Assessment plan of the Top Master degree programme in Nanoscience 2022-2023

Introduction

This assessment plan is a systematic description of the testing and assessment modes for all study components in the curriculum of the Top Master degree programme in Nanoscience, 2022-2023.
The plan is based on the assessment policy of the Faculty of Science and Engineering, as set out in the FSE Quality Assurance Manual and the protocol setting out the duties and powers of the Faculty's Board of Examiners (*FSE Protocol Board of Examiners).*
Faculty documents about the Quality Assurance Policy can be found through the following link: https://myuniversity.rug.nl/infonet/medewerkers/fse/education/policy-quality-education/quality-assurance-policy.

The assessment plan for the curriculum consists of the following parts:

1. Objective(s) of the degree programme.
2. The learning outcomes of the degree programme.
3. Descriptions of the course units, as set out in the appendices to the Teaching and Examination Regulations 2022-2023 of the degree programme.
4. Descriptions of the content of each course unit in Ocasys, the online course catalogue. The following elements are relevant in this context:
    - objectives;
    - description of content;
    - lecturers;
    - assessment mode(s) and calculation of final mark;
    - mode(s) of instruction.
5. An overview of the examiners and a detailed assessment mode for each course unit. This overview is based on the curriculum approved by the Programme Committee, as set out in the appendices to the Teaching and Examination Regulations 2022-2023 for the degree programme.
6. A matrix showing the relationship between the course units and the detailed learning outcomes for each competence area.

Parts 3 and 4 are not included in this document. For the descriptions of the course units, see the Appendices to the Teaching and Examination Regulations 2022-2023 for the Top Master degree programme in Nanoscience. Descriptions of the content of each course unit can be found in Ocasys, the online course catalogue (https://www.rug.nl/ocasys/rug/vak/showpos?opleiding=4100).

1. Objectives of the degree programme

A brief description of the mission and objective of the degree programme. These are found in the Critical Self-Reflection (Standard 1 of the limited degree programme assessment) Nanoscience 2018.

Domain-specific requirements

The Master's degree programme in Nanoscience has been conceived by active world-class researchers in Nanoscience to convey to the students the knowledge, skills, attitude, and ethics needed for an independent research career in the field of Nanoscience. On the international scene, students with such Nanoscience/Nanotechnology background are in high demand[1]. The highly interdisciplinary nature of Nanoscience comprising parts of chemistry, physics and aspects of molecular biology, all present at the Zernike Institute NRC, forms an integral part of its research approach and is reflected in the curriculum of the programme. The curriculum prepares the students for understanding the entire chain of research starting from design, through synthesis, device building, characterization, investigation of the theoretical foundation and feedback to the design process.

2. Learning outcomes of the degree programme

As set out in the appendices to the Teaching and Examination Regulations of the Top Master Nanoscience for 2022-2023:

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.

[1] See for example: http://www.bioin.or.kr/InnoDS/data/upload/tech/1191845407000.pdf http://www.sciencemag.org/careers/2007/09/skills-survey-highlights-varied-needs-nanotech-industry https://pubs.acs.org/doi/pdf/10.1021/acsnano.6b03872

3. Overview of examiners and testing and assessment modes for course units

Course unit name	**ECTS**	**Practical**	**Examiner(s) (*second examiner(s)*)**	**Mode of assessment**	**Changes in case of online exams.**
WMNS003-06 Guided self-study in Nanoscience	6	No	Coordinator: G.R. Blake Part Quantum Physics: C. H. van der Wal (*G.R. Blake*) Part Solid-Phase physics: J. Ye (*M.A. Loi*) Part Organic chemistry: T.L.C. Jansen (*S. Otto*) Part Inorganic Chemistry: G. R. Blake (*B. Noheda*),	All parts: WE. For resit: eventually OR instead of WE, depending on the number of students.	WE will be adjusted to online WE (or online OR for resit if applicable)
Core module WMNS008-10 Preparation of Nanomaterials and Devices	10	Yes	Coordinator: T. Banerjee Part 1, Design of Biomimetic Materials, M.M.G. Kamperman/N.H. Katsonis (*N.H. Katsonis/M.M.G. Kamperman*) Part 2, Thin-film growth, T. Banerjee (*B.J. van Wees*), Part 3, Preparation of inorganic devices, B.J. van Wees (*C.H. van der Wal*), Part 4, Preparation of solution processable devices, M.A. Loi (*L.J.A. Koster*), Part 5, Ordered molecular structures, S. Otto, *(N.H. Katsonis)*	Part 1: WE Part 2: PR, R Part 3: PR, R Part 4: PR, R Part 5: WE Part 1 and 5: Eventually OR instead of WE for resit depending on the number of students.	WE will be adjusted to online WE (or online OR for resit if applicable);
Core module WMNS009-08 Characterization of nanomaterials and Devices	8	Yes	Coordinator: B.J. Kooi Part 1, Surface and Single Molecule Techniques, W.H. Roos (*R. Vlijm*) Part 2, X-ray Diffraction, G. R. Blake/G. Portale (*B. Noheda*) Part 3, Optical Spectroscopy, R. Hildner (*M. S. Pchenitchnikov*) Part 4, Electron Microscopy, B. J. Kooi (*G.R. Blake*)	Part 1: WE, PR, R Part 2: WE, PR Part 3: WE, PR, R Part 4: WE, PR All parts: Eventually OR instead of WE for resit depending on the number of students.	For part 1, 2 and 4: WE will be adjusted to online WE (or online OR for resit if applicable); For part 3: WE will be adjusted to online OR
Core module WMNS010-11 Fundamental and functional properties of Nanomaterials and Devices	11	Yes	Coordinator: R.W.A. Havenith Part 1, Electronic Structure Properties, R.W.A. Havenith (*T.L.C. Jansen*), Part 2, Surfaces and Interfaces, G. Portale (*P. Rudolf*), Part 3, Electronic Transport Properties of Organic and Hybrid Materials and Devices, M.A. Loi (*L.J.A. Koster*), Part 4, Electronic Transport Properties of Inorganic Materials and Devices, B.J. van Wees (*C.H. van der Wal*),	Part 1: WE, PR Part 2: WE Part 3: OR Part 4: WE Part 5: WE Part 6: WE Part 7: WE TV-lectures: ATT	WE will be adjusted to online WE (or online OR for resit if applicable); OR will be adjusted to online OR;

			Part 5, Nanomedicine, A. Salvati/P.H.C. Aberg (*P.H.C. Aberg, A. Salvati)*, Part 6, Optical Properties, M.S. Pchenitchnikov (*T.L.C. Jansen*), Part 7, Magnetic Properties, J. Ye (*G.R. Blake*), Guest-lectures (TV-lectures in collaboration with Osaka University)		
WNMS011-06 Review paper	6	No	Coordinator: P.R. Onck Part ethics/scientific integrity: T. Banerjee Part literature search, academic writing: *M.S. Pchenitchnikov* *Various staff members for individual guidance*	R, ATT, ALT*	
WMNS007-13 Small research project and symposium	13	Research/ Yes	Coordinator: C.H. van der Wal Part lab journal: C.H. van der Wal Part oral presentations: M.H. Guimaraes Part Organization of scientific symposium: C.H. van der Wal *Various staff members for individual guidance*	PR, P, ATT, ALT*	
WMNS901-45 Master thesis project	45	Research/ Yes	Coordinator T.L.C. Jansen Part planning, time-management: T.L.C. Jansen *Various staff members for individual guidance*	PR, R, P, ALT*	
WMNS012-06 PhD Research proposal	6	No	Coordinator S.S. Faraji Part presentation and writing research proposal: S.S. Faraji *Various staff members for individual guidance*	R, ALT*	
Electives	15	See the Ocasys course descriptions of the electives and the assessment plan of the responsible degree programme. The electives are chosen from other degree programmes.			
Electives from other master degree programmes The students must choose at least three elective courses at master level (15 ECTS) that have relevance for their personal study programme, in particular in relation with the MSc thesis project. The electives are typically chosen from the master programmes of (Applied) Physics and Chemistry, but can also come from any other master programme of the Faculty of Science and Engineering. Before participating in these electives, the student must discuss and develop the choice with her/his mentor (staff member), and subsequently get it approved by the programme management. Before starting the Master Thesis (WMNS901-45) course, the students also ask approval from the supervisor of the master thesis. A list with approved electives is part of the Appendices of the Teaching and Examination Regulations for the Top Master Nanoscience and published on Ocasys for the students.					

Examples of assessment modes include:

- *Written exam with open questions (WE)*
- *Written exam with multiple-choice questions (MC)*
- *Oral exam (OR)*
- *Report (R)*
- *Presentation (P)*
- *Interimtest (IT)*
- *Assignment (AST)*
- *Practical work (PR)*
- *Other assessment mode to be specified (ALT)*
- *Mandatory Attendance (ATT)*

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.

4. Relationship between course units and details of the learning outcomes[2]

The numbering of columns 1 to 13 refers to the 13 learning outcomes that are listed in section 2, on page 2 of this assessment plan.

	1	2	3	4	5	6	7	8	9	10	11	12	13
WMNS003-06 Guided self-study				**X**		**X**							
WMNS008-10 Core module Preparation				**X**		**X**		x	x				
WMNS009-08 Core module Characterization				**X**		**X**		x	x				
WMNS010-11 Core module Properties				**X**		**X**		x	x				
WMNS011-06 Review Paper	x	x	**X**	x		**X**	**X**		**X**	**X**	x	x	**X**
WMNS007-13 Small Research Project	**X**	x	**X**		**X**	x	x	**X**	**X**	**X**	**X**	x	**X**
WMNS901-45 Master Thesis	**X**	**X**	x		**X**	x	**X**	**X**	**X**	**X**	**X**	**X**	**X**
WMNS012-06 PhD Research Proposal	x	**X**	x		**X**	x	**X**		**X**	**X**		**X**	**X**
Electives				**X**		x							

This table shows the relationship between the learning outcomes and the course units of the curriculum.

[2] **X**: makes an essential or advanced contribution to the specified learning outcome; x: makes an introductory or partial contribution to the specified learning outcome

5. List of Examiners for the Top Master Nanoscience containing

- **a. supervisors (examiners) for individual projects (WMNS011-06, WMNS007-13, WMNS012-06, WMNS901-45) for 2022-2023;**
- **b. and lecturers teaching in the Nanoscience curriculum.**

UTQ = University Teaching Qualification

1. Staff at Research groups of Zernike Institute for Advanced Materials

Staff	**Research group** **Zernike Institute for Advanced Materials**	**UTQ**
Banerjee, T.	Spintronics of Functional Materials	Yes
Blake, G.R.	X-ray/Neutron Scattering and Spectroscopy	Yes
Broer-Braam, H.B.	Theoretical Chemistry	Yes/Emeritus
Chicca, E.	Bio-inspired Systems & Circuits	In progress
Faraji, S.S.	Theoretical & Computational Chemistry	Yes
Giessen van der, E.	Micromechanics	Yes
Giuntoli, A.	Micromechanics	In progress
Grubisic-Cabo, A.	Surfaces and Thin Films	In progress
Guimaraes, M.H.	Opto-spintronics of Nanostructures	Yes
Hildner, R.	Optical Spectroscopy of Functional Nanosystems	Yes
Hoekstra, R.A.	Quantum Interactions and Structural Dynamics	Yes
Jansen, T.L.C.	Computational Spectroscopy	Yes
Kamperman, M.M.G.	Polymer Science	Yes
Knoester, J.	Theory of Condensed Matter	Exempt
Kooi, B.J.	Nanostructured Materials and Interfaces	Yes
Koster, L.J.A.	Physics of Novel Semiconductors and Devices	Yes
Loi, M.A.	Photophysics and Opto-Electronics	Yes
Loos, K.U.	Macromolecular Chemistry and New Polymeric Materials	Yes
Maniar, D.	Polymer-based composite materials	In progress
Mostovoy, M.V.	Theory of Condensed Matter	Yes

Noheda, B	Nanostructures of Functional Oxides	Yes
Ocelik, V.	Microstructural characterization of Materials	In progress
Onck, P.R.	Micromechanics of Biological and Active Materials	Yes
Palasantzas, G.	Surface Interactions and Nanostructures	Yes
Pchenitchnikov, M.S.	Ultrafast Dynamics in Molecular Systems	Yes
Portale, G.	Physical Chemistry of Polymeric and Nanostructured Materials	Yes
Protesescu, L.	Nanomaterials Chemistry	In progress
Roos, W.H.	Molecular Biophysics	Yes
Rudolf, P.	Surfaces and Thin Films	Yes
Schlathölter, T.A.	Gas Phase Biomolecules and Energetic Interactions	Yes
Slawinska, J.L.	Computational Materials Science	In progress
Stöhr, M.A.	Surface Science	Yes
Tromp, M.	Materials Chemistry	Yes
Vlijm, R.	Molecular & Cellular Scale Biophysics	In progress
Wal, C.H. van der	Quantum Devices	Yes
Wees, B.J. van	Physics of Nanodevices	Yes
Wel, P.C.A. van der	Solid-state Nuclear Magnetic Resonance	In progress
Ye, J.	Device Physics of Complex Materials	Yes

2. Associate members from Research Groups Stratingh Institute of Chemistry (Stratingh)

Staff	**Research Group**	**UTQ**
Browne, W.R.	Molecular Inorganic Chemistry	Yes
Chiechi, R.C.	(Bio) Organic Materials and Devices	Yes
Feringa, B.L.	Synthetic Organic Chemistry	Exempt
Harutyunyan, S.	Homogeneous Catalysis	Yes
Havenith, R.W.A.	(Bio) Organic Materials and Devices	Yes
Katsonis, N.H.	Active Molecular Systems	Yes
Klein, J.E.M.N.	Molecular Inorganic Chemistry	Yes
Kudernac, T.	Molecular Inorganic Chemistry	Yes (via University of Twente)

Minnaard, A.J.	Chemical Biology 2	Yes
Otten, E.	Molecular Inorganic Chemistry	Yes
Otto, S.	Systems Chemistry	Yes
Roelfes, J. G.	Biomolecular Chemistry & Catalysis	Yes

3. Associate members from Research Groups Biomolecular Sciences and Biotechnology Institute (GBB)

Staff	**Research group**	**UTQ**
Driessen, A.J.M.	Molecular Microbiology	Not completed
Marrink, S.J.	Molecular Dynamics	Yes
Poolman, B.	Membrane Enzymology	Yes
Slotboom, D.J.	Membrane Enzymology	Yes
Vries, de A.H.	Molecular Dynamics	Yes

4. Long-term research associates, but not listed above

Staff	**Research Institute**	**UTQ**
Aberg, P.H.C.	Groningen Research Institute of Pharmacy, lecturer in Nanoscience core modules	Yes
Jaeger, H.	Bernoulli Institute for Mathematics, Computer Science and Artificial Intelligence; Note: only second examiner for research projects related to computing in cognitive materials	Yes
Pei, Y	Engineering and Technology Institute Groningen; Note: only second examiner for research projects related to advanced production engineering	Yes
Pescarmona, P.P.	Engineering and Technology Institute Groningen; research group Catalysis & Sustainability.	Yes
Rijn, van P.	Faculty of Medical Sciences; Note: only second examiner for research projects related to Nanobiotechnology and Advanced Therapeutic Materials	Yes
Salvati, A.	Groningen Research Institute of Pharmacy, lecturer in Nanoscience core modules	Yes
Stuart, M.C.A.	Stratingh Institute for Chemistry; Note: only second examiner for research projects regarding advanced software TEM characterization	No, not applicable; Stuart is facility manager electronmicroscopy.

Taatgen, N.A.	Bernoulli Institute; Note: only second examiner for research projects regarding to artificial intelligence	Yes
Timmermans, R.G.E.	Van Swinderen Institute; Note: only second examiner for research projects regarding theoretical physics	Yes