

MASTER'S DEGREE APPLIED TO RADIOLOGIC PROTECTION IN RADIOACTIVE AND NUCLEAR INSTALLATIONS

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ABSTRACT

The master is focused on radiation protection (nuclear safety culture and radioactive waste management; radiation protection in radioactive facilities: industrial, medical and research). In addition, it will contribute to improve the safety and radiation protection culture and hence, the safety of nuclear and radioactive installations. The master is managed by the Chemical and Nuclear Engineering Department, of the Universitat Politècnica de València (UPV) and its coordination is carried out by Titania Servicios Tecnológicos (Titania), which is a UPV spin-off. There are many entities collaborating in the master with wide experience in radiologic protection and in the nuclear field, such as the regulator, hospitals, research centres, industrial facilities, nuclear power plants. All these entities collaborate giving theoretical and practical lessons in the master modules and allowing the use of their installations for carrying out applied sessions. It is a 65 ECTS course that lasts a full academic year. The sixth edition started on 3rd October 2016 and will end on July 14th, 2016. The master is divided into 4 modules, one general, two specific and one advanced. The general module covers the basic concepts of radiological protection. One of the specific modules is applied to "Radioactive Installations", which is divided into Industrial Facilities, Nuclear Medicine, Radiotherapy, Radio-diagnosis, and Research Installations. The other specific module, "Nuclear Installations and Fuel Cycle", regards to Safety and Radiation Shielding, Nuclear Safety, Processing, Storage and Disposal of Nuclear Wastes, Decommissioning and Environmental Management. The last module, the Advanced Module, is focused on advanced concepts of radiation and radiological protection. The course is mostly e-learning based. It is implemented on PoliformaT platform of the UPV with online resources as guided presentations, teaching videos, remote tutoring sessions, online exercises, temporized evaluations. Finally, at the end of each module the student must complete his/her training by attending a classroom seminar, helping to revise the course and resolving any queries, and also includes practical sessions, visits to installations, and a classroom examination to check the students' knowledge. This master qualifies its students to carry out tasks related to that of a Radiologic Protection Expert (RPE) and Radiologic Protection Officer (RPO), working in Radiologic Protection Services, so during this year it is planned to carry out a project jointly with a consortium of prestigious entities for its future internationalization.

1. Introduction

The aim of this work is to present the “Master in Radiation Protection for Radioactive and Nuclear Facilities”. This is a postgraduate training in Radiological protection managed by Universitat Politècnica de València (UPV), applied to nuclear and radioactive facilities. It is based on e-learning methodology and designed to cover various contents and applications in different areas and sections, related to Radiological protection general concepts, specific skills for radioactive facilities and nuclear facilities [1,2].

The master is managed by the Chemical and Nuclear Engineering Department, of the UPV while it is coordinated by Titania Servicios Tecnológicos (Titania), which is a UPV spin-off. Several entities, such as hospitals, research centers, industrial facilities, and nuclear power plants, collaborate in the master as they have a wide experience in Radiological Protection and in the nuclear field, such as Iberdrola and Enresa (the Spanish company in charge of radioactive waste management), and the Spanish Nuclear Safety Council (CSN), which coordinates the Nuclear and Radioactive Emergency area. All these entities collaborate giving theoretical and practical lessons in the master modules and allowing the use of their installations, such as hospitals or research centers, for developing practical exercises.

2. Material and Methods

The Master in Radiological Protection for Radioactive and Nuclear Installations has a duration of 65 ECTS. It lasts for a whole academic year and it is divided into four modules, one general, two specific and one advanced.

The general module covers the basic concepts of Radiological Protection. One of the specific modules is dedicated to “Radioactive Installations”, which is divided into Industrial Facilities, Nuclear Medicine, Radiotherapy, Radiodiagnostic, and Research Installations. The other specific module, “Nuclear Installations and Fuel Cycle”, refers to Safety and Radiation Shielding, Processing, Storage and Disposal of Nuclear Wastes, Decommissioning and Environmental Management. For each type of installation, attention is given to their general characteristics, operational Radiological Protection, and specific legislation. The “Nuclear Installations and the Fuel Cycle” module also includes a Nuclear Safety topic. The last module, the Advanced Module, is focused on advanced concepts of radiation and Radiological Protection.

The course is mostly e-learning based. It is implemented on the *PoliformaT* platform of the UPV, by presentations, explanatory practical videos, interactive tasks, self-assessments, to facilitate self-learning by students. Advanced technological methods have been employed, so they allow to adapt the training with flexibility to the experience provided by the expert professionals and make a follow-up of the students.

Once the students have access to the platform, there is a main menu. The environment of the *PoliformaT* platform is friendly, which makes it easy to use. It has various tools with different functions depending on whether one is an administrator with a wider management capacity, or whether one is a student, in which case permission is restricted to those authorized by administrators. For this reason, the existence of control tools is important as they guarantee efficient follow-up and control by the entity providing the course.

There are many tools and resources in *PoliformaT* platform for students to follow the contents of the master. They can see the course timetable and important dates such as those of examinations. Students can view the latest news about the progress of the course. In the Program option, they can download the list of materials that will be followed during the course. There is a specific tool for Contents, with the main material available to the student by areas with the presentations, explanatory videos, interactive tasks, etc. that cover the major objectives of the course.

Therefore, to facilitate the training of the students several on-line sessions are planned. They include remote reviews and the resolution of doubts of each area using specific software (named *Policonecta*) to be able to contact the students wherever they are. The student will only need a computer connected to Internet, a webcam, headphones and a microphone. Moreover, in these sessions the students can make an examination to control their progress. The access to these sessions may be performed online too. Figure 1 shows an example of one of these sessions.

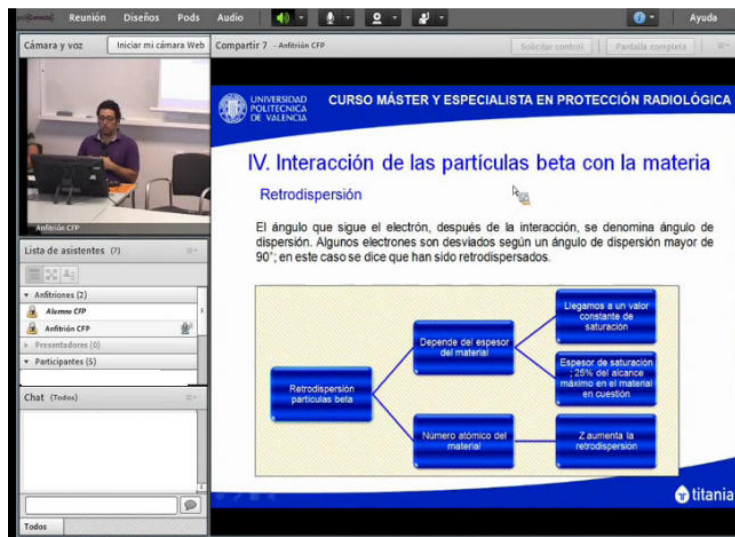


Fig.1: Policonecta session.

At the end of each module the students must complete their training by attending a classroom seminar, to help them as a final revision of the module and to solve any queries related with the module contents. There are also some practical sessions as visits to specific industrial facilities, laboratories, research centers and nuclear installations and a classroom examination to check the knowledge of students.

These practical sessions take place at UPV and at the dependencies of the entities that collaborate to the master. As an example in Figure 2 there is a picture of the practical sessions at Cofrentes Nuclear Power Plant, concretely in refueling building.



Fig. 2: Practical session in Cofrentes Nuclear Power Plant.

Some statistics tools can be used by the administrator to quickly follow up the steps that each student takes on the platform. He has at his disposal many automatic reports. Figure 3 shows an example. The administrator can see the visits that have been made by different students over a period of time as well as the resources and contents accessed by students during the visits.

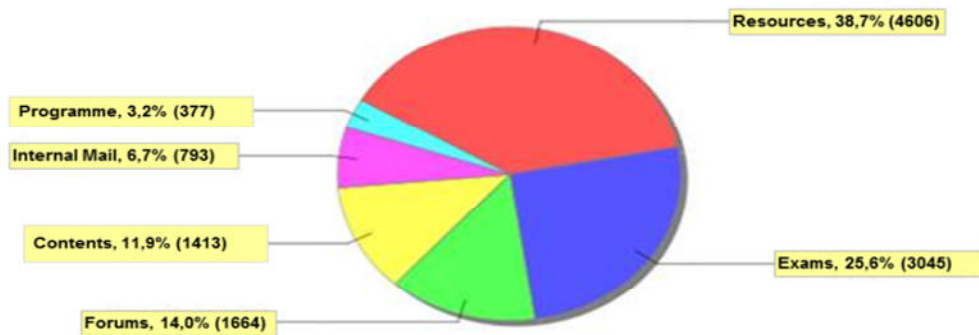


Figure 3: Screen in which can be appreciated a visit and event report.

3. Results and Discussion

The Master in Radiation Protection for Radioactive and Nuclear Facilities has been consolidated through its six editions as a powerful training in the field of Radiation Protection. Some highlights could be remarked in this sense:

- In the first editions of the master, it has been achieved a high level in the satisfaction of students, as showed the surveys carried out during the course.
- There has been an increase of the number of interested people during these years. The master webpage registered 21,500 visitors since the beginning of the first edition and 800 people interested have contacted with the master Direction/Coordination asking for more information.
- Several professional experts from the collaborating institutions participate in the master so its connection with practical approach is essential. One of the most important collaborators to the master is the Spanish Regulator CSN, of Radiological Protection and Nuclear Safety. This organization coordinates the area of nuclear and radiological emergencies in the advanced module.
- There are many students coming from different countries taken into account that the official language of the master is Spanish. In the last edition (2015/2016) there were students from Colombia, Panama, Italy..
- The structure of the master has been updated with other e-learning tools included as in the fifth edition (2015/16) of the Master where a new area was included about internal dosimetry in the advanced module with new practical sessions.

4. Conclusions

The experience during these editions of the Master in Radiation Protection for Radioactive and Nuclear Facilities shows the importance of this type of professional training using e-learning tools. A flexible and balanced training system can be achieved, which is more personalized for each individual.

The implementation of the Master provides training in Radiological Protection and Nuclear Safety mostly e-learning based, covering general and specific topics of nuclear power plants, radioactive installations, as well as industrial, research and medical facilities. It has been analyzed to carry out its internationalization to be accessible in English worldwide.

4 References

1. *Directive 2013/59/EURATOM, 2013.*
2. *IS-03: Reconocimiento de experto en protección contra las radiaciones ionizantes. Consejo de Seguridad Nuclear, 2002.*