Programme-specific Section of the Curriculum for the MSc Programme in Chemistry at the Faculty of Science, University of Copenhagen

2013 (Rev 2024)

Contents

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

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*).

1.4 Language

The language of this MSc Programme is English.

2 Academic profile

2.1 Purpose

The objective of the programme is to provide the graduates with an in-depth knowledge within the methods and scientific basis of chemical research. The education is based on the competences the students have acquired during the MSc programme. On completion of the programme, students will be able to perform research at advanced levels; analyse and solve problems within the broad field of chemistry. A master's degree in chemistry equips the graduates with the necessary skills for participating in research groups or for the independent leadership and management of complex work and development situations within the field. The MSc Programme in Chemistry combines formal coursework with independent research guided by an experienced researcher.

2.2 General programme profile

The MSc Programme in Chemistry is a research-based education. The master's programme in chemistry has four specializations: Inorganic Chemistry, Organic Synthesis, Physical Chemistry and Analytical Chemistry. In each of the specialization there are 30 ECTS obligatory courses which will give the graduate in-depth knowledge within the methods and scientific basis of chemical research in the given specialisation. The thesis work is experimental in nature, e.g. it must include experimental work or production of scientific work in terms of the generation of original data and/or original material.

Chemistry is the key subject area of the programme.

2.3 General structure of the programme

The MSc Programme is set at 120 ECTS.

The MSc Programme in Chemistry consists of the following elements:

- Specialisation, 120 ECTS, including the thesis.

The student must choose one of the following specialisations:

- Analytical Chemistry.
- Inorganic Chemistry.
- Organic Synthesis.
- Physical and Computational Chemistry.

2.4 Career opportunities

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

- A PhD programme
- The private sector such as chemical or pharmaceutical companies.
- High-tech companies.
- Consulting companies.
- The public sector.
- Universities.
- Sector Research Institute.
- Prerequisites for further studies, including a PhD program.

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 Analytical Chemistry

Graduates holding an MSc in Chemistry with a specialisation in Analytical Chemistry have acquired the following:

Knowledge about:

- A solid theoretical understanding of sampling theory and sample preparation methods, chromatography and mass spectrometry, spectroscopic methods.
- Practical use of advanced analytical techniques for analysis of gas, liquid and solid samples.
- Quantitative and qualitative chemical analyses.
- Method development, validation and quality control of chemical analyses.

Skills in/to:

- Plan sampling experiments and analyse the results.
- Plan, perform and optimize sample preparation for organic compounds and elements in simple and complex matrices.
- Develop and apply methods for separating chemical compounds in mixtures using chromatography and related methods.
- Develop sustainable analytical methods (green chemistry)
- Perform quantitative and qualitative chemical analysis of organic compounds and elements in gas, liquid and solid matrices.
- Apply data science in analytical chemistry (digitalization, data processing and evaluation).
- Critically assess reported analytical chemistry research including chromatographic, mass spectrometry, and spectroscopy research.
- Select a suitable analytical platform for the separation, detection and quantification of analytes from complex matrices on the basis of chemical properties of the analyte and knowledge of the matrix.

Competences in/to:

- Be able to critically read papers in current international advanced analytical chemistry journals.
- Enable the student to plan and perform: sampling, sample preparation of complex matrices, chemical analysis of simple and complex mixtures of chemicals and elements using modern analytical chromatography, mass spectrometry spectroscopy methods, data science methods for qualitative (identification) and quantitative (concentration measurements) analysis
- Be able to develop, validate and quality assure new analytical methods.

3.2 Inorganic Chemistry

Graduates holding an MSc in Chemistry with a specialisation in Inorganic Chemistry have acquired the following:

Knowledge about:

- Inorganic and coordination chemistry broadly.
- Synthesis, compound properties, element occurrences and The Periodic Table as a resource map including sustainability issues.
- Important electronic structure models
- Modern experimental techniques in modern inorganic chemistry.

Skills in/to:

- Describe the most important experimental techniques applied in the characterisation of inorganic compounds.
- Describe and rationalise the most important periodic variation in the chemical and physical properties of the elements and their compounds.
- Understand thermodynamic and kinetic factors in inorganic chemistry and their consequences for structure reactivity and catalysis.
- Critically assess and present reported inorganic chemistry research.

Competences in/to:

- Be able to critically read papers in current international advanced inorganic chemistry journals.
- Discuss descriptive inorganic chemistry and important models applied to inorganic chemistry.
- Analyse optical, magnetic, electric and other physical properties of inorganic compoundsAnalyse scientific papers with inorganic synthetic problems.
- Analyse and suggest preparative strategies and substitution options for inorganic compounds

3.3 Organic Synthesis

Graduates holding an MSc in Chemistry with a specialisation in Organic Synthesis have acquired the following:

Knowledge about:

- Physical organic chemistry.
- Outcome and application of reactions and synthesis employed in advanced organic and medicinal chemistry.
- Modern techniques for synthesis of advanced organic and inorganic small-molecules.
- Sustainability of chemical processes.

Skills in/to:

- Elucidate the reaction mechanisms of the desired and undesired organic reactions.
- Predict the conditional dependence of yield and stereochemistry in organic reactions.
- Select the optimal starting materials and conditions in synthesis of drugs.
- Work independently with specialised equipment and advanced synthesis methods
- Work with synthetic chemistry under inert atmosphere, anhydrous condition and extreme condition (temperature, pressure, etc.).
- Work with various type of chromatographic purification methods.

Competences in/to:

- Analyse reactions on the basis of physical organic chemistry, particularly electronegativities of the elements involved.
- Analyse scientific papers and patents dealing with synthetic problems.
- Analyse a complex synthetic problem and plan a feasible synthesis considering sustainable and green chemistry perspectives.
- Make educated choice regarding the use the advanced techniques, methodologies and advanced equipment.
- Make educated choice regarding the execution of the chemical reactions and purification methods.

3.4 Physical and Computational Chemistry

Graduates holding an MSc in Chemistry with a specialisation in Physical and Computational Chemistry have acquired the following:

Knowledge about:

- Computational chemistry.
- Experimental and theoretical advanced physical chemical methods.
- Experimental techniques used in gas, liquid and solid phase spectroscopy.

Skills in/to:

- Establish, evaluate and complete a theoretical investigation of a chemical problem using modern scientific computing software within chemistry.
- Use of basic spectroscopic instruments and to describe different techniques and the theory behind them.
- Critically assess and present reported physical and computational chemistry research.

Competences in/to:

- Be able to critically read papers in current international computational and physical chemistry journals.
- Discuss a concrete computation chemistry problem and utilise the most efficient and suitable calculation method to solve the problem.
- Assess the usefulness of different spectroscopic techniques to solve different research questions.
- Be critical and insightful in relation to the digital data obtained by experiments.

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 Chemistry:

- Chemistry (*kemi*) from University of Copenhagen (reserved access)
- Chemistry from Aarhus University or University of Southern Denmark
- Chemistry from Lund University, Stockholm University, University of Uppsala, University of Oslo, University of Tromsø, Norwegian University of Science and Technology, University of Iceland or University of Helsinki
- Medicinal Chemistry (*medicinalkemi*) from University of Copenhagen
- Medicinal Chemistry from Aarhus University
- Nanoscience (*nanoscience*) from University of Copenhagen

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 Chemistry if the programme includes the following:

- General and inorganic chemistry (min. 15 ECTS)
- Organic chemistry (min. 15 ECTS)
- Analytical chemistry and spectroscopy (min. 7.5 ECTS)
- Chemical synthesis (min. 7.5 ECTS)
- Physical chemistry (including quantum chemistry) (min. 15 ECTS)

Each of them must include experimental laboratory exercises including laboratory safety.

- Mathematics (min. 15 ECTS)

The elements must account for a total of min. 75 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 4.1-4.

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.

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 Chemistry from University of Copenhagen the student is granted reserved access and guaranteed a place on the MSc Programme in Chemistry 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 general and inorganic chemistry, organic chemistry, analytical chemistry and spectroscopy, chemical synthesis and physical chemistry (including quantum chemistry).

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).

Before the beginning of the MSc Programme the student must choose a specialisation.

6.1 Analytical Chemistry

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

- Compulsory subject elements, 30 ECTS.
- Elective subject elements, 30 ECTS.
- Thesis, 60 ECTS.

6.1.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NPLK13003U	Advanced Analytic Chemistry – Sampling and Sample Preparation	Block 1	7.5 ECTS
NKEA09010U	Scientific Writing, Planning and Presentation	Block 1	7,5 ECTS
NPLK13004U	Advanced Analytic Chemistry – Chromatography and Mass Spectrometry	Block 2	7.5 ECTS
NPLK16003U	Experimental Analytical Chemistry: Method Development and Quality Assurance	Block 2	7.5 ECTS

6.1.2 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 6.1.3 Projects.

6.1.3 Projects

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

6.1.4 Thesis

The MSc Programme in Chemistry with a specialisation in Analytical Chemistry includes a thesis corresponding to 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 in the MSc Programme in Chemistry with a specialisation in Analytical Chemistry is placed in block 3+4 of the 1st year.

For students admitted in February the academic mobility in the MSc Programme in Chemistry with a specialisation in Analytical Chemistry 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.

6.2 Inorganic Chemistry

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

- Compulsory subject elements, 30 ECTS.
- Elective subject elements, 30 ECTS.
- Thesis, 60 ECTS.

6.2.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NKEK15003U	Methods and Modelling in Inorganic Chemistry	Block 1+2	15 ECTS
NKEK15004U	Descriptive Inorganic Chemistry	Block 3+4	15 ECTS

6.2.2 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 6.2.3 Projects.

6.2.3 Projects

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

6.2.4 Thesis

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

6.2.5 Academic mobility

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

For students admitted in September the academic mobility in the MSc Programme in Chemistry with a specialisation in Inorganic Chemistry is placed in block 1+2 of the 1st year.

For students admitted in February the academic mobility in the MSc Programme in Chemistry with a specialisation in Inorganic Chemistry 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.

6.3 Organic Synthesis

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

- Compulsory subject elements, 30 ECTS.
- Elective courses, 30 ECTS.
- Thesis, 60 ECTS.

6.3.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NKEK13007U	Reaction and Synthesis in Medicinal Chemistry (KemiMed)	Block 1+2	15 ECTS
NKEK13006U	Organic Chemistry	Block 3+4	15 ECTS

6.3.2 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 6.3.3 Projects.

6.3.3 Projects

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

6.3.4 Thesis

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

6.3.5 Academic mobility

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

For students admitted in September the academic mobility in the MSc Programme in Chemistry with a specialisation in Organic Chemistry is placed in block 1+2 of the 1st year.

For students admitted in February the academic mobility in the MSc Programme in Chemistry with a specialisation in Organic Chemistry 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.

6.4 Physical and Computational Chemistry

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

- Compulsory subject elements, 30 ECTS.
- Elective subject elements, 30 ECTS.
- Thesis, 60 ECTS.

6.4.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NKEA07016U	Computational Chemistry	Block 1+2	15 ECTS
NKEK22001U	Advanced Vibrational Spectroscopy	Block 3	7.5 ECTS
NKEK22000U	Advanced Fluorescence Spectroscopy and Microscopy	Block 4	7.5 ECTS

6.4.2 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 6.4.3 Projects.

6.4.3 Projects

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

6.4.4 Thesis

The MSc Programme in Chemistry with a specialisation in Physical and Computational Chemistry includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.4.5 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 Chemistry with a specialisation in Physical and Computational Chemistry is placed in block 1+2 of the 1st year.

For students admitted in February the academic mobility for the MSc Programme in Chemistry with a specialisation in Physical and Computational Chemistry 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 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 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 – Analytical Chemistry

	Block 1	Block 2	Block 3	Block 4
1st year	Scientific Writing, Planning and Presentation	Experimental Analytical Chemistry: Method Development and Quality	Elective	Elective
	Advanced Analytic Chemistry – Sampling and Sample Preparation	Advanced Analytic Chemistry – Chromatography and Mass Spectrometry	Elective	Elective
2nd year	Thesis			

Table – Inorganic Chemistry

	Block 1	Block 2	Block 3	Block 4
1st year	Methods and Modelling in Inorganic Chemistry		Descriptive Inorganic Chemistry	
	Elective	Elective	Elective	Elective
2nd year	Thesis			

Table – Organic Synthesis

	Block 1	Block 2	Block 3	Block 4
1st year	Elective	Elective	Elective	Elective
	Reaction and Synthesis in Medicinal Chemistry		Organic Chemistry	
2nd year	Thesis			

Table – Physical and Computational Chemistry

	Block 1	Block 2	Block 3	Block 4
1st year	Elective	Elective	Elective	Elective
	Computational Chemistry		Advanced Vibrational Spectroscopy	Advanced Fluor-escence Spectroscopy and Microscopy
2nd year	Thesis			

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

Table – Analytical Chemistry*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Scientific Writing, Planning and Presentation	Experimental Analytical Chemistry: Method Development and Quality Assurance
	Elective	Elective	Advanced Analytic Chemistry – Sampling and Sample Preparation	Advanced Analytic Chemistry-Chromatogra-phy and Mass Spectrometry
2nd year	Thesis			

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

Table – Inorganic Chemistry*

	Block 3	Block 4	Block 1	Block 2
1st year	Descriptive Inorganic Chemistry		Methods and Modelling in Inorganic Chemistry	
	Elective	Elective	Elective	Elective
2nd year	Thesis			

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

Table – Organic Synthesis*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Elective	Elective
	Organic Chemistry		Reaction and Synthesis in Medicinal Chemistry	
2nd year	Thesis			

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

Table – Physical and Computational Chemistry*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Elective	Elective
	Advanced Vibrational Spectroscopy	Advanced Fluorescence Spectroscopy and Microscopy	Computational Chemistry	
2nd year	Thesis			

* 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 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.

1.1 Physical Chemistry

Title

The specialisation has changed its title from the academic year 2023/24. Students admitted in the academic year 2022/23 must finish the programme as listed in the specialisation Physical and Computational Chemistry in the curriculum above.

2 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.

2.1 Physical Chemistry

Title

The specialisation has changed its title from the academic year 2023/24. Students admitted in the academic year 2021/22 must finish the programme as listed in the specialisation Physical and Computational Chemistry in the curriculum above**.**

Table – Physical Chemistry (students admitted in September)

	Block 1	**Block 2**	**Block 3**	**Block 4**
1st year	**Elective**	**Elective**	**Elective**	**Elective**
	Computational Chemistry		***Advanced Molecular Spectroscopy***	
2nd year	**Thesis**			

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

Table – Physical Chemistry (students admitted in February)

	Block 3	**Block 4**	**Block 1**	**Block 2**
1st year	**Elective**	**Elective**	**Elective**	**Elective**
	Advanced Molecular Spectroscopy		**Computational Chemistry**	
2nd year	**Thesis**			

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

3 Discontinued courses

Course Code	Course Title	ECTS	Interim arrangement
NKEK21001U	Advanced Molecular Spectroscopy	15	The course was compulsory on the specialisation in Physical Chemistry 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 The course is replaced by Advanced Vibrational Spectroscopy (NKEK22001U) + Advanced Fluorescence Spectroscopy and Microscopy (NKEK22000U), 7.5 ECTS

Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:

- Acquired knowledge and learned appropriate methods within selected areas in chemistry of active research.
- Acquired in-depth knowledge of selected areas in chemistry at an international level by conducting independent research and working under supervision.

Skills in/to:

- Read and understand original academic literature in the field of chemistry.
- Explain chemistry work, both orally and in writing.
- Identify, define and formulate the scientific issue/impact of a research project.
- Define and develop testable hypotheses.
- Process and analyse data.

Competences in/to:

- Formulate, structure and manage a research project involving the development and use of chemical methods.
- Manage complex work and development situations.
- Seek out and summarise the available knowledge in selected areas of chemistry.
- Assess chemical methods, and their application and limitations.
- Discuss chemical methods, theory and results, both in general and on a scientific level.
- Discuss the application of chemical results in an industrial, social and ethical context in an academic manner.
- Take independent responsibility for own academic development and specialisation.