Programme-specific Section of the Curriculum for the MSc Programme in

Nanoscience

at the Faculty of Science, University of Copenhagen

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1 Title, affiliation and language

A shared section that applies to all BSc, part-time MSc and MSc Programmes at the Faculty of Science is linked to this programme-specific curriculum.

1.1 Title

The MSc Programme in Nanoscience leads to a Master of Science (MSc) in Nanoscience with the Danish title: *Cand.scient. (candidatus/candidata scientiarum) i nanoscience*.

1.2 Affiliation

The programme is affiliated with the Study Board of Physics, Chemistry and Nanoscience, and the students can both elect, and be elected, to this study board.

1.3 Corps of external examiners

The following corps of external examiners is used for the central parts of the MSc Programme:

- Corps of External Examiners for Chemistry (*kemi*)
- Corps of External Examiners for Physics (*fysik*)
- Corps of External Examiners for Biology (*biologi*)

1.4 Language

The language of this MSc Programme is English.

2 Academic profile

2.1 Purpose

The MSc Programme in Nanoscience is an interdisciplinary programme aimed at improving students' ability to cope with the concepts and methods used in science and nanotechnology. The programme is open to students from a wide variety of basic science subjects, including physics, chemistry, and biology, and from bachelor programmes in Nanoscience.

The programme aims to give each student a high degree of freedom in terms of their choice of which interfaces between the basic subjects they wish to focus on. Masters of Nanoscience possess in-depth knowledge of the methodology used in all of these disciplines and has used them in tangible, often collaborative projects involving colleagues from other disciplines.

2.2 General programme profile

Nanoscientists are able to liaise between specialists in, e.g. physics and biology, and communicate technical and conceptual subjects to interdisciplinary teams. In particular, Masters of Nanoscience have a keen eye for new and unconventional uses of scientific techniques and methodology, based on the many real-life examples contained within the programme.

Nanoscience is the key subject area of the programme.

2.3 General structure of the programme

The MSc Programme is set at 120 ECTS.

There are no defined specialisations in this programme.

2.4 Career opportunities

The MSc Programme in Nanoscience qualifies students to become professionals within business functions and/or areas such as:

- A PhD programme
- The private sector, farmaceutical companies, high-tech companies and consulting companies
- The public sector, University, Sector research institutes

3 Description of competence profiles

Students following the MSc Programme acquire the knowledge, skills and competences listed below. Students will also acquire other qualifications through elective subject elements and other study activities.

3.1 Competence profile

Graduates holding an MSc in Nanoscience have acquired the following:

Knowledge about:

- Appropriate methods and theories within selected areas of active research.
- How to conduct research in an area of specialization at an international level under supervision.

Skills in/to:

- Processing and analysing data.
- Setting up and analysing theoretical models.
- Reading and understanding original academic literature.
- Using the subject's main databases.
- Explaining nanoscience projects, both orally and in writing.

Competences in/to:

- Formulate, structure and manage a research project involving the development and application of the subject's methodology.
- Manage complex work and development situations in collaboration with other groups of experts.
- Identify and summarize the available knowledge in a given field of nanoscience.
- Evaluate the methodology use in nanoscience, its applications and its limitations.
- Discuss the subject's methods, theory and results, both in general and on a scientific level.
- Discuss the application of the subject's results in an industrial, social and ethical context in an academic manner.
- Apply nanoscience methods and techniques to develop green and sustainable technologies.
- Take independent responsibility for their own academic development and specialization.

4 Admission requirements

4.1 Bachelor's degrees that automatically fulfil the academic requirements

Applicants with one of the following Bachelor's degrees automatically fulfil the academic requirements for admission to the MSc Programme in Nanoscience:

- Nanoscience (*nanoscience*) from University of Copenhagen (reserved access)
- Nanoscience from Aarhus University

4.2 Other Bachelor's degrees

Applicants with a Bachelor's degree, Professional Bachelor's degree or equivalent from Danish or international universities other than those listed in 4.1 are qualified for admission to the MSc Programme in Nanoscience if the programme includes the following:

- A minimum of 30 ECTS within introductory physics (electromagnetism and quantum theory).
- A minimum of 30 ECTS within introductory chemistry (organic, inorganic and physical).

The elements must account for a total of min. 90 ECTS.

4.3 Other applicants

The Faculty may also admit applicants who, after an individual academic assessment, are assessed to possess educational qualifications equivalent to those required in Subclauses 4.1-2.

4.4 Language requirements

Applicants must be able to document English proficiency corresponding to one of the following:

- upper secondary school degree, bachelor's degree or master's degree in English from Australia, Canada, Ireland, New Zealand, United Kingdom or USA.
- Nordic entrance examination with an English level comparable to the Danish level B or higher
- International Baccalaureate (IB) from an international school
- European Baccalaureate (EB) from one of the approved schools
- English B or A as Single Subject Course in Denmark
- Abiturzeugnis from Germany
- IELTS test score of minimum 6.5
- TOEFL test score of minimum 83
- Cambridge Advanced English (CAE) or Cambridge English: Proficiency (CPE) passed at level C1 or C2

4.5 Supplementary subject elements

The qualifications of an applicant to the MSc programme are assessed exclusively on the basis of the qualifying Bachelor's degree. Supplementary subject elements passed between the completion of the Bachelor's programme and the admission to the MSc programme cannot be included in the overall assessment.

However, subject elements passed before the completion of the Bachelor's programme may be included in the overall assessment. This includes subject elements completed as

continuing education as well as subject elements completed as part of a former higher education programme. A maximum of 30 ECTS supplementary subject elements can be included in the overall assessment.

Subject elements passed before completing the Bachelor's programme which are to form part of the MSc programme to which the student has a legal right of admission (§15-courses) cannot be included in the overall assessment.

5 Prioritisation of applicants

With a Bachelor's degree in Nanoscience from University of Copenhagen the student is granted reserved access and guaranteed a place on the MSc Programme in Nanoscience if the student applies in time to begin the MSc Programme within three years of the completion of the Bachelor's degree.

If the number of qualified applicants to the programme exceeds the number of places available, applicants will be prioritised according to the following criteria:

- Total number of ECTS in relevant courses*
- Grades in relevant courses*

*Relevant courses include courses in introductory physics (electromagnetism and quantum theory) and introductory chemistry (organic, inorganic and physical).

6 Structure of the programme

The compulsory subject elements, restricted elective subject elements and the thesis constitute the central parts of the programme (Section 30 of the Ministerial Order on Bachelor and Master's Programmes (Candidatus) at Universities).

6.1 Programme components

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 7.5 ECTS
- Restricted elective subject elements
    - 37.5 ECTS (thesis, 45 ECTS)
    - 22.5 ECTS (thesis, 60 ECTS)
- Elective subject elements, 30 ECTS
- Thesis, 45 or 60 ECTS

6.1.1 Compulsory subject elements

The following subject element is to be covered (7.5 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NKEK12008U	Structural Tools in Nanoscience	Block 1	7.5 ECTS

6.1.2 Restricted elective subject elements

37.5 ECTS are to be covered as subject elements from the following list (thesis 45 ECTS): 22.5 ECTS are to be covered as subject elements from the following list (thesis 60 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK15006U	Biophysics of Cells and Single Molecules	Block 1	7.5 ECTS
NFYK18005U	Complex Physics	Block 1	7.5 ECTS
NDAA07012U	Scientific Computing	Block 1	7.5 ECTS
NKEA09010U	Scientific Writing, Planning and Presentation	Block 1	7.5 ECTS
NKEA07016U	Computational Chemistry	Block 1+2	15 ECTS
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7.5 ECTS
NFYB10021U	Condensed Matter Physics 2 (CMP2)	Block 2	7.5 ECTS
NKEA06015U	Crystallography - MSc	Block 2	7.5 ECTS
NBIK17001U	Dynamical Models in Molecular Biology	Block 2	7.5 ECTS
NFYK23005U	Physical Implementations of Quantum Information Processing	Block 2	7.5 ECTS
NFYK13013U	Experimental X-ray Physics	Block 3	7.5 ECTS
NFYK24003U	Quantum Nanoelectronics	Block 3	7.5 ECTS
NBIK22004U	Integrative Structural Biology	Block 3+4	15 ECTS
NKEK22000U	Advanced Fluorescence Spectroscopy and Microscopy	Block 4	7.5 ECTS
NFYK20002U	Applied Machine Learning	Block 4	7.5 ECTS
NFYK13021U	Neutron Scattering	Block 4	7.5 ECTS
NFYK14009U	Physics of Molecular Diseases	Block 4	7.5 ECTS

6.1.3 Elective subject elements

30 ECTS are to be covered as elective subject elements.

- All subject elements at MSc level may be included as elective subject elements in the MSc Programme.
- BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.
- Projects. See 6.1.4 Projects.

6.1.4 Projects

Projects outside the course scope (PUK), projects in practice (PIP) and thesis preparation projects (PREP) may not exceed 30 ECTS of the programme.

- PUK may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.
- PIP may be included in the elective section of the programme with 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum.
- PREP may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 6 to the shared section of the curriculum.

6.1.5 Thesis

The MSc Programme in Nanoscience includes a thesis corresponding to 45 ECTS or 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.1.6 Academic mobility

The curriculum makes it possible to follow subject elements outside the Faculty of Science.

For students admitted in September the academic mobility for the MSc Programme in Nanoscience (thesis 45 ECTS or 60 ECTS) is placed in block 3+4 of the 1st year.

For students admitted in February the academic mobility for the MSc Programme in Nanoscience (thesis 45 ECTS or 60 ECTS) is placed in block 3+4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition, the student has the possibility to arrange similar academic mobility in other parts of the programme.

7 Exemptions

In exceptional circumstances, the study board may grant exemptions from the rules in the curriculum specified solely by the Faculty of Science.

8 Commencement etc.

8.1 Validity

This subject specific section of the curriculum applies to all students enrolled in the programme – see however Appendix 2.

8.2 Transfer

Students enrolled on previous curricula may be transferred to the new one as per the applicable transfer regulations or according to an individual credit transfer by the study board.

8.3 Amendment

The curriculum may be amended once a year so that any changes come into effect at the beginning of the academic year. Amendments must be proposed by the study board and approved by the Dean.

Notification about amendments that tighten the admission requirements for the programme will be published online at science.ku.dk one year before they come into effect.

If amendments are made to this curriculum, an interim arrangement may be added if necessary to allow students to complete their MSc Programme according to the amended curriculum.

Appendix 1 The recommended academic progression

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Tables for students admitted to the programme in September (summer):

Table – MSc Programme in Nanoscience (thesis 60 ECTS)

Period	Block 1	Block 2	Block 3	Block 4
1st year	Structural Tools in Nanoscience	Restricted elective	Restricted elective	Restricted elective
	Elective	Elective	Elective	Elective
2nd year	Thesis			

Table – MSc Programme in Nanoscience (thesis 45 ECTS)

Period	Block 1	Block 2	Block 3	Block 4
1st year	Structural Tools in Nanoscience	Restricted elective	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Elective	Thesis		
	Elective			

Tables for students admitted to the programme in February (winter):

Table – MSc Programme in Nanoscience (thesis 60 ECTS)*

Period	Block 3	Block 4	Block 1	Block 2
1st year	Restricted elective	Restricted elective	Structural Tools in Nanoscience	Restricted elective
	Elective	Elective	Elective	Elective
2nd year	Thesis			

*This table is only relevant for students who begin the MSc Programme in February (block 3)

Table – MSc Programme in Nanoscience (thesis 45 ECTS)*

Period	Block 3	Block 4	Block 1	Block 2
1st year	Restricted elective	Restricted elective	Structural Tools in Nanoscience	Restricted elective
	Elective	Elective	Restricted elective	Restricted elective
2nd year	Elective	Thesis		
	Elective			

*This table is only relevant for students who begin the MSc Programme in February (block 3)

Appendix 2 Interim arrangements

The Shared Section of the BSc and MSc Curricula for Study Programmes applies to all students.

The interim arrangements below only consist of parts where the current curriculum differs from the rules and regulations that were previously valid. Therefore, if information about relevant rules and regulations are missing, it can be found in the curriculum above.

1 General changes for students admitted in the academic year 2024/25

Students admitted to the MSc Programme in the academic year 2024/25 must finish the programme as listed in the curriculum above with the following exceptions.

Restricted elective subject elements

37.5 ECTS are to be covered as subject elements from the following list (thesis 45 ECTS): 22.5 ECTS are to be covered as subject elements from the following list (thesis 60 ECTS):			
Restricted elective subject elements offered in this curriculum (see above)			
NIGK22003U	Plant-based Materials: Structure and Performance from Nano to Macro Scale	Discontinued*	7.5 ECTS

*See discontinued courses below.

2 General changes for students admitted in the academic year 2023/24

Students admitted to the MSc Programme in the academic year 2023/24 must finish the programme as listed in the curriculum above with the following exceptions.

Restricted elective subject elements

37.5 ECTS are to be covered as subject elements from the following list (thesis 45 ECTS): 22.5 ECTS are to be covered as subject elements from the following list (thesis 60 ECTS):			
Restricted elective subject elements offered in this curriculum (see above)			
NFYK12005U	Nanophysics 1 - Quantum Electronics	Discontinued*	7.5 ECTS
NIGK22003U	Plant-based Materials: Structure and Performance from Nano to Macro Scale	Discontinued*	7.5 ECTS

*See discontinued courses below.

3 General changes for students admitted in the academic year 2022/23

Students admitted to the MSc Programme in the academic year 2022/23 must finish the programme as listed in the curriculum above with the following exceptions.

Restricted elective subject elements

37.5 ECTS are to be covered as subject elements from the following list (thesis 45 ECTS): 22.5 ECTS are to be covered as subject elements from the following list (thesis 60 ECTS):			
Restricted elective subject elements offered in this curriculum (see above)			
	Project in Practice**	Block 1-5	15 ECTS
NFYK12005U	Nanophysics 1 - Quantum Electronics	Discontinued*	7.5 ECTS
NIGK22003U	Plant-based Materials: Structure and Performance from Nano to Macro Scale	Discontinued*	7.5 ECTS

*See discontinued courses below.

**The exam must be assessed with a grade from the 7-point grading scale.

4 General changes for students admitted in the academic year 2021/22

Students admitted to the MSc Programme in the academic year 2021/22 must finish the programme as listed in the curriculum above with the following exceptions.

Table – MSc Programme in Nanoscience (thesis 60 ECTS)

Period	Block 1	Block 2	Block 3	Block 4
1st year	*Unifying Concepts of Nanoscience*		Restricted elective	Restricted elective
	Elective	Elective	Elective	Elective
2nd year	Thesis			

Subject elements in italics have been discontinued. See discontinued courses below.

Table – MSc Programme in Nanoscience (thesis 45 ECTS)

Period	Block 1	Block 2	Block 3	Block 4
1st year	*Unifying Concepts of Nanoscience*		Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Elective	Thesis		
	Elective			

Subject elements in italics have been discontinued. See discontinued courses below.

Table – MSc Programme in Nanoscience (thesis 60 ECTS)*

Period	Block 3	Block 4	Block 1	Block 2
1st year	Restricted elective	Restricted elective	*Unifying Concepts of Nanoscience*	
	Elective	Elective	Elective	Elective
2nd year	Thesis			

*This table is only relevant for students who begin the MSc Programme in February (block 3)
Subject elements in italics have been discontinued. See discontinued courses below.

Table – MSc Programme in Nanoscience (thesis 45 ECTS)*

Period	Block 3	Block 4	Block 1	Block 2
1st year	Restricted elective	Restricted elective	*Unifying Concepts of Nanoscience*	
	Elective	Elective	Restricted elective	Restricted elective
2nd year	Elective	Thesis		
	Elective			

*This table is only relevant for students who begin the MSc Programme in February (block 3)
Subject elements in italics have been discontinued. See discontinued courses below.

Restricted elective subject elements

30 ECTS are to be covered as subject elements from the following list (thesis 45 ECTS): 15 ECTS are to be covered as subject elements from the following list (thesis 60 ECTS):			
Restricted elective subject elements offered in this curriculum (see above)			
Course Code	**Course Title**	**Block**	**ECTS**
NKEK12008U	Structural Tools in Nanoscience**	Block 1	7.5 ECTS
	Project in Practice***	Block 1-5	15 ECTS
NKEK13018U	Advanced Photochemistry	Discontinued*	7.5 ECTS
NKEK13019U	Molecular Electronics Theory	Discontinued*	7.5 ECTS
NFYK12005U	Nanophysics 1 – Quantum Electronics	Discontinued*	7.5 ECTS
NIGK22003U	Plant-based Materials: Structure and Performance from Nano to Macro Scale	Discontinued*	7.5 ECTS
NKEK13009U	Protein Structure and Function	Discontinued*	7.5 ECTS

*See discontinued courses below.
**If the compulsory subject element Unifying Concepts of Nanoscience has not been passed, this course must be passed instead. See discontinued courses below.
***The exam must be assessed with a grade from the 7-point grading scale.

5 Discontinued courses

Course Code	Course Title	ECTS	Interim arrangement
NKEK13018U	Advanced Photochemistry	7.5	The course was restricted elective in the academic year 2021/22 and earlier. Offered for the last time: 2021/22 Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23
NKEK13019U	Molecular Electronics Theory	7.5	The course was restricted elective in the academic year 2021/22 and earlier. Offered for the last time: 2021/22 Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23
NFYK12005U	Nanophysics 1 - Quantum Electronics	7.5	The course was restricted elective in the academic year 2023/24 and earlier. Offered for the last time: 2021/22 The course is identical to Quantum Nanoelectronics (NFYK24003U), 7.5 ECTS.
NIGK22003U	Plant-based Materials: Structure and Performance from Nano to Macro Scale	7.5	The course was restricted elective in the academic year 2024/25 and earlier. Offered for the last time: 2024/25 Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2025/26

Course Code	Course Title	ECTS	Interim arrangement
NKEK13009U	Protein Structure and Function	7.5	The course was restricted elective in the academic year 2021/22 and earlier. Offered for the last time: 2021/22 Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23
NKEA07005U	Unifying Concepts in Nanoscience (UCN)	15	The course was compulsory in the academic year 2021/22 and earlier. Offered for the last time: 2021/22 Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23 In this curriculum, Structural Tools in Nanoscience (NKEK12008U), 7.5 ECTS and a 7.5 ECTS restricted elective subject element replaces the course.

Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:

- How to identify scientific problems within the study programme's subject area.
- How to summarize a suitable combination of methodologies and theories based on international research for use in the work of problem formulation.
- How to discuss theories and models on the basis of an organized value system and with a high degree of independence.

Skills in/to:

- Apply and critically evaluate theories and methods including their applicability and limitations.
- Assess the extent to which the production and interpretation of findings/material depend on the chosen theory or method.
- Discuss academic issues arising from the thesis.
- Draw conclusions in a clear and academic manner in relation to the problem formulation.
- Discuss and communicate the academic and social significance, if any, of the thesis based on ethical principles.

If the thesis includes experimental content and own data production, the student will also be able to:

- Substantiate the idea of conducting experimenting in order to shed light on the topic as described in the problem formulation.
- Process data through a choice of academic analysis methods and present findings objectively and in a concise manner.
- Assess the credibility of own findings based on relevant data processing.

Competences in/to:

- Initiate and perform academic work in a research context.
- Solve complex problems and carry out development assignments in a professional context.