BSc in Earth and Ocean Science

Semester 1	Semester 2	Semester 3	Semester 4	Semester 5	Semester 6
Physical Geography	Physical and Faroese Geology	Introduction to Geophysics	Sedimentary Geology	Exploration & Environmental Geophysics	Bachelor Thesis
Mechanics and thermodynamics	Electro-magnetism	Data analysis	Modern physics	Petroleum Geoscience	
Mathematics 1	Mathematics 2	Mathematics 3	Mathematics 4	Numerical Ocean Modelling	
General Oceanography	Fluid Mechanics	Dynamical Oceanography	Small- to Medium-scale Oceanography	Surface Waves and Tides	Optional

The 3-year programme is structured in six semesters. The first five semesters contain four equally sized (7.5 ECTS) courses. The sixth semester contains the bachelor thesis and one additional course. Click on a course to read the course description.

The courses in the bachelor programme are briefly introduced as follows

Semester 1

Physical geography
This course studies the characteristics of the physical features of the Earth's surface and the natural processes that shape these features. Several sub-fields make up physical geography. Geomorphology deals with the form of the Earth's surface and how it was shaped. Hydrology studies the water on and under the surface, moving or accumulating, in rivers, lakes, aquifers, glaciers, etc. Glaciology focuses on glaciers and ice sheets. Climatology deals with climate and long-term weather. Field trips will examine physical features of the Faroe Islands.

Mechanics and thermodynamics
Mechanics deals with motion and forces in the macroscopic world, e.g. on land, in the sea, in the air, in space and in different instruments and means of transport. It is fundamental for other branches of physics, like thermodynamics, which primarily studies the effects of changes in pressure, temperature and volume of physical systems at the macroscopic scale. Entropy is a thermodynamic measure of the unavailability of a system's energy to do work, but entropy is e.g. also a subject of information technology regarding expected information.

Mathematics 1
This course has high school A-level mathematics as a prerequisite, including basic concepts such as real numbers, vectors, and functions. The main topics are complex numbers, series, differentiation, integrals, vector spaces, and matrices, which are treated and applied to describe and analyze phenomena in the natural sciences and technology. Besides using classical mathematical methodology the learning will be supported by software training (Maple).

General oceanography
This course provides a general description of the terminology used in oceanography. Characteristics of seawater and processes in the world ocean are discussed with emphasis on the circulation and watermasses around the Faroe Islands. Also, meteorology and climate change are briefly introduced, and how changing conditions in the oceans may affect living organisms.

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Semester 2

Physical and Faroese geology
This course focuses on the physical aspects and phenomena of geology in general, then looks particularly at the geology of the Faroe Islands region. These physical phenomena include widely varied things like earthquakes and volcanoes, glaciers and beaches, land topography and plate tectonics; and the questions considered include how mountains are built, where and why oil is concentrated, and what is found in the Earth's deep interior. You will look at real-world examples on field trips around the Faroe Islands.

Electromagnetism
Electromagnetism is an important subject in connection with e.g. wireless communication, computers, measuring instruments, supply of electrical energy, telemedicine and oil-and-gas explorations. Electromagnetic theory deals with electricity and magnetism, and with the relationship between them. Magnetic fields arise from electric charges in motion. Electric fields are found around all electrically charged particles. Time-varying electric and magnetic fields generate electromagnetic waves, e.g. light and radio waves.

Mathematics 2
This course is a continuation of the Mathematics 1 course. Differentiation and integration are used to describe physical properties, for instance how pressure and temperature change with time and place. Fundamental laws and relationships in physics and engineering are put forward in formulas and so called differential equations. Various techniques to solve such equations are presented.

Fluid mechanics
The main aim of this course is to establish an understanding of the forces that cause movements in fluids and gasses, based on physical and mathematical principles. This knowledge is fundamental when calculations are made on flow in pipes, channels, sounds, and in the open ocean or in the atmosphere.

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Semester 3

Introduction to geophysics
Geophysics studies mainly the Earth (also the Moon and other planets) by applying quantitative physical methods and often using high-powered computational tools. It includes the study of seismology, magnetism, heat flow, space physics, gravity, geodesy, meteorology, and sometimes physical oceanography. We learn about things like: what happens when earthquakes occur, what forces in the deep Earth cause continents to move around on the surface, how the Earth's magnetic field is generated, and how seismic and other geophysical data can help us find oil.

Data analysis
The course is under construction.

Mathematics 3
Numerical methods are procedures for solving mathematical problems using computers, like calculating the value of an integral. Different types of equations, such as simultaneous equations and differential equations, involve different numerical methods. Probability and statistics explain events and phenomena that are ruled by uncertainty and chance. Basic concepts like distribution, sample, estimation etc. are treated with mathematical tools. Appropriate computer software will be used.

Dynamical oceanography
This course discusses the principal laws that govern currents and other movements in the oceans. The most important equations are derived, and it is demonstrated how they create the currents in the world oceans. The influence of the atmosphere on the ocean is also a topic. How wind and heat transfer creates currents both in the upper and in the deeper layers of the oceans.

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Semester 4

Sedimentary geology
Sedimentology is the study of sediments (like sand, clay and skeletal remains) and sedimentary rocks (like sandstone, shale and limestone). It deals with sediment transport, deposition and hardening into rock, and the role of the environment. Sedimentary rocks cover most of the Earth, hold the world's oil and gas, contain the fossil record of life on Earth, and record much of the Earth's natural history. Stratigraphy and paleontology deal with the original succession and age relations of rock strata, their distribution, composition, fossils and life forms from the distant past.

Modern physics
Modern physics deals with matter and energy on scales where common-sense notions of space, time, matter and energy are no longer valid. Quantum theory is concerned with the discrete nature of phenomena at the atomic and subatomic scale, and with the complementary aspects of waves and particles in the description of such phenomena. The special theory of relativity contains two fundamental postulates: that the laws of physics are the same in all inertial frames of reference, and that the speed of light in vacuum is independent of the motion of the light source.

Mathematics 4
This course is a continuation of the Mathematics 2 course. Partial differential equations describe a mathematical connection between a function of several variables and partial derivatives of the same function. The theory of complex variables includes functions of complex numbers and their properties. From this theory one derives several useful formulae and theorems on, for instance, series and integrals.

Small to medium scale oceanography
This course deals with rapid movements in the oceans, and how they mix the watermasses. It is discussed how changes in temperature and salinity affect waves and other raid movement in sea water. These processes are essential in transport of pollution and for primary production and marine life in general. The propagation of light and sound in sea water are also discussed.

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Semester 5

Exploration and environmental geophysics
Exploration geophysics applies the principles of geophysics to the search for petroleum and minerals in the Earth. It deals with seismic methods for imaging the subsurface, gravity and magnetic methods (alone or in support of seismic), electric and electromagnetic methods (principally in exploring for metallic minerals), and radiometric methods (e.g. in uranium prospecting. All these physical methods are applied in borehole surveys (on land or the seafloor) to give direct observation at depth, and in the shallow subsurface in environmental studies.

Petroleum geoscience
Petroleum geoscience deals with the key concepts involved in the creation of petroleum reservoirs in subsurface rocks, how we discover this oil and gas and how we develop it through drilling and reservoir engineering. It considers petroleum chemistry, deposition of reservoir rocks, petroleum sources, creation of traps and seals, exploration for these resources using geophysics (mainly seismic), geology and petrophysics, exploitation from the appraisal stage through development and then production. Several actual case histories are studied.

Surface waves and tides
Waves and tidal currents are crucial for the marine environment in the area around the Faroe Islands. Detailed knowledge about waves and currents is important in almost all marine activities in the area. From basic physical and mathematical principles it is shown how waves are created, travel and dissapear, and also how changes in sealevel and currents are connected to the movements of the sun and the moon.

Numerical ocean modelling
Computer models have become important tools in weather forecasts and in estimation of the ocean currents. Marine applications of these models include dispersal of various materials, search and rescue operations, generation of sailing information and climate research. This course provides the basic understanding of the methods used to create these models.

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Semester 6

Bachelor thesis
The study is completed with an independent scientific investigation. The subject is chosen by the student in cooperation with a supervisor. The thesis comprises collection and working up of material, scientific analyses and presentation of results in a written report, which will be evaluated by the supervisor and an external examiner.

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Examples of optional courses
The following are examples of optional courses. Optional courses may also be selected from other degree programs.

Advanced exploration seismology
This course aims to give a working knowledge of advanced seismic methods currently in use as tools in petroleum exploration and reservoir monitoring. Seismic tools may have as their objective to yield images of geologic structure – mainly to map the boundaries between different layers – or to estimate physical properties of sedimentary rocks – such as their mineral composition, porosity, and fluid content. This course concentrates more on the estimation of sedimentary-rock properties by methods like amplitude variation versus offset, anisotropy, and inversion.

Igneous and metamorphic geology
This course deals with rocks that are formed not by sedimentation but, for example, from magma emplacement at depth, by volcanic extrusion, or by high-temperature and/or high-pressure alteration of pre-existing rocks. It looks particularly at the tectonics and stratigraphy of the North Atlantic region, in particular the Faroes, its volcanism and volcanic rocks (like basalt), its metamorphism and metamorphic rocks (like coal). More generally it involves elements of equilibrium chemistry, thermodynamics, mineralogy and petrology in considering these rocks.

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