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Appendices Teaching and Examination Regulations 2019-2020

Master's degree programme Nanoscience



Appendix I

Learning outcomes of the degree programme (art. 3.1)

The graduate of the Top Master Programme in Nanoscience:

1. is able to perform nanoscience research in the international and interdisciplinary environment of a world-leading institute
2. has the knowledge, skills and attitude that are needed for successful entrance and participation in a PhD programme
3. understands the importance of proper scientific conduct and responsible behaviour when performing research, and is aware of the social and ethical ramifications of scientific research and its applications;
4. can apply knowledge of those parts of the disciplines of physics, chemistry, and mathematics that are relevant to nanoscience, as well as knowledge of a selection of topics within molecular biology and medicine that are relevant to nanoscience.
5. is able to solve realistic scientific problems in the interdisciplinary field of nanoscience, even on the basis of a rudimentary problem specification
6. is capable of acquiring sufficient knowledge within a limited time span to work in a different speciality within nanoscience;
7. is capable of critically using the scientific literature in his/her chosen speciality;
8. is capable of both performing scientific research and of interpreting its results;
9. can effectively convey and discuss results of scientific research, orally and in written form, to specialists as well as non-specialists;
10. is able to plan and conduct research independently;
11. is able to perform research in a research team and work together with fellow students;
12. can formulate and defend a realistic and well-argued research plan on the basis of a rudimentary problem specification;
13. is able to adapt to the rapid changes occurring in the field of nanoscience;



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Appendix II Tracks/Specializations of the degree programme (art. 3.5)

The degree programme is not divided into tracks/specializations.



Appendix III Content of the degree programme (art. 3.6)

The compulsory part of the Top Master Programme in Nanoscience consists of:

- a. **Guided self-study in Nanoscience** (NS000, 6 ECTS) intended to enable students to follow the Core Curriculum. Topics from the following list will be assigned on an individual basis by the Board of Examiners (based on advice from the Admission Board):
 - Solid-state physics
 - Quantum theory
 - Organic chemistry
 - Inorganic chemistry
 - Mathematics

For each assigned topic, the tutor associated with the topic will determine in a written or oral exam whether the student has passed the requirements.

The Core Curriculum defines to a large extent the character of the Programme. It consists of the following three modules:

- b. **Preparation of nanomaterials and devices**

(NS001, core module, 8 ECTS)

This module consists of several parts:

Synthesis of functional molecules, Thin-film growth, Preparation of inorganic devices, Preparation of electronic and optoelectronic devices with solution-based techniques, Ordered molecular structures.

Each part will be examined in written or oral form with one, two or three parts per examination event, and/or via a practical with a written report.

- c. **Characterization of nanomaterials and devices**

(NS002, core module, 9 ECTS)

This module consists of several parts:

Surface and Single Molecule Techniques, X-ray Diffraction, Optical Spectroscopy, Electron Microscopy.

Each part will be examined in written or oral form with one, two or three parts per examination event, and/or via a practical with a written report.

- d. **Fundamental and functional properties of nanomaterials and devices**

(NS003A, core module, 13 ECTS)

This module consists of several parts:

Electronic Structure Properties, Surfaces and Interfaces, Electronic Transport Properties of Organic and Hybrid Materials and Devices, Electronic Transport Properties of Inorganic Materials and Devices, Nanomedicine, Optical Properties, Magnetic Properties.

Each part will be examined in written or oral form with one, two or three parts per examination event, and/or via a practical with a written report. This module includes TV lectures in collaboration with Osaka University, for which participation is obligatory.

- e. **Review paper, incl. lectures/workshops on transferable academic skills**

(NS190, 6 ECTS)



The student will write a review paper on a topic of his or her choice. This choice needs the approval of the mentor and of the coordinator of this component of the programme. The component is supervised by the mentor or another examiner of the programme. The supervisor and the coordinator of this component will also jointly determine the mark obtained. If requested to, and approved by the coordinator of this component before writing the paper, a student can work with an external supervisor when this ensures good supervision for the topic of the paper.

The course also provides lectures and workshops on academic skills, such as literature search, scientific writing, and ethics and scientific integrity. For the lectures and workshops on academic skills attendance and in-class participation is obligatory.

f. Small research project and symposium, incl. lectures/workshops on transferable academic skills

(NS194, 13 ECTS)

The student will carry out a small research project around an already defined problem. All students of a given cohort will jointly organize a symposium in which they will present their individual small research projects. The supervisor of the project and the coordinator of this component of the curriculum will jointly determine the mark obtained.

The course also provides lectures and workshops on academic skills, such as lab-journal keeping, oral presentation skills, and the organization of a scientific symposium. For the lectures and workshops on academic skills attendance and in-class participation is obligatory.

g. Master thesis project, incl. lecture on transferable academic skills

(NS200, 45 ECTS)

The student will carry out a substantial research project. This is the final degree project.

The course also provides a lecture on academic skills associated with the planning and time-management of a research project. For this lecture attendance and in-class participation is obligatory.

h. PhD research proposal, incl. lecture on academic skills

(NS202, 6 ECTS)

The student will write a proposal for a PhD project, based on the form required by Dutch funding agencies like NWO (division of Physical Sciences or Chemical Sciences). It is not necessary that the students actually intend to carry out this project themselves. The component is supervised by an examiner of the programme. The supervisor and the coordinator of this component will jointly determine the mark obtained. If requested to, and approved by the coordinator of this component before writing the proposal, a student can work with an external supervisor when this ensures good supervision given the topic of the proposal.

The course also provides a lecture on academic skills how to present and write a research proposal. For this lecture attendance and in-class participation is obligatory.

i. Elective courses (at least 14 ECTS)

The student must follow elective course with a summed weight of at least 14 ECTS (Appendix IV).



Note on having sufficient diversity in the topics of the individual projects, and the choice of electives:

The review paper (sub e), the small research project (sub f), and the MSc thesis project (sub g) cannot be on the same topic nor supervised by the same person. The three topics must be a diverse choice from the research topics that are present in the Zernike Institute for Advanced Materials (incl. associate members). The choice of electives (sub i) must support the choice of topics for the individual projects (sub e,f,g), in particular the MSc thesis project. Whether the choices of a student meet these criteria must be assessed and approved by the Board of Examiners well before the completion of these parts of the programme (where possible before the start). Exceptions are only possible with clarified motivation and explicit written approval from the Board of Examiners.

Course unit name	ECTS	Practical	Entry requirements	Mode of assessment
NS000 Guided self-study in Nanoscience	6	No		WE (or OR)
NS001 Core module Preparation of nanomaterials and devices	8	Yes	NS000	WE (or OR), PR, R
NS002 Core module Characterization of nanomaterials and devices	9	Yes	NS000	WE (or OR), PR, R
NS003a Core module Properties of nanomaterials and devices	13	Yes	NS000	WE (or OR), OR, PR, R, ATT
NS190 Review paper	6	No	NS000	R, ATT, ALT*
NS194 Small research project and symposium	13	Yes	NS000	PR, P, ATT, ALT*
NS200 Master thesis project	45	Yes	NS000, NS190, NS194 and maximal one resit for one part of NS001, NS002, NS003A	PR, P, R, ALT*
NS202 PhD research proposal	6	No	NS000, NS190, NS194 and maximal one resit for one part of	R, ALT*



			NS001, NS002, NS003A	
Electives	14	See course catalogue Ocasys	NS000	See course catalogue Ocasys

The following types of assessments are distinguished :

- Written exam with open questions (WE)
- Written exam with multiple-choice questions (MC)
- Oral exam (OR)
- Report (R)
- Presentation (P)
- Interim test (IT)
- Assignment (AST)
- Practical work (PR)
- Mandatory Attendance (ATT) ; if a student is not present for the concerning module, the student has to do a replace assignment
- Other assessment mode to be specified (ALT)

ALT* In the assessment of these courses part of the grade is based on the student's performance during the project, on aspects that are specified on the grading form.

Appendix IV Electives (art. 3.7)

Electives from other master programmes

The student will spend at least 14 ECTS on electives, on topics related to nanoscience but not sufficiently covered by the Core Curriculum. The choice of electives requires consultation with the mentor and approval by the Board of Examiners. These electives are taken from master programmes at the University of Groningen in directly related disciplines (typically, but not limited to, the regular master programs in physics and chemistry); the examination method is determined by the Board of Examiners of these programmes. The study load in ECTS is determined by the Board of Examiners of the Top Master Programme in Nanoscience, and is normally about 20% lower than that in the regular master programmes.

The Board of Examiners may permit the student to select one or more course units from a wider range of programmes (from the University of Groningen or from another university). In such case, the Board of Examiners will determine the study load on ECTS of the course units.

A selection of recommended electives (with ECTS) are in the list below. Up-to-date information on the electives is presented on the website (online study guide) of the Programme and the associated web pages of the OCASYS system.

For information on the electives see the teaching and examination regulations of the corresponding programme.

Course unit name	ECTS
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Advanced product engineering	4
Advanced Protein Crystallography	4
Advanced Quantum Mechanics	4
Advances in Chemical Biology	4
Biomaterials 2	4
Chemical Catalysis	4
Computational physics	3
Computational Chemistry	4
Introduction to plasma physics	4
Interfacial engineering	4
Lie Groups in Physics	4
Many-particle systems	4
Mathematical methods of physics	4
MEMS, NEMS and Nanofabrication	4
Mesosopic physics	4
Micromechanics	4
Modern laser microscopy	4
Molecular quantum mechanics 1	4
Molecular quantum mechanics 2	4
Nanomedicine and nanosafety	3
Non-linear optics	4
Organic synthesis: methods and strategy 1	4
Organic synthesis: methods and strategy 2	4
Organometallic chemistry	4
Physical methods for chemical analysis	4
Physics of lasers	4
Polymer physics	4
Polymer products	4
Quantum field theory	4
Reaction Mechanisms	4
Statistical mechanics	4
Statistical methods in physics	4
Statistical signal processing	4
Stereochemistry	4
Structure determination with spectroscopic methods	4
Supramolecular chemistry	4
Surfaces and Interfaces	3
Synthetic Biology and Systems Chemistry	4
Theoretical condensed matter physics	4
Ultrafast time-resolved spectroscopy	4



Appendix V Entry requirements and compulsory order of examinations (art. 4.4)

The Guided Self-study has to be completed prior to participating in the remainder of the programme. Students must participate in the first-offered partial exams on their tasks in the Guided self-study (NS000) before the first lectures in the Core Curriculum. When a re-exam is needed for passing a part of the Guided self-study (NS000), the re-exam must be held and passed before the first partial exams of the Core Curriculum.

See Appendix III.



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**Appendix VI Admission to the degree programme and
 different tracks/specializations (art. 2.1.1 and 2.2)**

Not applicable.



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Appendix VII Transitional provisions (art. 7.1)

Not applicable.



Appendix VIII

Application deadlines for admission (art. 2.6.1)

Deadline of Application	Non-EU students	EU students
Nanoscience	February 1st 2019	May 1st 2019

Decision deadlines (art. 2.6.3)

Deadline of Decision	Non-EU students	EU students
Nanoscience	June 1st 2019	June 1st 2019



Appendix IX Selection criteria selective master's degree Nanoscience

Additional selection criteria, next to the entry requirements in article 2.1.

1. The additional admission requirements comprise:

- a bachelor's degree in chemistry, (applied) physics, materials science, or other field deemed relevant by the Admissions Board;
- sufficient knowledge of the relevant sciences;
- a suitable attitude, motivation and talent to follow the programme.

2. Students apply to the admission procedure by submitting the following documents:

- a complete curriculum vitae;
- a survey of the study results attained in academic courses so far;
- a letter in which the student states why (s)he wants to follow this programme in particular, what her/his expectations and ambitions are;
- (if desired) results of former research projects, like reports or articles;
- two or three letters of recommendation from scientists or academic lecturers who are also willing to provide personal information on the applicant;
- (if desired) other documents that the student thinks are useful in furthering his/her application.

These documents are to be sent to the University of Groningen in a manner that is specified on the webpages associated with the programme, by the specified deadline, preceding the start of the programme.

3. The Admissions Board judges the student's fulfilment of the requirements. Part of the judgment is an interview with a scientific presentation.

4. Students who meet the requirements are provided with an admission letter by the Admission Board.

Students in possession of an admission letter can be admitted to the programme.

An admission letter is only valid for the academic year following the academic year in which the letter is granted.

There may be other conditions attached to the admission letter. The requirements must be met before the programme has started.