MASTER OF SCIENCE IN
NUCLEAR ENGINEERING

www.vub.ac.be/nuclear-engineering
http://bnen.sckcen.be

60 ECTS
WHY VUB

VUB education delivers strong individuals, critical minds & world citizens

The Vrije Universiteit Brussel (VUB) offers high-quality English-taught programmes, supported by outstanding research. Being a student at VUB means learning in an open atmosphere of tolerance and diversity and growing into an independent and critical-thinking individual.

All fields of study are offered on 4 student-friendly campuses in the cosmopolitan city of Brussels. At VUB, students have easy access to their lecturers and assistants. Faculty members are available and open to answer questions; small group workshops are used to ensure close interaction and hands-on experience.

VUB is a dynamic and modern university with almost two centuries of history. There are 15,000 students, 21% of whom are international students from more than 120 different countries.

The basis of our academic success

The Vrije Universiteit Brussel was founded on the principle of ‘free inquiry’ as formulated by the French mathematician and philosopher of science Henri Poincaré (1854-1912): ‘Thinking must never submit itself, neither to a dogma, nor to a party, nor to a passion, nor to an interest, nor to a preconceived idea, nor to anything whatsoever, except to the facts themselves, because for it to submit to anything else would be the end of its existence.’

Personal growth with a positive and critical attitude, a sense of responsibility and open-mindedness, these are characteristics that you will encounter in everyone at the university, from professors and researchers to students and staff. It lies at the heart of our academic success.
The Belgian Nuclear higher Education Network (BNEN)

More than 30% of electricity in the EU and roughly 55% in Belgium is provided by nuclear power. On a small absolute but high relative scale, Belgium has developed almost every kind of nuclear activity on its territory: nuclear power plants, fuel production, medical radio-isotope production, nuclear engineering companies, accelerator design and fabrication, nuclear waste and dismantling management, nuclear safety management, nuclear medicine, research and higher education. In short, it’s the ideal place to study all facets of nuclear engineering.

Six Belgian universities and the Belgian Nuclear Research Centre (SCK•CEN) collaborate on the Advanced Master in Nuclear Engineering. In this high-quality and demanding programme, students with high-level backgrounds in engineering investigate theoretical subjects such as neutron and reactor physics, fluid flow and heat transfer modelling, which are subsequently applied to topics such as reactor design, nuclear safety and plant operation and control.
MASTER OF SCIENCE IN NUCLEAR ENGINEERING

Part of the Belgian Nuclear higher Education Network
Six Belgian universities (Vrije Universiteit Brussel, Université Libre de Bruxelles, Université de Liège, Université Catholique de Louvain, KU Leuven, and Universiteit Gent) and the Belgian Nuclear Research Centre (SCK•CEN) have joined forces in the Belgian Nuclear higher Education Network (BNEN) to create the Advanced Master in Nuclear Engineering, a 60 ECTS-programme. The primary objective is to educate young engineers in nuclear engineering, its applications and its safe use, and to develop and maintain high-level nuclear competences in Belgium and abroad. The BNEN offers a strong programme and fosters networking between academia, research centres, industry and other nuclear stakeholders. All teaching activities take place at SCK•CEN, ensuring training that’s compatible with the industry and well-grounded in the field.

International programme
BNEN has served as a role model for the European Nuclear Education Network (ENEN Association). The association of roughly 70 members - universities, industry, regulators and research centres - aims to facilitate mobility in Europe for students in nuclear engineering. If you decide to take up at least 20 ECTS of courses in a foreign university, you receive an ENEN certificate, de-facto recognising the degree as an effective “European Master of Science in Nuclear Engineering”.

Multi-disciplinary and hands-on
The Advanced Master in Nuclear Engineering instructs students in all aspects of nuclear technology and its applications, creating nuclear engineering experts in the broad sense. The programme consists of a compulsory part of general courses, complemented with elective courses that are used to either broaden or deepen a theme. The programme includes important areas of material science, with a particular interest in the fuel cycle, as well as radiation protection and nuclear measurements. All subjects are taught by academics appointed by the partner universities. Exercises and hands-on sessions take place in the specialised laboratories and research reactors of SCK•CEN and are supervised by members of the research staff. This combination strengthens the development of nuclear skills and attitudes in an environment at the forefront of international nuclear research. The programme works closely with representatives of the utility companies and power plants and various technical visits are organised to research and industrial nuclear facilities. The final thesis offers an opportunity for an internship in industry or a research laboratory.

Job opportunities
This programme aims to provide young engineers and scientists with the knowledge and skills needed to start a career in the nuclear industry. It also prepares students for a career in government, regulatory or control organisms. The programme has been recognised by the Federal Agency of Nuclear Control (FANC) for recognition as Class I Expert (Class I facilities - nuclear reactors).
The programme consists of 60 ECTS and can be completed on a full-time (one-year) or part-time (two-years) basis. Courses are organised in a modular way with teaching blocks of one to three weeks for each module. This allows optimal time management for students and lecturers, facilitates registration for individual modules, and provides easy access for international students. The master thesis is an essential part of the programme. The chosen subject can be in a wide range of nuclear engineering related topics, that are directly linked to the of SCK-CEN’s R&D programme, research of the professors at the partner universities, or operational problems in industry.

<table>
<thead>
<tr>
<th>Master ECTS</th>
<th>ECTS</th>
</tr>
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<tbody>
<tr>
<td>Introduction to nuclear physics and measurements</td>
<td>3</td>
</tr>
<tr>
<td>Nuclear energy: introduction</td>
<td>3</td>
</tr>
<tr>
<td>Nuclear fuel cycle</td>
<td>3</td>
</tr>
<tr>
<td>Nuclear materials</td>
<td>3</td>
</tr>
<tr>
<td>Nuclear reactor theory</td>
<td>6</td>
</tr>
<tr>
<td>Nuclear thermal hydraulics</td>
<td>5</td>
</tr>
<tr>
<td>Safety of nuclear power plants</td>
<td>5</td>
</tr>
<tr>
<td>Radiation protection</td>
<td>3</td>
</tr>
<tr>
<td>Master Thesis Nuclear Engineering</td>
<td>20</td>
</tr>
</tbody>
</table>

**Elective courses (choose 9 credits)**

| Advanced nuclear reactor physics and technology | 3 |
| Advanced nuclear materials | 3 |
| Advanced radiation protection/radiation ecology | 3 |
| Advanced courses of the nuclear fuel cycle | 3 |
| Nuclear and radiological risk governance | 3 |
| Advanced course elective topic | 3 |

**Total** | **60**

*The programme is subject to change.*

*Check [www.vub.ac.be/en](http://www.vub.ac.be/en) for the latest information about the programme.*

ECTS (European Credit Transfer System):
1 credit represents 25-30 hours of study activity.
JOIN A STRONG RESEARCH NETWORK

SCK•CEN

The Belgian Nuclear Research Centre, SCK•CEN, is a foundation of public utility. With laboratories in Mol and a registered office in Brussels, it is one of the largest research centres in Belgium. About 700 people work on the development of peaceful applications for ionising radiation. Its statutory mission prioritises important societal issues: the safety of nuclear installations, solutions for radioactive waste disposal, radiation protection, sustainable development and education.

WORLD-CLASS RESEARCH FACILITIES

SCK•CEN has several research facilities and specialised laboratories for its own research activities and for services to partners and external clients. As a student in the BNEN programme, you will make use of several of these facilities in laboratory sessions. Belgian Reactor 1 (BR1) is a 4 MWth natural uranium, graphite-moderated, air-cooled reactor. BR1 offers flexible irradiation and calibration services. It is available to other research centres, universities and the industry, and plays an important role in educating scientists. Belgian Reactor 2 (BR2) is one of the most powerful research reactors in the world, used for testing fuels and materials for different reactor types and for the European fusion programme. It is also a main instrument for the production of radioisotopes for medical and industrial applications and for silicon doping for the electronics industry.
Belgian Reactor 3 (BR3) was the first pressurised water reactor (PWR) on the European continent and was used to train the first operators of Nuclear Power Plants in Belgium at Doel and Tihange. It was selected as a European pilot project for the optimisation of decommissioning and decontamination techniques and processes and for the realistic assessment of costs. VENUS is a zero-power critical facility that was intensively used for the validation of reactor core configurations and criticality codes. In 2008 and 2009, the VENUS facility was modified in the framework of the GUINEVERE project. New experiments aim to provide an answer to the questions of operational procedures in Accelerator Driven Systems (ADS). ADS are developed specifically for the transmutation of high-level nuclear waste, with which the radiotoxic lifetime of the waste could be reduced from the several hundred thousands of years to hundreds of years.

“We prepare engineers to guarantee the safety of existing nuclear installations and to study innovative solutions for future nuclear systems.”

Peter Baeten
head of Nuclear Engineering programme
ADMISSION CRITERIA

This programme is open for students holding a five-year Master degree in Science of Engineering from a Belgian university.

Applications from candidates holding a different master degree from the Flemish or the French Community will be evaluated by the Teaching Committee based on the candidate’s academic background. Candidates holding a foreign higher education degree may be admitted after evaluation and approval by the Teaching Committee and with observance of the procedural rules of the respective partner universities.

Prospective students must prove sufficient knowledge of English as language of instruction by having successfully completed the TOEFL-test with a minimum of 550 points on the written test. The scoring scale will be based upon the sum of the four section scores (reading, listening, writing and speaking).


Application deadline

Prospective students are advised to apply as soon as possible, even if they have not obtained their degree. The deadline for Belgian students to apply is June 14th. International students must apply before March 31st.

Application deadlines are strict, as all candidates will be screened by the Belgian Federal Agency for Nuclear Control for clearance and access to SCK-CEN’s nuclear infrastructure. Admission to the programme will depend on clearance and access being granted.

Tuition fees

All Flemish universities in Belgium are subsidised by the government, which results in relatively low tuition fees. The tuition fee for this master is euro 619.9 a year. Some master programmes have an increased tuition fee for students with non EU/EEA nationality. A detailed overview of the tuition fees can be found at: www.vub.ac.be/en/tuition-fees

Contact

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