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

2010 (Rev. 2022)

Contents

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 Physics leads to a Master of Science (MSc) in Physics with the Danish title: C*and.scient. (candidatus/candidata scientiarum) i fysik.*

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 Physics (*fysik*).

1.4 Language

The language of this MSc Programme is English.

2 Academic profile

2.1 Purpose

The overall goal of the 2 year MSc education in Physics is to train the students to a level where they can work, think and act independently as a physicist. In order to achieve this goal, the Master of Science Programme in Physics is a research based education that allows the student to specialise within a certain area of physics as chosen by the student. The student follows a curriculum composed partly by high level academic courses in theoretical and experimental physics and partly by a large independent thesis project with experimental content. This way the student obtains a general insight into a broader area of physics in combination with in-depth insight and practical experience within a highly specialised area at the research forefront.

2.2 General programme profile

The MSc Programme in Physics is a research-based education composed by 60 ECTS courses and a 60 ECTS thesis project. The MSc Programme in Physics has six specialisations: Quantum Physics, Astrophysics, Earth and Climate Physics, Biophysics, Computational Physics and Physics of Complex Systems. Each specialisation has one or two mandatory courses, introducing to the chosen field of specialisation, and a range of specialisation courses. The course component of the education will give the student a profound overview of the state of the art established knowledge within the chosen specialisation area. The thesis will allow the student to specialise further within a topic of physics. The student will perform independent research of experimental nature and this way, by the end of the studies, be in a position where he/she can challenge and further contribute to the established knowledge within a chosen area of physics.

Physics is the key subject area of the programme. Mathematics and computer science are also subject areas of the programme.

2.3 General structure of the programme

The MSc Programme is set at 120 ECTS.

The MSc Programme in Physics consists of the following elements:

- Specialisation, 120 ECTS, including the thesis.

The student must choose one of the following:

- Astrophysics
- Biophysics
- Computational Physics
- Earth and Climate Physics
- Physics of Complex Systems
- Quantum Physics

2.4 Career opportunities

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

- PhD-student in different profession directions at science and medical science faculties or in industry
- High school teacher
- Specialist in the consultancy industry, eg. datascience, wind and natural resources
- Biophysicist in the pharmaceutical industry
- Hospital physicist
- Meteorologist
- Risk Manager or Analyst in the bank sector or insurance companies
- A wide range of job opportunities within Danish and international high-tech companies, international agencies and national authorities
- Various jobs within research and development using physics as the basis of modern technology and a sustainable development, for example in high-tech companies and the consultancy industry

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 – Generic competences

Graduates holding an MSc in Physics have acquired the following regardless of the chosen specialisation:

Knowledge about:

- One or more areas within physics based on research at the highest international standards within the field.
- A given field of research, up-to-date and specialised, built up through research-based teaching and the thesis project.
- Mathematical, digital and numerical methods for quantifying and solving problems, numerical modelling, data processing and visualisation.
- Concepts and methods within physics.

Skills in/to:

- Master scientific methods and tools of one or more research areas within physics.
- Communicate and present research-based knowledge in the context of physics for a general academic audience.
- Solve complex problems within the field of physics by use of analytical, mathematical and quantitative methods.

- Use English as a working language.
- Make use of IT and digital tools for both information and data processing, communication and presentations, and in other contexts where it is academically relevant.

Competences in/to:

- Select and evaluate theoretical, experimental and/or numerical methods for analyzing and solving scientific questions and issues within the field of physics.
- Assess the relevance of concepts and methods from physics in other scientific disciplines as well as in a wider societal context and for a sustainable development.
- Work with others, both with peers and actively within research teams.
- Take independent responsibility for their own academic development, specialisation and skills development.

3.2 Astrophysics

In addition to the generic competence profile, graduates holding an MSc in Physics with a specialisation in Astrophysics have acquired the following:

Knowledge about:

- Key disciplines, methods, theories and concepts in astronomy, including phenomena such as stars, galaxies and the substances between them.
- The links between astronomy and other scientific disciplines.
- Advanced technological methods in astronomical observation.

Skills in/to:

- Independently planning and running astronomical and astrophysical projects.
- Setting up relevant analytical or numerical models for an astronomical system, and using observed data for analyses and for verification of the models.
- Working independently on astrophysics subjects.
- Explaining and communicating, both orally and in writing, specialized knowledge of general astrophysical principles.

Competences in/to:

- Study signals over most of the electromagnetic spectrum.
- To build up a clear and up-to-date picture of what the universe contains and how it is constructed.
- Master elements of multiple disciplines, from classical physics to quantum mechanicsand to be well versed in the methodology of mathematical physics.
- Apply scientific theory and methodology in an astronomy context.

3.3 Biophysics

In addition to the generic competence profile, graduates holding an MSc in Physics with a specialisation in Biophysics have acquired the following:

Knowledge about:

- How to describe in quantitative terms the physical processes of biological systems at levels down to the individual molecule.
- The possibilities and limitations of experimental, modern techniques in biophysics.
- The latest research at the academic interface between physics and biology.

Skills in/to:

- Quantitative descriptions of biological systems.
- Modern, experimental biophysics techniques, including single-molecule techniques and scattering techniques.
- Critical evaluation of biological data sets, including identifying the criteria used to identify significant trends.

Competences in/to:

- Have an understanding of the physical characteristics of life's molecular building blocks.
- They have built up a solid academic grounding in the border zone between physics and molecular biology, and insight into both biophysical and molecular biological experimental techniques, e.g. single-molecule techniques and super-resolution microscopy and X-ray and Neutron Scattering.

3.4 Computational Physics

In addition to the generic competence profile, graduates holding an MSc in Physics with a specialisation in Computational Physics have acquired the following:

Knowledge about:

- General techniques and ideas found in professionally written numerical software.
- General concepts needed for applying suitable software in a qualified manner to problems in computational physics.
- Simple mathematical models from science and numerical analysis of them.
- The ideas behind and the motivation for fundamental numerical methods for the solution of: linear and nonlinear equations, linear and nonlinear optimization, eigenvalue problems initial value problems for ordinary differential equations, partial differential equations, the fast fourier transform, and the use of Monte Carlo methods.

Skills in/to:

- Choosing an appropriate numerical method for the solution of the problem or sub-problem.
- Evaluate the numerical method with respect to potential accuracy, computational efficiency, robustness, and memory requirements.
- Evaluate the quality of the solution with respect to the accuracy obtained and the sensitivity to model parameter variations.
- Describe and quantify data uncertainties and modeling errors.
- Describe available information using probabilistic/statistical models and methods.

Competences in/to:

- Performing numerical analysis of simple mathematical models of physical system in order to solve concrete problems and to evaluate the results obtained.
- Treating data uncertainties and evaluating the accuracy and resolution of the solution.
- Apply methods and tools from a wide range of physical disciplines, in order to describe and understand numerical problems relevant to society, industry, companies, and teaching.

3.5 Earth and Climate Physics

In addition to the generic competence profile, graduates holding an MSc in Physics with a specialisation in Earth and Climate Physics have acquired the following:

Knowledge about:

- The basic physical principles of geophysics and their mathematical formulations in studies of the atmosphere, the oceans, the ice caps, Earth's interior and Earth's climate system in general.
- The structure of geophysical systems on different scales in space and time, and the fundamental principles and processes that operate on each scale.
- Methods of quantification for the study of geophysical systems.
- Numerical methods for solving a wide range of problems, using both linear and non-linear methods for data analysis.

Skills in/to:

- Planning and execution of geophysical experiments and observation campaigns, including numerical experiments.
- Setting up appropriate analytical or numerical models for a geophysical system based on the laws of physics, and using observed data for analyses and for verification of the models.
- Explaining and communicating, both orally and in writing, specialist knowledge of geophysical phenomena.

Competences in/to:

- Use exact quantitative scientific methodology in conjunction with data from field work, laboratory experiments and/or satellite-based measurements to describe both basic and specialized problems related to the Earth and its climate.
- Use geophysical models and principles in the study of the Earth and other planets.
- Assess and apply the relevance of results from geophysical and climate research to understand climate change and contribute to a sustainable development, as well as in a general professional and social context.

3.6 Physics of Complex Systems

In addition to the generic competence profile, graduates holding an MSc in Physics with a specialisation in Physics of Complex Systems have acquired the following:

Knowledge about:

- A broad range of physical complex phenomena and dynamical systems from physics and other disciplines.
- How methods from physics can be used to study complex phenomena in other disciplines.
- A range of physical, mathematical and numerical methods and models, which gives access to a wide range of professions which apply physics, mathematics, statistics and programming.

Skills in/to:

- Construct physical models to describe a variety of systems where interaction of many simple parts give rice to new phenomena larger scale.
- Construct quantitative models of problems relevant to industry and society.
- Simulations of stochastic systems, phase transitions, network theory, scale invariant phenomena, working with dynamical models of spatially extended systems.

Competences in/to:

- Using methodology from physics to model a variety of systems where phenomena emerge from the interaction of many simple parts.

- Apply a range of physical laws, methodology and analysis methods to actual problems in our surrounding world.
- Building and understanding quantitative models by use of mathematical and numerical methods.
- Developing testable mathematical-physical models of systems with internal feedbacks and interactions.

3.7 Quantum Physics

In addition to the generic competence profile, graduates holding an MSc in Physics with a specialisation in Quantum Physics have acquired the following:

Knowledge about:

- Key disciplines, methods, theories and concepts in quantum physics, including phenomena in solid state physics, atomic physics, and sub-atomic physics.
- The links between quantum physics and other scientific disciplines.
- Advanced technological methods in quantum physical experiments.

Skills in/to:

- Independently planning and running projects within quantum physical topics.
- Setting up relevant analytical or numerical models for a quantum physical system, and using experimental data for analyses and for verification of the models.
- Working independently on quantum physical subjects.
- Explaining and communicating, both orally and in writing, specialized knowledge of the nano-scale, atomic, and sub-atomic world.

Competences in/to:

- Build up a far clearer picture of what the nano-scale, atomic, and sub-atomic world contains and how it is constructed.
- Master elements of multiple disciplines and to be well versed in the methodology of mathematical physics.
- Apply scientific theory and methodology in context of quantum physics.

4 Admission requirements

With a Bachelor's degree in Physics from the University of Copenhagen the student is granted reserved access and guaranteed a place on the MSc Programme in Physics 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 Physics

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

4.2 Applicants with a Bachelor's degree in Natural Science and IT

Applicants with a Bachelor's degree in Natural Science and IT with a specialisation in Physics from the University of Copenhagen are directly academically qualified for admission to the MSc Programme in Physics.

4.3 Applicants with a Bachelor's degree in Nanoscience, Mathematics, Chemistry or Computer Science

Applicants with a Bachelor's degree in Nanoscience, Mathematics, Chemistry or Computer Science from the University of Copenhagen, other Danish or Nordic universities, may also be admitted if their programme includes the following:

- **A Basic requirements:**
    - Mathematics (linear algebra, differential equations) (min. 20 ECTS credits).
    - Classical mechanics (min. 10 ECTS credits).
    - Thermodynamics (min. 10 ECTS credits).
    - Electromagnetism (min. 10 ECTS credits).

B Advanced requirements (min. 30 ECTS credits):

- Advanced physics within one or more of the following subjects: Quantum Physics, Modern Physics, Geophysics, Biophysics, Medical Physics and/or Astrophysics.

- **The combined total of A and B must be min. 120 ECTS credits.**

4.4 Applicants with a related Bachelor's degree

Applicants with a Bachelors degree in related arears from the University of Copenhagen, other Danish, Nordic or international universities may also be admitted if their programme includes the following:

- **A Basic requirements:**
    - Mathematics (linear algebra, differential equations) (min. 20 ECTS credits).
    - Classical mechanics (min. 10 ECTS credits).
    - Thermodynamics (min. 10 ECTS credits).
    - Electromagnetism (min. 10 ECTS credits).

B Advanced requirements (min. 30 ECTS credits):

- Advanced physics within one or more of the following subjects: Quantum Physics, Modern Physics, Geophysics, Biophysics, Medical Physics and/or Astrophysics.

- **The combined total of A and B must be min. 120 ECTS credits.**

4.5 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 4.1-3.

4.6 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.

4.7 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 Physics from the University of Copenhagen with reserved access to the programme.
2) Applicants with a Bachelor's degree in Physics from the University of Copenhagen.
3) Applicants with a Bachelor's degree in Nanoscience, Natural Science and IT, Mathematics, Chemistry or Computer Science from the University of Copenhagen
4) Applicants with a Bachelor's degree in Physics from a Danish or Nordic university.
5) Applicants with a Bachelor's degree in Physics.
6) 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 credits within the relevant academic field (physics) and the grades obtained. If different grading systems make comparison impossible, applicants will be prioritised on the basis of an individual evaluation by the Admission Committee.

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 Astrophysics

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

- Compulsory subject elements, 15 ECTS
- Restricted elective subject elements
  - 45 ECTS (thesis, 45 ECTS)
  - 30 ECTS (thesis, 60 ECTS)
- Elective subject elements, 15 ECTS
- Thesis, 45 or 60 ECTS

6.1.1 Compulsory subject elements

All of the following subject elements are to be covered (15 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK14011U	Theoretical Astrophysics	Block 1	7.5 ECTS
NFYK16001U	Observational Astrophysics	Block 2	7.5 ECTS

6.1.2 Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS) 30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK12009U	Astronomical Data Processing	Block 1	7.5 ECTS
NFYA04022U	General Relativity and Cosmology	Block 2	7.5 ECTS
NFYK21004U	Computational Astrophysics	Block 2	7.5 ECTS
NFYK16010U	Particle Physics and the Early Universe	Block 2	7.5 ECTS
NFYK16008U	Exoplanets and Astrobiology	Block 3	7.5 ECTS
NFYK15002U	Advanced Methods in Applied Statistics	Block 3	7.5 ECTS
NFYK15014U	Gravitational Dynamics and Galaxy Formation	Block 3	7.5 ECTS
NFYK13017U	The Interstellar Medium and the Formation of Stars and Planets	Block 4	7.5 ECTS
NFYK18003U	Fundaments of High-Energy Astrophysics and Particle Astrophysics	Block 4	7.5 ECTS

6.1.3 Elective subject elements

15 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, projects in practice and thesis preparation projects may not exceed 45 ECTS of the programme if the programme includes a thesis corresponding to 45 ECTS or 30 ECTS of the programme if the programme includes a thesis corresponding to 60 ECTS.

- 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.

6.1.5 Thesis

The MSc Programme in Physics with a specialisation in Astrophysics includes a thesis corresponding to 45 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 Physics with a specialisation in Astrophysics is placed in block 3+4 of the 1st year (thesis 45 or 60 ECTS).

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

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 Biophysics

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

- Compulsory subject elements, 15 ECTS.
- Restricted elective subject elements
  - 45 ECTS (thesis, 45 ECTS)
  - 30 ECTS (thesis, 60 ECTS)
- Elective subject elements, 15 ECTS.
- Thesis, 45 or 60 ECTS

6.2.1 Compulsory subject elements

All of the following subject elements are to be covered (7.5 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK15006U	Biophysics of Cells and Single Molecules	Block 1	7.5 ECTS
NBIK17001U	Dynamical Models in Molecular Biology	Block 2	7.5 ECTS

6.2.2 Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS) 30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK18005U	Complex Physics	Block 1	7.5 ECTS
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7,5 ECTS
NBIK16001U	NMR Spectroscopy	Block 2	7.5 ECTS
NFYK15016U	Physics of Biological Nonequilibrium Systems	Block 3	7.5 ECTS
NFYK10005U	Continuum Mechanics	Block 3	7.5 ECTS
NFYK13013U	Experimental X-ray Physics	Block 3	7.5 ECTS
NFYK14039U	Radioactive Isotopes and Ionizing Radiation	Block 3	7.5 ECTS
NFYK10006U	Diffusive and Stochastic Processes	Block 4	7.5 ECTS
NFYK13021U	Neutron Scattering	Block 4	7.5 ECTS
NFYK14009U	Physics of Molecular Diseases	Block 4	7.5 ECTS

6.2.3 Elective subjects

15 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.

6.2.4 Projects

Projects outside the course scope, projects in practice and thesis preparation projects may not exceed 45 ECTS of the programme if the programme includes a thesis corresponding to 45 ECTS or 30 ECTS of the programme if the programme includes a thesis corresponding to 60 ECTS.

- 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.

6.2.5 Thesis

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

6.2.6 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 Physics with a specialisation in Biophysics is placed in block 3+4 of the 1st year (thesis 45 or 60 ECTS).

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

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 Computational Physics

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

- Compulsory subject elements, 15 ECTS.
- Restricted elective subject elements
    - 45 ECTS (thesis 45 ECTS)
    - 30 ECTS (thesis, 60 ECTS)
- Elective subject elements, 15 ECTS.
- Thesis, 45 or 60 ECTS

6.3.1 Compulsory subject elements

All of the following subject elements are to be covered (15 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NDAA07012U	Scientific Computing	Block 1	7.5 ECTS
NFYA04034U	Inverse Problems	Block 2	7.5 ECTS

6.3.2 Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS) 30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK18005U	Complex Physics	Block 1	7.5 ECTS
NFYK15003U	Advanced Quantum Mechanics (Quant3)	Block 1	7.5 ECTS
NFYK15006U	Biophysics of Cells and Single Molecules	Block 1	7.5 ECTS
NFYK15008U	Earth and Climate Physics	Block 1	7.5 ECTS
NFYK14011U	Theoretical Astrophysics	Block 1	7.5 ECTS
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7.5 ECTS
NFYK21004U	Computational Astrophysics	Block 2	7.5 ECTS
NBIK17001U	Dynamical Models in Molecular Biology	Block 2	7.5 ECTS
NFYK10005U	Continuum Mechanics	Block 3	7.5 ECTS
NDAA09027U	Signal and Image Processing	Block 3	7.5 ECTS
NFYK15002U	Advanced Methods in Applied Statistics	Block 3	7.5 ECTS
NFYK18001U	High Performance Parallel Computing	Block 3	7,5 ECTS
NFYK20002U	Applied Machine Learning	Block 4	7.5 ECTS
NFYK10006U	Diffusive and Stochastic Processes	Block 4	7.5 ECTS
NFYK22001U	Advanced Computational Geophysics	Block 4	7.5 ECTS
NFYK22003U	Computational Atmosphere and Ocean Dynamics	Block 4	7.5 ECTS

6.3.3 Elective subject elements

15 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 6.3.4 Projects.

6.3.4 Projects

Projects outside the course scope, projects in practice and thesis preparation projects may not exceed 45 ECTS of the programme if the programme includes a thesis corresponding to 45 ECTS or 30 ECTS of the programme if the programme includes a thesis corresponding to 60 ECTS.

- 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.

6.3.5 Thesis

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

6.3.6 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 Physics with a specialisation in Computational Physics is placed in block 3+4 of the 1st year (thesis 45 or 60 ECTS.

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

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

6.4 Earth and Climate Physics

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

- Compulsory subject elements, 15 ECTS.
- Restricted elective subject elements
  - 45 ECTS (thesis, 45 ECTS)
  - 30 ECTS (thesis, 60 ECTS)
- Elective subject elements, 15 ECTS.
- Thesis, 45 or 60 ECTS

6.4.1 Compulsory subject elements

All of the following subject elements are to be covered (15 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK15008U	Earth and Climate Physics	Block 1	7.5 ECTS
NFYA04034U	Inverse Problems	Block 2	7.5 ECTS

6.4.2 Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS) 30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK14007U	Paleo-Climatology	Block 1	7.5 ECTS
NDAA07012U	Scientific Computing	Block 1	7.5 ECTS
NFYK17002U	Climate Models and Observations	Block 2	7.5 ECTS
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7.5 ECTS
NFYK10005U	Continuum Mechanics	Block 3	7.5 ECTS
NFYK13000U	Climate Change Mechanisms and Tipping Points	Block 3	7.5 ECTS
NFYK16008U	Exoplanets and Astrobiology	Block 3	7.5 ECTS
NFYK22001U	Advanced Computational Geophysics	Block 4	7.5 ECTS
NFYK22003U	Computational Atmosphere and Ocean Dynamics	Block 4	7.5 ECTS

6.4.3 Elective subject elements

15 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 6.4.4 Projects.

6.4.4 Projects

Projects outside the course scope, projects in practice and thesis preparation projects may not exceed 45 ECTS of the programme if the programme includes a thesis corresponding to 45 ECTS or 30 ECTS of the programme if the programme includes a thesis corresponding to 60 ECTS.

- 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.

6.4.5 Thesis

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

6.4.6 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 Physics with a specialisation in Earth and Climate Physics is placed in block 3+4 of the 1st year (thesis 45 or 60 ECTS).

For students admitted in February the academic mobility for the MSc Programme in Physics with a specialisation in Earth and Climate Physics is placed in block 3+4 of the 1st year (thesis 45 or 60 ECTS).

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.

6.5 Physics of Complex Systems

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

- Compulsory subject elements, 7.5 ECTS.
- Restricted elective subject elements
    - 52.5 ECTS (thesis 45 ECTS)
    - 37.5 ECTS (thesis, 60 ECTS)
- Elective subject elements, 15 ECTS.
- Thesis, 45 or 60 ECTS

6.5.1 Compulsory subject elements

All of the following subject elements are to be covered (7.5 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK18005U	Complex Physics	Block 1	7.5 ECTS

6.5.2 Restricted elective subject elements

52.5 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS) 37.5 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)			
Course Code	**Course Title**	**Block**	**ECTS**
NDAA07012U	Scientific Computing	Block 1	7.5 ECTS
NFYK15003U	Advanced Quantum Mechanics (Quant3)	Block 1	7.5 ECTS
NFYK15006U	Biophysics of Cells and Single Molecules	Block 1	7.5 ECTS
NFYK15008U	Earth and Climate Physics	Block 1	7.5 ECTS
NFYK14011U	Theoretical Astrophysics	Block 1	7.5 ECTS
NFYK13005U	Quantum Information	Block 1	7.5 ECTS
NFYA04036U	Elementary Particle Physics	Block 1	7.5 ECTS
NFYA04034U	Inverse Problems	Block 2	7.5 ECTS
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7.5 ECTS
NFYK21004U	Computational Astrophysics	Block 2	7.5 ECTS
NFYK15007U	Condensed Matter Experiments	Block 2	7.5 ECTS
NBIK17001U	Dynamical Models in Molecular Biology	Block 2	7.5 ECTS
NFYK10017U	Condensed Matter Theory 1 (CMT1)	Block 2	7.5 ECTS
NFYA04022U	General Relativity and Cosmology	Block 2	7.5 ECTS
NFYK17002U	Climate Models and Observations	Block 2	7.5 ECTS
NFYB10021U	Condensed Matter Physics 2 (CMP2)	Block 2	7.5 ECTS
NFYK13006U	Quantum Optics	Block 3	7.5 ECTS
NFYK13013U	Experimental X-ray Physics	Block 3	7.5 ECTS
NFYK10005U	Continuum Mechanics	Block 3	7.5 ECTS
NFYK13000U	Climate Change Mechanisms and Tipping Points	Block 3	7.5 ECTS
NFYK15016U	Physics of Biological Nonequilibrium Systems	Block 3	7.5 ECTS
NFYA10009U	Fysiske undervisningsforsøg	Block 3	7.5 ECTS
NFYK15014U	Gravitational Dynamics and Galaxy Formation	Block 3	7,5 ECTS
NFYK12005U	Nanophysics 1 – Quantum Nanoelectronics*	Block 3	7.5 ECTS
NFYK10003U	Condensed Matter Theory 2	Block 3	7.5 ECTS
NFYK10006U	Diffusive and Stochastic Processes	Block 4	7.5 ECTS
NFYK13021U	Neutron Scattering	Block 4	7.5 ECTS
NFYK14009U	Physics of Molecular Diseases	Block 4	7.5 ECTS
NFYK22003U	Computational Atmosphere and Ocean Dynamics	Block 4	7.5 ECTS
NFYK22001U	Advanced Computational Geophysics	Block 4	7.5 ECTS

*The course is not offered in the academic year 2022/23.

6.5.3 Elective subject elements

15 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 6.5.4 Projects.

6.5.4 Projects

Projects outside the course scope, projects in practice and thesis preparation projects may not exceed 45 ECTS of the programme if the programme includes a thesis corresponding to 45 ECTS or 30 ECTS of the programme if the programme includes a thesis corresponding to 60 ECTS.

- 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.

6.5.5 Thesis

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

6.5.6 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 Physics with a specialisation in Physics of Complex Systems is placed in block 3+4 of the 1st year (thesis 45 or 60 ECTS).

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

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.

6.6 Quantum Physics

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

- Compulsory subject elements, 7.5 ECTS.
- Restricted elective subject elements
  - 52.5 ECTS (thesis 45 ECTS)
  - 37.5 ECTS (thesis, 60 ECTS)
- Elective subject elements, 15 ECTS.
- Thesis, 45 or 60 ECTS

6.6.1 Compulsory courses

All of the following subject elements are to be covered (7.5 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK15003U	Advanced Quantum Mechanics (Quant3)	Block 1	7.5 ECTS

6.6.2 Restricted elective subject elements

52.5 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS) 37.5 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS):			
Course Code	**Course Title**	**Block**	**ECTS**
NFYK13005U	Quantum Information	Block 1	7.5 ECTS
NFYK18005U	Complex Physics	Block 1	7.5 ECTS
NDAA07012U	Scientific Computing	Block 1	7.5 ECTS
NFYA04036U	Elementary Particle Physics	Block 1	7.5 ECTS

Course Code	Course Title	Block	ECTS
NFYA04022U	General Relativity and Cosmology	Block 2	7.5 ECTS
NFYB10021U	Condensed Matter Physics 2 (CMP2)	Block 2	7.5 ECTS
NFYK16010U	Particle Physics and the Early Universe	Block 2	7.5 ECTS
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7.5 ECTS
NFYK10017U	Condensed Matter Theory 1 (CMT1)	Block 2	7.5 ECTS
NFYK15007U	Condensed Matter Experiments	Block 2	7.5 ECTS
NFYK22002U	Modern Particle Physics	Block 2	7.5 ECTS
NFYK13006U	Quantum Optics	Block 3	7.5 ECTS
NFYK13013U	Experimental X-ray Physics (X-ray)	Block 3	7.5 ECTS
NFYK10003U	Condensed Matter Theory 2	Block 3	7.5 ECTS
NFYK12005U	Nanophysics 1- Quantum Nanoelectronics*	Block 3	7.5 ECTS
NFYK13004U	Quantum Field Theory 1	Block 3	7.5 ECTS
NFYK15002U	Advanced Methods in Applied Statistics	Block 3	7.5 ECTS
NFYK16000U	Modern Methods for Particle Scattering	Block 3	7.5 ECTS
NFYK18004U	Advanced Quantum Optics and Photonics	Block 4	7.5 ECTS
NFYK13021U	Neutron Scattering	Block 4	7.5 ECTS
NFYK18003U	Fundaments of High-Energy Astrophysics and Particle Astrophysics	Block 4	7.5 ECTS
NFYK14014U	Introduction to String Theory*	Block 4	7.5 ECTS
NFYK16005U	Introduction to Gauge-Gravity Duality	Block 4	7.5 ECTS
NFYK20002U	Applied Machine Learning	Block 4	7.5 ECTS

*The course is not offered in the academic year 2022/23

6.6.3 Elective subject elements

15 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 6.5.4 Projects.

6.5.4 Projects

Projects outside the course scope, projects in practice and thesis preparation projects may not exceed 45 ECTS of the programme if the programme includes a thesis corresponding to 45 ECTS or 30 ECTS of the programme if the programme includes a thesis corresponding to 60 ECTS.

- 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.

6.6.4 Thesis

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

6.6.5 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 Physics with a specialisation in Quantum Physics is placed in block 3+4 of the 1st year (thesis 45 or 60 ECTS).

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

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.

Table - Astrophysics (thesis, 45 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Theoretical Astrophysics	Observational Astrophysics	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

Table – Astrophysics (thesis, 60 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Theoretical Astrophysics	Observational Astrophysics	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Thesis			

Table - Biophysics (thesis, 45 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Biophysics of Cells and Single Molecules	Dynamical Models in Molecular Biology	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

Table - Biophysics (thesis, 60 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Biophysics of Cells and Single Molecules	Dynamical Models in Molecular Biology	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Thesis			

Table – Computational Physics (thesis, 45 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Scientific Computing	Inverse Problems	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

Table – Computational Physics (thesis, 60 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Scientific Computing	Inverse Problems	Elective	Elective
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Thesis			

Table – Earth and Climate Physics (thesis, 45 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Earth and Climate Physics	Inverse Problems	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

Table – Earth and Climate Physics (thesis, 60 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Earth and Climate Physics	Inverse Problems	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Thesis			

Table – Physics of Complex Systems (thesis, 45 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Complex Physics	Restricted elective	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

Table – Physics of Complex Systems (thesis, 60 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Complex Physics	Restricted elective	Elective	Elective
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Thesis			

Table - Quantum Physics (thesis, 45 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Advanced Quantum Mechanics	Restricted elective	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

Table - Quantum Physics (thesis, 60 ECTS)

	Block 1	Block 2	Block 3	Block 4
1st year	Advanced Quantum Mechanics	Restricted elective	Restricted elective	Restricted elective
	Restricted elective	Restricted elective	Elective	Elective
2nd year	Thesis			

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

Tabel – Astrophysics (thesis, 45 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Theoretical Astrophysics	Observational Astrophysics
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

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

Table – Astrophysics (thesis, 60 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Theoretical Astrophysics	Observational Astrophysics
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Thesis			

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

Table - Biophysics (thesis, 45 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Biophysics of Cells and Single Molecules	Dynamical Models in Molecular Biology
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

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

Table - Biophysics (thesis, 60 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Biophysics of Cells and Single Molecules	Dynamical Models in Molecular Biology
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Thesis			

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

Table – Computational Physics (thesis, 45 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Scientific Computing	Inverse Problems
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

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

Table – Computational Physics (thesis, 60 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Scientific Computing	Inverse Problems
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Thesis			

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

Table – Earth and Climate Physics (thesis, 45 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Earth and Climate Physics	Inverse Problems
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

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

Table – Earth and Climate Physics (thesis, 60 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Earth and Climate Physics	Inverse Problems
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Thesis			

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

Tabel - Physics of Complex Systems (thesis, 45 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Complex Physics	Restricted elective
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Restricted elective	Thesis		
	Restricted elective			

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

Table – Physics of Complex Systems (thesis, 60 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Complex Physics	Restricted elective
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Thesis			

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

Table - Quantum Physics (thesis, 45 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Advanced Quantum Mechanics	Restricted elective
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
2nd year	Restricted elective	Thesis		
	Restrictive elective			

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

Table - Quantum Physics (thesis, 60 ECTS)*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Advanced Quantum Mechanics	Restricted elective
	Restricted elective	Restricted elective	Restricted elective	Restricted elective
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 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.

1.1 Astrophysics

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Astrosphysics in this curriculum (see above)			
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7.5 ECTS

1.2 Biophysics

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Biophysics in this curriculum (see above)			
NDAK10005U	Medical Image Analysis	Block 1	7.5 ECTS
NBIK10024U	Advanced Protein Science 2 – Protein Structure Determination	Block 4	7.5 ECTS
NDAK14007U	Applied Programming	Block 4	7.5 ECTS
NPLK17000U	Biological Imaging	Block 4	7,5 ECTS
NFYK20001U	Particle Detectors and Beams: Fundamentals and Developments in Physics and Life Science	Discontinued*	7.5 ECTS
NBIK10023U	Advanced Protein Science 1 - Protein Interactions and Sequences	Discontinued*	7.5 ECTS

*See discontinued courses below.

1.3 Computational Physics

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Computational Physics in this curriculum (see above)			
NFYK14024U	Turbulence	Block 2	7.5 ECTS
NDAA09009U	Numerical Optimisation (NO)	Block 3	7,5 ECTS
NDAK14007U	Applied Programming	Block 4	7,5 ECTS
NMAK15003U	Advanced Mathematical Physics (AdvMathPhys)	Block 4	7.5 ECTS
NDAK12006U	Computational Methods in Simulation (CMIS)	Block 4	7.5 ECTS
NFYK16007U	Dynamical Models for Climate and NWP	Discontinued*	7.5 ECTS
NFYK15004U	Advanced Seismology	Discontinued*	7.5 ECTS
NFYK20000U	Ocean Dynamics and Carbon Cycle	Discontinued*	7.5 ECTS

*See discontinued courses below.

1.4 Earth and Climate Physics

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Earth and Climate Physics in this curriculum (see above)			
NFYK14024U	Turbulence	Block 2	7.5 ECTS
NFYK15012U	General Circulation of the Atmosphere	Discontinued*	7.5 ECTS
NFYK16007U	Dynamical Models for Climate and NWP	Discontinued*	7.5 ECTS
NFYK15004U	Advanced Seismology	Discontinued*	7.5 ECTS
NFYK20000U	Ocean Dynamics and the Carbon Cycle	Discontinued*	7.5 ECTS

*See discontinued courses below.

1.5 Physics

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

Restricted elective subject elements

52.5 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
37.5 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation Physics in Complex Systems in this curriculum (see above)			
NFYK12009U	Astronomical Data Processing	Block 1	7.5 ECTS
NFYK14024U	Turbulence	Block 2	7.5 ECTS
NDAA09007U	Computability and Complexity	Block 3	7.5 ECTS
NFYK13004U	Quantum Field Theory 1	Block 3	7.5 ECTS
NDAK14007U	Applied Programming	Block 4	7.5 ECTS
NDAK12006U	Computational Methods in Simulation (CMIS)	Block 4	7.5 ECTS
NFYK14014U	Introduction to String Theory**	Block 4	7.5 ECTS
NFYK16007U	Dynamical Models for Climate and NWP	Discontinued*	7.5 ECTS

*See discontinued courses below.
**The course is not offered in the academic year 2022/23

1.6 Quantum Physics

Restricted elective subject elements

52.5 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
37.5 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS):

Restricted elective subject elements offered as part of the specialisation in Quantum Physics in this curriculum (see above)			
NMAK14020U	Quantum Information Theory	Block 3	7.5 ECTS
NFYA10009U	Fysiske undervisningsforsøg	Block 3	7.5 ECTS
NMAK15003U	Advanced Mathematical Physics	Block 4	7.5 ECTS
NFYK15015U	Particle Physics Phenomenology	Discontinued*	7.5 ECTS
NFYK20001U	Particle Detectors and Beams: Fundamentals and Developments in Physics and Life Science	Discontinued*	7.5 ECTS
NFYK13010U	Particle Physics at the Energy Frontier	Discontinued*	7.5 ECTS
NFYK14010U	Advanced Topics in Condensed Matter Theory	Discontinued*	7.5 ECTS
NFYK21000U	Advanced Topics in QFT & Gravity	Discontinued*	7.5 ECTS

*See discontinued courses below.

2 General changes for students admitted in the academic year 2020/21

Students admitted to the MSc Programme in the academic year 2020/21 must finish the programme as listed in the curriculum above with the following exceptions.

2.1 Astrophysics

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Astrosphysics in this curriculum (see above)			
NFYK13011U	Applied Statistics: From Data to Results	Block 2	7.5 ECTS
NFYK14018U	Computational Astrophysics: Star and Planet Formation	Discontinued*	7.5 ECTS

*See discontinued courses below.

2.2 Biophysics

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Biophysics in this curriculum (see above)			
NDAK10005U	Medical Image Analysis	Block 1	7.5 ECTS
NBIK10024U	Advanced Protein Science 2 – Protein Structure Determination	Block 4	7.5 ECTS
NDAK14007U	Applied Programming	Block 4	7.5 ECTS
NPLK17000U	Biological Imaging	Block 4	7.5 ECTS
NFYK20001U	Particle Detectors and Beams: Fundamentals and Developments in Physics and Life Science	Discontinued*	7.5 ECTS
NBIK10023U	Advanced Protein Science 1 - Protein Interactions and Sequences	Discontinued*	7.5 ECTS

*See discontinued courses below.

2.3 Computational Physics

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Computational Physics in this curriculum (see above)			
NFYK14024U	Turbulence	Block 2	7.5 ECTS
NDAA09009U	Numerical Optimisation (NO)	Block 3	7,5 ECTS
NDAK14007U	Applied Programming	Block 4	7,5 ECTS
NMAK15003U	Advanced Mathematical Physics (AdvMathPhys)	Block 4	7.5 ECTS
NDAK12006U	Computational Methods in Simulation (CMIS)	Block 4	7.5 ECTS
NFYK14018U	Computational Astrophysics: Star and Planet Formation	Discontinued*	7.5 ECTS
NFYK18002U	Concurrent and Distributed Systems	Discontinued*	7.5 ECTS
NFYK16007U	Dynamical Models for Climate and NWP	Discontinued*	7.5 ECTS
NFYK15004U	Advanced Seismology	Discontinued*	7.5 ECTS
NFYK20000U	Ocean Dynamics and Carbon Cycle	Discontinued*	7.5 ECTS

*See discontinued courses below.

2.4 Earth and Climate Physics

Title

The specialisation changed title from Geophysics to Earth and Climate Physics in the academic year 2021/22. The change of title also applies to students admitted in the academic year 2020/21.

Restricted elective subject elements

45 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
30 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation in Earth and Climate Physics in this curriculum (see above)			
NFYK14024U	Turbulence	Block 2	7.5 ECTS
NFYK15012U	General Circulation of the Atmosphere	Discontinued*	7.5 ECTS
NFYK16007U	Dynamical Models for Climate and NWP	Discontinued*	7.5 ECTS
NFYK15004U	Advanced Seismology	Discontinued*	7.5 ECTS
NFYK20000U	Ocean Dynamics and the Carbon Cycle	Discontinued*	7.5 ECTS

*See discontinued courses below.

2.5 Physics

Students admitted to the MSc Programme in the academic year 2020/21 must finish the programme as listed in the curriculum above with the following exceptions

Restricted elective subject elements

52.5 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
37.5 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS)

Restricted elective subject elements offered as part of the specialisation Physics in Complex Systems in this curriculum (see above)			
NFYK12009U	Astronomical Data Processing	Block 1	7.5 ECTS
NFYK14024U	Turbulence	Block 2	7.5 ECTS
NDAA09007U	Computability and Complexity	Block 3	7.5 ECTS
NFYK13004U	Quantum Field Theory 1	Block 3	7.5 ECTS
NDAK14007U	Applied Programming	Block 4	7,5 ECTS
NDAK12006U	Computational Methods in Simulation (CMIS)	Block 4	7.5 ECTS
NFYK14014U	Introduction to String Theory**	Block 4	7.5 ECTS
NFYK14018U	Computational Astrophysics: Star and Planet Formation	Discontinued*	7.5 ECTS
NFYK16007U	Dynamical Models for Climate and NWP	Discontinued*	7.5 ECTS

*See discontinued courses below.
**The course is not offered in the academic year 2022/23

2.6 Quantum Physics

Restricted elective subject elements

52.5 ECTS are to be covered as subject elements from the following list (thesis, 45 ECTS)
37.5 ECTS are to be covered as subject elements from the following list (thesis, 60 ECTS):

Restricted elective subject elements offered as part of the specialisation in Quantum Physics in this curriculum (see above)			
NMAK14020U	Quantum Information Theory	Block 3	7.5 ECTS
NFYA10009U	Fysiske undervisningsforsøg	Block 3	7.5 ECTS
NMAK15003U	Advanced Mathematical Physics	Block 4	7.5 ECTS
NFYK15015U	Particle Physics Phenomenology	Discontinued*	7.5 ECTS

Restricted elective subject elements offered as part of the specialisation in Quantum Physics in this curriculum (see above)			
NFYK20001U	Particle Detectors and Beams: Fundamentals and Developments in Physics and Life Science	Discontinued*	7.5 ECTS
NFYK13010U	Particle Physics at the Energy Frontier	Discontinued*	7.5 ECTS
NFYK14010U	Advanced Topics in Condensed Matter Theory*	Discontinued*	7.5 ECTS
NFYK21000U	Advanced Topics in QFT & Gravity	Discontinued*	7.5 ECTS

*See discontinued courses below.

5 Discontinued courses

Course Code	Course Title	ECTS	Interim arrangement
NBIK10023U	Advanced Protein Science 1 – Protein Interactions and Sequences	7.5	The course was restricted elective on the specialisation Biophysics 2020/21 and 2021/22. Offered for the last time: 2021/22. The course is identical to Advanced Protein Science 1 – Biophysical Methods (NBIK22002U) (NFYK21004U), 7.5 ECTS
NFYK15004U	Advanced Seismology	7.5	The course was restricted elective on the specialisations Computational Physics and Earth and Climate Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.
NFYK14010U	Advanced Topics in Condensed Matter Theory	7.5	The course was restricted elective on the specialisation Quantum Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.
NFYK21000U	Advanced Topics in QFT & Gravity	7.5	The course was restricted elective on the specialisation Quantum Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.
NFYK14018U	Computational Astrophysics: Star and Planet Formation	7.5	The course was restricted elective on the specialisations Astrophysics, Computational Physics and Physics in the academic year 2020/21 and earlier. Offered for the last time: 2020/21. The course is identical to Computational Astrophysics (NFYK21004U), 7.5 ECTS

Course Code	Course Title	ECTS	Interim arrangement
NFYK18002U	Concurrent and Distributed Systems	7.5	The course was restricted elective on the specialisation Computational Physics in the academic year 2020/21 and earlier. Offered for the last time: 2020/21. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2021/22.
NFYK16007U	Dynamical Models for Climate and NWP	7.5	The course was restricted elective on the specialisations Computational Physics, Earth and Climate Physics and Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.
NFYK15012U	General Circulation of the Atmosphere	7.5	The course was restricted elective on the specialisation Earth and Climate Physics Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.
NFYK20000U	Ocean Dynamics and Carbon Cycle	7.5	The course was restricted elective on the specialisations Computational Physics and Earth and Climate Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.

Course Code	Course Title	ECTS	Interim arrangement
NFYK20001U	Particle Detectors and Beams: Fundamentals and Developments in Physics and Life Science	7.5	The course was restricted elective on the specialisations Biophysics and Quantum Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.
NFYK13010U	Particle Physics at the Energy Frontier	7.5	The course was restricted elective on the specialisation Quantum Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. Last exam if applicable (cf. SCIENCE's Teaching and exam rules): 2022/23.
NFYK15015U	Particle Physics Phenomenology	7.5	The course was restricted elective on the specialisation Quantum Physics in the academic year 2021/22 and 2020/21. Offered for the last time: 2021/22. The course is identical to Modern Particle Physics (NFYK22002U)

Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:

- Scientific problems within the study programme's subject areas.
- A suitable combination of methodologies/theories based on international research for use in his/her work with the problem formulation.
- Theories/models on the basis of an organised value system and with a high degree of independence.

Skills in/to:

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

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

- Substantiate the idea of conducting experimental work/producing own data in order to shed light on the topic as formulated 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 work context.