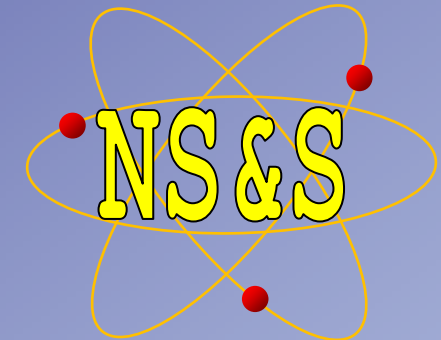




## University of Pisa Engineering Faculty



# Nuclear Safety and Security Specialization Course (“Master Universitario di II Livello”)

### PURPOSE

The objective of the Specialization Course is to form highly-qualified professionals in Nuclear Safety and Security of NPP. The Specialization resulting profile is an Expert in Nuclear Engineering, with knowledge and competences particularly suitable for the applications of nuclear safety and security in industries, research centers, regulatory bodies and technical support organizations (TSO).

### MAIN FEATURES

The Education and Training activity covers the following disciplines: Legislative and regulatory framework, international instruments, licensing requirements, safety principles, criteria and requirements for siting, design, construction and operation of NPP, safeguards and physical protection, radiation safety, emergency preparedness and response, quality assurance, research on safety, operating experience, radioactive waste (RW) management, transports of radioactive materials (RM) and nuclear liability.

The formation activity is designed to have a duration of one academic year (12 months), for 60 ECTS, distributed in a total of 12 disciplines, with intermediate verifications and a final examination.

About 410 hours of teaching and 90 hours of laboratory and working sessions are foreseen, given by top level university professors, scientists and technologists involved with Research Institutions, Industry, Regulatory Bodies and TSO all over Europe.

Lectures are complemented by Seminars given by experts of National and International Institutions.

A tour of one week for visiting European Nuclear Power Plants, Facilities of nuclear fuel cycle and RW is foreseen for the Master participants.

Attendance to lessons, seminars, exercises and laboratory activities is mandatory for at least 80% of total hours of the didactical activities.

### ENTRANCE CONDITIONS

A MSc degree in Nuclear Engineering or an equivalent title like the EMSNE supported by the European Community.

A MSc degree in Engineering or in Science with a first level nuclear Master.

Each student shall have a sufficient knowledge of English (at least at level B1 of the CEFR or equivalent).

The final admission to the Course will be decided by the Director and the Executive Board on a case-by-case basis.

### THESIS

Roughly 3 months full time, totaling 14 equivalent ECTS with a final dissertation, whose subject can be suggested by the ISC or by Sponsor Organizations

### CERTIFICATION

At the end of the NS&S Specialization Course, applicants will obtain the diploma of “Master Universitario di II livello” given by the Rector of University of Pisa.

Students at partial time and Auditors will receive a certificate of the developed activity by the Director of the NS&S Specialization Course.

### CALENDAR AND FEES

The preparation Summer Course will start on June 14 and end on September 2010.

Lectures of the NS&S Specialization Course will start on November 2010 and end on May 2011, while the Course itself will end at October 2011. The schedule can be extended following request of candidates or Sponsor Organizations for the preparation of the thesis.

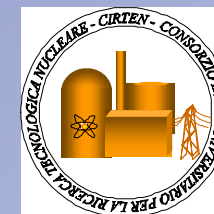
The first phase of inscription at the Summer and Specialization Courses ends on July 9, 2010.

If the available quota of inscriptions (30 full-time students) to the Specialization Course is not achieved, a second phase of inscription is foreseen, which will end at October 10, 2010. At maximum, 30 part-time students and auditors are admitted to the Specialization Course in any moment.

The Fee for inscription to the Specialization Course is 6000 Euro, while part-time students pay 100 Euro/ECTS.

### NS&S INTERNATIONAL STEERING COMMITTEE (ISC)

Name	Affiliation	Name	Affiliation
A. Alemberti	ANSALDO (Italy)	P.E. Labeau	ULB-BNEN (Belgium)
W. Ambrosini	UNIPI (Italy)	G. Lomonaco	UNIPI (Italy)
D. Aquaro	UNIPI (Italy)	A. Madonna	ITER Cons. (Italy)
Y. Bartosiewicz	UCL-BNEN (Belgium)	C. Mancini	MAE (Italy)
R. Bovalini	UNIPI (Italy)	M. Mazzini	UNIPI (Italy)
M. Carcassi	UNIPI (Italy)	E. Mikolaichuk	SNRCU (Ukraine)
G. Curzio	UNIPI (Italy)	J. Misak	NRI (Czech Rep.)
M. Coeck	SCK-CEN (Belgium)	F. Oriolo	UNIPI (Italy)
F. d’Errico	UNIPI (Italy)	S. Paci	UNIPI (Italy)
W. D’Haeseleer	KUL-BNEN (Belgium)	S. Orlandi	ANSALDO (Italy)
G. Forasassi	UNIPI-CIRTEN (Italy)	G. Petrangeli	Consultant (Italy)
M. Gasparini	IAEA	J. Reig	NEA-OECD
M. Giot	SCK-CEN (Belgium)	E. Van Walle	SCK-CEN (Belgium)
V. Giusti	UNIPI (Italy)	G. Yadigaroglu	ETH (Switzerland)



# SPECIALIZATION COURSE PROGRAM

## General Safety Basis (3 ECTS)

- Safety principles, criteria and requirements
- Basic safety standards
- Deterministic and probabilistic nuclear safety methodologies
- Elements of Reliability Theory
- The risk concept, types and dimensions of risk, risk evaluation and perception
- Nuclear safety culture

## Fission Reactor Core Design (3 ECTS)

- Nuclear fuel cycle
- Reactor fuel lattice optimization
- Reactor heat generation and power profile in the reactor core
- Fuel depletion analysis
- Thermal-hydraulic characteristics of fuel assemblies
- Thermal analysis of fuel elements

## Radiation Protection (3 ECTS)

- Radiological effects on human health
- Basic radioprotection standards
- Radiation protection system
- Controlled areas and personal dosimetry
- Applications of ALARA Principle

## Nuclear Standards & Requirements (2 ECTS)

- WENRA requirements
- IAEA safety standards and guides
- USNRC regulatory guides
- OPB requirements
- EU Utilities requirements
- ACI, IEEE codes

## Reactor Materials, Nuclear Fuel Cycle, RW & RM Management (5 ECTS)

- Fuel and control rod materials
- Coolants, reflectors and moderators
- Structural materials and embrittlement
- Nuclear fuel cycle facilities
- Radioactive Waste (RW) & Spent Fuel storage and disposal
- Transport of Radioactive Material (RM) and RW
- Management of RM physical protection and safeguards
- Nuclear Material Accountability

## NPP Siting, Design, Construction, Operation and Decommissioning (6 ECTS)

- Siting Requirements and interfaces with NPP design
- Conceptual design and Plant design conditions
- Construction requirements and supervision
- Commissioning program and objectives
- Space management requirements and Plant Lay out design
- Limits and conditions for the operation
- Instrumentation & Control (analog and digital)
- In-service inspection and maintenance
- Operational Wastes Treatment technologies
- Long-term NPP operation (life extension)
- Decommissioning of nuclear installations: general needs and present experience

## Project & Quality Management (2 ECTS)

- Project Management Principles in Power Sector (EPC Projects)
- Quality Systems Management
- Classified Safety Equipment and Analytical / Experimental Qualification Process
- Vendor, A/E, Utility interface requirements

## NPP Structures, Systems and Components (6 ECTS)

- Safety and seismic classification and requirements of structures, systems and components (SSC)
- Civil structures in NPP
- Principles of structural engineering and models for static and dynamic analyses
- Thermo-mechanical stresses
- Fluid-structure interaction
- ASME codes
- Primary and secondary loops
- Safety systems (ECCS and others)
- Auxiliary Systems
- Machinery & Equipments, Electrical systems

## Legal & Regulatory Framework, Licensing Process (3 ECTS)

- Background on nuclear safety and security
- Legal framework and International instruments
- Developing national infrastructure
- Roles and responsibilities
- Regulatory activities and functions
- Safety Analysis Report content and structure

## Nuclear Safety & Accidents Analysis (8 ECTS)

- Design basis accidents: internal & external, natural & man-made
- INES Scale of nuclear and radiological accidents
- DBA (LOCA, RIA) and accident analysis methodology
- Beyond Design Basis Accidents (BDBA) and Severe Accidents (SA)
- The source term in LWR
- Design of Reactor Containment Systems and ESF
- Accident radiological consequences calculation
- Probabilistic Safety Analysis (PSA) of NPP
- Historical overview of main occurred reactor accidents

## Environmental and Social Impacts (2 ECTS)

- Environmental Impact Assessment (EIA)
- Emergency preparedness
- Public communication and acceptance

## Nuclear Security (2 ECTS)

- Prevention activities, detection and response activities
- Basic criteria for physical protection
- Interaction between safety & security

## CONTACTS AND INFORMATION

University of Pisa

DIMNP - Largo L. Lazzarino, 2 - 56126 Pisa (Italy)

Director: Prof. Marino Mazzini

E-mail: mazzini@ing.unipi.it

Tel. ++39-050-2218058 Fax ++39-050-2218065

Scientific Secretary: Dr. Guglielmo Lomonaco

E-mail: g.lomonaco@ing.unipi.it

Tel. ++39-050-2218038 Fax ++39-050-2218065