



# Programme-specific Section of the Curriculum for the MSc Programme in Nanoscience at the Faculty of Science, University of Copenhagen 2008 (Rev. 2021)

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## 1 Title, affiliation and language

A shared section that applies to all BSc 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 Chemistry, Physics 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

Nanoscience is 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, pharmaceutical 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

On completion of the programme, an MSc in Nanoscience has 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 subjects 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.
- Take independent responsibility for their own academic development and specialization.

## 4 Admission requirements

With a Bachelor's degree in Nanoscience from the 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.

### 4.1 Applicants with a Bachelor's degree in Nanoscience

Applicants with a Bachelor's degree in Nanoscience from the University of Copenhagen, other Danish or Nordic universities are directly academically qualified for admission to the MSc Programme.

### 4.2 Applicants with a related Bachelor's degree

Applicants with a Bachelor's degree in Biochemistry, Physics, Chemistry, Molecular Biology, Material Science or Natural Science and IT with a specialisation in Physics or Chemistry or related areas from the University of Copenhagen or other Danish or international universities may also be admitted if their 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 and inorganic).

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 deemed to possess educational qualifications equivalent to those required in Subclauses 4.1-2.

### 4.4 Language requirements

Applicants must as a minimum document English language qualifications comparable to a Danish upper secondary school English B level or English proficiency corresponding to the tests and scores required. Accepted tests and required minimum scores are published online at [www.science.ku.dk](http://www.science.ku.dk).

### 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 BSc programme which are to form part of the MSc programme to which the student has a legal right of admission (§12-courses) cannot be included in the overall assessment.

## 5 Prioritisation of applicants

If the number of qualified applicants to the programme exceeds the number of places available, applicants will be prioritised as follows:

- 1) Applicants with a Bachelor's degree in Nanoscience from the University of Copenhagen with reserved access to the programme.
- 2) Applicants with a Bachelor's degree in Nanoscience.
- 3) Other applicants.

If the number of qualified applicants within a category exceeds the number of places available, applicants will be prioritised according to the following criteria (listed below in prioritised order):

- Total number of ECTS within the relevant academic fields and the grades obtained.

## 6 Structure of the programme

The compulsory subject elements, restricted elective subject elements and the thesis constitute the central parts of the programme (Section 21 of the Ministerial Order on Bachelor and Master's Programmes (Candidatus) at Universities).

### 6.1 Programme components

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

- Compulsory subject elements, 15 ECTS.
- Restricted elective subject elements
  - 30 ECTS (thesis, 45 ECTS)
  - 15 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 (15 ECTS):

• NKEA07005U	Unifying Concepts in Nanoscience (UCN)	Block 1+2	15 ECTS
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#### 6.1.2 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):

• NKEK13018U	Advanced Photochemistry	Block 1	7.5 ECTS
• NDAA07012U	Scientific Computing	Block 1	7.5 ECTS
• NKEA09010U	Scientific Writing, Planning and Presentation	Block 1	7.5 ECTS
• NFYK15006U	Biophysics of Cells and Single Molecules	Block 1	7.5 ECTS
• NFYK18005U	Complex Physics	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
• NKEA06015U	Crystallography - MSc	Block 2	7.5 ECTS
• NFYB10021U	Condensed Matter Physics 2 (CMP2)	Block 2	7.5 ECTS
• NBIK17001U	Dynamical Models in Molecular Biology	Block 2	7.5 ECTS
• NFYK12005U	Nanophysics 1 – Quantum Electronics	Block 3	7.5 ECTS
• NFYK13013U	Experimental X-ray Physics	Block 3	7.5 ECTS
• NKEK13019U	Molecular Electronics Theory	Block 4	7.5 ECTS
• NFYK13021U	Neutron Scattering	Block 4	7.5 ECTS
• NKEK13009U	Protein Structure and Function	Block 4	7.5 ECTS

• NKEK12008U	Structural Tools in Nanoscience	Block 4	7.5 ECTS
• NFYK14009U	Physics of Molecular Diseases	Block 4	7.5 ECTS
	Project in Practice	Block 1-5	15 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 outside the course scope 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.

Projects in practice may be included in the elective section of the programme with up to 15 ECTS. Projects in practice may not exceed 15 ECTS in total of the programme. Projects in practice may be written as a combination of the restricted elective and elective section of the programme. The regulations are described in Appendix 4 to the shared section of the curriculum.

Thesis preparation projects 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.

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

### ***6.1.4 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.

### ***6.1.5 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 1<sup>st</sup> 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 1<sup>st</sup> 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 [www.science.ku.dk](http://www.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 Tables

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

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

	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			

Compulsory
  Restricted elective
  Elective
 | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

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

	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			

Compulsory
  Restricted elective
  Elective
 | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

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

**MSc Programme in Nanoscience (thesis 60 ECTS)\***

	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			

Compulsory
  Restricted elective
  Elective
 | The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.


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




### MSc Programme in Nanoscience (thesis 45 ECTS)\*

	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			

 Compulsory

 Restricted elective

 Elective

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

\*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.

### 2 General changes for students admitted in the academic year 2018/19 or 2017/18

Students admitted to the MSc Programme in the academic year 2018/19 or 2017/18 must finish the programme as listed in the curriculum above with the following exceptions.

#### Restricted elective subject elements

30 ECTS are to be covered as subject elements from the following list:

• Restricted elective subject elements offered in this curriculum (see above)			
• NKEK12006U	Surface Physical Chemistry	Discontinued*	7.5 ECTS
• NFYK12010U	Quantum Nanophotonics	Discontinued*	7.5 ECTS

\* See course specific changes below.

### 3 Course specific changes

Discontinued course	Interim arrangement
Surface Physical Chemistry (NKEK12006U), 7,5 ECTS	The course was a restricted elective course in 2018/19 and earlier. It was cancelled in the academic year 2018/19.  Offered for the last time: 2017/18. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2018/19
Quantum Nanophotonics (NFYK12010U), 7,5 ECTS	The course was a restricted elective course in the academic year 2017/18 and earlier.  Offered for the last time: 2017/18 Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2018/19.

## 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.