Program Overview

1st year (60 ECTS):

1st semester	Contact hours					ECTS
	L	E	S	LE	∑	
Seminar 1	0	0	3	0	45	2
Reactor engineering	3	2	1	0	90	9
Computational physics 1	2	2	0	0	60	8
Elective courses						11
2nd semester	**Contact hours**					**ECTS**
	L	E	S	LE	∑	
Seminar 1	0	0	3	0	45	2
Research – masters study 1	0	0	0	4	60	10
Introduction to research work					30	3
Elective courses						15

2nd year (60 ECTS):

3rd semester	Contact hours					ECTS
	L	E	S	LE	∑	
Seminar 2	0	0	3	0	45	4
Nuclear, reactor and radiological physics	1	3	0	0	60	6
Elective courses						20
4th semester	**Contact hours**					**ECTS**
	L	E	S	LE	∑	
Research - masters study 2	0	0	0	8	120	20
Elective courses						10

1st & 2nd years total: 120 ECTS

Mandatory courses: 64 ECTS
Nuclear elective courses: at least 35 ECTS
Other elective courses: up to 21 ECTS

Notes:
L = lectures, E = exercises, S = seminar,
LE = laboratory exercises.

The total number of lectures, tutorials, seminars and laboratory work hours can vary by a few dozen, depending on the set of elective courses.

Curriculum 2023/24 ---->

orange - course with cyclic lectures every 2nd year.
violet - joint course with SARENA MSc prog. in English
* - no lectures.

Year & Semester w - Winter, s - Summer	Course	Lecturer
1w	**Reactor Engineering** (mandatory) (9 ECTS) Basic information about all topics of reactor engineering, the meaning and operation of nuclear reactor and nuclear facilities.	I. Tiselj
1w	**Radiation physics and dosimetry** (6 ECTS) Ionizing radiation, interaction with matter, dosimetry, detectors.	T.Podobnik
1ws	**Seminar 1** (mandatory) (4 ECTS) Recognizing innovation in nuclear technology, ability of study, seeking information and preparing written and oral presentations, following different instructors, asking questions and learning through mistakes, other problems.	S. Fajfer D. Arčon D. Cvetko T. Rejec
1w	**Experimental reactor physics** (6 ECTS) Implementation of experiments on the educational TRIGA reactor in order to consolidate knowledge of reactor physics and gain experience in managing and conducting experiments in a nuclear reactor.	L. Snoj A. Trkov
1s	**Physics and engineering of fusion reactors** (6 ECTS) To obtain theoretical and practical knowledge necessary to understand and control processes in fusion reactors.	T.Gyergyek
1w	**Computational physics 1** (8 ECTS) (mandatory) Introduction to basic modeling approaches and updating basic mathematical modeling tools. Each weekly unit is a combination of model-based content and mathematical tools.	S. Širca
1w	**Energy systems** (5 ECTS) Review of energy systems and power plants. Course at **Faculty of Mechanical Engineering**.	M. Sekavčnik
1s	**Introduction to research work** (3 ECTS) (mandatory)	N. Osterman
1s	**Research - masters study 1** (10 ECTS) (mandatory) Research for master's thesis.	N. Osterman mentor
2s	**Nuclear, reactor and** (mandatory) (6 ECTS) **radiological physics** Basic knowledge of nuclear and radiation physics, mainly based on practical exercises.	L. Snoj
2w	**Physics of fission reactors** (9 ECTS) Theoretical and practical knowledge necessary to understand and control processes in the nuclear reactor core.	L. Snoj A. Trkov
2w	**Nuclear thermalhydraulics** (6 ECTS) Understanding and modeling of thermal-hydraulic processes in systems of nuclear power plants. Understanding transients in cooling systems of nuclear power plants.	I. Kljenak I. Tiselj
2w	**Seminar 2** (mandatory) (3 ECTS) Students present a topic of their research to a wider audience.	Kaltenbaek N. Košnik
2s	**Computational physics 2** (8 ECTS) Knowledge in modeling trajectories and fields. Understanding and using efficient and stable algorithms.	S. Širca
2w	**Laboratory of Machine Learning Methods in Physics** (6 ECTS)	J. Fesel Kamenik
2w	**Experimental modeling in energy and process engineering** (5 ECTS) Experimental modeling, measurements, and analyses of processes in power systems. Course at **Faculty of Mechanical Engineering**.	M. Hočevar M. Dular
2w	**Materials in Nuclear Engineering** (6 ECTS) Gaining knowledge about material properties and behavior. Change of material properties under the influence of radiation. Application and synthesis of knowledge from the fields of thermodynamics, solid state physics and radiation physics.	L. Cizelj
2w	**Nuclear Safety** (6 ECTS) Acquiring basic information on safety and reliability. Gaining knowledge about the importance of safety systems for safe operation of nuclear facilities.	L. Cizelj
2s	**Nuclear facilities, control and instrumentation** (6 ECTS) Acquiring basic information on nuclear installations and on control and instrumentation.	M. Čepin
2s	**Research - masters study 2** (20 ECTS) (mandatory) Research for master's thesis.	N. Osterman mentor
*	**Structural Mechanics in Nuclear Engineering** (6 ECTS) Understand the basic mechanics of structures for use in design and dimensioning of safety-critical components of nuclear power plants with emphasis on pressure vessels and pipelines.	L. Cizelj
*	**Reactor calculations** (3 ECTS) Basic understanding of the origin and forms of nuclear data, which appear in calculations of transport of particulate matter: a review and application of mathematical methods for calculation of particle transport in reactor calculations.	R. Jeraj L. Snoj
*	**Radioactive waste and lifecycle of nuclear facilities** (6 ECTS) Basic knowledge about properties and behavior of matter and effects of radiation on changes in material properties	I. Tiselj T. Žagar
*	**Computational fluid dynamics** (6 ECTS) Gaining practical knowledge and skills needed for numerically solving basic equations of fluid mechanics and heat and mass transfer. Students develop their own computer programs and use existing software packages.	I. Kljenak I. Tiselj
*	**Fracture mechanics** (6 ECTS) Understanding basic processes of formation and growth of cracks in structural materials. Being familiar with methods and tools for predicting the load and the remaining lifetime of components with cracks. Learning and using of modern numerical tools.	L. Cizelj
*	**Radiation protection** (3 ECTS) Students will acquire knowledge on measurement and effects of ionizing radiation. They learn the principles of protection against ionizing radiation in accordance with applicable legislation and international recommendations.	D. Škrk
*	**Modelling of Power Systems** (6 ECTS) Operation and modelling of electric power systems. Course at **Faculty of Electrical Engineering**.	M. Čepin R. Mihalič I. Papič

Main objectives of the program and general competencies

The objective of the nuclear engineering program is to train experts in the field of nuclear engineering. The program offers students a wide range of fundamental knowledge in the areas of mathematics, physics, engineering and computer science - all focused on nuclear technology. The program is aimed at a wider range of students with a university degree, technical or natural sciences such as physics, mechanical engineering, electrical engineering, construction engineering, metallurgy, chemistry, mathematics. A Master degree in nuclear engineering means upgrading of students basic university education with knowledge from the areas of nuclear physics and technology. In addition, a wide range of elective courses will enable the student to get an insight into current scientific issues in selected areas of nuclear engineering.

Together with general competences that are similar to other related studies, the graduates will acquire specific competencies, which include in-depth knowledge of nuclear technology and nuclear energy. Nuclear Engineering program is designed uniformly with respect for branching and modularity of nuclear technology. The program is therefore only partly aimed at gaining broad competences in nuclear engineering. These are transferred by two fundamental (compulsory) subjects: Reactor Engineering and seminars, which cover all aspects of nuclear technology. With the proper choice in elective courses a student can be directed to different area of nuclear technology: nuclear physics, nuclear safety, thermalhydraulics and process engineering, nuclear materials, strength, probabilistic safety analysis, radiation safety and fusion technique. The student will develop an ability to formulate physical problems in the field of nuclear techniques in mathematical language, make physical models of practical problems, gain basic experimental skills, perform quantitative analyses of problems and gain the ability to present problems and results to professional community as well as to general public

International MSc program of nuclear engineering SARENA

In the years 2019-2023 FMF participates in international MSc programme SARENA (SAfe and REliable Nuclear Applications, Universities IMT Atlantique, Nantes, France, UPM, Madrid, Uni. Lappeenranta, Finland, Uni. Ljubljana, programme EU Erasmus+). FMF hosts the 3rd semester from 2020 to 2023 with courses, which are also the regular courses of the MSc programme Nuclear Engineering. These courses are given in English. Most of the scholarships for SARENA programme is reserved for non-European students, a small number is available also for students from Europe.

https://www.imt-atlantique.fr/en/courses-study/masters/masters-science/sarena

Admission requirements

The master's program may be entered by students who have completed:

a) First-level program in the fields of physics, mechanical engineering, electrical engineering, computer science, civil engineering, mathematics, chemistry, or other related engineering degrees.
b) First-level programs from other professional fields, but might be required to pass additional differential exams of between 10-60 credit points (ECTS). Differential exams are selected by the Faculty of Mathematics and Physics from the courses of the First cycle program of Physics: Physics I (8 ECTS), Physics II (12 ECTS), Modern Physics I (8 ECTS), Modern Physics II (5 ECTS), Mathematics I, II, III and IV (10,7,8 and 6 ECTS). Candidates can pass differential exams in the regular First cycle program or in other training programs prior to enrolment in the Second cycle program,
c) Old three-year programs with similar admission criteria as in points a) and b).,

Enrolment is also open to candidates who have completed an equivalent education as set out in paragraphs a) to d) abroad. They enter the program under the same conditions that apply to candidates who have completed their education in Slovenia.

Requirements for progression through the program

For enrolment in the second year, students must collect at least 52 ECTS.

To re-enrol into the first year of study, the student needs to complete at least half of subjects from first year of study (30 ECTS). To re-enrol into the second year of study, the student needs to complete all subjects from first year of study and half of subjects from second year of study (30 ECTS). Re-enrolment is possible once in the course of study program; change of a study program as a result of unfulfilled requirements from previous study program is also counted as re-enrolment.

Requirements for completion of study

To complete the studies, a student must fulfil all the requirements of 60 ECTS points per year (total: 120 ECTS). A student completes his studies with a defence of his thesis..

Employment possibilities

Employment opportunities in Slovenia
- NPP Krško
- GEN Energija
- Slovenian Nuclear Safety Administration
- Slovenian Radiation Protection Administration
- Agency for Radwaste Management
- PhD education at Jožef Stefan Institute

University *of Ljubljana*

UNIVERSITY OF LJUBLJANA

Faculty of Mathematics and Physics
Department of Physics

Programme
MASTER OF SCIENCE IN
NUCLEAR ENGINEERING

2023/2024

https://www.fmf.uni-lj.si/en/study-physics/programmes/2jet/2023/

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