

## EUROPEAN JOINT MASTERS IN SAFE AND RELIABLE NUCLEAR APPLICATIONS (SARENA)

### AN ERASMUS MUNDUS MASTER COURSE



Co-funded by the  
Erasmus+ Programme  
of the European Union

The SARENA programme received the financial support from the European Commission (EACEA) within the Erasmus Mundus programme for its editions from 2019-2022.

### TWO AWARDED DEGREES

All our students are graduates from IMT Atlantique (SARENA European Joint Masters in Safe and Reliable Nuclear Applications). The second degree depends on the study track:

- **Study Track A:** Master of Science with a major in Radioactive Waste Management and Decommissioning (IMT Atlantique, UPM).
- **Study Track B:** Master of Science with a major in Nuclear Reactors Operation and Safety (LUT, UL).

In addition, a joint certificate of the SARENA International Master programme is issued to each student.

### KEYWORDS

Nuclear energy, Reactor operation, Waste management, Decommissioning, Project Management, Sustainability.

### INSTITUTIONS OFFERING THE MASTER

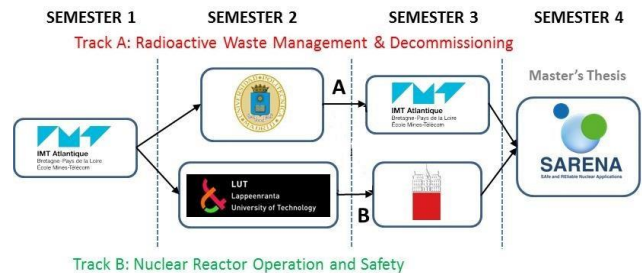
- **IMT Atlantique:** a leading French Higher Education and Research Institution in Engineering. IMT Atlantique (Nantes Campus) is part of the Institut Mines-Telecom.
- **The Technical University of Madrid (UPM):** the oldest and the largest Technical University in Spain.
- **The Lappeenranta University of Technology (LUT):** a pioneering science university in Finland, bringing together the fields of science and business since 1969.
- **The University of Ljubljana (UL):** the oldest and largest higher education and scientific research institution in Slovenia. University with its rich tradition was founded in 1919.

### CONTEXT

Sustainable development of the humankind in the future will require access to sufficient, environmentally acceptable and affordable energy sources. The most important and complex challenges are to improve the security of energy supply, reduce greenhouse gases emission and provide low-cost energy supply to industries and citizens. Sustainable nuclear energy is an integral part of the European Strategic Energy Technology Plan fighting against climate change and securing energy supply. The nuclear technologies today exhibit unparalleled levels of safety and reliability. This has been made possible through considerable and long-term efforts of the excellently educated and trained employees with outstanding safety culture in the industry, competent regulatory authorities, research, higher education and technical support (TSO) communities worldwide.

### PROGRAMME AND STUDY TRACKS

The 2-year programme (120 ECTS) allows students to study in up to three different European Countries.



#### YEAR 1 SEMESTER 1:

##### Foundations of nuclear physics and engineering – common core modules (IMT)

Physics and Detection of Ionizing Radiations, Integrated Scientific Project, Measurements & Data Analysis, Management, Energy Mix & Energetic Transitions.

For Track A: Advanced Technologies in Nuclear Reactors

For Track B: Introduction to Neutron Physics/Reactors, Introduction to Modelling of Nuclear Reactions

#### YEAR 1 SEMESTER 2:

##### Track A: Radioactive Waste Management & Decommissioning (UPM)

Radiochemistry, Environmental Radiological Impact, Radioactive Waste Management & Transmutation, Reliability & Risk Analysis, Energy Security, Nuclear Safety, History of Nuclear Physics & Nuclear Engineering, Entrepreneurship

##### Track B: Nuclear Reactor Operation and Safety (LUT)

Nuclear Power Plant Engineering, Nuclear Reactor Physics Analyses, Theoretical, Computational & Experimental Thermal Hydraulics, Turbulence Models, Advanced Modelling Tools for Transport Phenomena, Entrepreneurship

#### YEAR 2 SEMESTER 1:

##### Track A: Radioactive Waste Management & Decommissioning (IMT)

Waste Conditioning & Storage, Dismantlement & Decommissioning of Nuclear Installations, Geological Disposal Nuclear: Management, Safety & Society, Visits & Conferences, Languages

##### Track B: Nuclear Reactor Operation and Safety (UL)

Physics of Fission Reactors, Experimental Reactor Physics, Materials in Nuclear Engineering, Nuclear Safety, Seminar

#### YEAR 2 SEMESTER 2:

##### Master's thesis (30 ECTS) in a professional context (industry, R&D...).

## LANGUAGE OF TEACHING

100% English

## INDUSTRIAL AND RESEARCH COLLABORATIONS

EDF, GEN Energija, Orano, ASSYSTEM, Andra, Enresa, ARAO, Posiva, CEA, JSI, BRGM, VTT, STUK, CIEMAT, IRSN

## ACADEMIC AND NETWORK PARTNERS

Stanford University, Kyushu University, the University of Tokyo, Université Hassan-II, University Mohamed-I, Yerevan University, BME University, Lomonosov State University, Dmitry Mendeleev University, Belarusian State University, NRU HSE University, IZEN, ENEN

## SKILLS ACQUIRED

- Basic knowledge necessary for understanding nuclear energy production (power reactors) and industrial applications, e.g. accelerators, cyclotrons...
- Competences in reactor operation, maintenance and safety issues including radioprotection.
- Competences in nuclear modelling necessary for demonstrating the behaviour of nuclear systems in normal and abnormal situations.
- Competences in nuclear radiation applications: instrumentation, non-destructive control and security.
- Awareness of societal issues related to nuclear energy production.
- Scientific knowledge necessary for nuclear waste management and the capability to understand how to assess long-term safety and environment impacts.
- Appropriate solutions according to the type of waste through project work in industry.
- Possibility to build contacts with a large number of international key players in the field.
- Competencies to master dismantlement and decommissioning of nuclear installations.
- Societal considerations in the management of nuclear waste with regard to the public acceptance.

## TYPICAL JOBS

- Project engineer related to nuclear energy, decommissioning, nuclear waste processing, conditioning, safe storage.
- Manager of nuclear waste in industry, hospitals or research institutions.
- Safety engineer for radioactive waste management solutions.
- Regulators for governmental control of waste management practices.
- Engineer of international agencies involved in nuclear waste issues.
- Project engineer related to nuclear energy.
- Operation and maintenance engineer in power plant and other industrial applications.
- Safety engineer in nuclear power plant operation and industrial installations, and environmental controls.
- Research scientist and development engineer for industrial installations and power plants.

## ADMISSION REQUIREMENTS

A Bachelor's degree in Engineering, Physics, Chemistry, Environmental sciences and similar subjects closely related to the objectives of the course. For the bachelor's degree, a minimum overall/average grade of B according to the ECTS grading system is necessary.

## LANGUAGE REQUIREMENTS

English certificates and minimum scores are required:

- IELTS: 6.0
- TOEFL (paper based: 550, computer based: 200, IBT: 80)
- Cambridge English Test: B
- TOEIC: 605

## PARTICIPATION COSTS

- 9 000 €/year for non-EU students
- 4 500 €/year for EU students

## SCHOLARSHIPS

The SARENA programme offers approx. **17 scholarships per intake** (i.e., 2019-21, 2020-22, 2021-23, 2022-24) for students from:

- Program Countries (~3 scholarships): Member States of the European Union (EU) and Iceland, Liechtenstein, former Yugoslav Republic of Macedonia, Norway, Turkey
- Partner Countries (~12 scholarships): all other countries
- Additional ~2 scholarships for citizens of the following countries: *Afghanistan, Algeria, Armenia, Azerbaijan, Bangladesh, Belarus, Bhutan, Cambodia, DPR Korea, Egypt, Georgia, Indonesia, Israel, Jordan, Laos, Lebanon, Libya, Malaysia, Maldives, Moldova, Mongolia, Morocco, Myanmar, Nepal, Pakistan, Palestine, Philippines, Sri Lanka, Syria, Thailand, Tunisia, Ukraine, and Vietnam.*

The scholarships include participation fees, health insurance, aide for installation and local subsistence cost.

## CALENDAR

The academic year starts the following September (usually mid-September) in Nantes.

## APPLICATIONS

Application website is open from December to beginning of March:

<http://www.imt-atlantique.fr/sarena>

## SARENA CONTACT

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**POLITÉCNICA**



Univerza v Ljubljani

