

**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**

**2010-2011**

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

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## **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 90 (internet-based test), or an IELTS (academic version) overall band score of at least 6.5, 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 after consulting his/her personal Academic Advisor (tutor) and, if desired, 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. A study programme 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**

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 (see Article 2.2.1. for the topics)

Topic	Code	Course module title	ECTS	Level
A	NS3521TU	Mesosopic Physics	6	300/400
	NS3191	Theory of Condensed Matter	10	300
	NS3091	Surface Physics	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 Physics	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	Mesosopic Physics	6	300/400
	NS3611	Advanced Materials	6	400/500
	NS3191	Theory of Condensed Matter	10	300
	NS3091	Surface Physics	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
	LM3512	Systems Biology	3	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
	LM3512	Systems Biology	3	400/500
	NS3531TU	Molecular Electronics	6	500
	AP3021G	Advanced Statistical Mechanics	6	300/400

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CH4131MS	Polymer Structure and Dynamics	3	*
CH4151TU	Nanostructured Polymers	3	*
WM0320TU	Ethics	3	300

\* = these course modules are given at TU Delft and are as such not subject to the 'Level' as implemented at/practised by Leiden University.

**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	Mesosopic 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 Physics	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
NS3621	Quantum Information Processing	5	*
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
LM3512	Systems Biology	3	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

\* = these course modules are either given at TU Delft and are as such not subject to the 'Level' as implemented at/practised by Leiden University, or the level of the course module is not known.

### Section 3 - Description of the Erasmus Mundus Master of Nanoscience and Nanotechnology programme

#### Article 3.1 - General

The Erasmus Mundus Master of Nanoscience and Nanotechnology programme (EMM Nano programme) comprises three elements: specializing courses, broadening courses and the Master's Thesis project. The number of credits per element (in European credits) is as follows:

Code	Description	European credits
-	Specializing courses	15
-	Broadening courses	15
NS3912	Master's Thesis project	30

#### Article 3.2 – Composition of the individual study programme

1. There are three majors within the EMM Nano programme:
  - Nanoscience
  - Nanotechnology
  - Biophysics
2. Specializing courses differ per major, whereas broadening courses are the same for every major, as long as there is no overlap between specializing courses and broadening courses.
3. 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 of Delft/Leiden for approval at the beginning of the academic year.
4. Amendments to the individual study programme throughout the academic year are likewise subject to the approval of the Board of Examiners.

#### Article 3.3 – Approval of the individual study programme

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 3.4 – Specializing courses

1. Major Nanoscience:  
Students follow all the Specializing courses and choose 15 erts credits from the Broadening courses (no overlap allowed).

Code	Course module title	ECTS
NS3501-1	Nanotechnology part 1	3
NS3521TU	Mesosopic Physics	6
AP3211D	Advanced Solid State Physics	6
NS3912	Master thesis	30

2. Major Nanotechnology:  
Students follow all the Specializing courses and choose 15 erts credits from the Broadening courses (no overlap allowed).

Code	Course module title	ECTS
NS3501	Nanotechnology	6
AP3111D	Quantum Electronics & Quantum Optics	6
NS3641	Advanced Semiconductor Devices	3
NS3912	Master thesis	30

3. Major Biophysics:

Students follow all the Specializing courses and choose 15 ects credits from the Broadening courses (no overlap allowed).

Code	Course module title	ECTS
NS3511TU	Biophysics	6
NS3021	Supramolecular Chemistry	6
NS3133	Biomolecular Motors	3
NS3912	Master thesis	30

**Article 3.5 – Broadening courses**

Code	Course module title	ECTS
NS3521TU	Mesoscopic Physics	6
AP3051G	Advanced Quantum Mechanics	6
AP31111D	Quantum Electronics & Quantum Optics	6
AP3191D	Physics of Semiconductor Nanodevices	6
NS3021	Supramolecular Chemistry	6
NS3531TU	Molecular Electronics	6
AP3021G	Advanced Statistical Mechanics	6
CH4131MS	Polymer Structure and Dynamics	3
CH4151TU	Nanostructured Polymers	3
NS3511TU	Biophysics	6
NS3501	Nanotechnology	6
AP3211D	Advanced Solid State Physics	6
NS3641	Advanced Semiconductor Devices	3
NS3611	Advanced Materials	6
NS3091	Surface Physics	6
NS3132	Biomolecular Motors	4
LM3512	Systems Biology	3
NS3182	Quantum Optics and Quantum Information	10
NS3231	Statistical Physics	10
NS3191	Theory of Condensed Matter	10
WM0320TU	Ethics and Engineering	3
NS3161	Advanced Biophysics	6
NS3251	In-vivo Biomolecular Interactions	4
MS4111	Thin Film Materials	3
NS3541	Nanoparticulate Materials	6
NS3171	Quantum Theory	10
NS3571TU	Quantum Transport	6
NS3141	Superconductivity	6

**Section 4 – 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 5 – 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 6 – 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 7 – 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 8 – Date of commencement**

These regulations come into force on 30 August 2010.  
These regulations were set down by the Deans of the respective faculties.