



MASTERS OF SCIENCE IN NUCLEAR ENERGY

FRENCH INTERNATIONAL DEGREE PROGRAMMES
TAUGHT IN ENGLISH



MASTERS OF SCIENCE PROGRAMMES IN NUCLEAR ENERGY

French International Degree Programmes Taught in English

France has a wide variety of academic programmes for students interested in a career in the nuclear sector. There are a number of nuclear degrees taught in English.

Out of the 50 master programmes offered in French universities and engineering schools, nine nuclear majors are fully taught in English and especially designed for international students. These nine academic programmes are highlighted in this brochure covering all the fields required for the nuclear energy sector: civil engineering, nuclear plant design, reactor physics & engineering, operation, fuel cycle, materials science, waste management, and decommissioning. For each curriculum, the volume of credit courses is indicated. If interested in enrolling in one of these programmes, please contact the corresponding academic institution for further information and send in your application.

I2EN'S MISSION: COORDINATING THE FRENCH OFFER IN NUCLEAR HUMAN CAPACITY BUILDING

The International Institute of Nuclear Energy (I2EN) represents France's nuclear stakeholders, government agencies, industry, R&D, and academia internationally and coordinates all stakeholders to provide comprehensive and customized solutions to embarking, operating and expanding countries. By bringing all these stakeholders together (15 partners & 37 associate members), the I2EN serves as a single point of contact for countries wishing to develop their nuclear workforce and to benefit from French expertise.

MASTER OF SCIENCE IN NUCLEAR ENERGY (MNE)



Teaching institutions: CEA/INSTN, CentraleSupélec, Chimie ParisTech, Ecole des Ponts ParisTech, ENSTA ParisTech, Université Paris Saclay



Industry and R&D contributors: Andra, EDF, CEA, Framatome, Orano



Degree awarded by: Paris-Saclay University

City: Paris-Saclay Campus

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Website: <https://www.universite-paris-saclay.fr/en/formation/master/nuclear-energy>
<https://i2en.fr/en/fiche-formation/major-fuel-cycle-mne-fc/>

The Master of Science in Nuclear Energy covers all subject areas required for nuclear energy professionals. The first year provides a broad education ranging from the essential scientific and technological aspects to the physical and chemical aspects of nuclear energy. During the second year, students choose one of five possible tracks: fuel cycle, decommissioning and waste management, nuclear plant & design, reactor physics and engineering, or operations.

Track 1: Decommissioning & Waste Management
Track 2: Fuel Cycle
Track 3: Nuclear Plant Design
Track 4: Nuclear Reactor Physics & Engineering
Track 5: Operations

TRAINING CONTENT (CU & corresponding number of credits)	YEAR 1		YEAR 2				
	Physics	Chemistry	DWM	FC	NPD	NRPE	OP
Mathematics, physics and chemistry	9	13					
Nuclear physics and material radiation interaction	7	7	2	2		4	
Radiation protection			3	3	3	3	3
Thermodynamics	3	3					
Radiochemistry, analysis, radioelements		2		2			
General course on nuclear energy, reactor services, front-end & back-end cycle	6	3	6	9	6	6	6
Reactor physics, neutronics	2	2			3	12	3
Reactor physics, thermal hydraulics	4				4	8	4
Computing codes and simulation	2	2	5	3	3		
Reactor design					5		
Operation and maintenance of nuclear facilities							7
Reactor systems and equipment					4		
Reactor safety and regulation	3		3	3	3	3	12
Risk management			4	4	4		4
Measurement and instrumentation, control systems	2						1,5
Seismic and earthquake engineering					2		
Molten salt chemistry and cooling				3			
Fuel cycle processes		7		4			
Waste management			4	7			
Dismantling & decommissioning			9				
Materials, concrete and corrosion	5	4			5	4	
Project management & strategy	3	3	5				
Economics of the energy sector	3	3					
Energy transition			2	2	2	2	2
English and foreign languages	2	2					
Internship	9	9	18	18	18	18	18
TOTAL NUMBER OF CREDITS	60	60	61	60	62	60	61

MASTER OF SCIENCE IN MATERIALS SCIENCE FOR NUCLEAR ENERGY (MANUEN)



Teaching institutions: Grenoble INP – Phelma & CEA/INSTN

Industry and R&D contributors: EDF & CEA

Degree awarded by: Grenoble INP – Phelma

Location: Grenoble

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Website: <http://phelma.grenoble-inp.fr/en/studies/master-material-science-for-nuclear-energy-manuen>
<https://i2en.fr/en/fiche-formation/major-materials-science-for-nuclear-energy-manuen/>

The Master of Science in “Materials Science for Nuclear Energy” covers the metallurgical, physical and chemical aspects of the aging of irradiated materials. The core courses provide students with the fundamentals to understand the behaviour of materials in a nuclear environment with experience feedback from the nuclear industry. Two on-site courses take place at EDF’s R&D Material Ageing Institute (2 weeks) and at the CEA-Cadarache centre (three weeks). They focus on the technological aspects of PWR structural components and on nuclear fuels. This master’s degree is meant for engineers who wish to pursue a career in the industry, R&D, or in safety organizations.

TRAINING CONTENT (CU & corresponding number of credits)	Year2
General information on nuclear energy, reactor services, front-end & back-end cycle	1
Reactor physics, thermal hydraulics	0.5
Computing codes and simulation	6.5
Reactor design	1.5
Operation of nuclear facilities	0.5
Civil engineering in nuclear energy	1
Fuel cycle, methodology	0.8
Fuel cycle, processes	0.8
Political economics of the energy sector	1
Definition, properties, manufacturing materials (structure, fuel, matrices, containers)	3.3
Physical chemistry of radiation damage in materials	3.8
Ageing in nuclear environment, multi constraints	3.3
Personal project of studies (excluding internship)	4
English & foreign languages	2
Internship	30

ERASMUS MUNDUS JOINT MASTER DEGREES IN SAFE AND RELIABLE NUCLEAR APPLICATIONS (EMJMD SARENA)

Teaching Institutions: IMT Atlantique - Universidad Politécnica de Madrid - University of Ljubljana - Lappeenranta University of Technology



Degree awarded: Double degree IMT-Atlantique - UPM (RWMD track) and double degree UL-LUT (NROS track)

City: Nantes (France) - Madrid (Spain) - Ljubljana (Slovenia) - Lappeenranta (Finland)

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The EMJMD in Safe and Reliable Nuclear Applications (SARENA) aims to develop scientific, technical and management skills enabling engineers to work in all domains related to nuclear energy and applications with a strong international culture. It addresses the important issues of safe management of radioactive waste and installations dismantlement and decommissioning. The common denominator of the SARENA programme is nuclear safety.

The programme proposes two different tracks:

- 1) Radioactive waste management and decommissioning (RWMD)
- 2) Nuclear reactors operation and safety (NROS)

Track 1: Radioactive Waste Management and Decommissioning (RWMD)

Track 2: Nuclear Reactor Operation and Safety (NROS)

Training content (CU and corresponding number of credits)				
Physics of ionizing radiations	4		4	
Detection of ionizing radiations	3		3	
Integrated scientific project	3		3	
Measurement and data analysis	3		3	
Project management	3		3	
Energy mix and energetic transitions	3		3	
Introduction to modelling of nuclear reactions	3		3	
French language and culture	2	2	2	
Entrepreneurship	3		3	
Introduction to neutron physics			3	
Advanced technologies in nuclear reactors	3			
Radiochemistry	3			
Environmental radiological impact	3			
Nuclear fuel cycle and radioactive waste management	4			
Partitioning and transmutation of nuclear waste	3			
Reliability and risk analysis	3			
Advanced seminars and technical visits	2			3
Energy security	3			
Nuclear safety	3			6
Materials under irradiation	3			
Nuclear fusion	3			
Spanish language	2 (optional)			
Nuclear power plant engineering			6	
Nuclear reactor physics analyses			3	
Theoretical nuclear thermal hydraulics			3	
Computational nuclear thermal hydraulics			3	
Experimental nuclear thermal hydraulics			3	
Turbulence models			4	
Advanced modelling tools for transport phenomena			5	
Language and communication studies: Finnish			3	
Waste conditioning and storage		7		
Dismantlement and decommissioning of nuclear installations		4		
Geological disposal		7		
Safety and performance analysis		5		
Sustainability and safety management		5		
Physics of fission reactors				9
Experimental reactor physics				6
Material in nuclear engineering				6
Internship/Master thesis		30		30

MASTER OF SCIENCE IN NUCLEAR ENGINEERING (NE)



Teaching institution: IMT Atlantique

Degree awarded by: IMT Atlantique

City: Nantes

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Website: www.imt-atlantique.fr/en/study/msc/ne-anwm
www.imt-atlantique.fr/en/study/msc/ne-nepia

The **MSc in Nuclear Engineering** trains skilled and specialized workforces for countries that are currently developing their nuclear programmes, including for energy generation, waste management, and the dismantling and decommissioning of nuclear facilities. The combination of scientific and technical skills with management skills and strong safety culture (human factors and organizational safety) is meant to put human beings and environment safety as the number one priority.

It offers two possible study tracks in Year 2:

- **Advanced Nuclear Waste Management (ANWM)**
- **Nuclear Energy Production & Industrial Applications (NEPIA)**



TRAINING CONTENT (CU & corresponding number of credits)	Year I	ANWM	NEPIA
Measurement and Data Analysis	3		
Integrated Scientific Project	3		
Project Management	3		
Energy Mix and Energetic Transition	3		
Physics of Ionizing Radiation	4		
Detection of Ionizing Radiations	3		
Introduction to Nuclear Modelling	3		
Introduction to Neutron Physics	3		
Environmental Physical-Chemistry	7		
Radioprotection	6		
Introduction to Nuclear Technology	5		
Management & Organization	5		
Integrated Nuclear Engineering Project	4		
Entrepreneurship	3		
Company visits	1		
Basics for Reactors			7
Operation and Maintenance			9
Nuclear Materials			3
Wastes, Conditioning and Storage		7	
Geological Disposal		7	
Safety and Performance Analysis		5	
Dismantlement & Decommissioning of Nuclear Installations		4	4
Sustainability and Safety Management		5	5
French Language and Culture	4	2	2
Professional Coaching		0	0
Master Thesis		30	30

MASTER OF SCIENCE IN NUCLEAR CIVIL ENGINEERING



Teaching institutions: ESTP Paris

Degree awarded by: ESTP Paris

City: Cachan

Contact: Ms. Carinne BRAULT
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Website: <https://www.estp.fr/en/masters>
<https://i2en.fr/en/fiche-formation/nuclear-civil-engineering-gcn/>

The **Master of Science in "Nuclear Civil Engineering"** provides students with the knowledge and skills to meet the critical civil engineering challenges related to nuclear facilities: design of the new generation power plants; operation and dismantling of existing facilities with a strong emphasis on safety and waste management according to the demanding criteria of sustainable development. The French nuclear industry is a world leader from design, construction, operation, decommissioning of nuclear facilities. ESTP Paris trains the largest number of students in the field of civil engineering in France.

TRAINING CONTENT (CU & corresponding number of credits)	Year2
General technical disciplines relevant to nuclear power	9.00
General information on nuclear energy, reactor services, frontend and back-end cycle	0.20
Computing codes and simulation	1.00
Design of nuclear facilities	0.50
Operation of nuclear facilities	1.00
Reactor safety and regulation	1.40
Nuclear civil engineering	9.50
Fuel cycle, processes	0.20
Dismantling	1.00
Radiation protection	0.20
Measurement and Instrumentation, I&C, accelerators	0.50
English & foreign languages	2.00
Internship	30.00



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