**Faculty of Mathematics and Natural Sciences**
**of**
**Leiden University**

**&**

**Faculty of Applied Sciences**
**of**
**Delft University of Technology**

# Implementation Regulations

# for the MSc in NanoScience

**Corresponding to the Teaching and Examination Regulations of the MSc in NanoScience (master programme)**

*Contents:*

## Section 1 – General

**Article 1.1 -** Semesters

The academic year is divided into two semesters.

**Article 1.2** – Course admissions

1. Students that have a BSc degree in Physics from Leiden University or a BSc degree in Applied Physics from Delft University of Technology shall be admitted to the course. Students that are in possession of a BSc degree in Life Science & Technology with a minor in Physics from TU Delft, or Chemistry or Biology with a minor in Physics from Leiden University shall be considered for admission. Their application for admission will be reviewed by the Board of Admissions, which shall make a decision whether to admit them. The Board of Admissions shall also propose a set of conditions that the candidate will have to satisfy in order to be admitted.
2. Students that are in possession of a BSc degree in a field of study that is related to NanoScience (such as Materials Science, Biology, Chemistry or Physics) from any other university or higher vocational education institution (HBO) shall be considered for admission to the NanoScience programme. Their application for admission shall be reviewed by the Board of Admissions, which shall make a decision as to whether to admit them. The Board of Admissions shall also propose a set of conditions that the candidate will have to satisfy in order to be admitted.
3. Students from abroad must also satisfy the following conditions:
    - An average mark (Grade Point Average) of at least 75% of the scale maximum.
    - A TOEFL score of at least 80 (internet-based test), or an IELTS (academic version) overall band score of at least 6.0, or have passed the University of Cambridge 'Certificate of Proficiency in English' or the University of Cambridge 'Certificate in Advanced English'.
4. Applications for admission from outside the Netherlands must be accompanied by:
    - A fully-completed, recent admissions form with a recent passport photograph.
    - An original TOEFL or IELTS score form.
    - An original document stating the candidate's GRE (Graduate Record Examinations) general test score.
    - A curriculum vitae.
    - A personal essay (in English) stating the candidate's motives for taking the MSc programme of his/her choice.
    - Certified copies of the candidate's academic certificates, both in the native language of the candidate and in either English or Dutch.
    - An original or certified copy of the complete list of credits gained in the native language of the candidate, accompanied by a translation of that list into English or Dutch.
    - Two references from university staff members and, where applicable, from the student's current employer.

**Article 1.3 –** Specialisations / special tracks

The programme does not offer any specialisations / special tracks.

**Article 1.4** – Exit qualifications

The specific exit qualifications within the general objectives of the course, as formulated in Article 2.1 of the Teaching and Examination Regulations, read as follows:

1. Mastery of Nanoscience and nanotechnology at an academic level. Since Nanoscience encompasses a cross-disciplinary research area, including basic knowledge of physics, chemistry and biology, insofar as they each play a part on the nanoscale. This knowledge and expertise must be mastered to a level that is comparable with what is considered appropriate at internationally renowned universities.
2. In-depth knowledge of at least one subdiscipline of nanoscience, the corresponding international literature that can be understood.
3. Experience of research in the field of nanoscience and a keen eye for the technological applicability of research.
4. Ability to fathom and abstract a wide range of scientific and technological problems. Able to determine by means of abstracts the connection between various problems and able to contribute and execute creative solutions aimed at practical application.
5. Ability to integrate knowledge from various subject areas.
6. Ability to work within an interdisciplinary team of experts on the aforementioned activities. Ability to communicate easily, both in written and spoken English, whilst working on these projects.
7. Ability to work and learn independently and on his/her own initiative. Capable of identifying, and bringing in expertise, that what is lacking.
8. Ability to give a presentation of his/her expertise and/or activities to a lay audience in English. Able to respond to background and interests of readers / the audience.
9. Knowledge of social developments related to technology. Able to form and defend opinions in this field.

## Section 2 – Description of the MSc in NanoScience programme

**Article 2.1** - General

The MSc in NanoScience programme comprises three elements: lectures, the Master's Thesis project and an Internship. The number of credits per element (in European credits) is as follows:

| Code | Description | European credits |
|---|---|---|
| - | Lectures | 60 |
| NS3911 | Master's Thesis project | 48 |
| NS3901 | Internship | 12 (can be replaced by lectures) |

**Article 2.2** – Composition of the individual study programme

1. The lectures within the MSc in NanoScience programme can be divided into five categories or research topics:

   (A) Quantum Information
   (B) Molecular Electronics, Polymers, Complex Systems
   (C) Scanning Probe Instrumentation, THz Astronomical Sensors, Atomic Scale Electrons
   (D) Single Molecules Spectroscopy
   (E) Molecular Biophysics

2. Besides a list of general elective course modules, a number of elective course modules have been included in the curriculum for each topic.

3. Each student shall propose an individual study programme (ISP) after consulting with his/her personal Academic Advisor (tutor) and, if desired, with the Academic Counsellor (studieadviseur). Course modules should be chosen from the lists described in 2.7, 2.8 and 2.9 in particular. Course modules that are not specified here can also be included. An ISP must satisfy the final attainment targets as described in the Teaching and Examination Regulations (OER) and is subject to the approval of the Board of Examiners.

4. A maximum of 6 European credits can be taken in course modules that are not related to the subject, such as English or Ethics.

5. The Board of Examiners may oblige students to take an English course module, if they still deem it necessary after admission. The Board of Examiners consults the Academic Counsellor and Director of Education of the programme in this respect. The student will be notified of this within one month following upon the receipt of the individual study programme.

6. All individual study programmes must be submitted, possibly accompanied by a letter stating the reasons for taking the modules chosen, to the Board of Examiners for approval at the beginning of the academic year.

7. Amendments to the individual study programme throughout the academic year are likewise subject to the approval of the Board of Examiners.

**Article 2.3** – Approval of the individual study programme (ISP)

1. The Board of Examiners makes a decision with regard to the students' individual study programme within 20 working days following the submission of the proposal.
2. The students will be notified of the board's decision as soon as possible.

3. Amendments to the individual study programme will be taken into consideration, provided that they are declared in good time. Students must once again allow for a period of 20 working days for decisions regarding amendments.

**Article 2.4 –** Introductory course modules

1. The Board of Examiners shall determine which introductory course module(s) shall be made compulsory for each individual student, possibly on the advice of the Academic Counsellor or Director of Education of the programme. This decision is made on the basis of previous education/training that the student received.
2. Introductory course modules bearing a study load of 12 European credits can be included in the Nanoscience curriculum. In the event that the study load, which the Board of Examiners is obliging the student to take in introductory course modules, exceeds 12 credits, the surplus study load shall be considered as a transitional programme that does not count towards the 120 credits of the MSc in NanoScience programme.

**Article 2.5 –** List of all available introductory course modules

| Code | Course module title | ECTS | Level |
|---|---|---|---|
| NS3012 | Introduction to Quantum Mechanics | 3 | 300 |
| NS3001 | Introduction to Biochemistry | 6 | 400 |
| NS3261 | Introduction to Solid State Physics | 3 | 300 |

**Article 2.6 –** Compulsory core course module

The MSc in NanoScience programme includes 1 core course module that is compulsory for all students:

| Code | Course module title | ECTS | Level |
|---|---|---|---|
| NS3501 | Nanotechnology | 6 | 400/500 |

**Article 2.7 –** Elective course modules

Elective course modules can be selected as a component of the MSc in NanoScience programme up to a total weight of 60 European credits (or 72, in case the internship is replaced by electives), minus the total study load (in European credits) of introductory course modules and core course modules. These must be approved by the Board of Examiners as a component of each student's individual study programme.

**Article 2.8 –** List of elective course modules per topic

| Topic | Code | Course module title | ECTS | Level |
|---|---|---|---|---|
| A | NS3521TU | Mesoscopic Physics | 6 | 300/400 |
| | NS3191 | Theory of Condensed Matter | 10 | 300 |
| | NS3091 | Surface Science | 6 | 400/500 |
| | AP3051G | Advanced Quantum Mechanics | 6 | 300/400 |
| | AP3111D | Quantum Electronics & Quantum Optics | 6 | 400 |
| | NS3182 | Quantum Optics & Quantum Information | 10 | 300/400 |
| | AP3191D | Physics of Semiconductor Nanodevices | 6 | 400 |
| | NS3141 | Superconductivity | 6 | 500 |
| | WM0320TU | Ethics | 3 | 300 |

| | | | | |
|---|---|---|---|---|
| B | NS3021 | Supramolecular Chemistry | 6 | 400/500 |
| | NS3231 | Statistical Physics | 10 | 300 |
| | NS3531TU | Molecular Electronics | 6 | 500 |
| | NS3611 | Advanced Materials | 6 | 400/500 |
| | NS3191 | Theory of Condensed Matter | 10 | 300 |
| | NS3091 | Surface Science | 6 | 400/500 |
| | AP3051G | Advanced Quantum Mechanics | 6 | 300/400 |
| | AP3111D | Quantum Electronics & Quantum Optics | 6 | 400 |
| | NS3182 | Quantum Optics & Quantum Information | 10 | 300/400 |
| | AP3191D | Physics of Semiconductor Nanodevices | 6 | 400 |
| | NS3141 | Superconductivity | 6 | 500 |
| | AP3021G | Advanced Statistical Mechanics | 6 | 300/400 |
| | CH4131MS | Polymer Structure and Dynamics | 3 | ? |
| | CH4151TU | Nanostructured Polymers | 3 | ? |
| | WM0320TU | Ethics | 3 | 300 |
| C | NS3521TU | Mesoscopic Physics | 6 | 300/400 |
| | NS3611 | Advanced Materials | 6 | 400/500 |
| | NS3191 | Theory of Condensed Matter | 10 | 300 |
| | NS3091 | Surface Science | 6 | 400/500 |
| | AP3051G | Advanced Quantum Mechanics | 6 | 300/400 |
| | NS3182 | Quantum Optics & Quantum Information | 10 | 300/400 |
| | AP3111D | Quantum Electronics and Quantum Optics | 6 | 400 |
| | AP3191D | Physics of Semiconductor Nanodevices | 6 | 400 |
| | NS3141 | Superconductivity | 6 | 500 |
| | WM0320TU | Ethics | 3 | 300 |
| D | NS3511TU | Biophysics | 6 | 400/500 |
| | NS3231 | Statistical Physics | 10 | 300 |
| | LM3511 | Systems Biology | 6 | 400/500 |
| | NS3531TU | Molecular Electronics | 6 | 500 |
| | AP3021G | Advanced Statistical Mechanics | 6 | 300/400 |
| | CH4131MS | Polymer Structure and Dynamics | 3 | ? |
| | CH4151TU | Nanostructured Polymers | 3 | ? |
| | WM0320TU | Ethics | 3 | 300 |
| E | NS3511TU | Biophysics | 6 | 400/500 |
| | NS3021 | Supramolecular Chemistry | 6 | 400/500 |
| | NS3231 | Statistical Physics | 10 | 300 |
| | LM3511 | Systems Biology | 6 | 400/500 |
| | NS3531TU | Molecular Electronics | 6 | 500 |
| | AP3021G | Advanced Statistical Mechanics | 6 | 300/400 |
| | CH4131MS | Polymer Structure and Dynamics | 3 | ? |
| | CH4151TU | Nanostructured Polymers | 3 | ? |
| | WM0320TU | Ethics | 3 | 300 |

**Article 2.9** – List of all elective course modules

| Code | Course module title | ECTS | Level |
|---|---|---|---|
| NS3021 | Supramolecular Chemistry | 6 | 400/500 |
| NS3511TU | Biophysics | 6 | 400/500 |
| NS3521TU | Mesoscopic Physics | 6 | 300/400 |
| NS3531TU | Molecular Electronics | 6 | 500 |
| NS3051 | Scanning Probe Microscopy | 6 | 400/500 |

| | | | |
|---|---|---|---|
| NS3061 | Single Molecule Optics | 6 | 500 |
| NS3071 | NMR Spectroscopy | 3 | 200 |
| NS3091 | Surface Science | 6 | 400/500 |
| NS3102 | Cellular Signaling | 6 | 300 |
| NS3132 | Biomolecular Motors | 4 | 400/500 |
| NS3141 | Superconductivity | 6 | 500 |
| NS3161 | Advanced Biophysics | 6 | 500 |
| NS3171 | Quantum Theory | 10 | 300 |
| NS3182 | Quantum Optics & Quantum Information | 10 | 300/400 |
| NS3191 | Theory of Condensed Matter | 10 | 300 |
| NS3201 | Colloid and Interface Science | 6 | 500 |
| NS3231 | Statistical Physics | 10 | 300 |
| NS3251 | In-vivo Biomolecular Interactions | 4 | ? |
| NS3541 | Nanoparticulate Materials | 6 | 500 |
| NS3571TU | Quantum Transport | 6 | 300/400 |
| NS3581 | Solid State Physics II | 3 | 400 |
| NS3611 | Advanced Materials | 6 | 400/500 |
| | | | |
| AP3021G | Advanced Statistical Mechanics | 6 | 300/400 |
| AP3051G | Advanced Quantum Mechanics | 6 | 300/400 |
| AP3111D | Quantum Electronics and Quantum Optics | 6 | 400 |
| AP3191D | Physics of Semiconductor Nanodevices | 6 | 400 |
| AP3211D | Advanced Solid State Physics | 6 | 300/400 |
| AP3591 | Advanced Optical Imaging | 6 | ? |
| | | | |
| CH4131MS | Polymer Structure and Dynamics | 3 | ? |
| CH4151TU | Nanostructured Polymers | 3 | ? |
| | | | |
| ET4253 | Nanoelectronics | 4 | ? |
| | | | |
| LM3051 | Biophysical Structure Determination | 6 | 400 |
| LM3511 | Systems Biology | 6 | 400/500 |
| | | | |
| MS3011 | Semiconductor Principles and Devices | 3 | 300 |
| MS3031 | Computational Materials Science | 4 | 300 |
| MS4111 | Thin Film Materials | 3 | 400/500 |
| | | | |
| WM0320TU | Ethics | 3 | 300 |

**Section 3 – Academic Advisors**

1. Each student shall have his/her own Academic Advisor. This advisor shall be assigned by the Director of Education of the programme on the advice of the Board of Admissions. The decision-making process in this respect aims to admit students based upon the Academic Advisor's preferences, with regard to the content of the topics being studied (see 2.2). Upon his/her request, the student is able to change his/her Academic Advisor at all times.
2. Faculty staff members can be allocated as an Academic Advisor.
3. Academic Advisors supervise the students whilst they are making their individual study programme, during their academic progression and when they are making a choice for one of the thesis research groups. They meet with their allocated student when asked for by the student.
4. In dialogue with the student concerned and, if necessary, after consulting the Academic Counsellor, the Academic Advisor can formulate an individual study programme for the student which is then passed on to the Board of Examiners for approval.

**Section 4 – Internship**

Internships should preferably take place in companies, but in extraordinary cases university departments are also an option - provided that they are not part of the universities of Leiden or Delft. The Director of Education of the programme decides whether to approve or reject upon proposed Internships, if applicable based on the advice of the Board of Examiners. Internships can be carried out both in the Netherlands and abroad. The internship can also be replaced by elective course modules, of which the total weight is 12 European credits or more.

**Section 5 – Master's Thesis research project**

A research project that is concluded with a Master's Thesis (MEP) is carried out either at the Faculty of Mathematics & Natural Sciences at Leiden University, or at the Faculty of Applied Sciences at Delft University of technology, or at both. Any other location must be approved by the Board of Examiners.

**Section 6 – Degree supplement**

An overview of the individual study programme (including the individual course modules taken) is given on the certificate. This degree supplement is issued in English.

**Section 7 – Date of commencement**

These regulations come into force on 1 September 2009.
These regulations were set down by the Deans of the respective faculties.