality and friendliness. In order to facilitate the interaction of the students with the Portuguese people, it will be organized a language course.

Various playful activities will be organized with the purpose of integrate the new students into the academic community too.

### Objectives and Skills

After completing this Unit, the student should be able to:

- Identify important points about the history and culture of Portugal;
- Recognize the most emblematic monuments of Porto;
- Speak a few Portuguese words.

**Credit value:** 2 ECTS

**Type:** Compulsory

**Assessment mode:** Presentation

and, of course, ...get in love with Portugal!!!