STUDY REGULATION for **Physics and Scientific Modelling**

CAND.SCIENT.

Version: 8

Valid per 1 september 2024

ROSKILDE UNIVERSITY

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1. Study Regulation

1.1 The programme's name

Master programme in Physics and Scientific Modelling

1.2 Scope of the regulation

This study regulation is determined pursuant to The University Programme Order No. 2285 of 1 December 2021 on Bachelor and Master's (Candidatus) Programmes at Universities with any subsequent amendments and Roskilde University's common education regulations of 1 September 2023 with any subsequent amendments. The study regulation will become effective on 1 September 2024 and applies to all students.

Rules and Regulations concerning registration and de-registration for courses, projects, thesis and examination and regulations concerning start-of-studies examination, dispensations, mobility, credit transfer and pre-approval of credit transfer are specified in RUC's common education regulations.

1.3 Title

Graduates of the programme are awarded the degree: Master of Science (MSc) in Physics and Scientific Modelling
Graduates of the programme are awarded the Danish title: cand.scient. i Fysik og naturvidenskabelig modellering

2. The programme's objective, employment, and competency profile

2.1 Objective

The programme’s main purpose is to develop the students’ ability to apply the logic and fundamental theories and approaches of physics to solve problems and work with scientific and mathematical modelling both within and outside the domain of physics. The programme gives the students competence to identify, formulate and develop research questions on a physical basis, choose the right physical input and mathematical and/or numerical method for a given problem as well as evaluating the strength and limitation of a certain modelling approach. The programme trains skills and competences in experimental, numerical and analytical work while the weight of these components depends on the interests of the students.

The programme can be tuned to give different profiles depending on how the elective courses are chosen and the type of projects the student works with. Particularly there is the option of following one of three predefined thematic profiles, while it is also possible to follow the programme with an individual profile based on combining elements from the thematic profiles or including other elements. The three predefined thematic profiles are:

Experimental and computational physics: The focus in this theme is on the practical implementation of physics and scientific modelling. This includes a focus on the process of acquiring data via experiment or scientific computing and on data analysis and data science.

Mathematical foundation of physics and scientific modelling: The focus in this theme is on the role of mathematics in modelling and gives insight into the mathematical way of thinking and how it differs from physics. The theme has a focus on logic and proofs and gives a classical academic profile which for example is relevant for teaching.

Experimental and computational biophysics: The theme is analogous to that of experimental and computational physics, but with a focus on data acquisition, analysis and modelling in the specific area of biophysics, biochemistry and bioscience.

2.2 Employment

The programme has been designed with a particular view to qualifying for work within: Research, development and teaching within all areas and sectors where physics, mathematics and scientific modelling play a role including material

science, hospital physics, energy sector, medicine, finance, software development, data science as well as in companies that either provide or purchase modelling or consultancy tasks.

2.3 Competency profile

Through problem-oriented project learning and interdisciplinary problem identification and solving in combination with classroom and laboratory training the candidate will obtain the necessary knowledge and skills in physics and scientific modelling to understand and present data and complex problems within physics and in fields where thinking as a physicist plays a role in advancing the field. The programme is partly based on student-driven project work giving the candidate a solid foundation of independent identification, formulation and investigations of scientific research questions and especially how they can be answered with modelling using numeric as well as analytic methods. The candidate will be trained as a physicist with a focus on scientific modelling and depending on the choices within the programme the candidate will in addition be able to acquire a strong interdisciplinary profile particularly in the direction of mathematics or biophysics.

Knowledge and understanding

After completing the programme, the student is expected to be able to:

- apply their knowledge of fundamental theories of physics in problem solving
- identify different classes of mathematical and computational methods and models and decide which are relevant for a given problem
- demonstrate understanding and knowledge of advanced experimental and numerical methods and approaches in physics and scientific modelling
- demonstrate understanding and knowledge of the role of theory, experiment, models and numerical models in physics and the ability to combine these elements in solving problems within and outside the domain of physics
- reflect on what constitutes physics as an academic discipline and what concepts, ways of thinking, reasoning, and representations and mindsets are characteristic of physics.

Skills

After completing the programme, the student is expected to be able to:

- apply physical ways of thinking, reasoning, representations and mindsets in solving problems both within and outside the domain of physics
- develop, apply, implement and assess mathematical models within and outside the domain of physics
- summarize and evaluate scientific physics literature and relate it to data and results obtain in their own work
- obtain, analyse, present experimental data and relating data to theory and models
- decode, interpret and distinguish between and connect various representations of models, data and theory
- tackle an openly formulated problem by reformulating it in terms of physics and mathematics, solving the problem and evaluating the solution
- carry-out experiments, and model and evaluate the output data
- use a numerical tool to implement and analyse a mathematical model and evaluate the output data
- communicate concisely with different audiences and in different contexts – in writing as well as orally.

Competencies

After completing the programme, the student is expected to be able to:

- independently acquire knowledge and skills of concepts and methods within physics and scientific modelling

- identify, formulate and develop research questions within physics and establish testable hypotheses on a scientific basis
- plan and structure a scientific research projects with the relevant experimental and/or numerical strategies
- contribute with central knowledge of and approaches of physics to collaborative projects
- reflect critically on approaches to scientific modelling, including their strengths and limitations
- take responsibility for own professional development and specialisation within specific areas of the subjects.

3. Language

The programme is offered in English.

The examination language is identical to the teaching language.

4. Admission requirements

The Board of Studies specifies the admission requirements following the Ministerial Order on Admission to and Enrolment on Master's Degree Programmes at Universities.
The admission requirements are published as an appendix to the study regulation on the university's website. Changes in admission requirements are announced at least one year before the commencement of studies.

5. ECTS rating and duration

The programme is a full-time programme corresponding to 120 ECTS and planned in preparation for a two years full-time study.

6. Board of Studies, Corps of External Examiners and Main area affiliation

6.1 Board of Studies

The programme falls under Board of Studies for Natural Sciences

6.2 Corps of External Examiners

The programme falls under Physics and Astronomy

6.3 Main area affiliation

The programme falls under the main subject area natural sciences

7. The programme's structure

7.1 Schematic structure of the programme

General Profile

4 semester	Master Thesis (30 ECTS)				
3 semester	Problem Solving in Physics II (10 ECTS)		Elective / Thematic course (5 ECTS)	Specialisation Project /Project-oriented Internship (15 ECTS)	
2 semester	Problem Solving in Physics I	Elective/Thematic Course (Total of 10 ECTS)		Differential Equations in Models / Dynamical Systems Analysis (5 ECTS)	Scientific Computing and Data Science / Advanced Topics in Mathematics (10 ECTS)
1 semester	Experiments and Models - Linear Response: Structure and Dynamics of Condensed Matter (10 ECTS)		Statistical Physics with Scientific Programming (5 ECTS)	Modelling Project (15 ECTS)	

Thematic Profile 1: Experimental and Computational Physics

4 semester	Master Thesis (30 ECTS)				
3 semester	Problem Solving in Physics II (10 ECTS)		Parameter Estimation (5 ECTS)	Specialisation Project /Project-oriented Internship (15 ECTS)	
2 semester	Problem Solving in Physics I (5 ECTS)	Integrated Science / Elective (5 ECTS)	Probability and Statistics (5 ECTS)	Differential Equations in Models (5 ECTS)	Scientific Computing and Data Science (10 ECTS)
1 semester	Experiments and Models - Linear Response: Structure and Dynamics of Condensed Matter (10 ECTS)		Statistical Physics with Scientific Programming (5 ECTS)	Modelling Project (15 ECTS)	

Thematic Profile 2: Mathematical Foundation of Physics and Scientific Modelling

4 semester	Master Thesis (30 ECTS)				
3 semester	Problem Solving in Physics II (10 ECTS)		Differential Geometry (5 ECTS)	Specialisation Project /Project-oriented Internship (15 ECTS)	
2 semester	Problem Solving in Physics I (5 ECTS)	Integrated Science / Elective (5 ECTS)	Probability and Statistics (5 ECTS)	Dynamical Systems Analysis (5 ECTS)	Advanced Topics in Mathematics (10 ECTS)
1 semester	Experiments and Models - Linear Response: Structure and Dynamics of Condensed Matter (10 ECTS)		Statistical Physics with Scientific Programming (5 ECTS)	Modelling Project (15 ECTS)	

Thematic Profile 3: Experimental and Computational Biophysics

4 semester	Master Thesis (30 ECTS)				
3 semester	Problem Solving in Physics II (10 ECTS)		Proteomics and Metabolomics (5 ECTS)	Specialisation Project /Project-oriented Internship (15 ECTS)	
2 semester	Problem Solving in Physics I (5 ECTS)	Integrated Science / Elective (5 ECTS)	Biophysical Chemistry (5 ECTS)	Differential Equations in Models (5 ECTS)	Scientific Computing and Data Science (10 ECTS)
1 semester	Experiments and Models - Linear Response: Structure and Dynamics of Condensed Matter (10 ECTS)		Statistical Physics with Scientific Programming (5 ECTS)	Modelling Project (15 ECTS)	

Regarding elective courses and thematic profiles

Students can choose between the offered elective courses. The students also have the opportunity, as part of the elective courses, to choose between three thematic profiles, each consisting of four pre-appointed courses. Please note that the offering of the specialisation courses is depending on the total number of course registrations.

Thematic profile 1: Experimental and Computational Physics

- Scientific Computing and Data Science (10 ECTS)
- Differential Equations in Models (5 ECTS)
- Probability and Statistics (5 ECTS)
- Parameter Estimation (5 ECTS)

Thematic profile 2: Mathematical Foundation of Physics and Scientific Modelling

- Advanced Topics in Mathematics (10 ECTS)
- Dynamical Systems Analysis (5 ECTS)

- Probability and Statistics (5 ECTS)
- Differential Geometry (5 ECTS)

Thematic Profile 3: Experimental and computational biophysics

- Scientific Computing and Data Science (10 ECTS)
- Differential Equations in Models (5 ECTS)
- Biophysical Chemistry (5 ECTS)
- Proteomics and Metabolomics (ECTS)

7.2 First semester

Objective

The objective of the first semester is that the student through exemplary work in a semester project and mini-project-based courses gets experience with and knowledge about the interplay between experiment, theory, models and numerical methods in physics and scientific modelling. The students will acquire both experimental and computational skills in the courses and the project can be tuned in a theoretical, experimental or computational direction depending on the students' interest.

Mandatory study activities

- Experiments and Models – Linear Response and Structure and Dynamics of Condensed Matter (10 ECTS)*
- Statistical Physics with Scientific Programming (5 ECTS)
- Modelling Project (15 ECTS)

*Students who passed Physical Techniques - please look for the transitional rules in 7.6.

7.3 Second semester

Objective

The second semester is the profiling semester where the students start working with their thematic profile of choice or their individual profile. In addition, all students are introduced to problem solving in physics, which trains the students in tackling openly formulated problem, formulating it in terms of physics and mathematics, solving the problem and evaluating the solution.

In the thematic profile "Experiments and computational physics" the student will develop computational knowledge and numeric skills in scientific computing and data science as well as acquiring methods in statistics and probability theory.

In the thematic profile "Mathematical Foundation" the student will develop competences of the logical thinking and proofs furthermore the student will obtain knowledge of an advanced topic in mathematics and acquire knowledge and methods of statistics and probability theory.

In the thematic profile "Experimental and computational biophysics" the student will develop computational knowledge and numeric skills in scientific computing and data science as well as applying the fundamental theories of physics in the context of biophysics and establish knowledge of a biochemical way of thinking and analysing a given problem.

General profile

Mandatory study activities (20 ECTS)

- Problem Solving in Physics I (5 ECTS)*
- Scientific Computing and Data Science (10 ECTS) or Advanced Topics in Mathematics (10 ECTS)
- Differential Equations in Models (5 ECTS)** or Dynamical Systems Analysis (5 ECTS)

Elective study activities (the student must choose a total of 10 ECTS)

- Integrated Science (5 ECTS)
- Probability and Statistics (5 ECTS)
- Biophysical Chemistry (5 ECTS)

The student can also choose among the following courses if the courses do not already account for a mandatory course in the student's programme:

- Scientific Computing and Data Science (10 ECTS)
- Advanced Topics in Mathematics (10 ECTS)
- Dynamical Systems Analysis (5 ECTS)

Each semester, the board of studies approves a number of courses for the students to choose from. Please note that the offering of the specialisation courses is depending on the total number of course registrations.

*Students who passed the Bachelor Subject Course in Problem Solving I - please look for the transitional rules in 7.6.

**Students who passed the Subject Module Course 1: Dynamical Systems and Models - please look for the transitional rules in 7.6.

7.4 Third semester

Objective

In the third semester the students learn how to think like a physicist where the course problem solving in physics II serves as a culmination of the training in working with modelling in a problem-solving context using all the different sub-disciplines of physics. The students will learn to tackle an openly formulated problem, formulate it in terms of physics and mathematics, solving the problem and evaluating the solution. The semester also serves as a specialisation semester where students via the project and a profile/elective course develop their profile further either in a branch of physics or by broadening their scope by applying physics and scientific computing in other branches of science.

General profile

Mandatory study activities

- Problem Solving in Physics II (10 ECTS)
- Specialisation project or Project-oriented Internship (15 ECTS)

Elective study activities (5 ECTS)

- Parameter Estimation (5 ECTS)
- Differential Geometry (5 ECTS)
- Proteomics and Metabolomics (5 ECTS)
- Advanced Physics (5 ECTS)

Each semester, the board of studies approves a number of courses for the students to choose from. Please note that the offering of the specialisation courses is depending on the total number of course registrations.

7.5 Fourth semester - Master Thesis

Objective

The objective of the master thesis is that the student reaches the research front in a selected area within physics and/or scientific modelling, the mathematical foundation of physics and scientific modelling, or in another field where thinking as a physicist and/or scientific modelling plays a role in advancing the field. The goal is that the student makes

independent methodological choices and conducts experimental, computational and/or analytical work to solve a scientific problem. The master thesis also serves as the final specialisation of the student.

- Master Thesis (30 ECTS)

7.6 Transitional rules

Students who have passed Physical Techniques (5 ECTS) must take an elective course (5 ECTS) and are not allowed to follow Experiments and Models (10 ECTS).

Students who have passed Problem Solving I (10 ECTS) during their Bachelor programme are not allowed to take the course Problem Solving in Physics I (5 ECTS). The students must take Quantum Mechanics (10 ECTS) instead of Problem Solving in Physics I and one of the elective courses (5 ECTS).

Students who have passed Subject Module Course 1: Dynamical Systems and Models (5 ECTS) during their bachelor programme are not allowed to take Differential Equations in Models (5 ECTS).

Students who have completed a course in Quantum Mechanics during their bachelor programme are not allowed to follow Quantum Mechanics (10 ECTS). Students who have completed a course in Electrodynamics during their bachelor programme are not allowed to follow Electrodynamics in Advanced Physics (5 ECTS).

7.7 Overall description of study activities

Study activities

- Experiments and Models – Linear Response: Structure and Dynamics of Condensed Matter. (10 ECTS)
- Statistical Physics with Scientific Programming (5 ECTS)
- Modelling Project (15 ECTS)
- Problem Solving in Physics I (5 ECTS)
- Scientific Computing and Data Science (10 ECTS)
- Advanced Topics in Mathematics (10 ECTS)
- Differential Equations in Models (5 ECTS)
- Dynamical Systems Analysis (5 ECTS)
- Integrated Science (5 ECTS)
- Probability and Statistics (5 ECTS)
- Biophysical Chemistry (5 ECTS)
- Problem Solving in Physics II (10 ECTS)
- Specialisation Project (15 ECTS)
- Parameter Estimation (5 ECTS)
- Differential Geometry (5 ECTS)
- Proteomics and Metabolomics (5 ECTS)
- Advanced Physics (5 ECTS)
- Project-oriented Internship (15 ECTS)
- Quantum Mechanics (10 ECTS)
- Master Thesis (30 ECTS)

Title	**Experiments and Models – Linear Response: Structure and Dynamics of Condensed Matter**
Type of activity	Course
Mandatory or elective	Mandatory
ECTS-rating	10 ECTS

Teaching language	English
Overall objective	The course in Experiments and Models is intended to train the student's skills to conduct experiments, treat data and construct models for physical systems. The students will acquire exemplary knowledge on the interplay between theory, models and experiments and learn to bring them into play in a concrete context.
Overall learning outcomes	After completing the course the students will be able to • demonstrate skills in using certain technical apparatus for physics experiments e.g., electronic measuring equipment and data collection on computers • analyse and present the data obtained • demonstrate knowledge, understanding and insight into selected elements of electrodynamics, continuum mechanics, thermodynamics and condensed matter physics in a concrete experimental context • demonstrate understanding and reflection on the overview of the experimental methods used and their status in physics • apply complex functions and linear differential equations in order to model experimental results. • define basic scattering theory and use it to describe theory and dynamics of liquids • discuss the importance of the experimental results achieved and relate them to relevant theories and models.
Type of exam	**Type of exam** Individual oral exam based on a portfolio. The character limit of the portfolio is 1,200-120,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an assessment of the oral examination. The written product(s) is not part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale. Moderation: Internal co-assessor

	Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Statistical Physics with Scientific Programming**
Type of activity	Course
Mandatory or elective	Mandatory
ECTS-rating	5 ECTS
Teaching language	English
Overall objective	To give the student in-depth understanding of advanced thermodynamics and statistical physics, including: • Free energies and phases • Boltzmann statistics • Systems of interacting particles To give the student experience in the interplay between analytical and numerical methods as applied to these subjects. To give the student exemplary knowledge and understanding of the strengths and limitations of analytical and numerical methods in the above contexts so that the student can recognize these when the methods are applied in other contexts
Overall learning outcomes	After completing the course, the students will be able to • apply in-depth knowledge and understanding of free energies and Boltzmann statistics to new problems • understand and demonstrate in-depth knowledge of systems of interacting particles and analyse such systems • apply numerical and simulations methods to models in statistical physics. This includes the relevant programming, testing, and analysis of data.
Type of exam	**Type of exam** Individual oral exam based on a portfolio. The character limit of the portfolio is 1,200-120,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30

	minutes. The assessment is an assessment of the oral examination. The written product(s) is not part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale. Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Modelling Project**
Type of activity	Project
Mandatory or elective	Mandatory
ECTS-rating	15 ECTS
Teaching language	English
Overall objective	The project work is problem-oriented and exemplary. The project must contain specific work of a modelling nature. The project may be mainly experimental, computational and/or theoretical in nature, and must in an exemplary manner illustrate the interplay between model, theory and experiment/data. The research question addressed in the project may be within physics or may be a question (or problem) where physics approaches (such as methodologies from physics and physical thinking) plays a role in the solution.
Overall learning outcomes	After completing the project, the students will be able to independently plan and carry out relevant theoretical, computational and/or experimental work • analyse and present the results achieved • demonstrate in depth knowledge and understanding of the experimental/theoretical methods applied in the project and argue for why these are the relevant methods • apply in-depth mathematical and/or physical concepts, models and ways of thinking • relate experiment, data and theory • decode, interpret, distinguish between and connect various representations of models, data and theory in relation to the project • critically discuss the significance of the results achieved and to relate the results to the relevant scientific literature in the area.
Type of exam	

	Type of exam Oral project exam in groups with individual assessment. Permitted group size: 2-7 students. The character limits of the project report are: For 2 students: 4,800-240,000 characters, including spaces. For 3 students: 4,800-240,000 characters, including spaces. For 4 students: 4,800-240,000 characters, including spaces. For 5 students: 4,800-240,000 characters, including spaces. For 6 students: 4,800-240,000 characters, including spaces. For 7 students: 4,800-240,000 characters, including spaces. The character limits include the cover, table of contents, summary, bibliography, figures and other illustrations, but exclude any appendices. The project report must include a summary in English, that is part of the assessment. Time allowed for exam including time used for assessment is for: 2 students: 60 minutes. 3 students: 75 minutes. 4 students: 90 minutes. 5 students: 105 minutes. 6 students: 120 minutes. 7 students: 135 minutes. Writing and spelling skills in the project report are part of the assessment. Permitted support and preparation materials at the oral exam: All Assessment: 7-point grading scale. Moderation: Internal co-assessor. Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Problem Solving in Physics I**
Type of activity	Course
Mandatory or elective	Mandatory
ECTS-rating	5 ECTS
Teaching language	English

Overall objective	The course Problem Solving in Physics will develop the students' skills and competences in recognising the difference between formalised and unformalized physics problems, formalising problems in terms of physics, solving these problems and evaluating the solutions. This is done by exemplary work within a series of the theory constructs of physics.
Overall learning outcomes	After completing the course the students will be able to • demonstrate knowledge and understanding of some of the theory constructs of physics, e.g., Classical Mechanics and Thermodynamics • determine and argue for which type of physics is in play in an unformalized problem in physics • distinguish between formalized and unformalized problems in physics • tackle an unformalized problem, formulating it in terms of physics and mathematics, solving the problem and evaluating the solution • "think like a physicist" within selected parts of physics.
Type of exam	**Type of exam** Individual oral exam based on a portfolio. The character limit of the portfolio is 1,200-120,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 15 minutes. The assessment is an assessment of the oral examination. The written product(s) is not part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: Pass/Fail. Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Scientific Computing and Data Science**

Amended	01.09.2024
Type of activity	Course
Mandatory or elective	Mandatory Physics and Scientific Modelling - Thematic profile 1 and 3. Mathematical Bioscience and Physics and Scientific Modelling - General profile: a choice between Advanced topics in Mathematics and Scientific Computing and Data Science.
ECTS-rating	10 ECTS
Teaching language	English
Overall objective	To give the student experience in choosing and applying the methods of Scientific Computing and Data Science to new problems and to give the student an overview of methods associated with: • Scientific Computing, i.e., the use of computers and applied math to generate data from models by numerical methods and/or simulation. • Data Science, i.e., the use of computers, models, and applied math to gain insight from data.
Overall learning outcomes	After completing the course the students will be able to • demonstrate an overview of methods in Scientific Computing and Data Science. • choose methods in Scientific Computing and Data Science relevant for a given problem. • independently learn about methods in Scientific Computing and Data Science on an advanced level. • apply methods in Scientific Computing and Data Science to a new problem. This includes the relevant programming, testing, and interpretation of results.
Type of exam	**Type of exam** Individual oral exam based on a portfolio. The character limit of the portfolio is 1,200-120,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an assessment of the oral examination. The

	written product(s) is not part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale. Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Advanced Topics in Mathematics**
Amended	01.09.2024
Type of activity	Course
Mandatory or elective	Mandatory/Elective
ECTS-rating	10 ECTS
Teaching language	English
Overall objective	The overall objective of the course is to give the student an understanding of an advanced mathematical topic relevant to the Mathematical Bioscience and Physics and Scientific Modelling programmes. This includes topics on pure mathematics and/or applied mathematics.
Overall learning outcomes	After completing the course, the students will be able to: • Demonstrate knowledge and understanding of the topic on an advanced level. • Critically validate the topic's strengths and limitations. • Independently obtain further understanding the specific topic. • Communicate and present the topic's element to both experts and non-experts. • Engage (alone or in a research team) in further development of the topic.
Type of exam	**Type of exam** Individual written portfolio and oral exam The character limit of the portfolio is 1,200-12,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback,

	reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an assessment of the oral examination. The written product(s) is not part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Differential Equations in Models**
Type of activity	Course
Mandatory or elective	Mandatory Physics and Scientific Modelling - Thematic profile 1 and 3. Physics and Scientific Modelling - General profile: a choice between Differential Equations in Models and Dynamical Systems Analysis.
ECTS-rating	5 ECTS
Teaching language	English
Overall objective	The objective is to give the students skills and competences to work with mathematical modelling and dynamic systems in general, including the mathematical concepts and theories that are included in the study of ordinary differential equations. The objective is to give the students proficiency in solving and analysing differential equations both with analytical and numerical methods.
Overall learning outcomes	After completing the course the student will be able to • demonstrate knowledge and understanding of fundamental concepts in mathematical modelling and dynamic systems in general • knowledge and understanding of exemplary mathematical models, their basis, structure, characteristics, scope and validity

	• knowledge and understanding of mathematical methods and theories typically used in connection with mathematical modelling • analyse and use mathematical models and dynamic systems in general • handle and use the symbolic mathematical language and the key mathematical concepts involved • analyse and critically assessing available mathematical models in terms of scope, usability and relevance • communicate with colleagues and laymen about mathematical models and dynamic systems, their properties and usability • mathematical modelling • independently identify and analyse exemplary mathematical models and dynamic systems.
Type of exam	**Type of exam** Individual written take-home assignment The character limit of the assignment is: 1,200-120,000 characters, including spaces. The character limit includes the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. The students start writing the take-home assignment during the course. The duration is 7 days and may include public holidays. The submission deadline will be announced on study.ruc.dk. Assessment: 7-point grading scale Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Dynamical Systems Analysis**
Type of activity	Course
Mandatory or elective	Mandatory Physics and Scientific Modelling - General Profile: a choice between Differential Equations in Models and Dynamical Systems Analysis.
ECTS-rating	5 ECTS
Teaching language	English

Overall objective	The overall objective of the course is to give the student an advanced understanding dynamical systems and how analysis of these are constructed.
Overall learning outcomes	After the course the student will be able to • formulate mathematical analysis of non-linear differential equation systems, e.g., via phase plane analysis. • perform local and global stability analysis. • demonstrate in-depth knowledge about bifurcations and how these affect the dynamics in mathematical models. • present results from the mathematical analysis in a clear and concise manner using mathematical formalism and reasoning. • critically assess the mathematical methodology behind analysis of dynamical systems analysis
Type of exam	**Type of exam** Individual oral exam based on a portfolio. The character limit of the portfolio is 1,200-120,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an assessment of the oral examination. The written product(s) is not part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale. Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Integrated Science**
Type of activity	Course
Mandatory or elective	Elective
ECTS-rating	5 ECTS

Teaching language	English
Overall objective	The purpose of the course is to provide the student with an overview of the application, reflection and internal subject-matter perspectives in the field of mathematics and physics
Overall learning outcomes	After completing the course the students will be able to • Explain and understand different scientific subject-matters and perspectives in the field of mathematics and physics. • explain and analyse differences and similarities between examples of mathematical-physical models • explain and analyse differences and similarities between examples of application, reflection and internal subject-matter perspectives in the field of mathematics and physics • convey and communicate accurately different perspectives in the field of mathematics and physics
Type of exam	**Type of exam** Individual written take-home assignment. The character limit of the assignment is: 24,000-48,000 characters, including spaces. The character limit includes the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. The students start writing the take-home assignment during the course. The duration is 28 days and may include public holidays. The submission deadline will be announced on study.ruc.dk. Assessment: Pass/Fail. Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Probability and Statistics**
Amended	01.09.2024
Type of activity	Course
Mandatory or elective	Mandatory Mandatory: Mathematical Bioscience and Physics and Scientific Modelling - Thematic profile 1 and 2. Elective: Physics and Scientific Modelling - General profile.

ECTS-rating	5 ECTS
Teaching language	English
Overall objective	The overall objective of the course in Probability and Statistics is to endow the student with a fundamental understanding of how the mathematical theory of probability and statistics is constructed, enabling the student to critically reflect on how statistical analysis of data is applied.
Overall learning outcomes	After the course the student will be able to • compute with and understand the theory behind probability distributions, and model random phenomena using probability theory, stochastic variables and mathematical reasoning, • apply parametric statistics to data, in particular in formulating hypotheses, assessing estimators, computing test probabilities and interpreting the results using mathematical and statistical reasoning, • apply digital tools for statistical investigations, model simulation, and analysis, • describe and explain the mathematical structure of probability theory, • demonstrate in-depth understanding of how parametric statistics is built upon probability theory. • analyse, evaluate and formulate models of stochastic phenomena using mathematical and statistical reasoning. • present stochastic and statistical theories and methods in a clear and concise manner using mathematical formalism
Type of exam	**Type of exam** Individual written portfolio and oral exam The character limit of the portfolio is 1,200-24,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an overall assessment of the written product(s) and the subsequent oral examination. Permitted support and preparation materials for the oral exam: All.

	Assessment: 7-point grading scale Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Biophysical Chemistry**
Amended	01.09.2024
Type of activity	Course
Mandatory or elective	Elective
ECTS-rating	5 ECTS
Teaching language	English
Overall objective	The aim of this course is to give the student molecular-level understanding of the structure, stability, interactions and dynamics of proteins—basically “Why do proteins behave like they do and how can we interfere with it?”. The course will also introduce the principal methods used in modern protein science and provide practical experience in using some of these.
Overall learning outcomes	After completing the course the student will be able to: • account for the principal physico-chemical properties of proteins, such as structure, stability, interactions and dynamics and accounting for these properties in terms of molecular-level theroetical models • interpret experimental results from physico-chemical studies of proteins • apply physico-chemical concepts and models to solve problems involving proteins • carry out spectroscopic measurements on proteins • critically assess research literature in protein science, and effectively communicate with researchers in protein science.
Type of exam	**Type of exam** Group portfolio and oral exam Permitted group size: 2-3 students. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits.

	The character limit of the portfolio is: For 2 students: 12,000-36,000 characters, including spaces. For 3 students: 12,000-36,000 characters, including spaces. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude appendices. Time allowed for the exam including time used for assessment is for: 2 students: 35 minutes. 3 students: 50 minutes. The assessment is individual and based on the student's individual performance. The assessment is an overall assessment of the written product(s) and the subsequent oral examination.. Permitted support and preparation materials at the oral exam: Personal notes, own reports and assignments. Assessment: Pass/Fail Moderation: Internal co-assessor. Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Problem Solving in Physics II**
Type of activity	Course
Mandatory or elective	Mandatory
ECTS-rating	10 ECTS
Teaching language	English
Overall objective	The course Problem Solving in Physics II will develop the student's skills and competences in formalising problems in terms of physics, solving these and evaluating the solutions. This is done by exemplary work within the fundamental theories of physics (i.e., the fundamental theories of physics covered in Problem Solving in Physics I are included).
Overall learning outcomes	After completing the course the students will be able to • demonstrate and apply knowledge and understanding of electrodynamics, optics, quantum physics, statistical physics, atomic, nuclear, particle and solid state physics • determine and argue which physics are at play in an openly formulated problem

	• work out an openly formulated problem in physical and mathematical terms, solve the problem and evaluate the solution • 'think like a physicist'.
Type of exam	**Type of exam** Individual written invigilated exam. The duration of the exam is 4 hours. Permitted support and preparation materials for the exam: A formulae collection of max. one A4 size page (both sides of the paper may be used) made by the student. Assessment: 7-point grading scale. Moderation: External examiner. Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Specialisation Project**
Type of activity	Project
Mandatory or elective	Elective
ECTS-rating	15 ECTS
Teaching language	English
Overall objective	The purpose of the specialisation project is that the students start their specialisation – which will be culminated in the master thesis. The aim is that the student specialises in a concrete competence and obtain specific skills, and if relevant make preparatory studies for the thesis project. The project may be experimental, empirical, computational and/or theoretical. The specialisation project is problem-oriented and exemplary and should address a research question within one of the following three variants: • Fundamental research within physics and/or scientific modelling, the mathematical foundations of physics and scientific modelling, or aneighbouring discipline where thinking as a physicist and/or scientific modelling plays a role in advancing the field. • Applied research where physics and/or scientific modelling plays a role in solving a problem. • Research within philosophy, history or didactics of physics, mathematics and science in which having a background in physics,mathematics and scientific modelling contributes significantly to developing the understanding of the problem.

Overall learning outcomes	After completing the specialisation project the students will be able to • demonstrate knowledge and understanding of the theoretical concepts relevant for the project as well as their scope and relations • explain and choose the relevant analytical/numerical/empirical and/or experimental methods applied in the project • critically relate the strengths and weaknesses of applied theories, methods and models in the project • communicate the results achieved to a selected target group • identify and formulate an exemplary research question within the selected area, which can be handled by using the means available • discuss the significance of the results achieved critically and to relate the results to relevant scientific literature in the area, including in particular theoretical literature.
Type of exam	**Type of exam** Oral project exam in groups with individual assessment. Permitted group size: 2-7 students. The character limits of the project report are: For 2 students: 4,800-240,000 characters, including spaces. For 3 students: 4,800-240,000 characters, including spaces. For 4 students: 4,800-240,000 characters, including spaces. For 5 students: 4,800-240,000 characters, including spaces. For 6 students: 4,800-240,000 characters, including spaces. For 7 students: 4,800-240,000 characters, including spaces. The character limits include the cover, table of contents, summary, bibliography, figures and other illustrations, but exclude any appendices. The project report must include a summary in English, that is part of the assessment. Time allowed for exam including time used for assessment is for: 2 students: 60 minutes. 3 students: 75 minutes. 4 students: 90 minutes. 5 students: 105 minutes. 6 students: 120 minutes. 7 students: 135 minutes. Writing and spelling skills in the project report are part of the assessment. Permitted support and preparation materials at the oral exam: All

	Assessment: 7-point grading scale. Moderation: Internal co-assessor. Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Parameter Estimation**
Type of activity	Course
Mandatory or elective	Mandatory/Elective Mandatory: Mathematical Bioscience. Physics and Scientific Modelling - Thematic profile 1 Elective: Physics and Scientific Modelling - General profile
ECTS-rating	5 ECTS
Teaching language	English
Overall objective	The overall objective of the course is to provide students with a fundamental understanding of selected methods in the field of parameter estimation. Students will learn to apply parameter estimation critically in various biological applications, by working with empirical data and mathematical models.
Overall learning outcomes	The student will be able to • apply singular-value decomposition to big data sets, principal component analysis, and model selection, • critically use the concept of identifiability and evaluate methods to determine parameter identifiability to real world data and models, • critically judge the applicability of various methods for parameter estimation • show an overview of selected methods for parameter estimation, and critically and analytically explore the limitations and validity of the methods, • calculate and discuss uncertainty quantification critically. • perform case based numerical explorations using software
Type of exam	**Type of exam** Individual written take-home assignment. The character limit of the assignment is: 1,200-120,000 characters, including spaces.

	The character limit includes the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. The duration of the take-home assignment is 24 hours. Assessment: 7-point grading scale. **Reexam** Individual oral exam without time for preparation. Time allowed for exam including time used for assessment: 30 minutes. Permitted support and preparation materials: Course material and own notes. Assessment: 7-point grading scale. Moderation: Internal co-assessor. Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Differential Geometry**
Type of activity	Course
Mandatory or elective	Mandatory/Elective Mandatory: Mathematical Bioscience. Physics and Scientific Modelling - Thematic profile 2 Elective: Physics and Scientific Modelling - General profile
ECTS-rating	5 ECTS
Teaching language	English
Overall objective	The overall objective of the course in Differential Geometry is to give the student an understanding of its construction and formalism, which enables the student to apply differential geometry in the critical analysis of other mathematical contexts.
Overall learning outcomes	After the course the student will be able to • construct, examine and analyse curves and surfaces in R3. • apply mathematical analysis and linear algebra in differential geometry.

	• describe the notion and power of chart invariance. • demonstrate in-depth understanding of the relation between manifolds, synthetic differentiability, tangent space, Riemannian metrics and the metric structure of manifolds. • demonstrate in-depth understanding of the relation between ODE's on manifolds and vector fields on manifolds. • operate with concepts and ideas from differential geometry in other mathematical contexts.
Type of exam	**Type of exam** Individual oral exam based on a portfolio. The character limit of the portfolio is 1,200-120,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an assessment of the oral examination. The written product(s) is not part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale. Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Proteomics and Metabolomics**
Amended	01.09.2024
Type of activity	Laboratory Course
Mandatory or elective	Elective
ECTS-rating	5 ECTS
Teaching language	English
Overall objective	Proteomics and metabolomics are used to profile large numbers of proteins and small molecule metabolites, respectively, within a cell,

	tissue, organ, or organism. This provides an overview of which biochemical processes that are affected and can provide new biological insights and unravel new hypotheses. These methods represent a shift in paradigm from hypothesis-driven studies where only one or a few compounds are measured. The aim of this course is to teach the students the principles of proteomics and metabolomics by mass spectrometry (MS) and NMR, and to make them acquainted with the practical steps involved in both types of analyses.
Overall learning outcomes	After completing the course the student will be able to: • account for essential aspects of the techniques used in proteomics and metabolomics • perform simple metabolomic and proteomic experiments • prepare samples for preparation metabolomics and proteomics • analyse and interpret metabolomic and proteomic data • apply those methods to solve unfamiliar problems.
Type of exam	**Type of exam** Individual written portfolio and oral exam The character limit of the portfolio is 12,000-36,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude appendices. Time allowed for the exam including time used for assessment: 20 minutes. The assessment is an overall assessment of the written product(s) and the subsequent oral examination. Permitted support and preparation materials for the oral exam: PowerPoint presentation or equivalent and notes to presentation. Assessment: Pass/Fail Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Advanced Physics**
Type of activity	Course

Mandatory or elective	Elective
ECTS-rating	5 ECTS
Teaching language	English
Overall objective	The course covers a selected area of physics that is dealt with in depth. The field can be theoretical, experimental or a combination of theoretical and experimental. For each academic year, the selected field of the course is announced in advance by the Board of Studies.
Overall learning outcomes	After completing the course the students will be able to • in-depth knowledge and understanding of a selected area of physics • skills relevant to the selected area of physics • competences relevant to the selected area of physics. • competences in being able to independently learn about a (to the student) new area of physics.
Type of exam	**Type of exam** Individual oral exam based on a portfolio. The character limit of the portfolio is 1,200-12,000 characters, including spaces. Examples of written products are exercise responses, talking points for presentations, written feedback, reflections, written assignments. The preparation of the products may be subject to time limits. The character limits include the cover, table of contents, bibliography, figures and other illustrations, but exclude any appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an overall assessment of the written product(s) and the subsequent oral examination. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale. Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Project-oriented Internship**
Type of activity	Project oriented internship

Mandatory or elective	Elective
ECTS-rating	15 ECTS
Teaching language	English
Overall objective	The purpose of the project-oriented internship is that the student engages and works in a professional context where physics and/or scientific modelling play a role. The student will achieve experience with using the thinking and methods of physics and/or scientific modelling in a practical context. The student will write a project based on the internship which can either report the results of the work done during the internship in a scientific manner or report the work along with an analysis and reflection on the role of physics and scientific modelling in the workplace in question.
Overall learning outcomes	After completing the project the student will be able to • present and reflect on the experience of working in an institution/company engaged in teaching, research, development or operation by means of physics and/or scientific computing • argue which experimental/theoretical/analytical methods that are relevant to the selected research question including the strengths and weaknesses of the methods applied • plan and perform practical tasks by applying the models, methods and fundamental theories used in physics, mathematics and/or scientific computing according to the opportunities offered in a specific organizational context • analyse and present results achieved on the basis of the relevant theories and methods to selected target groups • reflect critically on the practices of a specific organization participate actively and autonomously in solving assignments in organizations where mathematical physical capabilities and skills contribute to creating value for the organization • enter a dialogue with other professional groups on how their own knowledge and skills can contribute to a qualified execution of tasks • discuss the significance of the results achieved critically based on the relevant methods and theories and to relate the results to selected scientific literature in the area.
Type of exam	**Type of exam** Project-oriented internship based on an individual written product and an oral exam The character limit of the written product is: 24,000-240,000 characters, including spaces. The character limit includes the cover, table of contents, bibliography, figures and other illustrations, but excludes

	appendices. Time allowed for exam including time used for assessment: 30 minutes. The assessment is an assessment of the written product and the oral performance. Writing and spelling skills in the report are part of the assessment. Permitted support and preparation materials for the oral exam: All. Assessment: 7-point grading scale Moderation: Internal co-assessor Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Quantum Mechanics**
Type of activity	Course
Mandatory or elective	Mandatory
ECTS-rating	10 ECTS
Teaching language	English
Overall objective	The course is offered for a short period of time and only to students who have passed the Bachelor Course in Problem Solving I. Quantum mechanics is treated as a self-consistent theoretical foundation in physics. Emphasis is placed on the student's acquisition of an in-depth understanding of, and practice in, problem solving within quantum mechanics, as well as an insight into different interpretations of quantum mechanics.
Overall learning outcomes	After completing the course the students will be able to • in-depth knowledge and understanding of quantum mechanics, seen as a self-consistent theoretical foundation in physics • knowledge and understanding of different interpretations of quan-tum mechanics • proficiency in solving problems and tasks relevant in quan-tum mechanics • proficiency in applying a variety of frequently used mathemati-cal methods in quantum mechanics • competences in assessing the relevance of applying quantum mechan-ics to a given physical research question

	• competences in determining which method(s) can be applied in solv-ing a given research question in quantum mechanics.
Type of exam	**Type of exam** Individual written invigilated exam The duration of the exam is 5 hours. Permitted support and preparation materials for the exam: A formulae collection of max. one A4 size page (both sides of the paper may be used) made by the student. Assessment: 7-point grading scale Each semester the Board of Studies will choose the exam type if more than one is listed.

Title	**Master Thesis**
Amended	01.09.2024
Type of activity	Master Thesis
Mandatory or elective	Mandatory
ECTS-rating	30 ECTS
Teaching language	English
Overall objective	The objective of the master thesis is that the student reaches the research front in a selected area within physics and/or scientific modelling, the mathematical foundation of physics and scientific modelling, or in another field where thinking as a physicist and/or scientific modelling plays a role in advancing the field. The goal is that the student makes independent methodological choices and conducts experimental, computational and/or analytical work to solve a scientific problem. The master thesis problem-oriented and exemplary and should address a research question within one of the following three variants. • Fundamental research within physics and/or scientific modelling, the mathematical foundations of physics and scientific modelling, or a neighbouring discipline where thinking as a physicist and/or scientific modelling plays a role in advancing the field. • Applied research where physics and/or scientific modelling plays a role in solving a problem. • Research within philosophy, history or didactics of physics, mathematics and science in which having a background in physics, mathematics and scientific modelling contributes significantly to developing the understanding of the problem.

Overall learning outcomes	After completing the master thesis the students will be able to • demonstrate knowledge and expert level understanding of the theoretical concepts relevant for the project as well as their scope and relations • independently choose, argue and understand the relevant analytical/numerical/empirical and/or experimental methods applied in the project • critically relate the strengths and weaknesses of applied theories, methods and models in the project • communicate the results achieved on a scientific level • identify and formulate an exemplary research question within the selected area, which can be handled by using the means available • discuss the significance of the results achieved critically and to relate the results to relevant scientific literature in the area, including in particular theoretical literature.
Type of exam	**Type of exam** Master's thesis exam based on the written product and the oral exam The master's thesis can be written individually or in a group. Permitted group size: 2-3 students. The oral exam is individual for students that have written the thesis alone or students that have requested an individual exam. All other oral master's thesis exams are conducted as group exams. The assessment is individual and based on the student's individual performance. The assessment is an assessment of the master's thesis and the oral performance. The character limits of the master's thesis are: For 1 student: 24,000-367,200 characters, including spaces. For 2 students: 24,000-367,200 characters, including spaces. For 3 students: 24,000-367,200 characters, including spaces. The character limits include the cover, table of contents, summary, bibliography, figures and other illustrations, but exclude appendices. The master's thesis must include a summary. The summary can either be written in English or Danish. The summary is included in the overall assessment. Time allowed for the exam including time used for assessment for: 1 student: 30 minutes.

	2 students: 60 minutes. 3 students: 75 minutes. Writing and spelling skills in the thesis are part of the assessment. Permitted support and preparation materials at the oral exam: All. Assessment: 7-point grading scale Moderation: External examiner Each semester the Board of Studies will choose the exam type if more than one is listed.

8. Approval

8.1 Approved by the Board of Studies

Board of Studies for Natural Sciences on 18 December 2023.

The chairperson for external examiners and the panel of employer representatives are informed about major amendments before the study regulation comes into force.

8.2 Approved by the Dean and the Vice-Dean

Approved by the Dean and the Vice-Dean of departmentDepartment of Science and Environment on 18 December 2023.

8.3 Approved by the Rector

Approved by Rector Hanne Leth Andersen on 6 May 2024.

9. Appendix

9.1 Constituent study activities

- Experiments and Models – Linear Response and Structure and Dynamics of Condensed Matter (10 ECTS)
- Statistical Physics with Scientific Programming (5 ECTS)
- Problem Solving in Physics I (5 ECTS)
- Problem Solving in Physics II (10 ECTS)
- Specialisation project or Project-oriented Internship (15 ECTS)
- Modelling Project (15 ECTS)
- Master Thesis (30 ECTS)