الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

جامعة فرحات عباس سطيف 1

كلية العلوم

Master's in Radiation Physics

Program Overview and Objectives:

• This is a modern specialty aligned with current developments and the growing need for qualified professionals in several fields.
• Below is an overview of the applications of ionizing radiation across different sectors:

I - Health Sector:

- **Radiography:** Use of X-rays to produce images of internal structures.
- **CT-scan:** Detailed cross-sectional images for precise diagnosis.
- **Mammography:** Early detection of breast cancer.
- **Nuclear Medicine:** Injection of radioactive substances (e.g., technetium-99m) to visualize organ metabolism (scintigraphy, PET-scan).
- **Radiotherapy:** Treatment of cancer by destroying tumor cells with radiation (gamma, X-rays, or particles).

II - Industrial Sector:

- **Non-destructive testing:** Inspection of welds and metal structures using industrial radiography.
- **Sterilization:** Sterilizing medical equipment (syringes, catheters, implants) and certain food products (food irradiation).
- **Measurements and controls:** Use of radioactive sources for density, thickness, or liquid level measurements.

III - Scientific Research:

- **Radioactive tracers:** Studying biological and chemical processes.
- **Dating:** Carbon-14 dating for archaeological studies.

IV - Energy Production:

- **Nuclear power plants:** Electricity production through nuclear fission (ionizing radiation in reactors).

The program aims to train highly skilled professionals in the design and operation of nuclear equipment at research centers and nuclear power plants, in compliance with legal and regulatory safety standards.
More broadly, it aims to develop internationally competitive expertise in nuclear science and technology.

Admission Requirements:
• A Bachelor's degree in fundamental physics or in radiation physics.
• Academic ranking in the degree program.

Career Opportunities:
• Nuclear Research Centers.
• Nuclear reactors and facilities.
• Operations Engineer.
• Researcher or Research Assistant.

Program Outline:

Semester 1:

- Neutron Physics
- Nuclear Physics I
- Nuclear Materials I
- Nuclear Facilities
- Atomic Physics
- Quantum Mechanics I
- Mathematics
- Radiation Detection
- Advanced Course
- History of Nuclear Energy
- English I
- Nuclear Legislation

Semester 2:

- Radioactivity and Nuclear Reactions
- Nuclear Physics II
- Quantum Mechanics II
- Nuclear Fuel Cycle
- Nuclear Materials II
- Nuclear Techniques
- Programming Languages: Fortran 77, C, and C++
- Nuclear Reactor Thermohydraulics
- Scientific Research Methodology

- English II

Semester 3:

- Particle Physics
- Radiation
- Reactor Physics
- Radiation Protection and Nuclear Safety
- Modeling and Calculation Codes
- Nuclear Assessment Methods
- Nuclear Waste Management
- Medical Physics
- English III
- Corruption and Professional Ethics

Semester 4:

- Internship in a research laboratory or a company, culminating in a final thesis and a defense.

Key Strengths of the Curriculum:

The Master's in Radiation Physics is designed to train students in the applications of ionizing radiation in various fields. The primary goal is to provide students with the knowledge and skills needed to meet the challenges associated with the use of radiation for medical, therapeutic, industrial, and research purposes.
Students will acquire essential skills to work in professional environments such as Medical Imaging Centers, Nuclear Medicine Centers, Cancer Treatment Centers, Nuclear Research Centers, nuclear reactors and facilities, universities, and institutions using any type of ionizing or non-ionizing radiation.
Additionally, it emphasizes the ability to integrate into academic research teams for advanced studies (PhD or other postgraduate research).

Admission Information:
According to the current application of Articles 171 and 1023 of the relevant decrees:
• Competency and knowledge acquisition is evaluated every six months through continuous assessment and a final exam.
• Progression from the first to the second year is automatic if the first two semesters are successfully completed.
• Student evaluation, as outlined in the program, includes lectures, practical work, tutorials, and internships.

Language of Instruction:
French and English.

Core Courses:

- Radiation-Matter Interaction
- Ionizing Radiation
- Detection of Ionizing Radiation
- Nuclear Physics
- Quantum Mechanics I
- Mathematics
- Nuclear Materials II
- Nuclear Techniques