

Nuclear Applications Master of Science

FACULTY 03
CHEMISTRY AND BIOTECHNOLOGY



**Kontrollbereich
Radioaktiv**

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You will find all relevant information with respect to the course of studies Nuclear Applications in the internet. For that purpose, just photograph the QR code and use the adequate reader of your mobile phone*.



* Please note: Costs may arise upon initiating the web page.

Introducing in the degree programme

The use of nuclear technologies is very widespread in many different industries and in research. Many applications of nuclear technologies are not immediately obvious, such as the use of nuclear scattering techniques for the characterization of surfaces in materials science and nanotechnology or the production of very high quality semiconductor materials.

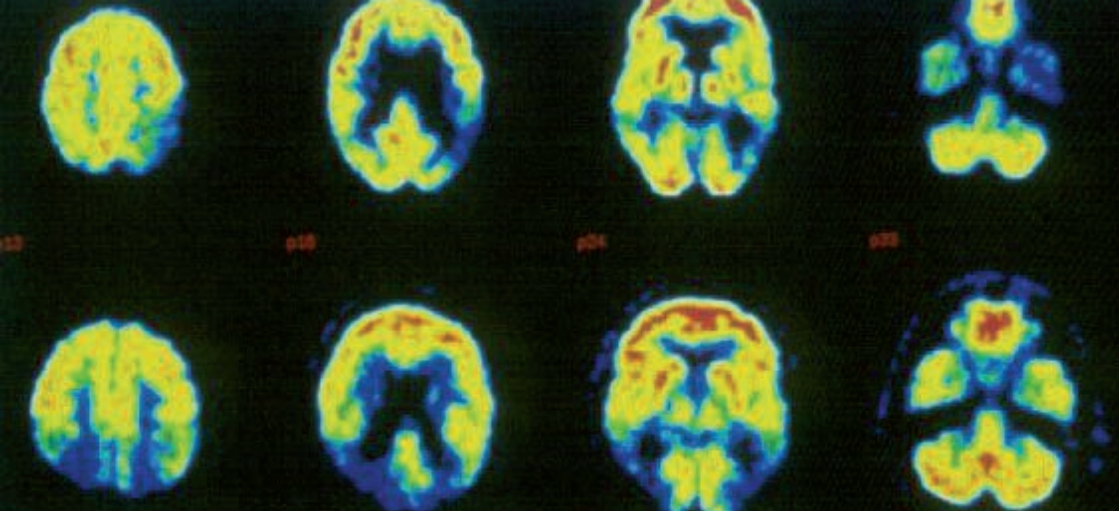
Best known is the production of nuclear energy which provides many countries with up to one third of their energy needs in a reliable and safe way. Moreover, nuclear power plants do not produce greenhouse gases and therefore can contribute to the goals of the Kyoto protocol. New technologies for improved fuels and even safer power plants are being developed.

Nuclear energy production is closely connected to the safe handling and storage of nuclear waste. A growing

industry is developing systems for the decommissioning and decontamination of nuclear installations. Impressive technical solutions have been developed and are steadily being improved.

Our present knowledge in life sciences is based to a large extent on the use of radioactive tracers. These tracer methods still play a vital role in the development of new drugs and in the characterization of the toxicological profiles of chemical compounds. A particular application of the tracer technique is the use of radiopharmaceuticals in nuclear medicine to diagnose and treat numerous diseases. Radiation therapies using radioactive sources as well as accelerators are used very successfully for cancer therapies world-wide.

In order to measure the environmental impact of nuclear technologies, radio-analytical techniques are applied.



These include the measurement of natural and artificial radionuclides at high levels as well as at the ultra-low levels prevailing in most regions worldwide. Radio-analytical chemical separations are frequently required to meet such high demands.

For these and many other fields of technology, an increasing number of specialists with an interdisciplinary background are required. We accept applications from graduates holding a Bachelor's degree in the relevant fields of engineering and science, and aim to provide a challenging program to educate them further.

We cooperate on a local level in the Competence Centre together with the

Research Centre Jülich, RWTH Aachen, and RWE. We contribute to the German Competence Alliances in Nuclear Technology as well as to Radiation Research. On a European level, we are the founding member of the network CHERNE. Within this cooperation, each of the member institutions organizes classes for interested students who are part of the network in order to share resources and gain access to facilities (e.g. research reactors, accelerators etc.).

We focus our energy on practical research projects. Our students perform their two research projects in industry, European research centres or at our own facilities.



Nuclear Applications

Career openings

The broad scientific and technical training given to our students enables graduates to choose from a wide range of possible career paths, the importance of which will continue to grow in the future. Depending on the specialist area chosen and personal interest and preferences, they find employment in many different branches of industry and public service.

- > Nuclear Power Producers
- > Power Plant Development, Design and Construction
- > Decommissioning
- > Nuclear Waste Management
- > National and international legal authorities
- > Radiation Safety
- > Radiopharmacy
- > Hospitals (Medical Physics Experts)
- > Environmental Agencies
- > Radioisotope Production
- > Detector Industries
- > Conventional Industries
- > Research Institutions

Above all, career opportunities present themselves wherever technical problems must be solved systematically, using interdisciplinary skills based on scientific expertise.

A substantial number of our graduates have been accepted onto Ph.D. programmes.

Skills and expertise

The European Master of Science in Nuclear Applications (EMiNA) programme provides students with a solid scientific basis to their studies, especially in specialist areas, enabling them to employ scientific and engineering methods to analyse technical procedures, and develop practical solutions while taking into consideration related areas outside their specific field of study.

During the program, the students acquire wide-ranging, integrated knowledge and understanding of the scientific and technical fundamentals of nuclear science and technology. They have at their disposal a critical understanding of the basic theories, principles and methods dealt with during their studies, and are in a position to broaden this knowledge independently.

Moreover, students gain the ability to collect and interpret data and to infer scientifically-based judgements from it, as well as to implement appropriate solutions which take into account social, scientific and ethical issues and to construct continuous learning processes independently. They learn how to formulate and defend opinions and solutions with reference to their specific field, to exchange information, ideas, problems and solutions with experts and lay people, and work responsibility in a team.

These wide-ranging skills ensure flexibility with regard to career openings and form the ideal basis for the indisputable necessity of lifelong learning skills in modern professional life.

Areas of specialisation

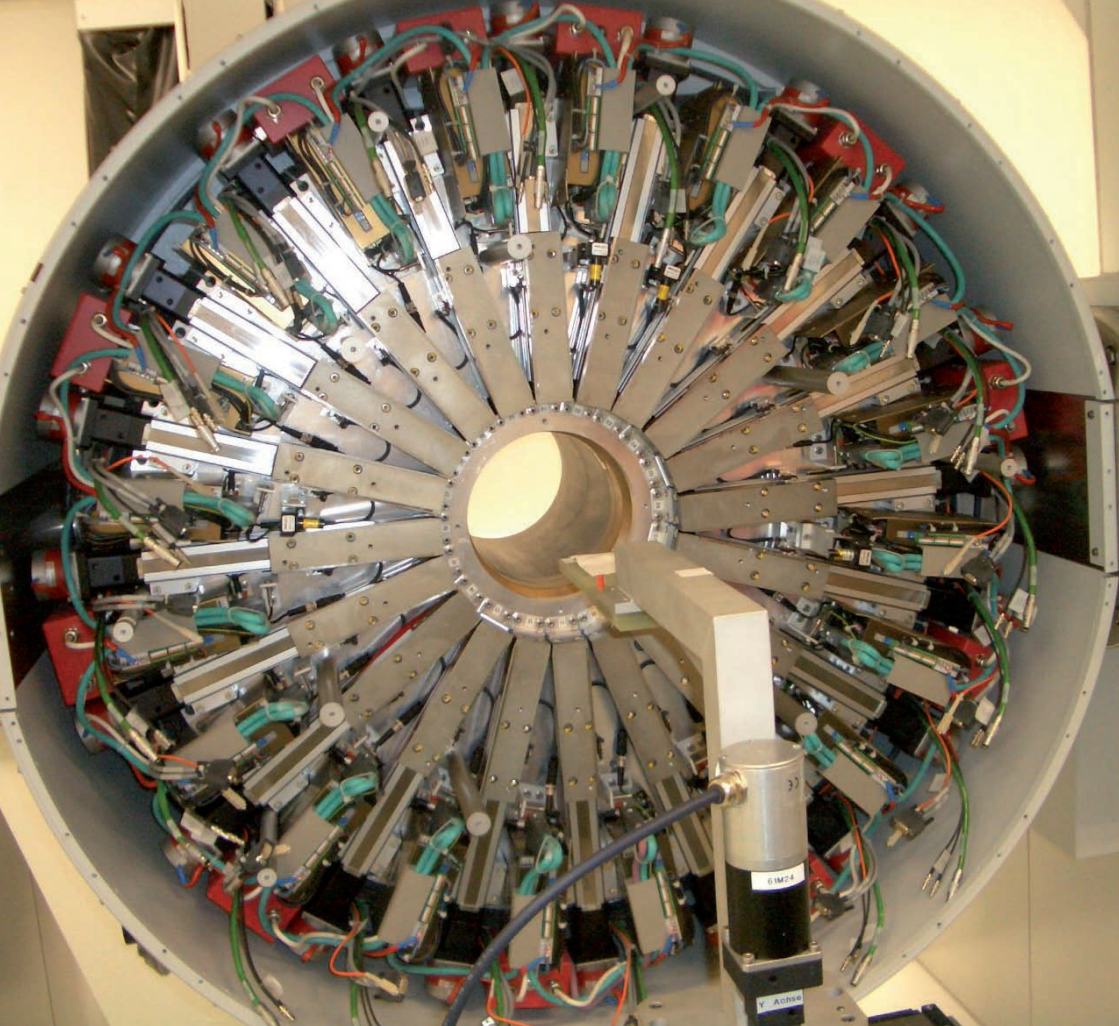
Nuclear Power Technology | In choosing this specialist area, you will open up opportunities for a career in the field of nuclear energy technology. You will gain insight into the working principles of nuclear power plants, their design and operation. The discussion of safety aspects plays an important role. Included in this area are all the aspects of the nuclear fuel cycle.

Radioecology | In this specialist area, the impact of radioactive materials on human health is studied. It includes practising the relevant techniques to measure natural and artificial radioactivity, including radioanalytical methods. The curriculum includes a deep insight into radiation biology. The issue of the decommissioning of nuclear plants plays a significant role here along with the safe treatment of nuclear waste as well as the design and operation of nuclear repositories.

Biomedical Applications | Several career opportunities are available to students choosing this specialist area. One field is connected to the development of radio-nuclides, labelled compounds and radio-pharmaceuticals and their manifold uses. Students will learn to apply a variety of nuclear chemistry methods.

The second branch deals with imaging methods based on nuclear effects such as SPECT, PET (and MRI).

At present we are expanding our programme to train experts in Medical Physics where radiation safety aspects and dosimetry in medical diagnostics and therapy play a dominant role.



Before you start

Application requirements

We are happy to receive your application and consider you for admission. However, spaces in the Master's programs are limited, so unfortunately not all qualified applicants can be admitted.

Admission Requirements are a Bachelor of Science, Bachelor of Engineering, Dipl.-Ing., Dipl.-Ing.(FH) degree in Chemistry or Chemical Engineering, Mechanical Engineering, Electrical Engineering, Process technology, Physics or Applied Physics, Biomedical Engineering or equivalent.

English | All courses in the Master's programme are in English, therefore fluency in English is required. As proof of your English language ability, you must submit one of the following:

- > TOEFL score 520 on the paper-based test or equivalent,
 - > TOEFL score 190 on the computer-based test or equivalent
 - > TOEFL score 68 on the internet-based test or equivalent.
- Our TOEFL code number is 9023
- > IELTS Band 5.5
 - > German Abitur or Fachhochschulereife with a minimum mark of 3 (befriedigend) in English

The Program Coordinator reserves the right to decide if the student's academic background demonstrates sufficient English knowledge.

German | International students must submit the German language examination „Zertifikat Deutsch.“ If you do not have this certificate upon application, you must, if admitted, submit it by the third semester.



The practical degree programme Nuclear Applications

Partners in industry, research and universities

Throughout the history of our university, a long-term collaboration with the Research Center Jülich has provided us with access to all facilities on the research site. Many of our students have performed their projects in leading laboratories.

Close partnerships have been developed with leading nuclear industries and power companies including RWE, Siem-pelkamp Nukleartechnik, GNS, Westinghouse Electric Germany, AREVA, Enrichment Technologies and others.

We are contributors to the German Nuclear Competence Alliance in Nuclear Technology as well as in Radiation Research.

As well as enjoying several bilateral partnerships with universities, we are a founding member of the Cooperation in Higher Education on Radiological and Nuclear Engineering CHERNE where our students can participate in a large variety of specialized courses organized by the twelve partner institutions.

Course description

The first semester concentrates on laying a sound foundation in the basic nuclear sciences and the principles of radiation detection. As we accept students from a large variety of disciplines and countries, we offer additional courses to enable students to close gaps in their knowledge in relevant subjects.

During following second semester the students are introduced to the areas of specialization: Nuclear Power Technology, Radioecology and Biomedical Applications. Students work first in a study project, which can be undertaken in our own laboratories or undertaken as an internship in the facilities of our partners.

The third semester is devoted to specialist study in the chosen field. In very intensive theoretical and practical classes, given by specialists from industry and research, the students study principles and learn to apply them to practical problem-solving.

The program is corroborated by additional classes which aim to develop additional skills, e.g. project management, developing presentation techniques or business administration.

Curriculum

SWS									
No.	Name of module	C/E	Cr	L	T	Lab	SU	Σ	
1st semester									
103310	Fundamentals of Engineering	C	10						
31320	Nuclear Physics and Radiation Detection	C	10						
31340	Nuclear Chemistry and Radiation Biology	C	10						
Total			30						
2nd semester									
32310	Nuclear Applications	C	10						
32320	Management Skills and Business Adminsitration	C	10						
32330	Study Project Nuclear Application	C	10						
Total			30						
3rd semester									
33310	Tools for working in Science	C	10						
33XXX	Elective Module 1	E	10						
33XXX	Elective Module 2	E	10						
Total			30						
4th semester									
34400	Master's Thesis	C	25						
34402	Defense	E	10						
Total			30						
Cr: Credits L: Lecture									
C: Compulsory T: Tutorial									
E: Elective Lab: Laboratory									
SWS: Contact hours per week SU: Seminar									

No.	Name of module	C/E	Cr	SWS					Σ
				L	T	Lab	SU		

Elective Modules

33610	Nuclear Power	E	10					
33620	Nuclear Fuel Cycle	E	10					
33630	Radio-Ecology	E	10					
33640	Radioisotope Technology	E	10					
33650	Biomedical Techniques	E	10					
33660	Radiochemical Methods	E	10					
33670	Radiation Safety	E	10					

Cr: Credits
L: Lecture

C: Compulsory
T: Tutorial

E: Elective
Lab: Laboratory

SWS: Contact hours per week
SU: Seminar



General Information

Organisational Matters

Programme duration, commencement of study and course structure

| Programmes at the FH Aachen are offered in modules and ECTS-credit points are awarded. Including the Master's thesis, the standard length of the programme is two years (four semesters) or 120 ECTS-points. Lectures are held in English.

The Master's program currently starts in both the winter (September) and summer (March) semester (each year in March). The program starting in March is only open to applicants with previous knowledge in the nuclear field. Applicants from other fields of study should apply for the program starting in September.

Fees and the cost of the programme

| Every semester all students must pay a social contribution to the Studentenwerk (Student Services) and a student contribution, to the work of the ASTA (General Student's Committee). These include the semester ticket of the ASEAG (Aachen Public Transport Association). The amount is determined each semester. Current fees are listed at

www.fh-aachen.de/sozialbeitrag.html

Starting in the winter semester of 2011 the Land Government North-Rhine Westphalia refrains from charging additional study fees.

Application Documents | All documents must be in English or German or must be accompanied by certified translations into English or German. The following documents must be attached to the application:

- > curriculum vitae/resume
- > all university transcripts and degrees

- > proof of English language requirement
- > a letter of motivation
- > proof of previous work experience (if applicable)

Important | Applications will only be considered if all prerequisites are fulfilled and all documents are notarized by a notary or the German embassy. We cannot consider documents that have been stamped by a school, or faxes, emails or uncertified photocopies.

Application Fee | There is no application fee at this time.

Confirmation of Receipt of Application and Admission

| We will send you an email with an application number when we receive your application. You must use your application number in all correspondence with us. In most cases you will receive a letter from us by the first week in January regarding your admission status.

Application Deadline | 15 June for the program starting the following September. 15 November for the program starting the following March.

Send completed applications with all documents, including notarized copies of all certificates to

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Jülich Campus
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Germany
www.fh-aachen.de/master.html

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studentensekretariat.html](http://www.fh-aachen.de/studentensekretariat.html)

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