

Master programme of the Faculty of Science Leiden University

2005

- Descriptions
- Qualifications for admission
- Condensed programmes

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| Onderwijs en Examenregeling Masteropleiding Bijlage |
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Leiden University offers five tracks of an MSc programme in mathematics. Two of these correspond to research specialisations in the Leiden Mathematical Institute. The remaining three are the mathematics track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Mathematics, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Programme Committee. An Admission Committee will advise on admissions.

Candidates with a BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. Individual combinations of the research programmes, with research projects from different groups, are possible in principle, depending on the decision by the Exam Committee. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5). Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. Further information is available on the website <http://www.math.leidenuniv.nl/>

The goal of each programme is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Algebra, Geometry and Number theory

Description

The MSc programme Algebra, Geometry and Number theory leads students to a high level of knowledge in this area. It consists of advanced courses from the field and a final research project including a master thesis and an oral presentation of it. Students with this MSc in Mathematics are admissible to a PhD programme. The programme is suited as preparation for an academic career, in particular via a subsequent PhD study, but also for a career as mathematical researcher outside the universities.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

For each student a programme will be tailored individually. It consists of a choice of advanced courses (at least 60 EC; at least 30 EC of these must be obtained via courses of the **Dutch Master Programme in Mathematics**) from algebra, algebraic and analytic number theory and algebraic and differential geometry, a research project (at least 40 EC), and a free choice of courses from any field (maximum 20 EC); required is a total of at least 120 EC.

Track

Applied mathematics

Description

The MSc programme Applied Mathematics leads students to a high level of knowledge in this area. It consists of advanced courses from the field and a final research project including a master thesis and an oral presentation of it. Students with this MSc in Mathematics are admissible to a PhD programme. The programme is particularly suited as preparation for a career as mathematical researcher in industry, government and other institutions, but also for an academic career, in particular via a subsequent PhD-study.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Mathematics or with a BSc major in Mathematics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present -knowledge of the candidate.

Programme

For each student a programme will be tailored individually. It consists of a choice of advanced courses (at least 60 EC; at least 30 EC of these must be obtained via courses of the **Dutch Master Programme in Mathematics**) on differential equations and dynamical systems, analysis of industrial problems, probability theory, statistics, numerical analysis and operations research, a research project (at least 40 EC), and a free choice of courses from any field (maximum 20 EC); required is a total of at least 120 EC.

Track

Mathematics and Science-Based Business

Description

The MSc programme Mathematics and Science-Based Business (SBB) prepares students for a career in science-related business and administration and for innovation and enterprise from a mathematical perspective. In addition to knowledge in mathematics, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Mathematics and Science-Based Business are also admissible to a PhD programme.

In order to get an SBB Master annotation, a minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the “free choice” part of the research MSc programmes “Algebra, Geometry and Number theory” and “Applied Mathematics”.

Qualifications for admission

Students from any university in The Netherlands will be admitted to the programme with a BSc degree in Mathematics or with a BSc major in Mathematics.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present-knowledge of the candidate.

Programme

Mathematics

The Mathematics component of the Science-based Business (SBB) specialization consists of a research project of 40 EC in one of the research groups of the Leiden Mathematical Institute, including a master's thesis and an oral presentation, 20 EC of courses to be selected in correspondence with the research topic, and a mathematical project connected with the SBB training period (see below).

Science-Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components.

| <i>Mandatory:</i> | level | EC |
|--|-------|---------|
| SBB Fundamentals | 400 | 17 |
| SBB Internship | 500 | 23-34 |
| <i>Optional:</i> | | |
| Orientation on Technopreneurship | 400 | 5 or 10 |
| SBB electives | | 0-20 |
| Extension of the mathematic research component | | 0-20 |

See for more information on Science-Based Business the following website:
<http://www.sbb.leidenuniv.nl/>.

Track Mathematics and Communication

Description

The MSc programme Mathematics and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularization of science, for example, as a science communicator, a science policymaker or a public relations officer, or for a career as a scientist with a communicating mindset. Students with an MSc in Mathematics and Communication are admissible to a PhD programme in Mathematics or in Science Communication.

Qualifications for admission

Students from any Dutch university with a BSc degree or major in Mathematics will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or equivalent courses.

Programme

Mathematics (60 EC)

The research component consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Communication (60 EC)

The Communication component consists of the following components:

| Media basics. | level | EC |
|---|---------|----|
| A choice of the following courses, adding up to | 200/300 | 16 |
| The choice of the courses has to be in accordance with. | | |
| the chosen training period | | EC |
| - Basics of science communication (obligatory) | 300 | 4 |
| - Basics of journalism & editing (obligatory) | 300 | 4 |
| - Webtext & webdesign | 300 | 4 |
| - Website testing | 300 | 4 |
| - The changing media landscape | 300 | 4 |
| - Methodology in scientific research | 200 | 4 |
| - Radio & television journalism | 300 | 4 |
| - Visual journalism basics | 300 | 4 |
| - Technology & philosophy | 300 | 4 |

Media specials.

| | | |
|--|-----|---|
| A choice of the following courses, adding up to | 400 | 8 |
| The choice of the courses has to be in accordance with the chosen training period. | | |
| - Science journalism & new media | 400 | 8 |
| - Television documentaries | 400 | 8 |
| - Museology | 400 | 6 |
| - Infographics | 400 | 8 |
| - Seminar journalism & new media | 400 | 2 |

Designing, reflection & academic training.

| | | |
|---|---------|---|
| Designing for a Communication & Education environment (including a design project) | 500/600 | 6 |
| Reflection & Academic training | | |
| - How to write a research proposal | 400 | 2 |
| Reflection (one of the following courses): | 400 | 1 |
| - Philosophical aspects of science | 400 | 1 |
| - Scientific conduct | 400 | 1 |

Training period in Journalism, Museology or New media. 500/600 27
Including a research project, a report and an oral presentation

Track**Mathematics and Education****Description**

The MSc programme Mathematics and Education prepares students for a career in teaching Mathematics. The programme includes a 60-EC Mathematics research programme. Students with a MSc in Mathematics and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Mathematics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Mathematics will be considered. It is strongly recommended that the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme*Mathematics (60 EC)*

The research component of the Mathematics and Education specialization consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Education (60 EC)

The Education option of the MSc programme Mathematics and Education is offered as a joint programme of the faculty and the Leiden School of Education (ICLON) and consists of the following components:

| | Level | EC |
|--------------------------|-------|----|
| Didactics | | 13 |
| Professional functioning | | 10 |
| Educational research | 500 | 7 |
| School training | | 30 |

This programme is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc Computer Science

Crohonummer 60300

The Leiden Institute of Advanced Computer Science (LIACS) is the computer science institute of Leiden University. The LIACS curriculum includes six MSc tracks in computer science. Three of these correspond to research specialisations of LIACS, the remaining three are the computer science track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations. In addition, LIACS offers two Master programmes in Mediatechnology and in ICT in Business, respectively.

The duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Computer Science, with description of the specialisation, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Programme Committee. An Admission Committee will advise on admissions.

Candidates with a BSc degree in Computer Science or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5).

The goal of each programme is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Core Computer Technologies

Description

This MSc programme is intended to provide students with a thorough computer science background that will allow them to pursue careers in research or industrial environments. The strength of the programme is its individual approach: for each student an individually tailored programme will be designed. This programme consists of courses, research and a Master's thesis project. The research directions are embedded systems, high performance computing, imaging & bioinformatics, and digital life technologies. Students with an MSc in Computer Science are admissible to a PhD programme.

Qualification for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the programme.

For all other (international) candidates, the Admission Committee will determine the equivalence of their previous training to these BSc degrees. The choice of the specialisation courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme is 120 EC in extent, and consists of specialisation courses (40 EC in total), a project (software project or project study, 20 EC), and two research projects (60 EC in total).

| <i>Components</i> | level | EC |
|---|-------|----|
| Specialisation courses | 500 | 40 |
| Option: software project or project study | 500 | 20 |
| Research project | 600 | 17 |
| Master's thesis project | 600 | 43 |

Track

Computer Science Theory and Advanced Technologies

Description

The MSc programme is intended to provide students with a thorough computer science background that will allow them to pursue careers in research or industrial environments. The strength of the programme is its individual approach: for each student an individually tailored programme will be designed. This programme consists of courses, research and a Master's thesis project. The research directions are theoretical computer science, algorithms and programme methodology, and software engineering and information systems. Students with an MSc in Computer Science are admissible to a PhD programme.

Qualification for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the programme.

For all other (international) candidates, the Admission Committee will determine the equivalence of their previous training to these BSc degrees. The choice of the specialisation courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme is 120 EC in extent, and consists of specialisation courses (40 EC in total), a project (software project or project study, 20 EC), and two research projects (60 EC in total).

| Components | level | EC |
|---|-------|----|
| Specialisation courses | 500 | 40 |
| Option: software project or project study | 500 | 20 |
| Research project | 600 | 17 |
| Master's thesis project | 600 | 43 |

Track

Bioinformatics

Description

The main focus of the Bioinformatics track will be on *Data Analysis and Modeling*, which represents the unique expertise of the different research groups of Leiden University and the Delft University of Technology participating in this track. This expertise is used to address issues like data capturing, data warehousing and data mining that have become major issues for biotechnologists and biological scientists due to sudden growth in quantitative data in biology. On the other hand, bioinformatics heavily contributes to the identification of new informatics principles and the development of new informatics tools. Bioinformatics offers a new synthetic approach for formulating hypotheses and solving problems in biology and bio chemistry versus the classical reductionistic approach.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme is 120 EC in extent. The programme is outlined below.

| <i>Core programme</i> | level | EC |
|--|-------|-------|
| Data analysis / Pattern Recognition | | 6 |
| Databases / Data mining | | 6 |
| Microscopy / Modelling and Visualization | | 6 |
| <i>Specialization courses</i> | | 24 |
| A choice can be made out of 7 different courses of each 6 EC. More details can be found at the web-site of the institute. | | |
| <i>Minor (Deficiency) courses</i> | | 16-18 |
| A choice can be made out of courses in Life Science, Computer Science, Mathematics or of optional courses for deficiency programmes. More details can be found at the web-site of the institute. | | |
| <i>Research assignment</i> | | 17-15 |
| <i>Thesis project</i> | | 45 |

Note that sum of EC for the Minor/deficiency and Research assignment must equal 33 EC.

Track

Computer Science and Science-Based Business

Description

The MSc programme Computer Science and Science-Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a computer science perspective. In addition to knowledge in computer science, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Computer Science and Science-Based Business are admissible to a PhD programme.

In order to get an SBB Master annotation, a minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the “specialisation” part of the research MSc programmes “Core Computer Technologies” and “Computer Science Theory and Advanced Technologies”.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the programme.

For all other (international) candidates, the Admission Committee will determine the equivalence of their previous training to these BSc degrees.

Programme

Computer Science

The computer science component of the Science-based Business (SBB) specialization consists of a research project of 40 EC in one of the research groups of LIACS, including a master’s thesis and an oral presentation, and 20 EC of level-500 courses to be selected in correspondence with the research topic. The choices for courses and research project will be made in consultation with a supervisor.

Science-Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components.

| | | |
|--|-------|---------|
| <i>Mandatory:</i> | level | EC |
| SBB Fundamentals | 400 | 17 |
| SBB Internship | 500 | 23-34 |
| <i>Optional:</i> | | |
| Orientation on Technopreneurship | 400 | 5 or 10 |
| SBB electives | | 0-20 |
| Extension of the Computer Science research component | | 0-20 |

See for more information on Science-Based Business the following website:
<http://www.sbb.leidenuniv.nl/>.

Track Computer Science and Communication

Description

The MSc programme Computer Science and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularization of science, for example, as a science communicator, a science policymaker or a public relations officer, or for a career as a scientist with a communicating mindset. Students with an MSc in Computer Science and Communication are admissible to a PhD programme in Computer Science or in Science Communication.

Qualifications for admission

Students from any Dutch university with a BSc degree or major in Computer Science will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or equivalent courses.

Programme

Computer Science (60 EC)

The research component consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Communication (60 EC)

The Communication component consists of the following components:

| | | |
|--|---------|----|
| Media basics. | level | EC |
| A choice of the following courses, adding up to | 200/300 | 16 |
| The choice of the courses has to be in accordance with. | | |
| the chosen training period | | EC |
| - Basics of science communication (obligatory) | 300 | 4 |
| - Basics of journalism & editing (obligatory) | 300 | 4 |
| - Webtext & webdesign | 300 | 4 |
| - Website testing | 300 | 4 |
| - The changing media landscape | 300 | 4 |
| - Methodology in scientific research | 200 | 4 |
| - Radio & television journalism | 300 | 4 |
| - Visual journalism basics | 300 | 4 |
| - Technology & philosophy | 300 | 4 |
| Media specials. | | |
| A choice of the following courses, adding up to | 400 | 8 |
| The choice of the courses has to be in accordance with the chosen training period. | | |
| - Science journalism & new media | 400 | 8 |
| - Television documentaries | 400 | 8 |

| | | |
|---|---------|----|
| - Museology | 400 | 6 |
| - Infographics | 400 | 8 |
| - Seminar journalism & new media | 400 | 2 |
| Designing, reflection & academic training. | | |
| Designing for a Communication & Education environment (including a design project) | 500/600 | 6 |
| Reflection & Academic training | | |
| - How to write a research proposal | 400 | 2 |
| Reflection (one of the following courses): | 400 | 1 |
| - Philosophical aspects of science | 400 | 1 |
| - Scientific conduct | 400 | 1 |
| Training period in Journalism, Museology or New media. | 500/600 | 27 |
| Including a research project, a report and an oral presentation | | |

Track

Computer Science and Education

Description

The MSc programme Computer Science and Education prepares students for a career in teaching Computer Science or Mathematics. The programme includes a 60-EC Computer Science research programme. Students with a MSc in Computer Science and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Computer Science will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Computer Science will be considered. It is strongly recommended that the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme

Computer Science (60 EC)

The research component of the Computer Science and Education specialization consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Education (60 EC)

The Education option of the MSc programme Computer Science and Education is offered as a joint programme of the Faculty and the Leiden School of Education (ICLON) and consists of the following components:

| | Level | EC |
|--------------------------|-------|----|
| Didactics | | 13 |
| Professional functioning | | 10 |
| Educational research | 500 | 7 |
| School training | | 30 |

This programme is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc ICT in Business

Crohonummer 60205

The Leiden Institute of Advanced Computer Science (LIACS) is the computer science institute of Leiden University. LIACS, in partnership with the Leiden University School of Management (LUSM), offers an MSc programme in ICT in Business.

The duration of the programme, which is taught entirely in English, is two years (120 EC). The programme starts in September; there are limited possibilities for a start at another moment. Students who complete the programme receive the degree Master of Science in ICT in Business.

Description

Rapid changes in information and communication technology (ICT) and its application over the last years have caused major changes for individuals, organizations and industries. The Internet, and information systems and communication technology in general, have radically impacted our personal and professional lives and challenged our thinking on physical, geographical and industry boundaries, on distance, speed and communication. The MSc. in ICT in Business programme aims at providing a deeper understanding of the issues, challenges and opportunities in this area, with a specific focus on the alignment of ICT and management. The programme builds on a solid foundation of Computer Science that students bring from their Bachelor's education, and expands this knowledge and augments it with concepts and methods from the field of management.

Qualifications for admission

Candidates with a BSc degree in Computer Science or equivalent can apply for admission. An Admission Committee will advise on admissions. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English.

Programme

The M.Sc. programme in ICT in Business consists of six modules of seven weeks each, and a 6 months thesis project. The courses cover business fundamentals, core ICT & Business topics and electives, and are normally offered in a combination of (guest)lectures, company visits, case work, lab work, and student presentations. Many activities are based on team work. At regular intervals research colloquia are offered to supplement and enrich the program.

The programme structure is as follows:

- **Business Fundamentals**
A set of courses that will bring students onto a basic level of business understanding, including a management simulation and courses on global marketing, financial accounting, international management and corporate finance.
- **Core courses: ICT and Business**
A set of advanced courses that focus on the interrelationship between organisational processes, management and ICT. The courses focus on Software Engineering, ICT-enabled Business Process Innovation, ICT Strategy and Planning, System's Development and Project Management, ICT Infrastructure and a capstone integration course.
- **Electives**
The electives allow students to individualise their programme and accommodate special interests. Examples of electives are entrepreneurship, supply chain management, operations management, legal aspects of ICT, human resource management, virtual organizations, and data warehousing. Parallel to the electives students follow a course on methodology to better prepare them for the master's thesis.
- **An MSc Thesis research project** that often will be based on an in-company project (6 months).

Following the above, the programme consists of the components:

| Courses | Level | EC |
|-----------------------|-------|----|
| Management Simulation | 400 | 1 |
| Software Engineering | 500 | 7 |
| Global Marketing | 500 | 6 |

| | | |
|---|-----|----|
| ICT-enabled Process Innovation | 500 | 7 |
| Financial Accounting | 500 | 6 |
| System's Development and Project Management | 500 | 7 |
| International Management | 500 | 6 |
| ICT Strategy and Planning | 500 | 7 |
| Corporate Finance | 500 | 6 |
| Electives I | 500 | 6 |
| Electives II | 500 | 6 |
| Research Seminar | 500 | 4 |
| Colloquia | 500 | 4 |
| ICT Infrastructure | 500 | 7 |
| Capstone Cases | 500 | 7 |
| MSc Thesis project | 600 | 33 |

MSc Media Technology

Crohonummer 60206

The Leiden Institute of Advanced Computer Science (LIACS) is the computer science institute of Leiden University. In addition to five MSc tracks in computer science, LIACS offers a separate Master programme in Media Technology. The duration of this programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Media Technology. Details are provided below. An Admission Committee will decide on admissions.

Candidates with a BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5).

Description

This Master programme aims at innovative application of technology rather than at innovation of technology: how can innovation be realized with use of technology. As a Master programme, the curriculum focuses on underlying principles of specific software and skills. The first part of the programme consists of lectures and practical courses. This part is followed by projects to be realized by a small team. These projects always contain a media component: visual, auditive or else.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Computer Science or with a BSc major in Computer Science will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence of their previous training to these BSc degrees. Applications are welcome especially from students with a BSc in "Informatiekunde", a successfully completed HIO-study or HBO-study in Computer Science or "Informatiekunde". Applications will be judged with observance of specific work- and training experience with regard to Media Technology.

Programme The programme is 120 EC in extent.

| Subject | Level | EC |
|-----------------------------|-------|----|
| Sense Interference | 400 | 2 |
| Introduction to Programming | 400 | 3 |
| Multi Media Programming | 400 | 4 |
| Human Computer Interfaces | 500 | 7 |
| LabLand | 500 | 3 |
| Sound, Space & Interaction | 500 | 4 |
| Image | 500 | 3 |
| Language & Text | 500 | 3 |
| Multi Media Systems | 500 | 7 |
| Webtechnology | 500 | 4 |
| Science Practice | 500 | 2 |
| Technology & Philosophy | 500 | 3 |
| Media Philosophy | 500 | 7 |
| Meta Media | 500 | 3 |
| Free choice courses | 500 | 12 |
| Project | 500 | 20 |
| Hardware | 500 | 3 |
| Graduate project | 600 | 30 |

MSc Astronomy

Crohonummer 60200

Leiden Observatory, the oldest university astronomy department in the world, offers four tracks of an MSc programme in astronomy. The research track focuses on two major research themes, (i) formation and evolution of galaxies, and (ii) birth and death of stars. The remaining three are the astronomy track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Astronomy, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Programme Committee. An Admission Committee will advise on admissions.

Candidates with a BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5).

Aim of each programme is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Research in Astronomy

Description

This 2-year programme consists of advanced astronomy courses, two research projects in astronomy, and courses outside of astronomy. It prepares the student for independent research in astronomy.

Qualifications for admission

Students with a BSc in Astronomy or equivalent from universities who participate in the NOVA research school will be admitted to the programme.

For all other (international) candidates, the Admission Committee will evaluate whether their degree is equivalent to the BSc in Astronomy Degree. Students with Bachelors degrees in other sciences such as mathematics, physics, or chemistry can also apply for enrollment. However, they may be required to take introductory courses in astronomy before they can be accepted.

Programme (120 EC)

Students are required to consult the MSc student advisor on the viability of their proposed MSc programme selection, or changes therein, before embarking on it.

| | | |
|--|---------|----|
| <i>year 1</i> | level | EC |
| first research project | 600 | 24 |
| astronomy courses | 500 | 24 |
| non-astronomy courses | 400/500 | 12 |
| <i>year 2</i> | | |
| Masters research project (including 1 EC for the colloquium) | 600 | 36 |
| astronomy courses | 500 | 12 |
| non-astronomy courses | 400/500 | 12 |

The astronomy courses can be chosen from the different courses offered every year. The course Stellar Evolution is compulsory for all.

The non-astronomy courses are chosen from the MSc programmes in Physics, Mathematics and Computer Science. The selection requires prior approval by the MSc student advisor. In individual cases a course from a different programme or field of study may be elected, but only after prior

written approval by the Board of Examiners. Before starting such a course, the student should contact the chairman of this board to obtain such approval.

The research projects will be supervised by a staff member. The two projects should be of a different nature and be supervised by a different person.

The programme will be adapted for Masters students who have not followed the entire Astronomy Bachelors programme. The first research project can be reduced to 15 EC, and the number of courses in astronomy will be increased. The students will take these additional courses in the first semester, if possible. These additional courses can be selected from the normal courses in the Masters curriculum, and from the following courses in the Bachelors curriculum: Stars, Radiative Processes, Galaxies and Cosmology. These students may also add astronomy courses at the cost of the non-astronomy courses, after approval of the student advisor and exam committee.

Track

Astronomy and Science-Based Business

Description

The MSc programme Astronomy and Science-Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a physical/astronomical perspective. In addition to knowledge in astronomy and physics, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Astronomy and Science-Based Business are also admissible to a PhD programme.

In order to get a SBB Master annotation, a minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the “free choice” part of the research MSc programme “Astronomy”.

Qualifications for admission

Students with a BSc in Astronomy from universities who participate in the NOVA research school or with a BSc major in Astronomy will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Programme (120 EC)

Students are required to consult the MSc student advisor on the viability of their proposed MSc programme selection, or changes therein, before embarking on it.

Astronomy

The astronomy component of the Science-based Business (SBB) specialization consists of a research project of 30 EC in one of the research groups of the Leiden Observatory, including a master’s thesis and an oral presentation, and 30 EC of courses to be selected in correspondence with the research topic. The latter courses include non-astronomy courses with 8-14 EC. The non-astronomy courses are chosen from the MSc programmes in Physics, Mathematics and Computer Science. The selection requires prior approval by the MSc student advisor. In individual cases a course from a different programme or field of study may be elected, but only after prior written approval by the Board of Examiners. Before starting such a course, the student should contact the chairman of this board to obtain such approval.

Science-Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components.

| <i>Mandatory:</i> | level | EC |
|-------------------|-------|-------|
| SBB Fundamentals | 400 | 17 |
| SBB Internship | 500 | 23-34 |

Choice of:

| | | |
|--------------------------------------|-----|---------|
| Orientation on Technopreneurship | 400 | 5 or 10 |
| SBB electives | | 0-20 |
| Extension of the astronomy component | | 0-20 |

See for more information on Science-Based Business the following website:
<http://www.sbb.leidenuniv.nl/>.

Track

Astronomy and Communication

Description

The MSc programme Astronomy and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularization of science, for example, as a science communicator, a science policymaker or a public relations officer, or for a career as a scientist with a communicating mindset. Students with an MSc in Astronomy and Communication are admissible to a PhD programme in Astronomy or in Science Communication.

Qualifications for admission

Students from any Dutch university with a BSc degree or major in Astronomy will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or equivalent courses.

Programme (120 EC)

Students are required to consult the MSc student advisor on the viability of their proposed MSc programme selection, or changes therein, before embarking on it.

Astronomy

The research component consists of a project of 30 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 30 EC of courses to be selected in correspondence with the research topic. The latter includes non-astronomy courses with 8 -14 EC. The non-astronomy courses are chosen from the MSc programmes in Physics, Mathematics and Computer Science. The selection requires prior approval by the MSc student advisor. In individual cases a course from a different programme or field of study may be elected, but only after prior written approval by the Board of Examiners. Before starting such a course, the student should contact the chairman of this board to obtain such approval.

Communication

The Communication component consists of the following components to a total of 60 EC:

| Media basics. | level | EC |
|--|---------|----|
| A choice of the following courses, adding up to | 200/300 | 16 |
| The choice of the courses has to be in accordance with. | | |
| the chosen training period | | EC |
| - Basics of science communication (obligatory) | 300 | 4 |
| - Basics of journalism & editing (obligatory) | 300 | 4 |
| - Webtext & webdesign | 300 | 4 |
| - Website testing | 300 | 4 |
| - The changing media landscape | 300 | 4 |
| - Methodology in scientific research | 200 | 4 |
| - Radio & television journalism | 300 | 4 |
| - Visual journalism basics | 300 | 4 |
| - Technology & philosophy | 300 | 4 |
| Media specials. | | |
| A choice of the following courses, adding up to | 400 | 8 |
| The choice of the courses has to be in accordance with the chosen training period. | | |

| | | | |
|---|---------|---|----|
| - Science journalism & new media | 400 | 8 | |
| - Television documentaries | 400 | 8 | |
| - Museology | 400 | 6 | |
| - Infographics | 400 | 8 | |
| - Seminar journalism & new media | 400 | 2 | |
| Designing, reflection & academic training. | | | |
| Designing for a Communication & Education environment (including a design project) | 500/600 | | 6 |
| Reflection & Academic training | | | |
| - How to write a research proposal | 400 | | 2 |
| Reflection (one of the following courses): | 400 | | 1 |
| - Philosophical aspects of science | 400 | 1 | |
| - Scientific conduct | 400 | 1 | |
| Training period in Journalism, Museology or New media. | 500/600 | | 27 |
| Including a research project, a report and an oral presentation | | | |

Track

Astronomy and Education

Description

The MSc programme Astronomy and Education prepares students for a career in teaching Physics. The programme includes a 60-EC Astronomy research programme. Students with a MSc in Astronomy and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Astronomy will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Astronomy will be considered. It is strongly recommended that the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme (120 EC)

Students are required to consult the MSc student advisor on the viability of their proposed MSc programme selection, or changes therein, before embarking on it.

Astronomy (60 EC)

The research component of the Astronomy and Education specialization consists of a project of 30 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 30 EC of courses to be selected in correspondence with the research topic. The latter includes non-astronomy courses with 8 -14 EC. The non-astronomy courses are chosen from the MSc programmes in Physics, Mathematics and Computer Science. The selection requires prior approval by the MSc student advisor. In individual cases a course from a different programme or field of study may be elected, but only after prior written approval by the Board of Examiners. Before starting such a course, the student should contact the chairman of this board to obtain such approval.

Education

The Education option of the MSc programme Astronomy and Education is offered as a joint programme of the faculty and the Leiden School of Education (ICLON) and consists of the following components:

| | Level | EC |
|--------------------------|-------|----|
| Didactics | | 13 |
| Professional functioning | | 10 |
| Educational research | 500 | 7 |
| School training | | 30 |

This programme is adequate to obtain the so-called “eerste graads lesbevoegdheid” needed for teaching at Dutch high schools.

MSc Physics

Crohonummer 60202

Leiden University offers seven tracks of an MSc programme in physics. Four of these correspond to different research groups in the Leiden Institute of Physics (LION). The remaining three are the physics track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

Students can start an MSc programme in Physics at any moment during the year and the duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Physics, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Programme Committee. An Admission Committee will advise on admissions.

Candidates with a BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5). Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. Further information is available on the website <http://www.physics.leidenuniv.nl>

The goal of each programme is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Quantum optics and quantum information

Description

This programme concentrates on the basic knowledge and expertise in the field of modern optics in general, in particular as it relates to the emerging field of quantum information. A student will gain experience in a variety of experimental techniques and application of light sources and optical instrumentation, in situations in which quantum coherence and entanglement is created and applied. It is also possible to work on theoretical research projects. Typically, the student will participate in two ongoing projects in the field, and thereby will be trained in the basic aspects of scientific research. A participant in this programme will spend 40 EC on following courses and preparing exams. The remaining 80 EC will be spent on research work in the group, the preparation of a master's thesis, and contributions to group seminars.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics or Astronomy, including in-depth knowledge of optics, quantum physics and electrodynamics, will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme contains two research projects (40 EC each), and compulsory and optional courses (40 EC in total).

| Compulsory components | level | EC |
|--|-------|----|
| Course on Quantum Optics and Quantum Information | 500 | 10 |
| Course on Quantum Theory | 400 | 10 |
| Research project 1 | 600 | 40 |
| Research project 2 | 600 | 40 |

Optional components

Additional courses

20 EC

These additional courses can be selected, depending on the research project, from the set of courses available in the MSc Physics Programme or related fields.

Track

Biological and Molecular Physics

Description

Research in the field of biological and molecular physics at the Leiden Institute of Physics (LION) is aimed at the interaction between light and matter, the photophysics of optically excited states of (bio)molecules, and the conformational dynamics of proteins. The objective of these studies is to establish at the molecular level the relationship between structure and function of biomolecules. This research involves a range of advanced methods of optical and magnetic resonance spectroscopy, and the application of state-of-the-art imaging techniques such as single-molecule fluorescence microscopy and scanning-probe imaging.

Participants in this MSc programme will join the Section of Biological and Molecular Physics, and will work under close supervision on two different, consecutive research projects of 40 EC each, to broaden the scope of their education. In addition, the student will have to acquire 40 EC in various courses specified below.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, students with a BSc degree in Chemistry or Biology are invited to apply. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme contains two research projects (40 EC each), and compulsory and optional courses (40 EC in total).

Compulsory components

At least one of the following two courses:

| | level | EC |
|---------------------|---------|----|
| Quantum Theory | 400 | 10 |
| Biophysics | 400/500 | 6 |
| Research project I | 600 | 40 |
| Research project II | 600 | 40 |

Optional components

| | | |
|-----------------------------------|---------|---|
| Advanced Biophysics | 500 | 6 |
| Laser Physics | 400 | 6 |
| Linear and nonlinear spectroscopy | 500 | 6 |
| Scanning probe microscopy | 500 | 6 |
| Single molecule optics | 500 | 6 |
| Nanotechnology | 400/500 | 6 |
| Biomolecular Motors | 400/500 | 6 |
| Group Theory | 400/500 | 6 |

Track Theoretical Physics

Description

The Theoretical Physics specialization in the MSc Physics programme prepares the student for scientific research towards the PhD in a broad range of topics in Theoretical Physics. The master will also be well-equipped for industrial research or other problem-solving tasks that demand strong analytical and computational skills.

A participant in this programme will spend the first year following courses (60 EC), some in an interactive format, and the second year on a research project under supervision of one of the theoretical physicists at the Leiden Institute of Physics (LION), completed by writing a master's thesis and by giving an oral presentation (total 60 EC).

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in physics, with in-depth knowledge of undergraduate courses with theoretical and mathematical emphasis: quantum physics, electrodynamics, statistical physics, and complex analysis, will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The first year is devoted to compulsory courses (20 EC) and optional courses (40 EC). The second year is devoted to research (60 EC).

First year:

The *compulsory courses* are:

| | level | EC |
|---------------------------|-------|----|
| Quantum Theory | 400 | 10 |
| Caput Theoretical Physics | 500 | 10 |

The 'Caput Theoretical Physics' has a topic that varies from year to year, and has an interactive format in the sense that weekly meetings consist of presentations by the participating students.

The *optional courses* consist of at least two Theoretical Physics master courses, to be selected from the set:

| | | |
|--|---------|----|
| Theory of Condensed Matter | 400/500 | 10 |
| Quantum Field Theory | 400 | 10 |
| Advanced Quantum Field Theory | 500 | 10 |
| Theory of General Relativity | 500 | 10 |
| Quantum Optics and Quantum Information | 500 | 10 |
| Statistical Physics | 400/500 | 10 |
| Computational Physics | 400/500 | 10 |

(Some courses are not provided every year.)

Other optional courses can be taken in Mathematics or (General) Physics. A maximum of one master course can be taken anywhere at Leiden University.

Second year:

| | | |
|-------------------|-----|----|
| Research project | 600 | 45 |
| Master's thesis | 600 | 10 |
| Oral presentation | 600 | 5 |

Track

Condensed Matter Physics

Description

Condensed matter physics concerns the study of the fundamental properties of solids and quantum liquids at the microscopic level, and uses the acquired understanding to develop new model systems and new materials. This often requires the development of new concepts to describe the collective behaviour of dense interacting systems. A student will gain experience in condensed matter research, which in Leiden spans a wide variety of different phenomena, different materials and different techniques. Typically a student will perform two projects (about 40 EC each) in ongoing research programmes, to be trained as an independent researcher by working in one of the groups in the Condensed Matter section (see webpage <http://www.physics.leidenuniv.nl/sections/cm/welcome.htm>), but in fact the research component has considerable flexibility. Timely planning with the study advisor and the supervisor is required.

Qualifications for admission

Students from all universities in the Netherlands with a BSc degree in Physics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc degree with a major in a related field, such as Astronomy, Chemistry or Mathematics, and a minor in Physics will be considered. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

| <i>Compulsory components</i> | level | EC |
|---------------------------------------|---------|----|
| Research project 1 | 600 | 40 |
| Research project 2 | 600 | 40 |
| At least one of the following courses | | |
| Theory of Condensed Matter | 400/500 | 10 |
| Statistical Physics | 400/500 | 10 |
| <i>Elective courses:</i> | | |
| Quantum Theory | 400 | 10 |
| Surface physics | 400/500 | 6 |
| Scanning probe microscopy | 500 | 6 |
| Superconductivity and magnetism | 500 | 6 |
| Nanotechnology | 400/500 | 6 |

Courses can also be selected from the set of courses available in the MSc Physics Programme or related fields, to be discussed with the supervisor of the research project, and subject to approval of the Exam Committee.

Track

Physics and Science-Based Business

Description

The MSc programme Physics and Science-Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a physical perspective. In addition to knowledge in physics, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with a MSc in Physics and Science-Based Business are also admissible to a PhD programme.

In order to get a SBB Master annotation, a minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB

Fundamentals can also be taken in the “free choice” part of the research MSc programmes “Core Computer Technologies” and “Condensed Matter Physics”.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Physics and a minor in a related field, such as Astronomy, Chemistry or Mathematics, will be considered.

Programme

Physics

The physics component of the Science-based Business (SBB) specialization consists of a research project of 40 EC in one of the research groups of the Leiden Institute of Physics (LION), including a master’s thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Science-Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components.

| | | |
|---|-------|---------|
| <i>Mandatory:</i> | level | EC |
| SBB Fundamentals | 400 | 17 |
| SBB Internship | 500 | 23-34 |
| <i>Optional:</i> | | |
| Orientation on Technopreneurship | 400 | 5 or 10 |
| SBB electives | | 0-20 |
| Extension of the Physics research component | | 0-20 |

See for more information on Science-Based Business the following website: <http://www.sbb.leidenuniv.nl/>.

Track

Physics and Communication

Description

The MSc programme Physics and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularization of science, for example, as a science communicator, a science policymaker or a public relations officer, or for a career as a scientist with a communicating mindset. Students with an MSc in Physics and Communication are admissible to a PhD programme in Physics or in Science Communication.

Qualifications for admission

Students from any Dutch university with a BSc degree or major in Physics will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or equivalent courses.

Programme

Physics (60 EC)

The research component consists of a project of 40 EC in one of the research groups of the institute, including a master’s thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Communication (60 EC)

The Communication component consists of the following components:

Media basics.

| | level | EC |
|---|---------|----|
| A choice of the following courses, adding up to | 200/300 | 16 |
| The choice of the courses has to be in accordance with. | | |
| the chosen training period | | EC |
| - Basics of science communication (obligatory) | 300 | 4 |
| - Basics of journalism & editing (obligatory) | 300 | 4 |
| - Webtext & webdesign | 300 | 4 |
| - Website testing | 300 | 4 |
| - The changing media landscape | 300 | 4 |
| - Methodology in scientific research | 200 | 4 |
| - Radio & television journalism | 300 | 4 |
| - Visual journalism basics | 300 | 4 |
| - Technology & philosophy | 300 | 4 |

Media specials.

| | | |
|--|-----|---|
| A choice of the following courses, adding up to | 400 | 8 |
| The choice of the courses has to be in accordance with the chosen training period. | | |
| - Science journalism & new media | 400 | 8 |
| - Television documentaries | 400 | 8 |
| - Museology | 400 | 6 |
| - Infographics | 400 | 8 |
| - Seminar journalism & new media | 400 | 2 |

Designing, reflection & academic training.

| | | |
|---|---------|---|
| Designing for a Communication & Education environment (including a design project) | 500/600 | 6 |
| Reflection & Academic training | | |
| - How to write a research proposal | 400 | 2 |
| Reflection (one of the following courses): | 400 | 1 |
| - Philosophical aspects of science | 400 | 1 |
| - Scientific conduct | 400 | 1 |

Training period in Journalism, Museology or New media. 500/600 27
Including a research project, a report and an oral presentation

Track

Physics and Education

Description

The MSc programme Physics and Education prepares students for a career in teaching Physics. The programme includes a 60-EC Physics research programme. Students with a MSc in Physics and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Physics will be considered. It is strongly recommended that the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme

Physics (60 EC)

The research component of the Physics and Education specialization consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Education (60 EC)

The Education option of the MSc programme Physics and Education is offered as a joint programme of the faculty and the Leiden School of Education (ICLON) and consists of the following components:

| | Level | EC |
|--------------------------|-------|----|
| Didactics | | 13 |
| Professional functioning | | 10 |
| Educational research | 500 | 7 |
| School training | | 30 |

This programme is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc NanoScience

Crohonummer 60618

Description

The ability to construct tiny objects atom-by-atom and molecule-by-molecule forms one of the exciting prospects of the emerging research field of NanoScience. This highly cross-disciplinary research area, which is expected to play a crucial role in future scientific discoveries and new technologies, combines a number of key elements from modern physics and chemistry, materials science and molecular biology.

Leiden University and Delft University of Technology have been pioneers in the field of NanoScience, and now join forces to offer students their renowned expertise in a unique, two-year MSc programme in NanoScience. The programme is especially aimed at students who are eager to transcend the traditional borders between scientific disciplines.

The aim of this programme is to educate the student in both science and technology of nanometer-scale phenomena. Students will benefit from the academic climate and infrastructure of both universities by taking courses from and participating in the research activities of the foremost experts in NanoScience.

The MSc programme in NanoScience is attractive to those students who wish to gain the skills and experience required to join the new generation of researchers in NanoScience. Being at the crossroads of a broad range of research fields, it provides students with an excellent opportunity to discover the most appealing aspects. It opens the door to a career in industry and is a stepping-stone for those graduates with the ambition and aspiration to pursue a PhD degree. The programme is starting preferably in September.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Physics will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a minor in Physics and a BSc in biochemistry, chemistry, molecular biology or materials science are encouraged to apply. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme (120 EC)

The programme consists of course modules (60 EC), an industrial training period (12 EC) and a Master thesis research project (48 EC).

Introductory courses

Introduction Quantum Mechanics, and/or
Introduction in Biochemistry, and/or Introduction Statistical Thermodynamics 0 - 6 EC

Core courses

Nanotechnologies 6 EC
Biophysics and/or Supramolecular Chemistry 6 - 12 EC

Quantum physics and chemistry and/or
Mesoscopic Physics and/or
Molecular Electronics 6 - 18 EC

Elective courses

Electives 18 - 42 EC*

The total EC weight of the introductory-, core- and the electives courses should be 60 EC.

Practical work

Industrial Training Period 12 EC
Master thesis research project 48 EC

The Leiden Institute of Chemistry (LIC) is the basis for research and collaborations of the Leiden chemistry groups. LIC offers seven tracks of an MSc programme in chemistry. Four of these correspond to major research themes in LIC. The remaining three are the chemistry track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Chemistry, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Programme Committee. An Admission Committee will advise on admissions and all programmes will be made in consent with an advisor and must be submitted for approval to the Exam Committee before the start of the programme.

Candidates with a BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5). Admission is possible throughout the year, but we advise foreign students to start in Januari or September when new classes begin. The programme in Industrial Ecology is starting preferably in September. Further information is available on the website <http://wwwchem.leidenuniv.nl>.

Aim of each programme is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Chemistry or with a BSc Major in Chemistry will be admitted to the programme. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate. For all other (international) candidates, such as students with a degree related to Chemistry, HBO Bachelors and foreign students, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Track

Biological Chemistry

Description

In the Master programme Biological Chemistry, students are trained in understanding and application of the chemistry of biomacromolecules. After successful completion of the programme, the students have extensive knowledge at the molecular level of structure and interactions of biomacromolecules, and master the skills to obtain this knowledge. Furthermore, they have insight in biochemical processes at the cellular level and at the level of the organism. They can communicate with cell biologists and biotechnologists in a multidisciplinary (and, if appropriate, industrial) team. The programme is internationally oriented, and students are stimulated to take courses abroad.

Programme

The programme contains two training periods (35 and 20 EC), including a written report and an oral presentation and compulsory and optional courses (65 EC). It is mandatory that major and minor research projects take place in different specializations. Free choice consists of a free choice of theory or an extension of the research period. Students can choose their "free choice courses" within or outside their specialisation. Students can also choose these courses from bachelor or non-chemistry courses if allowed by the exam committee.

| | |
|---|-------|
| <i>Compulsory components</i> | |
| Biophysical Structure Chemistry | 6 EC |
| Bioinformatics | 4 EC |
| Cellular signalling | 4 EC |
| Research project I, including master thesis | 35 EC |
| Research project II (preferably abroad), including report | 20 EC |
| Colloquium | 6 EC |
| <i>Optional components</i> | |
| A selection of courses within specialization | 5 EC |
| A selection of courses outside specialization | 6 EC |
| Free choice or extension of research | 34 EC |

Track

Physical and Theoretical Chemistry

Description

In the Master programme Physical and Theoretical Chemistry, students are trained in a quantitative description of nature, with a focus on “understanding” rather than on “making”. Dependent on the subject of choice, ranging from a quantum-mechanical description of chemical reactions to “mimicking” the origin of life, the students gain extensive knowledge of experimental research, theoretical research and/or computer calculations.

Programme

The programme contains two research periods (35 and 20 EC), including a written report and an oral presentation and compulsory and optional courses (65 EC). It is mandatory that major and minor research projects take place in different specializations. Free choice consists of a free choice of theory or an extension of the research period. Students can choose their “free choice courses” within or outside their specialization. Students can also choose these courses from bachelor or non-chemistry courses if allowed by the exam committee.

Compulsory components

Three of the next five courses:

| | |
|--|------|
| 1. Advanced Soft Matter | 6 EC |
| 2. Biophysical Structural Chemistry | 6 EC |
| 3. Molecular quantum mechanics and molecular modelling | 4 EC |
| 4. Quantum Chemistry | 6 EC |
| 5. Colloid and Interface Science | 6 EC |

| | |
|---|-------|
| Research project I, including master thesis | 35 EC |
| Research project II (preferably abroad), including report | 20 EC |
| Colloquium | 6 EC |

Optional components

| | |
|---|------|
| A selection of courses within specialization | 6 EC |
| A selection of courses outside specialization | 6 EC |

| | |
|--------------------------------------|----------|
| Free choice or extension of research | 31-29 EC |
|--------------------------------------|----------|

Track Design and synthesis

Description

After successful completion of the Master programme Design and Synthesis, students have extensive knowledge of the structure of molecules, reactivity of molecules, the course of biological processes and design and synthesis of molecules.

Programme

The programme contains two research periods (35 and 20 EC), including a written report and an oral presentation and compulsory and optional courses (65 EC). It is mandatory that major and minor research projects take place in different specializations. Free choice consists of a free choice of theory or an extension of the research period. Students can choose their "free choice courses" within or outside their specialization. Students can also choose these courses from bachelor or non-chemistry courses if allowed by the exam committee.

Compulsory components

| | |
|---|-------|
| Advanced Organic Chemistry | 11 EC |
| Bio-inorganic Chemistry | 5 EC |
| Research project I, including master thesis | 35 EC |
| Research project II, including report | 20 EC |
| Colloquium | 6 EC |

Optional components

| | |
|---|------|
| A selection of courses within specialization | 6 EC |
| A selection of courses outside specialization | 6 EC |

Free choice or extension of research 31 EC

Track Industrial Ecology

Description

The Track Industrial Ecology is the result of a cooperation agreement between the Faculty of Mathematics and Natural Sciences of Leiden University, the Faculty of Applied Sciences of Delft University of Technology, and the Faculty of Social Sciences of Erasmus University. All three universities deliver the same amount of educational effort.

The Track Industrial Ecology starts for the first time in September 2004 as a track in the MSc Programmes Chemistry (University of Leiden, Faculty of Mathematics and Natural Sciences) and Chemical Engineering (Delft University of Technology, Faculty of Applied Sciences). The Students will receive a degree in either Chemistry or Chemical Engineering with a specialisation to Industrial Ecology. However, if the official accreditation for an independent Industrial Ecology programme is granted before August 2006, the degree received will be in Industrial Ecology.

Qualifications for admission

Students with a bachelor's degree in any of the Natural sciences, Technical sciences and Social sciences with good results from a recognised university, and with a thorough proficiency in written and spoken English (IELTS level ≥ 6.5), can apply for admission to the two-year programme starting in September 2005. Admission is subject to the approval of the department's selection committee.

Overview of the Programme

The MSc programme Industrial Ecology consists of the following components:

| | | |
|-------------|----------------------------------|-------|
| First year | Adaptation Modules | 9 EC |
| | Core Modules | 39 EC |
| | Elective Modules | 12 EC |
| Second year | Interdisciplinary Project Groups | 12 EC |
| | Specialization Modules | 12 EC |
| | Master's Thesis Research Project | 36 EC |

Detailed information about the modules for the first year can be found on the website www.industrialecology.nl, or obtained from the study advisor or Programme Coordinator. The information about the second year will be announced in the course of the first year.

Track

Chemistry and Science-Based Business

Description

The MSc programme Chemistry and Science-Based Business prepares students for a career in science-related business and administration and for innovation and enterprise from a chemical perspective. In addition to knowledge in Biological Chemistry, Physical and Theoretical Chemistry or Design and Synthesis, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Chemistry and Science-Based Business are also admissible to a PhD programme.

In order to get an SBB Master annotation, a minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the "free choice" part of the research MSc programmes "Biological Chemistry", "Physical and Theoretical Chemistry" and "Design and Synthesis".

Programme

Chemistry

The Chemistry component of the Science-based Business (SBB) specialization consists of a research project of 20 EC in one of the research groups of LIC, including a master's thesis and an oral presentation, and 34-54 EC of courses in Biological Chemistry, Physical and Theoretical Chemistry and/or Design and Synthesis, to be selected in correspondence with the research topic, and a general colloquium (6 EC). The choices for courses and research project will be made in concert with an advisor.

Science-Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components.

| | | |
|---|-------|---------|
| <i>Mandatory:</i> | level | EC |
| SBB Fundamentals | 400 | 17 |
| SBB Internship | 500 | 23-34 |
| <i>Optional:</i> | | |
| Orientation on Technopreneurship | 400 | 5 or 10 |
| SBB electives | | 0-20 |
| Extension of the Chemistry research component | | 0-20 |

See for more information on Science-Based Business the following website: <http://www.sbb.leidenuniv.nl/>.

Track Chemistry and Communication

Description

The MSc programme Chemistry and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularization of science, for example, as a science communicator, a science policymaker or a public relations officer, or for a career as a scientist with a communicating mindset. Students with an MSc in Chemistry and Communication are admissible to a PhD programme in Chemistry or in Science Communication.

Qualifications for admission

Students from any Dutch university with a BSc degree or major in Chemistry will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or equivalent courses.

Programme

Chemistry (60 EC)

The research component consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Communication (60 EC)

The Communication component consists of the following components:

| Media basics. | level | EC |
|---|---------|----|
| A choice of the following courses, adding up to | 200/300 | 16 |
| The choice of the courses has to be in accordance with. | | |
| the chosen training period | | EC |
| - Basics of science communication (obligatory) | 300 | 4 |
| - Basics of journalism & editing (obligatory) | 300 | 4 |
| - Webtext & webdesign | 300 | 4 |
| - Website testing | 300 | 4 |
| - The changing media landscape | 300 | 4 |
| - Methodology in scientific research | 200 | 4 |
| - Radio & television journalism | 300 | 4 |
| - Visual journalism basics | 300 | 4 |
| - Technology & philosophy | 300 | 4 |
| Media specials. | | |
| A choice of the following courses, adding up to | 400 | 8 |
| The choice of the courses has to be in accordance with the chosen training period. | | |
| - Science journalism & new media | 400 | 8 |
| - Television documentaries | 400 | 8 |
| - Museology | 400 | 6 |
| - Infographics | 400 | 8 |
| - Seminar journalism & new media | 400 | 2 |
| Designing, reflection & academic training. | | |
| Designing for a Communication & Education environment (including a design project) | 500/600 | 6 |
| Reflection & Academic training | | |
| - How to write a research proposal | 400 | 2 |
| Reflection (one of the following courses): | 400 | 1 |
| - Philosophical aspects of science | 400 | 1 |
| - Scientific conduct | 400 | 1 |
| Training period in Journalism, Museology or New media. | 500/600 | 27 |
| Including a research project, a report and an oral presentation | | |

Track Chemistry and Education

Description

The MSc programme Chemistry and Education prepares students for a career in teaching Chemistry. The programme includes a 60-EC Chemistry research programme. Students with a MSc in Chemistry and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Chemistry will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Chemistry will be considered. It is strongly recommended that the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme

Chemistry (60 EC)

The research component of the Chemistry and Education specialization consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Education (60 EC)

The Education option of the MSc programme Chemistry and Education is offered as a joint programme of the faculty and the Leiden School of Education (ICLON) and consists of the following components:

| | Level | EC |
|--------------------------|-------|----|
| Didactics | | 13 |
| Professional functioning | | 10 |
| Educational research | 500 | 7 |
| School training | | 30 |

This programme is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

MSc Life Science and Technology

Crohonummer 66286

The living cell is central in Life Science and Technology. Life Science & Technology offers five tracks of an MSc programme, resulting from the collaboration of Leiden University and the Technical University of Delft. Each of four tracks corresponds to a research area in the field of life sciences and technology. The fifth track consists of the combination of a research programme with a specialization in Science-Based Business.

The duration of each programme is two years (120 EC). Students receive the degree Master of Science in Life Science & Technology after completion of the programme, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Programme Committee. An Admission Committee will advise on admissions.

Candidates with an BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5). The programmes are starting preferably in September. Further information is available on the website www.lst.leidenuniv.nl or www.lst.tudelft.nl

Aim of the programmes is to train the student as an independent researcher and to develop the necessary skills and proficiency to advance his/her career.

Track

Cell Factory

Description

Cell factory is the most process-oriented track of the MSc programme. It concerns cells operating as factories as well as in factories. The student focuses on gaining all information and skills necessary for the industrial application of (parts of) living organisms in the production of valuable components. Consequently, this educational programme focuses strongly on technological aspect such as fermentation technology, as well as on purification and formulation aspects of a biotechnological product on its way to the end consumer, in addition to modern molecular biology with its basis in genomics and physiology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the applications.

Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. programme of the candidate with the BSc-LS&T programme. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme consists of a research project (45 EC), and compulsory and optional programme components (75 EC). The programme has two variants, one of which can be chosen.

Compulsory components

(i) Profile courses

Analysis of metabolic networks

5 EC

Metabolic reprogramming

5 EC

Bioprocess integration

5 EC

| | |
|---------------------------------------|----------|
| Variant "Cells in factories" | |
| -Fermentation technology | 3 EC |
| -Bioseparations | 3 EC |
| -Bioconversion technology | 3 EC |
| Variant "Cells as factories" | |
| - Metabolic diversity | 3 EC |
| - Industrial genomics | 3 EC |
| - Molecular cell biology IV | 3EC |
| (ii) General courses | |
| - Ethics and technology | 6 EC |
| - Literature study (colloquium) | 4 EC |
| - Design project | 11 EC |
| - Company traineeship | 13-18 EC |
| (iii) Researchproject in Cell Factory | 45 EC |
| <i>Optional courses</i> | 17-12 EC |

Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

Track Cell Diagnostics

Description

This programme focuses on development and implementation of methods, techniques and instruments in order to obtain the maximum of information about the living cell. This applies to all organizational levels, from molecule through subcellular structure to the whole cell, in vitro and in situ. In addition to acquiring new fundamental knowledge, the development of new medicines is one of the most important applications. Cell diagnostics is absolutely a bio-instrumentational track in which the definition 'Biorecognition' - the detailed specificity of binding, interaction and biocatalysis through biomolecules -is central. A well-grounded knowledge of biological systems is essential in protein chemistry and protein technology, cell biology, immunobiology, bio -organic and bio-anorganic chemistry. In addition, the student is introduced to new developments in physics, spectroscopy, electron microscopy, (micro)electronics, micro array techniques, image processing and image interpretation as well as in bio-informatics.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the applications. Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. programme of the candidate with the BSc-LS&T programme. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme consists of a research project (45 EC), and compulsory and optional programme components (75 EC).

Compulsory components

(i) Profile courses (24 EC from the following courses)

| | |
|---|------|
| Biotechnology: from molecular defect to molecular therapy | 3 EC |
| Microbiology of man, animals, food and environment | 3 EC |
| Modern drug development technology | 3 EC |
| Advanced bioinformatics | 4 EC |
| Themes in biomedical engineering | 4 EC |
| Biophysics | 6 EC |
| Forensic Science | 3 EC |
| Metals in biology and medicine | 3 EC |

(ii) General courses

| | |
|---------------------------------|----------|
| - Ethics and technology | 6 EC |
| - Literature study (colloquium) | 4 EC |
| - Design project | 11 EC |
| - Company traineeship | 13-18 EC |

(iii) Research project in Cell Diagnostics 45 EC

Optional courses 17 -12 EC

Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

Track

Functional Genomics

Description

This programme is characterised by the in-depth study of molecular genetics and cell biology with emphasis on those processes which play a role in regulation of information transport in the cell. In addition, the student gains insight and skills in modern analysis (genomics, proteomics, single cell/single molecule spectroscopy) and recombinant DNA/PCR technologies. A thorough understanding of Bioinformatics is essential in view of the complexity and enormity of the data sets which are generated.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the applications. Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. programme of the candidate with the BSc-LS&T programme. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme consists of a research project (46 EC), and compulsory and optional programme components (74 EC).

Compulsory components

(i) Profile courses

| | |
|---------------------------------------|------|
| - Bioinformatics 2 | 4 EC |
| - Bioinformatics 3 | 4 EC |
| - Transcriptome & proteome analysis | 5 EC |
| - Biophysical structure determination | 6 EC |
| = Gene expression | 5 EC |

(ii) General courses

| | |
|---------------------------------|----------|
| - Ethics and technology | 6 EC |
| - Literature study (colloquium) | 4 EC |
| - Design project | 11 EC |
| - Company traineeship | 13-18 EC |

(iii) Research project in Functional Genomics 45 EC

Optional courses 17-12 EC

Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

Track Living Matter

Description

This programme concerns the identification of molecular structures and mechanisms and research of the physical principles underlying cellular organisation. This is the most fundamental track, literally focused on the 'Science of Life'. Students will learn to understand living processes in terms of models, rules, laws and theories. Currently, a fundamental, theoretical description of the majority of biological processes is unknown. In order to arrive at a meaningful understanding of nature, it is important to discover regularities or laws in nature. This approach is evident in the Systems Biology where biological processes are described in model form without knowledge of the underlying theory. Graduates with the Living Matter profile will have accumulated in-depth knowledge stretching from physics and chemistry through mathematics and informatics to molecular biology. Whilst mathematical skills are important for a more quantitative description, the emphasis in these modules lies more on the application rather than the precise definition of mathematical rules. The interdisciplinary nature of the Living Matter profile means that both theoretical and experimental internship positions are possible in both Leiden University and TU Delft within a large number of research groups, in particular chemistry, biochemistry, biophysics, theoretical biology, mathematics and informatics.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Life Science & Technology will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the applications. Applicants with a BSc or HBO degree in a related field of science will be considered. In general, the committee will compare the BSc, HBO etc. programme of the candidate with the BSc-LS&T programme. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme consists of a research project (46 EC), and compulsory and optional programme components (74 EC).

Compulsory components

(i) Profile courses) (*besides Mathematical modelling 18 EC from the other courses*)

| | |
|--|------|
| - Systems Biology | 6 EC |
| - Dynamic energy budgets | 4 EC |
| - Mathematical modelling in development and evolutionary biology | 6 EC |
| - Bioinformatics 2 | 4 EC |
| - Bioinformatics 3 | 4 EC |
| - Biophysical structure determination | 6 EC |

(ii) General courses

| | |
|---------------------------------|----------|
| - Ethics and technology | 6 EC |
| - Literature study (colloquium) | 4 EC |
| - Design project | 11 EC |
| - Company traineeship | 13-18 EC |

(iii) Research project in Living Matter 45 EC

Optional courses 17-12 EC

Note that sum of EC for the Company traineeship and the Optional courses must equal 30 EC.

Track

Life Science & Technology and Science-Based Business

Description

This MSc programme prepares students for a career in science-related business and administration and for innovation and enterprise from an LS&T perspective. In addition to knowledge obtained from one of the above mentioned programmes, students obtain competence with respect to organisation, people in organisations and establishment and management of processes.

Students with a MSc in Life Science & Technology and Science-Based Business are also admissible to a PhD programme.

In order to get a SBB Master annotation, the minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the “free choice” part of the research MSc programmes mentioned above.

Programme

| | | |
|--|-------|----|
| <i>Life Science and Technology</i> | level | EC |
| Compulsory courses of the chosen profile (Cell Factory, Cell Diagnostics, Functional Genomics or Living Matter). | | 24 |
| Compulsory general courses | | |
| Ethics & technology | | 6 |
| Literature study | | 4 |
| Design project | | 11 |
| Research project in the chosen profile (Cell Factory, Cell Diagnostics, Functional Genomics or Living Matter). | | 35 |
| <i>Science-based business</i> | | |
| SBB fundamentals | 400 | 17 |
| SBB internship | 500 | 23 |

See for more information on Science-Based Business the following website:
<http://www.sbb.leidenuniv.nl/>.

MSc Bio-Pharmaceutical Sciences Crohonummer 60207

Students in the Center for Bio-Pharmaceutical Sciences (CBPS) of Leiden University are trained for a research career in drug research and development, not for a career as a (public) pharmacist. CBPS offers eight tracks of an MSc programme in Bio-Pharmaceutical Sciences (BPS). Five of these correspond to major research themes in CBPS. The remaining three are the bio-pharmaceutical track of the research MSc with Science-Based Business (SBB), and the Communication and Education specializations.

The duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Bio-Pharmaceutical Sciences, with specification of the specialization, if applicable. Details are provided below. All tracks have the same Director, the same Exam Committee, and the same Programme Committee. An Admission Committee will advise on admissions.

Candidates with a BSc degree or equivalent can apply for admission. The admission guidelines are given below for each specialization. The admission process may include an interview with the Admission Committee. Foreign applicants must provide proof of proficiency in English (IELTS level ≥ 6.5). Admission is possible throughout the year, but we advise foreign students to start in January or September when new classes begin. Further information is available on the website www.bfw.leidenuniv.nl

Aim of each programme is to train the student as an independent researcher, and to develop the necessary skills and proficiency to advance his/her career.

Track

Medicinal Chemistry

Description

The MSc programme Medicinal Chemistry (drug design and molecular modelling) trains for junior drug researchers, and prepares students for a career in medicinal chemistry.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry with an equivalent BSc will be considered. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme contains two research periods (52 and 30 EC), and compulsory and optional programme components (38 EC):

| | |
|---|-------|
| Lecture series 1 (in BPS) | 4 EC |
| Lecture series 2 (in BPS) | 4 EC |
| Research project I (Medicinal chemistry; including Master's thesis and oral presentation) | 52 EC |
| Research project II (preferably in another discipline of BPS) | 30 EC |
| Course Scientific Conduct | 1 EC |
| 20 Lectures and Colloquia | 1 EC |
| Literature study plus thesis | 7 EC |
| Optional courses or traineeships | 21 EC |

Track

Analytical Bio-Sciences

Description

The MSc programme Analytical Bio-Sciences (analytical chemistry focussing on hyphenated bio-analytical strategies including proteomics) trains for junior drug researchers, and prepares students for a career in analytical chemistry.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry with an equivalent BSc will be considered. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme contains two research periods (52 and 30 EC), and compulsory and optional programme components (38 EC):

| | |
|--|-------|
| Lecture series 1 (in BPS) | 4 EC |
| Lecture series 2 (in BPS) | 4 EC |
| Research project I (Analytical Bio-Sciences; including Master's thesis and oral presentation) | 52 EC |
| Research project II (preferably in another discipline of BPS) | 30 EC |
| Course Scientific Conduct | 1 EC |
| 20 Lectures and Colloquia | 1 EC |
| Literature study plus thesis | 7 EC |
| Optional courses or traineeships | 21 EC |

Track

Pharmacology

Description

The MSc programme Pharmacology (drug transport and disposition; pharmacokinetics/pharmacodynamics; hormones in neurosciences; clinical pharmacology) trains for junior drug researchers, and prepares students for a career in pharmacology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Biology or Biomedical Sciences, as well as HBO Bachelors in Biomedical Sciences with an equivalent BSc will be considered. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme contains two research periods (52 and 30 EC), and compulsory and optional programme components (38 EC):

| | |
|---------------------------|------|
| Lecture series 1 (in BPS) | 4 EC |
| Lecture series 2 (in BPS) | 4 EC |

| | |
|---|-------|
| Research project I (Pharmacology, Medical Pharmacology, Clinical Pharmacology; including Master's thesis and oral presentation) | 52 EC |
| Research project II (preferably in another discipline of BPS) | 30 EC |
| Course Scientific Conduct | 1 EC |
| 20 Lectures and Colloquia | 1 EC |
| Literature study plus thesis | 7 EC |
| Optional courses or traineeships | 21 EC |

Track

Drug Delivery Technology and Biopharmaceutics

Description

The MSc programme Drug Delivery Technology and Biopharmaceutics (drug delivery and formulation research; drug target finding and gene modulation in cardiovascular disease) trains for junior drug researchers, and prepares students for a career in drug delivery technology and/or drug target finding and therapeutic gene modulation.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Biology, Biomedical Sciences, Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry or Biomedical Sciences with an equivalent BSc will be considered. The choice in optional courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme contains two research periods (52 and 30 EC), and compulsory and optional programme components (38 EC):

| | |
|--|-------|
| Lecture series 1 (in BPS) | 4 EC |
| Lecture series 2 (in BPS) | 4 EC |
| Research project I (Drug Delivery Technology or Biopharmaceutics; including Master's thesis and oral presentation) | 52 EC |
| Research project II (preferably in another discipline of BPS) | 30 EC |
| Course Scientific Conduct | 1 EC |
| 20 Lectures and Colloquia | 1 EC |
| Literature study plus thesis | 7 EC |
| Optional courses or traineeships | 21 EC |

Track

Toxicology

Description

The MSc programme Toxicology (cellular and molecular mechanisms of toxicity) trains for junior drug researchers, and prepares students for a career in toxicology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a BSc (or equivalent) in Biomedical Sciences, Chemistry, Life Science and Technology, as well as HBO Bachelors in Chemistry or Biomedical Sciences with an equivalent BSc will be considered. The choice in optional courses in

the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate.

Programme

The programme contains two research periods (52 and 30 EC), and compulsory and optional programme components (38 EC):

| | |
|--|-------|
| Lecture series 1 (in BPS) | 4 EC |
| Lecture series 2 (in BPS) | 4 EC |
| Research project I (Toxicology; including Master's thesis and oral presentation) | 52 EC |
| Research project II (preferably in another discipline of BPS) | 30 EC |
| Course Scientific Conduct | 1 EC |
| 20 Lectures and Colloquia | 1 EC |
| Literature study plus thesis | 7 EC |
| Optional courses or traineeships | 21 EC |

Track

Bio-Pharmaceutical Sciences and Science-Based Business

Description

The MSc programme Bio-Pharmaceutical Sciences and Science-Based Business trains for junior drug researchers, who consider a career in science-related business and administration, preparing for innovation and enterprise from a bio-pharmaceutical perspective. In addition to knowledge in Bio-Pharmaceutical Sciences, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Bio-Pharmaceutical Sciences and Science-Based Business are also admissible to a PhD programme.

In order to get an SBB Master annotation, a minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the optional part of the research MSc programmes "Medicinal Chemistry", "Analytical Bio-Sciences", "Pharmacology", "Drug Delivery Technology and Biopharmaceutics" and "Toxicology".

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences, Pharmaceutical Sciences, or Pharmacy will be admitted to the programme.

For all other (international) candidates, such as HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Programme

Bio-Pharmaceutical Sciences

The Bio-Pharmaceutical component of the Science-Based Business (SBB) specialization consists of a research project of 50 EC in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lecture series of 4 EC each, the course Scientific Conduct of 1 EC and attendance of at least 20 colloquia or seminars (1 EC). The choices for lecture series and research project will be made in concert with an advisor.

Science-Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components.

| | | |
|--|-------|---------|
| <i>Mandatory:</i> | level | EC |
| SBB Fundamentals | 400 | 17 |
| SBB Internship | 500 | 23-34 |
| <i>Optional:</i> | | |
| Orientation on Technopreneurship | 400 | 5 or 10 |
| SBB electives | | 0-20 |
| Extension of the Bio-Pharmaceutical research component | | 0-20 |

See for more information on Science-Based Business the following website:
<http://www.sbb.leidenuniv.nl/>.

Track

Bio-Pharmaceutical Sciences and Communication

Description

The MSc programme Bio-Pharmaceutical Sciences and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularization of science, for example, as a science communicator, a science policymaker or a public relations officer, or for a career as a scientist with a communicating mindset. Students with an MSc in Bio-Pharmaceutical Sciences and Communication are admissible to a PhD programme in Bio-Pharmaceutical Sciences or in Science Communication.

Qualifications for admission

Students from any Dutch university with a BSc degree or major in Bio-Pharmaceutical Sciences will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or equivalent courses.

Programme (120 EC)

Bio-Pharmaceutical Sciences (60 EC)

The research component consists of a project of 50 EC in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lecture series of 4 EC each, the course Scientific Conduct of 1 EC and attendance of at least 20 colloquia or seminars (1 EC). The choices for lecture series and research project will be made in concert with an advisor.

Communication (60 EC)

The Communication component consists of the following components:

Media basics.

| | level | EC |
|---|---------|----|
| A choice of the following courses, adding up to | 200/300 | 16 |
| The choice of the courses has to be in accordance with the chosen training period | | EC |
| - Basics of science communication (obligatory) | 300 | 4 |
| - Basics of journalism & editing (obligatory) | 300 | 4 |
| - Webtext & webdesign | 300 | 4 |
| - Website testing | 300 | 4 |
| - The changing media landscape | 300 | 4 |
| - Methodology in scientific research | 200 | 4 |
| - Radio & television journalism | 300 | 4 |
| - Visual journalism basics | 300 | 4 |
| - Technology & philosophy | 300 | 4 |

Media specials.

| | | |
|--|-----|---|
| A choice of the following courses, adding up to | 400 | 8 |
| The choice of the courses has to be in accordance with the chosen training period. | | |
| - Science journalism & new media | 400 | 8 |
| - Television documentaries | 400 | 8 |
| - Museology | 400 | 6 |
| - Infographics | 400 | 8 |
| - Seminar journalism & new media | 400 | 2 |

Designing, reflection & academic training.

| | | |
|---|---------|----|
| Designing for a Communication & Education environment (including a design project) | 500/600 | 6 |
| Reflection & Academic training | | |
| - How to write a research proposal | 400 | 2 |
| Reflection (one of the following courses): | 400 | 1 |
| - Philosophical aspects of science | 400 | 1 |
| - Scientific conduct | 400 | 1 |
| Training period in Journalism, Museology or New media. | 500/600 | 27 |
| Including a research project, a report and an oral presentation | | |

Track**Bio-Pharmaceutical Sciences and Education****Description**

The MSc programme Bio-Pharmaceutical Sciences and Education prepares students for a career in teaching Bio-Pharmaceutical Sciences. The programme includes a 60-EC Bio-Pharmaceutical research programme. Students with a MSc in Bio-Pharmaceutical Sciences and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Bio-Pharmaceutical Sciences will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Bio-Pharmaceutical Sciences will be considered. It is strongly recommended that the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme*Bio-Pharmaceutical Sciences (60 EC)*

The research component of the Bio-Pharmaceutical Sciences and Education specialization consists of a project of 50 EC in one of the research groups of CBPS, including a master's thesis and an oral presentation, two lecture series of 4 EC each, the course Scientific Conduct of 1 EC and attendance of at least 20 colloquia or seminars (1 EC). The choices for lecture series and research project will be made in concert with an advisor.

Education (60 EC)

The Education option of the MSc programme Bio-Pharmaceutical Sciences and Education is offered as a joint programme of the faculty and the Leiden School of Education (ICLON) and consists of the following components:

| | Level | EC |
|--------------------------|-------|----|
| Didactics | | 13 |
| Professional functioning | | 10 |
| Educational research | 500 | 7 |
| School training | | 30 |

This programme is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.

Leiden University offers ten different tracks of an MSc programme in Biology. Specializations range from the molecular to the population level, and from fundamental research to applied science. All tracks are organized around specialized state-of-the-art courses and research training provided by leading research groups within an international, academic setting. Five tracks are linked with research programmes within the Institute of Biology (IBL), one is a joint programme with the Centre of Environmental Studies (CML) and another one is a joint programme between the Leiden branch of the National Herbarium of the Netherlands (NHN), *Hortus botanicus* and Naturalis (the National Museum of Natural History). In the remaining three tracks, research programmes are combined with training in science-based business, communication and education, respectively.

The duration of each programme is two years (120 EC). Students who complete the programme receive the degree Master of Science in Biology, with specification of the specialization, if applicable. The MSc degree guarantees thorough research training founded on a firm theoretical basis, enabling students to function on the international scene. Details are provided below. All tracks have the same Director and the same Exam Committee. An Admission Committee will advise on admissions, and all programs will be made in concert with the track coordinator.

Most-updated information can be found on the website following the following links: www.biologie.leidenuniv.nl > Opleiding > Master program. A detailed description of the theoretical elements can be found on www.studiegids.leidenuniv.nl/index.php3?m=32&c=974.

Qualifications for admission

Students from any university in The Netherlands with a BSc degree in Biology will be admitted to the programme without restriction. The choice in elective courses in the MSc programme may be limited by the need to adapt the programme to the present knowledge of the candidate. For all other (international) candidates, such as BSc graduates from other universities, graduates with a BSc in other natural sciences, life sciences, mathematics or biomedical sciences and specific HBO Bachelors as well as for foreign students, the Admission Committee will judge the equivalence of the previous training to the Dutch BSc in Biology which may result in additional coursework. The admission process may include an interview with the Admission Committee. The admission guidelines are given below for each specific track if they differ from these general admission qualifications. Foreign applicants must provide proof of proficiency in English.

Start of the programme

Students may enter each programme throughout the year. However, they are encouraged to start in either September or February when theoretical courses are scheduled. Courses starting in either the first or the second semester are not identical. Often, the first semester course starts with an introduction to the specified track.

Track

Molecular and Cellular Biology

Description

This MSc track provides students with knowledge about all basic aspects of molecular and cellular biology of prokaryotes and eukaryotes. Attention is given to genetic, microbiological and cellular approaches to understand the functioning of uni- and multicellular organisms at the molecular level. Application of functional genomics tools and implications for the understanding of diseases of animals and plants are highlighted. Students are trained to understand and critically evaluate specialized scientific literature.

They will be able to use state of the art technology in at least one of the major subdisciplines genetics, microbiology or cell biology. They are trained in skills for presentation of their results.

This master track is optimally suited as a basis for starting a career in experimental molecular-biological or biomedical research.

Programme (120 EC)

Mandatory are both profile courses, a seminar, and an MSc thesis project. In a profile course, students are trained in critical reading and writing about recent scientific literature. A major part of the master training is actively taking part in a running research project. This main research project is to be completed with an MSc thesis, which can be performed within either of the research groups of Molecular Developmental Genetics, Microbiology, Molecular Cell Biology or Cell Physiology. Emphasis will be put on model organisms such as zebrafish, *Arabidopsis* and yeast or on their interactions with microbes.

Additional EC can be obtained by following optional courses or by doing a minor research project.

| <i>Compulsory:</i> | level | EC |
|-------------------------------------|-------|---------|
| Profile course 1 Mol Cell Biology : | | |
| MCB textbook | 400 | 6 |
| MCB MSc thesis proposal | 500 | 3 |
| MCB oral defense proposal | 500 | 2 |
| MCB proof of practical skills | 400 | 1 |
| Profile course 2 Mol Cell Biology | 500 | 9 |
| Seminar | 500 | 4 |
| MSc thesis project | 600 | 56 - 74 |
| <i>Optional</i> | | |
| Courses or minor research project | 500 | 39 – 21 |

Track

Animal Biology

Description

This MSc track provides students with knowledge about organism-level processes in a range of animal species. Emphasis will be on developing critical skills and judgment necessary for planning and executing experiments, and for analyzing data. The subject areas covered include physiology, (molecular) developmental biology, including normal and abnormal development, behavioural biology, evolution and development (evo-devo), neurobiology and morphology. Students will learn scientific methods and selected laboratory techniques by carrying out an in-depth research project in one of the participating groups: Integrative Zoology, Behavioural Biology and Evolutionary Biology.

This course will form an ideal foundation for students who want to pursue a career in zoological or biomedical research. Students will also be given the opportunity to gain a certificate in animal care. This qualification is required for the handling of experimental animals. Vertebrates, in particular fish and birds, are emphasised as main model systems.

Programme (120 EC)

The programme consists of one extensive MSc research project, compulsory components to cover the theoretical aspects (profile courses 1 and 2 and a seminar) and optional programme components, which may include a second research project. Introductory profile courses are mandatory, including guided self-study in the basic underlying facts and principles of experimental animal sciences. The MSc thesis project can be performed in any of the research groups of Integrative Zoology, Behavioural Biology or Evolutionary Biology. In some cases and after approval by the track coordinator, it is possible that a medically-orientated research project is performed at the Leiden University Medical Centre (LUMC). The course "Animal care" (4 EC, taught in Dutch) is strongly recommended as an additional course.

| <i>Compulsory:</i> | level | EC |
|-----------------------------------|-------|---------|
| Profile course 1 Animal Biology : | | |
| AB General Skills | 400 | 6 |
| AB Theory | 500 | 8 |
| Profile course 2 Animal Biology | | |
| AB Advanced Textbook | 500 | 6 |
| Seminar Animal Biology | 500 | 4 |
| MSc thesis project | 600 | 56 - 74 |
| <i>Optional</i> | | |
| Courses or minor research project | 500 | 40 – 22 |

Track

Molecular Plant Biotechnology

Description

In addition to training in general academic skills, this MSc track provides students with up-to-date knowledge about general and specific molecular genetic and physiological aspects of plant growth and development as well as the responses of plants to biotic (viruses, bacteria, fungi) and abiotic stresses. The students are able to critically assess recent developments in the field. Based on this, they can discover, describe and analyze new scientific questions and design creative approaches to tackle these questions via experimentation. They are equipped with the necessary practical skills to outline, plan and execute experiments. Their training in functional genomics, proteomics and metabolomics will provide the essential knowledge and skills to be able to apply these powerful techniques in the broad fields of biological and medical research. The students are trained to present scientific results in oral presentations and in writing. Masters in Molecular Plant Biotechnology are well qualified for a position at a research (related) institute or to successfully conduct a PhD project. As the students will be provided the option to do a project at the interface of fundamental and applied science, this will also qualify them for positions at commercial companies.

Programme (120 EC)

The programme consists of a mandatory profile course, which includes guided self-study on molecular/physiological subjects, and two theoretical courses. Other mandatory components are an MSc thesis project and a seminar. The MSc thesis research project can be performed in any of the research groups of Molecular Developmental Genetics, Plant Cell Physiology or Applied Plant Sciences (TNO). Additional EC can be obtained by following optional courses or by doing a minor research project.

| <i>Compulsory:</i> | level | EC |
|--|-------|---------|
| Profile course Molecular Plant Biotechnology : | | |
| MPB Textbook | 400 | 9 |
| MPB Essay | 600 | 6 |
| MPB Oral presentation | 500 | 2 |
| Stress in plants | 500 | 3 |
| Seminar | 500 | 6 |
| MSc thesis project | 600 | 56 - 74 |
| <i>Optional</i> | | |
| Courses or minor research project | 500 | 38 – 20 |

Track

Natural Products

Description

The major aim of this MSc track is to provide the students with a broad theoretical background to multidisciplinary research in natural products and plant cell biotechnology, to obtain in depth knowledge about the various experimental tools, and the application of these during a research

project utilizing state-of-the-art equipment. The students should be able to collect scientific information and assess this in terms of possible applications, and identify and develop strategies to overcome potential scientific bottlenecks for realization of these applications. The students should be able to communicate scientific results in the oral and written form, including posters. The students should develop into independent researchers which are able to continue for a PhD program, or take the responsibility for projects in an industrial or institutional research environment.

Qualifications for admission

The track is open for students with at least a BSc degree in biology, forestry, (bio)chemistry, pharmacy or medicine. Special target groups for this MSc track are students from 2nd and 3rd world countries. Besides the necessary academic diplomas, important criteria for the latter applicants can be that they already hold positions that are connected with the field of research, or have shown to have been active in this field of research, i.e. have professional credits. For all other (inter)national candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in elective courses in the MSc track may be limited by the need to adapt the programme to the fore-knowledge of the candidate.

Programme (120 EC)

The programme consists of two parts. The first part is a series of short courses of at least 28 EC, and a maximum of 42 EC, depending on the level of the student. Methods for phytochemical screening and testing of biological activity of plant extracts will be dealt with, as well as the isolation and identification of natural products, including structure elucidation. It will provide knowledge about chemotaxonomy and the role of secondary metabolism. Basic knowledge on plant cell culture as a tool for biosynthetic studies and plant cell biotechnology is included in the program. "Natural products" is dealing with aspects of the production and quality control of drugs from natural origin. The use of chromatographic methods is an important aspect of this. It will also include courses on drug discovery. "Plant Cell Biotechnology" as a method for studying biosynthesis and for the production of secondary metabolites. Strategies to improve production such as metabolic engineering will be dealt with. Also plant tissue culture as method for micro propagation will be learned.

The second part concerns participation in the research of the department. The MSc thesis project (experimental research project) part should last 9-12 months. In the second part of the program, the student should participate in an international scientific meeting and present a poster on his/her research. A seminar should be followed as well.

Additional EC can be obtained by following optional courses or seminars. It is also possible to earn EC points by writing a literature review. Based on the information on the educational background of the applicant, a tailor-made programme will be made. The individual study programme will be discussed with the student by the track coordinator.

| <i>Compulsory:</i> | level | EC |
|-----------------------------------|---------|---------|
| Profile course Natural Products | 400/500 | 27 - 33 |
| <i>To choose from</i> | | |
| Biosynthesis sec. metabol | 400 | 2 |
| Bioprospecting | 400 | 4 |
| Natural products I | 400 | 4 |
| Natural products II | 500 | 9 |
| Plant cell biotechnology | 500 | 4 |
| Chromatography course | 500 | 4 |
| Structure elucidation | 500 | 4 |
| Science communication | 500 | 2 |
| Seminar | 500 | 4 |
| MSc thesis project | 600 | 56 - 74 |
| <i>Optional</i> | | |
| Courses or minor research project | 500 | 9 – 33 |

Track

Biodiversity in Time and Space

Description

The unique combination of the National Herbarium Netherlands (NHN), Naturalis (the Dutch National Museum of Natural History), *Hortus botanicus*, collections of the Institute of Biology (IBL) and specializations in the field of evolutionary patterns, zoological, botanical and mycological biodiversity studies enables this integrated track.

The prime aim of this MSc track is to provide the students with a broad theoretical background to comparative research in biodiversity (i.e. theory, methodology and practice of systematics and taxonomic biodiversity studies). The students will obtain in depth knowledge about the various research tools (descriptive, observation, experimental, computer algorithmic) and will apply this during a minor and a major research project utilizing state-of-the-art equipment and under two different supervisors. Several specialized programs can be chosen: plant diversity (mainly NHN-based), animal diversity (mainly Naturalis and IBL-based), marine diversity (both Naturalis and NHN) or fungal diversity (mainly NHN-based).

Key fields of study for research projects include: Alpha-taxonomy; phylogeny reconstruction; morphological character analyses; molecular systematics and total evidence analyses; historical biogeography; quantitative spatial pattern analysis, range modeling and GIS applications; multi-media identification tools and biodiversity assessments.

Qualifications for admission

The track is open for students with at least a BSc degree in biology or forestry. This track is also excellently suited for students from 2nd and 3rd world countries. Besides the necessary academic diplomas, important criteria for the latter applicants can be that they already hold positions that are connected with the field of research, or have shown to have been active in this field of research, i.e. have professional credits. For all other (inter)national candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. The choice in elective courses in the MSc track may be limited by the need to adapt the programme to the fore-knowledge of the candidate.

Programme (120 EC)

The students need to spend at least 30 EC on course and other class work, and theoretical items (term paper, etc.). The first semester as envisaged comprises profile course 1 (8 weeks) and profile course 2 (4 weeks). The courses are being decided upon yet. Further compulsory elements include an MSc thesis project (major research project), a minor research project and a seminar. If appropriate, additional EC can be obtained by following optional courses or a second seminar.

| <i>Compulsory:</i> | level | EC |
|-----------------------------------|-------|---------|
| Profile course Biodiversity 1 | | |
| Collections and taxonomy | 400 | 3 |
| Advanced Phylogeny Reconstruction | 500 | 3 |
| Biogeographic Assessment | 500 | 3 |
| Patterns – Processes | 400 | 3 |
| Profile course Biodiversity 2 | | |
| BD Textbook | 500 | 6 |
| MSc thesis project | 600 | 48 – 74 |
| Minor research project | 500 | 15 - 30 |
| Seminar | 500 | 4 - 5 |
| <i>Optional</i> | | |
| Elective courses | 500 | 32 – 0 |

Track Evolutionary and Ecological Sciences

Description

This MSc track provides students with a general understanding of the research field of Evolutionary and Ecological Sciences, including the latest scientific developments. The students can analyze scientific literature and recognize relevant and interesting scientific problems on the basis of scientific and social developments and practical situations. The students can translate these problems into scientifically testable hypotheses and can design an adequate research strategy. They can formulate problems in the form of mathematical formulas or simulation models in such a way that they can be analyzed. They are able to analyze scientific data and to formulate scientific conclusions on the basis of these data. They can deliver adequate oral and written presentations of their research projects.

With a completed Master program, the students should be well equipped to start a PhD-project in one or more of the following disciplines: evolutionary biology, (plant- and animal) ecology, behavioural biology, and theoretical biology or to function in a position in which evaluation or commission of research projects is an important element.

Programme (120 EC)

The programme consists of one or two research projects (total 56-74 EC), and compulsory and optional programme components. The mandatory profile course 1 includes the following elements: statistics, genetics and a general overview of (theoretical) evolutionary ecology. The mandatory profile course 2 is individual deepening of knowledge. A seminar is one of the compulsory elements. The MSc thesis project, either one project lasting 9-12 months or two of 6 months each, will be carried out within one of the IBL research groups on Plant Ecology, Animal Ecology, Theoretical Biology, Evolutionary Biology or Behavioural Biology.

| <i>Compulsory:</i> | level | EC |
|-----------------------------------|-------|---------|
| Profile course EvoEco Biology 1 | | |
| EEB General Skills | 400 | 6 |
| EEB Part 2 | 500 | 13 |
| Profile course EvoEco Biology 2 | | |
| EEB Textbook | 500 | 6 |
| Seminar | 500 | 4 |
| MSc thesis project(s) | 600 | 56 – 74 |
| <i>Optional</i> | | |
| Courses or minor research project | 500 | 35 – 17 |

Track Sustainability and Biodiversity

Description

This MSc track offers knowledge of and insight in the conservation and management of biodiversity from a local to a global scale. By using 'sustainability' as a guiding principle, the programme not only takes into account ecological but also economical and social aspects of biodiversity and conservation. The programme provides students with an academic attitude by stimulating reflective, independent and creative thinking. It prepares students for a PhD programme and/or for research positions at universities, research institutes, government organisations and consult agencies.

Programme (120 EC)

Compulsory is a three-part profile course (Introduction, Methods and Models for Environmental Biology; Environmental processes), two seminars ("Biodiversity" and "Sustainability"), training in scientific writing skills and a main research project including an MSc thesis. Additional time might be spent on courses or extra research project time to be performed outside the Centre of Environmental Studies (CML). Usually; the main research project should be performed within the

CML or at one of the institutes connected to it. Alternative suggestions might be considered and should be discussed with the coordinator who should approve on them before the actual start.

| <i>Compulsory:</i> | level | EC |
|--|-------|---------|
| Profile course Sustainability and Biodiversity | | |
| Introduction | 400 | 2 |
| Methods and Models | 400 | 8 |
| Environmental Processes | 400 | 9 |
| Scientific writing | 400 | 4 |
| Two Seminars | 500 | 8 |
| MSc thesis project | 600 | 56 – 74 |
| <i>Optional</i> | | |
| Courses or minor research project | 500 | 33 – 15 |

Track

Biology and Science-Based Business

Description

This Msc programme Biology and Science-Based Business prepares students for a career in science-related business and administration, and for innovation and enterprise from a biological perspective. In addition to knowledge in biology, students obtain competence with respect to organisations, people in organisations, and establishment and management of processes. Students with an MSc in Biology and Science-Based Business are also admissible to a PhD programme.

In order to get a SBB Master annotation, a minimal programme consisting of the course SBB Fundamentals and the SBB training period must be completed (see below). The course SBB Fundamentals can also be taken in the optional part of the research MSc programmes in Biology.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biological Sciences will be admitted to the programme.

For other (international) candidates, such as BSc graduates from other natural sciences, life sciences and biomedical sciences as well as specific HBO Bachelors, the Admission Committee will judge the equivalence to these BSc degrees of their previous training.

Programme

Biology

The Biology component of the Science-based Business (SBB) specialization consists of a research project of 40 EC in one of the research groups of the Institute of Biology, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic. The choices for courses and research project will be made in concert with an advisor.

Science-Based Business

The Business-related part of the complete SBB programme consists of 40 to 60 EC of the following components.

| <i>Mandatory:</i> | level | EC |
|---|-------|---------|
| SBB Fundamentals | 400 | 17 |
| SBB Internship | 500 | 23-34 |
| <i>Optional:</i> | | |
| Orientation on Technopreneurship | 400 | 5 or 10 |
| SBB electives | | 0-20 |
| Extension of the Biology research component | | 0-20 |

See for more information on Science-Based Business the following website:
<http://www.sbb.leidenuniv.nl/>.

Track Biology and Communication

Description

The MSc programme Biology and Communication concerns science communication in a broad sense. The programme prepares students for a career in popularization of science, for example, as a science communicator, a science policymaker or a public relations officer, or for a career as a scientist with a communicating mindset. Students with an MSc in Biology and Communication are admissible to a PhD programme in Biology or in Science Communication.

Qualifications for admission

Students from any Dutch university with a BSc degree or major in Biology will be admitted to the programme. For all other (international) candidates, the Admission Committee will judge the equivalence to these BSc degrees of their previous training. Preferably, the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden Graduate School of Education (ICLON), or equivalent courses.

Programme

Biology (60 EC)

The research component consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Communication (60 EC)

The Communication component consists of the following components:

| Media basics. | level | EC |
|---|---------|----|
| A choice of the following courses, adding up to | 200/300 | 16 |
| The choice of the courses has to be in accordance with. | | |
| the chosen training period | | EC |
| - Basics of science communication (obligatory) | 300 | 4 |
| - Basics of journalism & editing (obligatory) | 300 | 4 |
| - Webtext & webdesign | 300 | 4 |
| - Website testing | 300 | 4 |
| - The changing media landscape | 300 | 4 |
| - Methodology in scientific research | 200 | 4 |
| - Radio & television journalism | 300 | 4 |
| - Visual journalism basics | 300 | 4 |
| - Technology & philosophy | 300 | 4 |
| Media specials. | | |
| A choice of the following courses, adding up to | 400 | 8 |
| The choice of the courses has to be in accordance with the chosen training period. | | |
| - Science journalism & new media | 400 | 8 |
| - Television documentaries | 400 | 8 |
| - Museology | 400 | 6 |
| - Infographics | 400 | 8 |
| - Seminar journalism & new media | 400 | 2 |
| Designing, reflection & academic training. | | |
| Designing for a Communication & Education environment (including a design project) | 500/600 | 6 |
| Reflection & Academic training | | |
| - How to write a research proposal | 400 | 2 |
| Reflection (one of the following courses): | 400 | 1 |
| - Philosophical aspects of science | 400 | 1 |
| - Scientific conduct | 400 | 1 |
| Training period in Journalism, Museology or New media. | 500/600 | 27 |
| Including a research project, a report and an oral presentation | | |

Track Biology and Education

Description

The MSc programme Biology and Education prepares students for a career in teaching Biology. The programme includes a 60-EC Biology research programme. Students with a MSc in Biology and Education are also admissible to a PhD programme.

Qualifications for admission

Students from any university in the Netherlands with a BSc degree in Biology will be admitted to the programme.

For all other (international) candidates, the Admission Committee will judge the equivalence to this BSc degree of their previous training. Notably, applicants with a major in Biology will be considered. It is strongly recommended that the BSc programme has included the 10-EC-course Learning, Presentation and Communication, offered by the Leiden School of Education (ICLON), or an equivalent course. Applicants must provide proof of proficiency in Dutch.

Programme

Biology (60 EC)

The research component of the Biology and Education specialization consists of a project of 40 EC in one of the research groups of the institute, including a master's thesis and an oral presentation, and 20 EC of courses to be selected in correspondence with the research topic.

Education (60 EC)

The Education option of the MSc programme Biology and Education is offered as a joint programme of the faculty and the Leiden School of Education (ICLON) and consists of the following components:

| | Level | EC |
|--------------------------|-------|----|
| Didactics | | 13 |
| Professional functioning | | 10 |
| Educational research | 500 | 7 |
| School training | | 30 |

This programme is adequate to obtain the so-called "eerste graads lesbevoegdheid" needed for teaching at Dutch high schools.