



# **Contribution of a Master Program to Building Competencies in Nuclear Sciences in Morocco**

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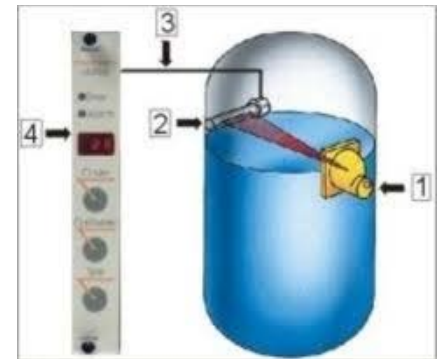
University of Ibn Tofail

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Programmes: Building and Sustaining Capacity  
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# Applications of Nuclear Techniques in different sectors in Morocco



# Regulated practices

## Medical Applications

- Radiotherapy and Curitherapy (20 facilities & 4 in project)
- Nuclear Medicine Department (21 facilities & 4 in project)
- Diagnostic and interventional radiology (~ 800 facilities)
- Dental radiology (~3000 facilities)

# Research and Industrial Practices

- Industrial Radiography (13 facilities)
- Irradiation Facilities (Research/ Industry) (1)
- Radiometric gauges and oil exploitation (56 facilities)
- Cyclotrons for the production of  $^{18}\text{F}$ -FDG (2 facilities)
- Research Reactor Triga Mark II, power 2MW (1)

## Other practices

- Management of radioactive waste (1)
- Radiology vet (9 facilities)
- Security equipments (X-ray baggage control, inspection of containers, etc) (200 X rays & 6 scanners).

# New Law and New Agency under approval

- All the practices are regulated by law of 1971.
- Morocco is in the final stages of adopting a **new law** on radiological and nuclear safety and security, and the **creation of the agency** to ensure control.

# Master Program in Nuclear Techniques & Radiation Protection

- University of Ibn Tofail has launched on September 2010, a National professional Master entitled Nuclear Techniques & Radiation Protection (Master TNRP).

## *Objectives of the master:*

- To provide knowledge and know-how directly used in the various sectors using nuclear techniques and requiring radiation protection.
- To prepare students for research



# Program design (1)

- **International partners**

- National Institute of Nuclear Sciences and Techniques (INSTN – Saclay) and (INSTN-Grenoble), France
- Laboratory of Climate Sciences and Environment, LSCE-Gif sur Yvette (France)
- University of Sousse (Tunisia)
- US-Department of State's Partnership for Nuclear Security (PNS), USA
- IAEA/International Nuclear Security Education Network (INSEN)

# Program design (2)

- **National Partners**

- CNESTEN (National Centre for Energy, Sciences & Nuclear Techniques)
- CNRP (National Centre for Radiation-Protection)
- Universities
- Scientific Associations in nuclear field
  - Moroccan Radiation Protection Association (AMR),
  - Association of Nuclear Engineers in Morocco (AIGAM)

# Program Accreditation

- The program is accredited at 3 successive levels respecting local recommendations, national and international standards:
  - Faculty Council
  - University Council
  - Ministry of Higher Education and Research throughout « National Commission charged of the accreditation, CNACES »

# Program Admission

- The master is open to national and international students having Bachelor degree. (in general in Physics)
- We have many demands from African countries speaking french and in each class, we have 2 students.
- The pre-selection of the candidates is based on their CVs.
- The final selection is based on oral interview.

# Program admission

## 5.1. Effectif des étudiants

| Promotion   | Année universitaire | Effectif prévu dans le descriptif de la filière accréditée | Effectifs des candidatures et effectifs retenus  |                   |   |                   |                                      |                   |
|---|---------------------|--|--|-------------------|---|-------------------|--------------------------------------|-------------------|
|   |                     |  | De l'établissement                               |                   | Externes à l'établissement                        |                   | Total De l'établissement et externes |                   |
|   |                     |  | Nombre de candidatures reçues de l'établissement | Effectifs retenus | Nombre de candidatures externes à l'établissement | Effectifs retenus | Nombre de candidatures               | Effectifs retenus |
| 1 <sup>ère</sup> promotion  | 2010                | 25   | 80   | 6                 | 140   | 19                | 220                                  | 25                |
| 2 <sup>ème</sup> promotion  | 2012                | 25   | 100  | 12                | 130   | 7                 | 230                                  | 19                |
| 3 <sup>ème</sup> promotion  |                     |  |  |                   |   |                   |                                      |                   |
| .....   |                     |  |  |                   |   |                   |                                      |                   |
| n <sup>ème</sup> promotion  |                     |  |  |                   |   |                   |                                      |                   |
| <b>Commentaires, recommandations et alternatives pour amélioration,... :</b> <ul style="list-style-type: none"> <li>- Au niveau de notre master, il ya une forte demande des candidats sub-Saharien pour suivre des études en sciences nucléaires et radioprotection, c'est pourquoi, nous avons eu 2 étudiants (1 Sénégalais et 1 Mauritanien) au niveau de la première promotion et encore 2 étudiants (1 Tchadien et 1 Nigérien) au niveau de cette promotion qui est en cours.</li> </ul> |                     |  |  |                   |   |                   |                                      |                   |

# Curriculum (1)

## **M1: First year**

*Mod.1* Mathematics, Statistics and Scientific English

*Mod.2* Radiation-matter interactions and nuclear detection

*Mod.3* Nuclear Physics and Particle Accelerators

*Mod.4* Molecular spectroscopy and Thermal-Hydraulic

Semester 1

*Mod.5* Programming codes, Numerical Analysis and Project Management

*Mod.6* Exposure, Dosimetry and Biological Effects of ionizing Radiation

*Mod.7* Radiochemistry and behavior of radionuclides in the environment and applications

*Mod.8* Nuclear analytical techniques

Semester 2

# Curriculum (2)

## **M2: Second year**

*Mod.9* Reactor physics and nuclear safety

*Mod.10* Legislation, management of radioactive waste,  
accidents and radiological interventions in  
emergency situations

*Mod.11* Radiation protection

*Mod.12* Applications of nuclear techniques (Health, Industry,  
agriculture, ....)



Semester 3

# Curriculum (3)

## **M2: Second year**

### **Semester 4**

- Internship of about 5 months in a professional environment and thesis defense.
- **Internship organizations:**  
CNESTEN, CNRP, OCP (Office Chérifien des Phosphates), Hospitals and research Laboratory



# Teaching methods

- Lectures, exercises, practical works, Seminars, educational visits, workshops.
- New: Students seminars and participation of students in national scientific conferences followed by report on the event
- Master website: [www.master-tnrp.com](http://www.master-tnrp.com)

# Educational visits (1)



## 1. Visit of CNESTEN's Laboratories

## Educational visits (2)



Visit of Cyclopharma Company (Cyclotron)  
-Casablanca-

# Educational Visits (3)

- Visit of CNRP Laboratories – Salé
- Visits of Radiotherapy and Curitherapy Services – Rabat

# Program progression

Semester 1

Students must validate 2 modules /4

Semester 2

Students must validate 6 modules/8

Semester 3

Students must validate 12 modules/12

Semester 4: Internship

Thesis defense

**Master Degree**

# Knowledge Assessment

Continuous Control (CC), Terminal Control, Practical work (TP), Reports of educational visits.

## 7. EVALUATION

|

### 7.1. Modalités d'évaluation

*(Indiquer les modalités d'évaluation prévues : contrôle continu, examens, exposés, rapports, ...)*

1: CC + Examen terminal

2: Examen des TP + Examen terminal

### 7.2. Notes des éléments du module (matières ou activités pratiques)

*(Pour chaque élément du module, préciser les coefficients de pondération attribués aux différents contrôles pour obtenir la note de l'élément.)*



Elément 1 : CC : 20%, Examen terminal : 80%

Elément 2 : TP : 20%, Examen terminal : 80%

# Stakeholders

- International level:
  - 2 weeks course provided by French experts from (INSTN-Saclay) & (INSTN-Grenoble)
  - 1 week course provided by a Tunisian expert (University of Sousse)
  - 1 week course provided by Tunisian expert (CNSTN-Tunis)
  - Seminar provided by American expert (University of Texas-Austin)
  - 2 days Workshop animated by American expert (Idaho State University)

# Stakeholders

- National level
  - University of Ibn Tofail
  - University Hassan II
  - CNESTEN, CNRP, ONE (Office Nationale d'Electricité) , INRA-Tangier (Institut Nationale de Recherche Agronomique), OCP, Radiophysicists (Hospitals)
  - National Associations: AMR, AIGAM



# Opportunities

- The master provides a broad and complete vision on nuclear science and applications.
- The master offers the opportunity to work in a wide range of jobs using nuclear techniques and requiring radiation protection.
- The master also prepares students for careers in research and higher education.

# Outcomes

- 60% of students validate all semester's 1 modules in the normal session
- 40% residual students validate in the second session
- 100% of students validate all semester's 2 modules in the normal session
- 84% of students validate all semester's 3 modules
- All the students (84%) validate the semester's 4

# Outcomes

- Among the 84% who have successfully completed the master, we note that about 50% of the laureates found jobs in medical and industrial sectors and regulatory body, 40% are enrolled in PhD and 10% are looking for job.

# Program Evaluation



ROYAUME DU MAROC  
Ministère de l'Enseignement Supérieur  
de la Recherche Scientifique  
et de la Formation des Cadres

| Code CNCES (réservé à la DES) | Date d'arrivée (réservé à la DES) |
|-------------------------------|-----------------------------------|
|                               | / /2013                           |

|                        |  |
|------------------------|--|
| Université             | Ibn Tofail                               |
| Établissement          | Faculté des Sciences                     |
| Diplôme                | Master Spécialisé                        |
| Intitulé de la filière | Techniques Nucléaires et Radioprotection |
| Date d'accréditation   | 2010                                     |

## FORMULAIRE D'AUTO-EVALUATION

(Le formulaire d'auto-évaluation doit être impérativement rempli même en cas où la demande de renouvellement de l'accréditation n'est pas souhaitée)

- ❖ Bac+2 : ☐ DUT ☐ CPI  
 ❖ Bac+3 : ☐ LEF ☐ LP ☐ LST  
 ❖ Bac+5 : ☐ M ☒ MS ☐ MST ☐ DI ☐ DENCg ☐ Diplôme de Traduction

## RENOUVELLEMENT DE L'ACCRÉDITATION DE LA FILIÈRE

- ☐ Oui, sans modifications  
☒ Oui, avec modifications  
☐ Non

# Participation of master's students in national conferences

1- Conference "Medical applications of ionizing radiation & radiation protection" with the participation of INSTN – Saclay, France), February 24, 2011 in Kenitra



2- International Symposium "The use of radioactivity for sustainable development", May 06-07, 2011, Meknes



# Participation of master' s students in national conferences

3- Second study day "New technologies for oncology" October 26, 2011 at FST Settat

4- Conference on "Radiation Protection in Nuclear Medicine" with collaboration of AMPM association, October 1<sup>st</sup> 2012, Faculty of Sciences-Kenitra (FSK).

## 5- First edition of master's workshop



June 12, 2012 - Kenitra

## AIGAM Association-Laureates of Master first Meeting (July 26, 2012)

- This meeting aims to :
  - Present the various opportunities of employment
  - Present the graduate schools throughout the Kingdom
  - Make the laureates sensitive to join the association



# 1<sup>st</sup> Meeting AIGAM Association-Laureates of Master TNRP (July 26, 2012, Kenitra)



## 2<sup>nd</sup> Meeting AIGAM-Master (Feb. 05, 2014, Kenitra)

Objective: Creation of AIGAM UIT Students' Section



# Integration of Nuclear Safety Security and Safeguards (3Ss) with support of our partners

- Importance of 3Ss education
- Significant role of IAEA and INSEN in organizing PDCs (Professional Development Courses) in nuclear security for educators and producing teaching material available on IAEA/Nusec Portal.
- PNS helps its partners to develop nuclear security curriculum at their universities and support their participation in meetings related to nuclear security.



# Train-The-Trainer Nuclear Security Workshop, May 30-31, 2013, University of Ibn Tofail-Kenitra



# Conclusion & Perspectives

- Given the high number of demands from African countries to join the master and as the master program has developed a wide and structured network of collaborations and partnerships with national and international institutions. We wish to have the support of IAEA and other international organizations to establish a regional master program in nuclear science and engineering focused on safety, security and nonproliferation aspects in order to meet the needs of the African region and to contribute to the proper management of radioactive and nuclear material.

*Thank you for your attention!*