Curriculum for the Master’s Program in Geography with specialisation in Physical Geography

Aalborg University 2014
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Preface:
Pursuant to Act 367 of May 22, 2013 on Universities (the University Act) with subsequent changes, the following curriculum for the Master's program in Geography with specialisation in Physical Geography is stipulated. The program also follows the Framework Provisions and the Examination Policies and Procedures for the Faculty of Engineering and Science and the Faculty of Medicine.
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Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in ministerial orders
The Master’s program in Geography with specialisation in Physical Geography is organized in accordance with the Ministry of Science, Technology and Innovation’s Ministerial Order no. 1520 of December 16, 2013 on Bachelor’s and Master’s Programs at Universities (the Ministerial Order of the Study Programs) and Ministerial Order no. 1518 of December 16, 2013 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 1488 of December 16, 2013 (the Admission Order) and Ministerial Order no. 250 of March 15, 2007 (the Grading Scale Order) with subsequent changes.

1.2 Faculty affiliation
The Master’s program falls under the Faculties of Engineering and Science, Aalborg University.

1.3 Board of Studies affiliation
The Master’s program falls under the Study Board for Civil Engineering in the School of Engineering and Science.

Chapter 2: Admission, Degree Designation, Program Duration and Competence Profile

2.1 Admission
Admission to the Master’s program Geography with specialisation in Physical Geography requires a Bachelor’s degree in geography or the like.

Students with another Bachelor's degree, upon application to the Board of Studies, will be admitted after a specific academic assessment if the applicant is deemed to have comparable educational prerequisites. The University can stipulate requirements concerning conducting additional exams prior to the start of study.

2.2 Degree designation in Danish and English
The Master’s program entitles the graduate to the designation Cand.scient. (candidatus/candidata scientiarum) i geografi med specialisation i naturgeografi. The English designation is: Master of Science (MSc) in Geography with specialisation in Physical Geography.

2.3 The program’s specification in ECTS credits
The Master’s program is a 2-year, research-based, full-time study program. The program is set to 120 ECTS credits.

2.4 Competence profile on the diploma
The following competence profile will appear on the diploma:

A graduate of the Master’s program has competencies acquired through an educational program that has taken place in a research environment.

The graduate of the Master’s program can perform highly qualified functions on the labor market on the basis of the educational program. Moreover, the
graduate has prerequisites for research (a Ph.D. program). Compared to the Bachelor’s degree, the graduate of the Master’s program has developed her/his academic knowledge and independence, so that the graduate can independently apply scientific theory and method in both an academic and occupational/professional context.

2.5 Competence profile of the program

The graduate of the Master’s program:

Knowledge
- Understand the physical, chemical and biological processes governing and sustaining the natural resources.
- On climate change modelling and scenarios and associated uncertainties
- On fundamental hydrogeology and the basic principles of numerical groundwater modelling.
- Understand and describe the fundamental transport processes of substances in the oceans and the atmosphere and the connection between the CO2 cycle, the use of fossil fuels and the production of biomass.
- Analyse environmental consequences of the interaction between natural landscape structure and function and human land use.
- Integrate knowledge of complex landscapes using information on geology, hydrology, human activities, land use and natural ecosystem processes.
- On theory for physical, chemical and microbial processes in marine systems and on the most common types of marine pollution.
- Understand how anthropogenic activities affect the physical, chemical and biological conditions in freshwater ecosystems.
- Knowledge on the important ecological processes acting on the regional and local scale.
- Shall have knowledge on how numerical methods and experiments methods complement each other and how to use experimental data to improve models in the field of physical geography.
- Knowledge on the computer based data acquisition, accuracy and error handling.
- Understands and can, on a scientific basis reflect on the knowledge within the subjects studied
- Ability to identify scientific problems within in the subjects studied within the field of physical geography

Skills
- To collect, analyse and visualise the data on natural resource occurrence, governing processes and human impacts that forms the basis for a conceptual resource
model.
• To construct, calibrate and validate numerical resource models
• Conceptually model biogeochemical cycles in the atmosphere, the oceans and on land
• Select and apply relevant literature, theories and methods used to describe landscape and land use processes and collect, analyse and visualise the data on ecosystem processes and human impacts.
• Determination of the degree of pollution of freshwater ecosystems based on water chemistry data and data on the biological community structure.
• Use impact assessment methods.
• Conceptual and numerical modelling of ecosystem processes.
• Use the existing literature and theories to plan a literature study and field and/or laboratory work within the field of physical geography.
• Critically use a select models currently used in physical geography.
• Be able to represent data in time and space based on data generated by field measurements or numerical models.
• Independently explain choice of scientific theoretical and/or experimental methods.
• During the project and when finalising it make an independent and critical estimation of the chosen theories and methods as well as the analyses, results and conclusions
• Communicate relevant scientific and professional aspects of project work in a clear and systematic way

Competencies
• Evaluate current and future used of natural resources
• Discuss and analyse anthropogenic alterations to the global biogeochemical cycles
• Critically evaluate climate change modelling scenarios
• Critically evaluate methods for estimating consequences of reduction of pressures on the ecosystems.
• Work with and analyse nutrient cycling in coastal marine ecosystem and describe important organic and inorganic pollutants and pollution effects in coastal marine waters.
• Recommend possible solutions to reduce anthropogenic stress on freshwater ecosystems.
• Integrate information from different ecosystems to recommend possible solutions to reduce anthropogenic stress on ecosystems.
• Be able to combine, literature surveys, experimental data and numerical methods to develop better models within the field of physical geography.
• Structure and produce documentation of complex problems and recommend possible solutions to natural
resource problems.
- Independently initiate problem based scientific work within the field of physical geography
- Can maintain focus and reflect on the literature and methods used to develop the scientific basis of the project.
- Can evaluate the scientific progress independently and select and include additional literature, experiments or data when needed in order to maintain a scientific basis for the project

Chapter 3: Content and Organization of the Program

The program is structured in modules and organized as a problem-based study. A module is a program element or a group of program elements, which aims to give students a set of professional skills within a fixed time frame specified in ECTS credits, and concluding with one or more examinations within specific exam periods that are defined in the curriculum.

The program is based on a combination of academic, problem-oriented and interdisciplinary approaches and organized based on the following work and evaluation methods that combine skills and reflection:

- project work
- lectures
- classroom instructions
- study groups
- workshop
- exercises
- laboratory tests
- measurements and testing in the field
- portfolio work
- independent study

The modules are evaluated either through written or oral exams as started in the description of the modules in the Appendix. Project modules are normally evaluated in a group based oral exam based upon a submitted report and an oral group presentation according to the Framework provisions (examination policies).

For individual written exams the study board selects among the following possibilities:

- written exam based on handed out exercises
- multiple choice
- ongoing evaluation of written assignments

For individual oral exams the study board selects among the following possibilities:

- oral exam with or without preparation
- oral exam based on project report
- oral exam based on presentation seminar
• portfolio based oral exam

Project modules are normally examined by a group based oral exam based on a project report and an oral group based presentation.

If the number of students following a module is small and/or if the number of students having to attend a re-exam is small the study board can decide that an exam is conducted either as an oral or written individual exam for economic reasons. In the first case decision must be notified before the start of the teaching activity in the latter case the students must be notified when the examination date is decided.
3.1 Overview of the program

All modules are assessed through individual grading according to the 7-point scale or Pass/Fail. All modules are assessed by external examination (external grading) or internal examination (internal grading or by assessment by the supervisor only).

Of a total of 120 ECTS, 85 - 115 ECTS are assessed by the 7-point scale and 45-75 ECTS are assessed by external examination.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Module</th>
<th>ECTS</th>
<th>Assessment</th>
<th>Exam</th>
</tr>
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<tbody>
<tr>
<td>1st</td>
<td>Climate Change and Natural Resources</td>
<td>15</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Experimental Hydrology</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Environmental Soil Science and Geostatistics</td>
<td>5</td>
<td>Pass/no-pass</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Global Ecological Processes</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>2nd</td>
<td>Obligatory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Landscape, Land Use and the Environment</td>
<td>15</td>
<td>7-point scale</td>
<td>External</td>
</tr>
<tr>
<td></td>
<td>Local Ecological Processes</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>B</td>
<td>Freshwater Ecology</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Danish Biotypes</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Hydrodynamics and Time Series Analysis of</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Environmental Flows</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marine Pollution</td>
<td>5</td>
<td>7-point scale</td>
<td>Internal</td>
</tr>
<tr>
<td>A</td>
<td>Applied Methods in Physical Geography</td>
<td>20</td>
<td>Pass/no-pass</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Measurement Technology and Data Acquisition</td>
<td>5</td>
<td>Pass/no-pass</td>
<td>Internal</td>
</tr>
<tr>
<td></td>
<td>Visualisation</td>
<td>5</td>
<td>Pass/no-pass</td>
<td>Internal</td>
</tr>
<tr>
<td>B</td>
<td>Relevant internship in a public or private</td>
<td>30</td>
<td>Pass/no-pass</td>
<td>Internal</td>
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<td></td>
<td>organization 1)</td>
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<td></td>
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<td>C</td>
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<td>30</td>
<td>Pass/no-pass</td>
<td>Internal</td>
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<td>3rd-4th</td>
<td>Long Master’s Thesis</td>
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<td>7-point scale</td>
<td>External</td>
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<td>4th</td>
<td>Master’s Thesis</td>
<td>30</td>
<td>7-point scale</td>
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<tr>
<td>Total</td>
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<td>120</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1) The study board must approve the internship content and the contents of study abroad prior to the semester

The students are given options in the project modules as they can select among different projects within the same general theme. Moreover, the Master Thesis on the 4th semester
can be selected freely within the field of natural geography. The students have the choice of making a long master’s thesis comprising both 3rd and 4th semester.

The physical geography program includes optional courses on the 2nd semester, where the students have one fixed course and can choose between two clusters of courses; one focused on Danish nature (A) and freshwaters and one focusing on marine environment (B). Option (B) is relevant to non Danish speaking students.

The study board of civil engineering can decide, that the contents of a course module on a semester is taught in the project module in the same semester, by increasing the ECTS extend of the project module by the same number of ECTS. The decision is taken regarding to capacity and/or economy.

3.2 Module descriptions
Descriptions of the modules of the education are inserted in the Appendix, ordered alphabetically after their English title.

Chapter 4: Entry into Force, Interim Provisions and Revision

The curriculum is approved by the Dean of the Faculty of Engineering and Science and enters into force as of 1 September 2014.

Students who wish to complete their studies under the previous curriculum from 2009 must conclude their education by the summer examination period 2014 at the latest, since examinations under the previous curriculum are not offered after this time.

In accordance with the Framework Provisions for the Faculty of Engineering and Science at Aalborg University, the curriculum must be revised no later than 5 years after its entry into force.

Chapter 5: Other Provisions

5.1 Rules concerning written work, including the Master's thesis
In the assessment of all written work, regardless of the language it is written in, weight is also given to the student's spelling and formulation ability, in addition to the academic content. Orthographic and grammatical correctness as well as stylistic proficiency are taken as a basis for the evaluation of language performance. Language performance must always be included as an independent dimension of the total evaluation. However, no examination can be assessed as ‘Pass’ on the basis of language performance alone; similarly, an examination normally cannot be assessed as ‘Fail’ on the basis of poor language performance alone. The Board of Studies can grant exemption from this in special cases (e.g., dyslexia or a native language other than Danish).
The Master’s thesis must include an English summary.¹ If the project is written in English, the summary must be in Danish.² The summary must be at least 1 page and not more than 2 pages. The summary is included in the evaluation of the project as a whole.

5.2 Rules concerning credit transfer (merit), including the possibility for choice of modules that are part of another program at a university in Denmark or abroad
In the individual case, the Board of Studies can approve successfully completed (passed) program elements from other Master’s programs in lieu of program elements in this program (credit transfer). The Board of Studies can also approve successfully completed (passed) program elements from another Danish program or a program outside of Denmark at the same level in lieu of program elements within this curriculum. Decisions on credit transfer are made by the Board of Studies based on an academic assessment. See the Framework Provisions for the rules on credit transfer.

5.3 Rules for examinations
The rules for examinations are stated in the Examination Policies and Procedures published by the Faculty of Engineering and Science on their website.

5.4 Exemption
In exceptional circumstances, the Board of Studies study can grant exemption from those parts of the curriculum that are not stipulated by law or ministerial order. Exemption regarding an examination applies to the immediate examination.

5.5 Additional information
The current version of the curriculum is published on the website of the School of Engineering and Science, including detailed information about the program, including exams.

5.6 Completion of the Master’s program
The Master’s program must be completed no later than four years after it was begun.

5.7 Rules and requirements concerning the reading of texts in foreign languages and a statement of the foreign language knowledge this assumes
It is assumed that the student can read academic texts in modern Danish, Norwegian, Swedish and English and use reference works, etc., in other European languages.

¹ Or another foreign language (upon approval from the Board of Studies.
² The Board of Studies can grant exemption from this.
Appendix: Module Descriptions

Applied Methods in Physical Geography
Avancerede naturgeografiske metoder

Prerequisites: Bachelor in geography, experimental methods, visualisation methods

Objective: The main objective of the semester is to qualify the student to analyse and evaluate one or more problems within the field of physical geography. The project can comprise field surveys, laboratory experiments, modelling and/or theoretical problems. Emphasis in the project is on development of a strategy for measuring and modelling of physical geography processes. The project also aims to get the students to evaluate critically the use of literature, measurements and models.

Knowledge:
- Shall have knowledge on how numerical methods and experiments methods complement each other and how to use experimental data to improve models in the field of physical geography
- Understand and which uncertainties are associated to each method and how they can be analysed.

Skills:
- Use the existing literature and theories to plan a literature study and field and/or laboratory work within the field of physical geography
- Critically use a select models currently used in physical geography
- Independently explain choice of scientific theoretical and/or experimental methods in relation to the aim of the study.
- Plan and carry out the measurement program for field and laboratory measurements.
- Make a critical estimation of the chosen theories and methods as well as the analyses, results and conclusions.

Competences:
- Be able to combine, literature surveys, experimental data and numerical methods to develop better models within the field of physical geography.
- Communicate relevant scientific and professional aspects of project work in a clear and systematic way.
- Present and communicate results in a web-based media.
- Must be able to contribute successfully to teamwork within the problem area and make a common presentation of the result of the project work

Type of instruction: Project work with supervision supplemented with instructions, workshops, presentation seminars, lab tests, etc.
Exam format: Oral exam based on presentation seminar and project rapport.


Climate Change and Natural Resources
*Klimaændringer og naturressourcer*

Prerequisites: Bachelor in Geography or similar

Objective: To give the students knowledge of the occurrence of natural resources and how these are affected by climate change. Based on a description and analysis of the natural processes governing the resource under current conditions, the natural resource use and protection under future climate conditions is analysed.

Knowledge:
- Understand the physical, chemical and biological processes governing and sustaining the natural resources.
- On climate change modelling and scenarios and associated uncertainties.
- On different national data bases containing information on natural resources.
- Human impacts on natural resources and global circulation models.

Skills:
- To select relevant theories and literature.
- To collect, analyse and visualise the data on natural resource occurrence, governing processes and human impacts that forms the basis for a conceptual resource model.
- To construct, calibrate and validate numerical resource models.
- To use climate change scenarios in relation natural resource planning.

Competencies:
- Critically evaluate the data and theories used.
- Evaluate current and future used of natural resources.
- Structure and produce documentation of complex problems and recommend possible solutions to natural resource problems.
- To communicate problems related to natural resources and climate change, findings and solutions graphical as well as oral to the relevant target audience.
- Must be able to communicate the results of the project work in a project report
- Must be able to contribute successfully to teamwork within the problem area and make a common presentation of the result of the project work
Type of instruction: Project work with supervision supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Oral exam based on presentation seminar and project rapport.


**Experimental Hydrogeology**

*Eksperimentiel hydrogeologi*

**Prerequisites:** Bachelor degree in Geography or similar. Speaking and writing English fluently is necessary.

**Objective:** To qualify the student to understand and estimate hydro-geological parameters by in-situ and laboratory test and experiments in relation to a specific site and/or transport phenomenon. This includes the planning of a measuring programme based on suitable measuring methods and positions, setting up a time schedule and a data processing procedure. The course aims to give especially students without experiences in problem and project based learning hands-on experiences with this leaning method.

**Knowledge:**
- Groundwater system and its essential properties and parameters.
- Experimental methods for property and parameter estimation of the ground water zone.
- Uncertainties and limitations of the applied methods.

**Skills:**
- To select, design and conduct suitable in-situ test for estimating saturated hydraulic properties.
- To select, design and conduct suitable laboratory test for estimating hydraulic saturated hydraulic properties.
- To analyse and evaluate test results and methods regarding suitability and reliability.
- To organise documentation and presentation of measured data.

**Competencies:**
- To describe, analyse, and evaluate a specific part of the groundwater system, regarding its composition and its properties through a planned investigation of the system.
- To structure and plan the project and the work in a group.
- To produce technical documentation of complex problems, methods and results in group co-operation.
- To communicate findings and solutions graphical as well as oral to the relevant target audience.

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.
Exam format: Individual oral or written exam. Exam format is decided on by start of semester.

Evaluation criteria: As stated in the framework provisions.

**Freshwater Ecology**
*Ferskvandsøkologi*

**Prerequisites:** Bachelor in geography.

**Objective:** The aim of the course is to introduce the student to river hydraulics and to introduce the organisms in the rivers; fish, invertebrates, plants and algae. The course focuses on the interactions between hydraulic, water chemistry and the organisms and how human activities affect these interactions.

**Knowledge:**
- Describe the fundamental physical processes governing the formation and development of rivers and lakes – hydrology and geomorphological conditions
- On physical and chemical processes in rivers and lakes.
- On the biological communities in rivers and lakes.
- Understand how anthropogenic activities affect the physical, chemical and biological conditions in freshwater ecosystems.

**Skills:**
- Measurement of discharge in rivers and residence time in lakes.
- Perform simple hydraulic modelling in rivers and use these to model hydraulic conditions in restored rivers.
- Measure and determine the oxygen balance in rivers.
- Determine and model the uptake and release of nutrients from the bed sediments and the water.
- Quantification of the nutrient loading to freshwater ecosystems and the description of the ecological consequences.
- Determination of the degree of pollution of freshwater ecosystems based on water chemistry data and data on the biological community structure.
- Recommend possible solutions to reduce stress on biological communities in the freshwater ecosystems.

**Competencies:**
- Select data and methods to be used in the assessment of the pollution of a freshwater recipient.
- Analyse and reflect on the importance of the different processes in relation to current environmental problems in rivers.
- Recommend possible solutions to reduce anthropogenic stress on freshwater ecosystems.
Global Ecological Processes  
*Globale Økologiske Processer*

**Prerequisites:** Bachelor in geography

**Objective:** The aim of the course is to introduce the student to fundamental ecological processes acting on a global scale. This will enable the student to analyse global changes to the atmosphere and the biosphere and the overall bio-geo-chemical cycles of the Earth.

**Knowledge:**
- On the global biogeochemical cycles including water, carbon, nitrogen, phosphorous and sulphur.
- Understand and describe the fundamental transport processes in the oceans and the atmosphere and the connection between the CO₂ cycle, the use of fossil fuels and the production of biomass.

**Skills:**
- Perform an analysis of global biogeochemical cycles
- Analyse the global distribution of biodiversity in relation global biogeochemical cycles.
- Conceptual model biogeochemical cycles in the atmosphere, the oceans and on land

**Competences:**
- To evaluate and handle data on biogeochemical processes
- Discuss and analyse anthropogenic alterations to the global biogeochemical cycles
- Critically evaluate climate change modelling scenarios

Environmental Soil Science and Geostatistics  
*Jordfysik og geostatistik*

**Prerequisites:** Bachelor in environmental engineering or civil engineering
Objective: To give the students fundamental knowledge of water and contaminant transport, sorption and degradation in soil, and the use of geostatistical methods in contaminated soil studies. The student should understand the links between the physical, chemical and biological processes in soil. The student should know the principles behind and how to apply relevant laboratory and field methods for measurement of water and solute transport in soil, know the principles behind and the applicability of relevant physical- and biological-based remediation methods for contaminated soil sites, and be able to calculate one-dimensional water and solute transport in the soil vadose zone (from soil surface to capillary water table).

Knowledge:
• On fundamental soil physics
• On soil texture and structure, physical and chemical phase distribution (solids, water, air), pore-size distribution, water retention, hydraulic conductivity, soil-water sorptivity, unsaturated zone water transport, gas diffusion and chemical transport, sorption and biodegradation
• On the basic principle of 1D analytical and numerical water and contaminant transport modeling
• On evaluating the uncertainty of measured data and model results

Skills:
• To measure soil hydraulic properties in the laboratory
• To apply parameter models for water retention, hydraulic conductivity, gas diffusion, and chemical dispersion to measured data or as predictive tools.
• To program and apply analytical and simple numerical water and solute transport models to measured data or in risk assessment.
• To apply relevant geostatistical methods to measured data in the soil and groundwater zones.

Competences:
• To perform preliminary risk assessment and evaluate the conditions for on-site or in-situ clean-up methods for contaminated soil sites.
• To structure and produce technical documentation of complex problems, methods and results.
• To communicate problems, findings and solutions graphical as well as oral to the relevant target audience.

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester.

Evaluation criteria: As stated in the framework provisions.

Hydrodynamics and Time Series Analysis of Environmental Flows
Hydrodynamik og tidsserieanalyse for miljøhydrauliske forhold

Prerequisites: Basic Hydraulics, basic statistics
Objective: The aim of the course is to give the student a fundamental knowledge of water flow in marine Environments. Based on the gained knowledge the student shall be able to analyse time series of environmental data and set up numerical models for a given aquatic Environment.

Knowledge:
- On advanced hydrodynamics
- On numerical modelling of turbulent flows
- On modelling of transport and mixing
- On environmental flow in coastal zones and estuaries
- On basic time series analysis

Skills:
- To perform a systematic analysis of the physics in the coastal zone and estuaries
- To perform non-stationary time simulations with advanced hydrodynamic models
- To analyse time series for persistence and harmonic elements
- To analyse geophysical flows in the ocean and coastal zone

Competences:
- To evaluate and handle data that forms the basis of hydrodynamic and water quality modelling.
- To structure and produce technical documentation of complex problems, methods and results.
- To communicate problems, findings and results graphically as well as oral to the relevant target audience.

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester. Evaluation criteria: As stated in the framework provisions.

Marine Pollution
Forurening af marine områder

Prerequisites: None specific

Objective: To provide fundamental insight into coastal marine waters including effects and prevention of natural and anthropogenic pollution.

Knowledge:
- On marine ecosystems
- On theory for physical, chemical and microbial processes in marine systems
- On the most common types of marine pollution

Skills:
- To understand the exchange of matter between aquatic and terrestrial environments.
- To describe the marine ecosystem, light, salinity and temperature
To understand primary production, respiration and re-oxidation
To analyze microbial loops, food webs, turnover of C-N-S in aquatic environments
To analyze marine sediments
To distinguish pollution impacts on individuals, populations and communities
To evaluate man-made pollutants (xenobiotics), disease-causing microorganisms (pathogens) in marine waters
To assess recreational and bathing water quality and related fecal pollution source tracking

Competences:
• Work with and analyze nutrient cycling in coastal marine ecosystem.
• Describe important organic and inorganic pollutants and pollution effects in coastal marine waters.
• evaluate methods to prevent and alleviate antropogenic pollution in coastal marine waters evaluate meth

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester. Evaluation criteria: As stated in the framework provisions.

Evaluation criteria: As stated in the framework provisions.

Landscape, Land Use and the Environment
*Landskab, arealanvendelse og miljø*

Prerequisites: Bachelor in Geography or similar

Objective: The general reduction in landscape quality and species reduction in the agricultural landscape is caused by human activities such as cultivation, nutrient pollution and fragmentation of habitats. In order to prevent further deterioration of natural ecosystems it is essential to be able to identify the actual causes of bad ecosystem health. The aim is to give the students knowledge of structure and functions in the ecosystems in the landscape and provide the student with the opportunity to quantify the ecosystem problems and their spatial distribution and hence be able to restore ecosystem functioning and health.

Knowledge:
• Understand natural ecological processes in the relevant ecosystem.
• Analyse environmental consequences of the interaction between natural landscape structure and function and human land use.
• Integrate knowledge of complex landscapes using information on geology, hydrology, human activities, land use and natural ecosystem processes.
• On methods, data and databases containing information on landscape, land use and ecosystem state.

Skills:
• To select and apply relevant literature, theories and methods used to describe landscape and land use processes and discuss these in relation to the problem in the project.
• To collect, analyse and visualise the data on ecosystem, governing processes and human impacts.
• To construct, calibrate and validate numerical resource models.
• To use climate change scenarios in relation natural resource planning.

Competencies:
• Critically evaluate the data and, literature and theories used.
• Critically evaluate methods for estimating consequences of reduction of pressures on the ecosystems.
• Structure and produce documentation of complex ecological problems and recommend possible solutions to reduce environmental problems.
• To communicate problems related to ecosystem processes and interactions between landscape and land use, findings and solutions graphical as well as oral to the relevant target audience.
• Must be able to communicate the results of the project work in a project report.
• Must be able to contribute successfully to teamwork within the problem area and make a common presentation of the result of the project work.

Type of instruction: Project work with supervision supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Oral exam based on presentation seminar and project rapport.


**Local Ecological Processes**

**Lokale Økologiske Processer**

**Prerequisites:** Bachelor in geography

**Objective:** The aim of the course is to introduce the student to the important ecological processes acting on the local and regional scale. The student should be able to analyse changes to the processes and ecosystems and ecosystem health on the local and regional level.

**Knowledge:**
• Knowledge on the important ecological processes acting on the regional and local scale.
• Knowledge on ecological processes in different aquatic and terrestrial ecosystems

**Skills:**
• Quantify the importance of different ecological processes in an ecosystem.
• Conceptual and numerical modelling of ecosystem processes.
• Analyse anthropogenic stress on ecosystem structure and processes

Competencies:
• Analyse and reflect on the importance of ecological processes for maintaining ecosystem health
• Integrate information from different ecosystems to recommend possible solutions to reduce anthropogenic stress on ecosystems.

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester.

Evaluation criteria: As stated in the framework provisions.

**Danish Biotypes**  
*Danske naturtyper*

Prerequisites: Bachelor in biology, geography or similar

Objective: The aim of the course is to introduce the student to the important Danish biotypes. The student should be able to describe important vegetation and fauna and analyse changes to the biotypes and governing chemical and biological processes.

Knowledge:
• On Danish geology, soil types and climate in different landscapes
• On the important Danish biotypes and localities
• On the important biological processes acting in terrestrial and aquatic ecosystems (succession, species interactions)
• On a wide number of the most important flora and fauna (vertebrates and invertebrates) elements found in Denmark and their ecological demands

Skills:
• Conduct an analysis on the most important stressors acting in Danish nature
• Identify relevant legislation governing the protection of species and habitat types
• Identify conflicts (between society and nature) of interests in relation to the most important Danish biotopes

Competencies:
• Characterise biotopes based on floral and faunistic analyses
• Evaluate the condition of a certain biotype based on biological information, legislation and pressure analysis.
Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Active participation, hand in of written assignments and oral presentations

Master's Thesis
*Kandidatspeciale*

Prerequisites: Successful completion of the first three semesters of the master programme.

Objective:
After completion of the project, the student should within the following topics:

Knowledge:
- Have knowledge and comprehension within the field of the specialization at the highest international level
- Be able to critically evaluate knowledge and identify new scientific problems within the field of the specialization
- Have understanding of implications within the related research area including research ethics

Skills:
- Independently explain choice of scientific theoretical and/or experimental methods
- During the project and when finalising it make an independent and critical estimation of the chosen theories and methods as well as the analyses, results and conclusions
- Be able to apply a wide range of engineering methods in research and development in the field of specialization
- Be able to communicate relevant scientific and professional aspects of project work in a clear and systematic way both to specialists and the public

Competencies:
- Be able to work independently with a project on a specific problem within the field of the specialization at the highest international level
- Independently be able to define and analyse scientific problems and based on that make and state the reasons for the decisions made
- Be competent to solve new and complicated technical problems by the use of advanced mathematics, scientific and technological knowledge
- Be able to evaluate the progress of the project independently and select and include additional literature, experiments or data when needed in order to maintain a scientific basis for the project
- Be able to control complex and unexpected working situations and be able to develop new solutions
• Must be able to communicate the results of the project work in a project report

**Type of instruction:** Project work with supervision supplemented with instructions, workshops, presentation seminars, lab tests, etc.

**Exam format:** Oral exam based on presentation seminar and project report.

**Evaluation criteria:** Are stated in the Framework Provisions.

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**Relevant internship in a public or private organization**

*Virksomhedsophold*

**Prerequisites:** Corresponding to having passed the 1st and 2nd semester

**Objective:** Students who complete the module have:

**Knowledge:**
- Must have knowledge about analytical, numerical and/or experimental methods for investigation of advanced geographical (physical) problems within the organization’s field

**Skills:**
- Must be able to apply analytical, numerical and/or experimental methods for analysis and assessment of advanced problems within the organization’s field.
- Must be able to compare and evaluate limitations and uncertainties related to the methods used for solving advanced physical geography problems.

**Competencies:**
- Must be able to apply proper scientific terminology in oral, written and graphical communication and documentation of problems and solutions within the organization’s field.
- Must be able to communicate the results of the project work in either a project report or similar.

**Type of instruction:** Internship in company/organization and project work. The study board must approve content of the project work before the internship is commenced.

**Exam format:** Oral or exam based on presentation seminar and project report.

**Evaluation criteria:** As stated in the framework provisions.
Prerequisites: Bachelor in geography

Objective: The aim of the course is to enable the student to perform measurement and data acquisition in the laboratory and in the field. The course is equally divided between sensor technology and data acquisition with computers and data loggers.

Knowledge:
- Knowledge on the different sensors available and the fundamental measuring principles.
- Knowledge on the computer based data acquisition, accuracy and error handling.

Skills:
- Be able to plan experiments in order to get optimal information compared to the experimental effort.
- Be able to choose the right sensor technology for the problem at hand.
- Setting up the A/D and D/A converters with commercial programs or by own programs.
- Basic knowledge on digital image analysis

Competencies:
- Be able to plan an laboratory or field experiment and setup appropriate data acquisition
- Be able to discuss validity of results and errors of the data acquired in relation to choice of sensor and analysis method.

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester.

Evaluation criteria: As stated in the framework provisions.

Visualisation

Prerequisites: Bachelor degree

Objective: The aim of the course is to make the student able to visualize scientific and technical data on different platforms. Emphasis in the project is on practical application of commercial programs for analysis and presentation of large primary datasets or modeling results. The course should make it possible for the student to produce a complete webpage
presenting scientific and technical data as well as model results and documentation of methods.

Knowledge:
- Shall have knowledge on database structure and database administration of large datasets.
- Shall have knowledge on how data can be represented graphically.
- Understand principal methods for graphical communication.

Skills:
- Be able to represent data in time and space based on data generated by field measurements or numerical models.
- Webpage programming
- Data animation
- Spatial data analysis
- Presentation techniques
- Plan and carry out a complete setup of a complete website with multimedia integration.

Competencies:
- Be able to lead the development of communication of scientific and technical data on a web-based platform
- To structure and produce technical documentation of complex problems.

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester.

Evaluation criteria: As stated in the framework provisions.