NTNU

MASTER OF PHILOSOPHY
MASTER OF SCIENCE IN ENGINEERING
MASTER OF SCIENCE IN NATURAL SCIENCES

DEGREE PROGRAMMES
2003 - 2004

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INTRODUCTION

This Course Catalogue is a guide for students who are enrolled in one of the International Master's Degree Programmes at NTNU, and who are in the process of planning or completing their degree. The Catalogue contains complete and updated prospectuses for the degree programmes, with discipline and course descriptions for the individual International Master's Degrees.

The Course Catalogue is revised annually, and only the latest edition is valid. This edition is valid until the end of the academic year 2003/2004.

Good luck with your studies,

Student and Academic Division

Office of International Relations

NTNU

NTNU consists of 7 faculties. The University has over 18 000 students, and approximately 3 800 employees.

Although the University has a technological and natural science main profile it also has a full range of degrees in the social sciences, arts, humanities, medicine, and psychology. NTNU has a number of non-degree courses, such as those for practising musicians and teachers, as well as for artists in the visual arts.

NTNU is concerned with innovation – a University where its students can meet the challenges of a new era. In its work, NTNU is concerned with interrelations at a macro- and micro-levels, and contributes to developing society that is in harmony with our natural resources, and also in interplay with traditional and new knowledge.

GUIDE TO COURSE CATALOGUE FOR THE MASTER OF SCIENCE PROGRAMMES

TABLES

The tables show the subjects in relation to the overall degree programme, number of lectures, credits, when the examination is held etc. The following gives a guide to the specific boxes:

Ex (Course year and time of examination)
This box states which course year and examination period this examination can be taken for the first time in each subject. The examination period is marked **a** for the August examination, **h** for the autumn examination and **v** for the spring examination.

Subject no.
The subject number comprises 6 or 7 digits.

Subject title
This box gives the subject title in abbreviated form.

Note
This box includes any references to footnotes.

Weekly hours in summer, autumn and spring semesters
The boxes provide information about the weekly number of lessons each semester in each subject and which semester the teaching is given.

These weekly hours are divided into:

- F: Lecture hours per week
- Ø: Exercise hours with instruction
- S: Additional hours with self study

Cr (credits)
The credits give the weighting of each subject in the degree programme.

Exam
The mark **x** shows if the subject has an examination or not.

DESCRIPTION OF SUBJECTS FOR THE MASTER OF SCIENCE PROGRAMMES

The description of subjects provides a survey of the topics covered in each subject. The description of subjects also gives the following information:

Subject title
The subject titles in the course catalogue show:

Abbreviated subject title (English)

Complete subject title (English)

Complete subject title (Norwegian)

Teacher(s)
This indicates the teacher(s) who is responsible for the teaching etc. and who is the contact person for students and others.

Weekly hours
This provides information about the weekly hours of each subject per semester and the semester teaching is given in.

Time/venue
This provides information about when and where teaching will be given during the academic year.

Examination
This provides information about the examination date for the subject in the academic year. (The examination date is only determined well in advance for subjects that are also part of the *Master i teknologi* degree. Other subjects will have the examination date decided after students have been registered for the examination.)

Examination support
Information about permitted examination support is given at each examination. The following codes are used:

A - All written and handwritten examination support materials are permitted.

All calculators* are permitted.

B - All written and handwritten examination support materials are permitted. Certain, specified calculator** are permitted.

C - Specified written and handwritten examination support materials are permitted. Certain, specified calculator** are permitted.

D - No written or handwritten examination support materials are permitted. Certain, specified calculator** are permitted.

Oral exam has code D in the absence of any understanding to the contrary.

* When "all calculators" are allowed, the following rules apply:

- No possibility of communication with other sources of data is allowed.
- Cannot be connected to mains electricity.
- Is not to make a noise.
- Is not to have any other equipment for reading data than a display.
- Is only to be one - 1 - unit.
- Is only to be pocket sized.

** "Certain, specified calculator" means a calculator with simple, numerical and trigonometrical functions such as +, -, sine, cosine etc. The type of calculator is to be easy for examination invigilators to recognize.

(The specified calculator is HP30S).

Exercises
This indicates if there are exercises in a subject and whether the exercises are compulsory or voluntary. (More details about exercises are given in the Description of Subjects). The following codes are used for exercises:

O - Compulsory exercises

F - Voluntary exercises

I - No exercises

Grades
All subjects have grades based on the letter scale.

MASTER OF PHILOSOPHY IN ENGLISH LANGUAGE AND LINGUISTICS

Admission requirements
Applicants should hold a BA or an equivalent degree in English or Linguistics with a sufficient background with topics related to English language or linguistics. Only candidates with a minimum of 3 English language/linguistics courses will be considered.

Officially certified copies of all educational certificates, including transcripts and diplomas from secondary school and university education, must be submitted.

An English proficiency test must be included. Applicants must pass either the TOEFL with a minimum paper score of 550 (230 computer) or IELTS with 6.0 or better. Citizens from Ireland, the UK, the US, Canada, Australia and New Zealand do not have to submit TOEFL/IELTS test results. This is also the case for applicants who have spent at least one year in either of these countries, attending higher secondary school or university. Applicants from African countries with a BA/BSc/BEng degree where the language of instruction has been English and those who have passed English as a subject at GCE A-level with grade C or better are also exempted. Applicants with a university degree in English language (BA in English) are also exempted from the language requirement. Please be aware that applicants from Asian countries (for example Bangladesh, India, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam) with a BA/ BSc/ BEng degree where the language of instruction has been English are not exempted from the English language requirements, except for candidates holding a BA degree in English.

NB! The programme is also open for non-quota programme applicants.

Course outline
The MPhil Programme will take 2 years of full-time studies, and starts in the autumn term. The credits are divided between 4 courses (each counting 15 credits) and a thesis of 60 credits. 60 credits indicate the normal workload for a full-time student for one academic year. The 4 courses should include intermediate and advanced courses of the candidate's choice, where at least two of them should be advanced. The courses should be selected from among topics offered to regular students at the department. The courses should be completed during the first year of study, and the second year should be devoted to the thesis.

Topics offered in the programme

The range of topics that could be offered includes advanced topics in Modern English syntax, English synchronic and diachronic variation, Studies of the lexicon, First language acquisition and second language acquisition studies, Translation theory and communication studies. Normally, course topics are chosen from the main subject-areas of English language teaching at Trondheim, which (at the intermediate level) cover "English Grammar", "Varieties of English", "English Language and Communication" and "Translation", and (at the advanced level) include "English language structure and Varieties of English" and "English Language and Cognition/Communication".

More detailed descriptions of each course, together with reading-lists, will be made available by the department no later than the 31st of March and the 31st of October of the semester previous to the course being taught, and may be collected outside the departmental office.

Teaching and exams
Intermediate and advanced courses at NTNU are normally evaluated using a combination of methods, including a final, four (sometimes six-) – hour, written test, and a substantial piece of writing (a term paper, log-book, or other written activity). In addition, an oral presentation may be required. The term paper or log-book is written under supervision, and is a requirement for being eligible to take the final

test. It may be given a specific letter-grade, or awarded a general pass / fail mark. More detailed information about forms of evaluation for a given course will be supplied at the same time as reading-lists are made available.

Students submitting a Master's thesis should be aware that they must deliver a 30 minute oral presentation or lecture on their topic before the thesis itself is completed. This presentation must be approved by two examiners, appointed from the staff of the English section at the Department of Modern Languages.

Supervision

The department teaches and researches in a variety of topics, and historically students have sought supervision in areas such as experimental and acoustic phonetics, the history of English, the Syntax/Semantics Interface and Contemporary Information Structure Theories. The exact range of supervision is nevertheless dependent on staff resources at any given time. After the first year of studies – and during the period from 15 June-15 August – the candidates are given the opportunity to go back to their home countries to do field-work if this is necessary for the completion of their theses. Students who are supported by the Quota programme are awarded an extra grant to cover field-trip expenditures.

MASTER OF PHILOSOPHY (MPHIL) IN LINGUISTICS

The degree is also called 'International Master‘s'.

Admission requirements
Applicants should hold a BA or an equivalent degree in Linguistics or in a field with a sufficient background with topics related to Linguistics. Only candidates with a minimum of 3 Linguistics courses will be considered.

Officially certified copies of all educational certificates, including transcripts and diplomas from secondary school and university education, must be submitted.

An English proficiency test must be included. Applicants must pass either the TOEFL with a minimum paper score of 550 (230 computer) or IELTS with 6.0 or better. Citizens from Ireland, the UK, the US, Canada, Australia and New Zealand do not have to submit TOEFL/IELTS test results. This is also the case for applicants who have spent at least one year in either of these countries, attending higher secondary school or university. Applicants from African countries with a BA/BSc/BEng degree where the language of instruction has been English and those who have passed English as a subject at GCE A-level with grade C or better are also exempted. Applicants with a university degree in English language (BA in English) are also exempted from the language requirement. Please be aware that applicants from Asian countries (for example Bangladesh, India, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam) with a BA/ BSc/ BEng degree where the language of instruction has been English are not exempted from the English language requirements, except for candidates holding a BA degree in English.

NB! The programme is also open for non-quota programme applicants.

Course outline
The MPhil Programme will take 2 years of full-time studies, and starts in the autumn term. The credits are divided between 4 courses (each counting 15 credits) and a thesis of 60 credits. 60 credits indicate the normal workload for a full-time student for one academic year. The 4 courses should include intermediate (LING2xxx) and advanced (LING3xxx) courses of the candidate’s choice, where at least one of them should be advanced. The courses should be selected from among topics offered to regular students at the department. The courses should be completed during the first year of study, and the second year should be devoted to the thesis.

Topics offered in the programme
The range of topics that could be offered is a subset of the topics offered in the general Bachelor’s and Master’s programme in Linguistics, namely:

LING2201	Syntax II	7.5	Spring
LING2202	Phonology II	7.5	Spring
LING2203	Semantics II	7.5	Autumn
LING2204	Pragmatics II	7.5	Autumn
LING2207	Grammar Engineering I	7.5	Spring
LING2217	Grammar Engineering II	7.5	Spring
LING2221	Intonation	15	Autumn
LING2222	Language Typology	15	Autumn

LING3001	Syntax and Semantics	15	Autumn and Spring
LING3003	Pragmatics III	15	Spring
LING3005	Grammar Engineering III	15	Autumn

Teaching and exams
Each course – intermediate and advanced – has a take-home exam, of duration one week for intermediate level and two weeks for advanced level. Normally each 15 credits course has 4 hours of teaching per week in the form of lectures and seminars.

After the first year of studies – for the period 15 June-15 August – the candidates are given the opportunity to go back to their home countries to do field-work if this is necessary for the completion of their theses. Students who are supported by the Quota programme are awarded an extra grant to cover field-trip expenditures.

MPhil in Linguistics: Example with focus on grammar and pragmatics

Sem.	7.5 credits	7.5 credits	7.5 credits	7.5 credits
4	MPhil Thesis			
3	MPhil Thesis			
2	Syntax and Semantics		Pragmatics III	
1	Semantics II	Pragmatics II	Language Typology	

MPhil in Linguistics: Example with focus on phonology and pragmatics

Sem.	7.5 credits	7.5 credits	7.5 credits	7.5 credits
4	MPhil Thesis			
3	MPhil Thesis			
2	Pragmatics III		Phonology II	Syntax II
1	Semantics II	Pragmatics II	Intonation	

MPhil in Linguistics: Example with focus on syntax and semantics

Sem.	7.5 credits	7.5 credits	7.5 credits	7.5 credits
4	MPhil Thesis			
3	MPhil Thesis			
2	Syntax and semantics		Grammar Engineering I	Syntax II
1	Semantics II	Pragmatics II	Language Typology	

MASTER OF PHILOSOPHY IN SOCIAL CHANGE, SPECIALISING IN GEOGRAPHY

Vedtatt av styret ved NTNU 16.12.02, med endringer vedtatt av Fakultet for samfunnsvitenskap og teknologiledelse 17.12.02

The Master's in Social Change is a programme designed for students who want to specialize in development studies and social change. The degree is awarded by the Faculty of Social Sciences and Technology Management at NTNU and administered by the Department of Geography. It has a stronger focus on Geography than on other social sciences, but is still an interdisciplinary degree that is relevant for students with backgrounds in different social sciences and development studies.

The programme is relevant for a variety of jobs, including research, planning, resource management, and teaching. The programme is also relevant for further studies within the field of Geography, other social sciences, and interdisciplinary studies such as development studies and natural resource management.

The programme is open to both for foreign and Norwegian students. There are 10 places for students financed by the Quota programme, 4 for students financed by NORAD, 5 places for Norwegian students, and up to 4 places open for other exchange students.

Admission requirements
Applicants should preferably hold a Bachelor's in Geography, a cand.mag. degree with Geography "mellomfag" from a Norwegian university, or other equivalent education. Candidates with a Bachelor's/cand.mag. degree in other social sciences are also considered for admission, if their first degree includes studies within Geography or Development studies.

The teaching language is English, and the applicants must document their English proficiency by achieving one of the following:

Pass in the foundation course ("grunnkurs") in English at a Norwegian Upper Secondary School.

TOEFL-test with a minimum of 550 points. (213 computer-based test)

IELTS-test with 6.0 points or better

Exceptions from this requirement can be given for certain groups of applicants under the guidelines determined by the Faculty.

Grades
NTNU uses the following grading scale:

A, B, C, D, E, and F (fail)

Course outline
The programme involves 2 years of full-time studies. The programme is structured around core courses (45 credits), electives (30 credits) and a Master's thesis (45 credits).

Due to a change in the credit system at NTNU, the normal workload for a full-time student for one academic year is 60 credits, as compared to 20 credits prior to August 2003

The core courses are: GEO 3050 Theories of Social Change, GEOG 3051 History of Geographical thought and GEOG 3052 Research Methodology.

Students can choose electives worth 30 credits from a number of courses offered by the Department of Geography. Most of the electives will be offered in the autumn term. Students can earn a maximum of

15 credits in GIS/Remote sensing (i.e. either GEOG 3510 or GEOG 3511). Courses offered by other departments can be chosen as electives if approval is given by the Department of Geography.

1st term:		
Core course:	GEOG 3050	Theories of Social Change (15 credits)
Electives:	GEOG 3505	Landscape and Planning (15 credits.)
	GEOG 3511	Remote Sensing (15 credits)
	GEOG 3506	Geography, Health and Development (7.5 credits)
	GEOG 3561	Gender and Social Change (7.5 credits)
2nd term:		
Core courses:	GEOG 3051	History of Geographical Thought (15 credits)
	GEOG 3052	Research Methodology (15 credits)
Electives:	SAA 4077	Planning and Construction in Developing Countries
3rd term:		
Core course:	GEOG 3920	Master's Thesis (45 credits)
Electives:	GEOG 3505	Landscape and Planning (15 credits)
	GEOG 3510	Geographical Information Systems (GIS) – principles and application (15 credits)
	GEOG 3506	Geography, Health and Development (7.5 credits)
	GEOG 3561	Gender and Social Change (7.5 credits)
4th term:		
Core course:	GEOG 3920	Master's Thesis (45 credits)

Candidates are expected to use the summer between the second and third term to collect data and conduct fieldwork for their thesis. The thesis is expected to be completed within four terms from admission to the course. Supervision will not be given beyond this. The thesis must be written in English.

Course Plan
Compulsory core courses

GEOG 3050	Theories of Social Change
Credits:	15
Duration:	1 term (autumn)
Required qualifications: (for non-MPhil students)	Bachelor's or "mellomfag" in geography. Other relevant qualifications can be accepted if approved by the Department.
Lectures:	28 hours
Requirement:	Assignment
Exam:	Written (6 hours)
Max. no. of students:	25. students admitted the Master's in Social Change will be given priority

Aim and description of the course
GEOG3050 Theories of Social Change is compulsory for students taking the Master's in Social Change and elective for students doing a Master's in Geography. The course serves as an introduction to the main theme of the Social Change programme. Students shall broaden their knowledge of theories of social change through an introduction to different analytical perspectives on the study of social change. The course will focus on conceptualisations of development and social change, and on themes such as the relationship between growth and poverty, globalisation and processes of marginalisation. The course will also include presentations of relevant empirical material from research within development studies. The teachers for the course represent several disciplines within the social sciences.

GEOG 3051	History of Geographical Thought
Credits:	15
Duration:	1 term (spring)
Lectures:	18 hours
Seminars	16 hours
Requirement:	Assignment
Exam:	Assignment and oral exam

Aim and description of the course
This course is only for students who are taking the Master's in Social Change.

The course deals with the historical development of central geographical ideas and approaches relevant to the conceptualising, implementation and writing of a Master's thesis. The course is divided into two sections. The first section, based on lectures and readings, focuses on theory. The second section, grounded in seminar participation, focuses on preparing and writing a paper on how the history of geographical thought can be related to the formulation of the thesis.

GEOG 3052	Research Methodology
Credits:	15
Duration:	1 term (spring)
Lectures:	14 hours (introduction)
Seminars:	6 hours
Field trip:	7-10 days (incl. preparations), compulsory
Exam:	Assignment and oral

Aim and description of the course
This course is only for students who are taking the Master's in Social Change.

The course will give an introduction to research methodology and different kinds of research methods, covering both qualitative and quantitative approaches. The aim of the course is to give students the necessary tools for their thesis work, concerning defining a research problem, making a research design, and techniques for data collection and analysis.

The course builds on a common introductory course and a choice of modules. Each student chooses one out of two modules, one covering quantitative and one covering qualitative methodologies.

The field trip is a compulsory part of the course. One of the aims of the field trip is to give students practical training in using different methods. Participation in preparatory lectures and seminars for the field trip is compulsory. After the field trip all students must write contributions to a common report (group work). The report contributions have to be approved by the Department, but a grade will not be given.

GEOG 3920	Master's Thesis in Social Change
Credits:	45
Exam:	Thesis and oral. The oral exam is used to adjust the grade given for the thesis.

Aim and description of the course
This course is only for students who are taking the Master's in Social Change.

The thesis consists of a scientific presentation of a chosen topic. The thesis should be 90 - 100 pages (Times Roman 12/ spacing 1.5/ approximately 40000 words). The student must prepare a project proposal of at least 4 pages before the 15th February in the second term. On the basis of the project proposal, a faculty member will be appointed as supervisor in accordance with the guidelines approved by the Board of the Department. The supervisor must be kept informed about the progress of the writing. Seminars with emphasis on theoretical and practical issues related to the writing of a Master's thesis will be held during the first and the second year. Students are expected to present their thesis work for fellow students and faculty members at 2-3 seminars. It is expected that students will need a full academic year to complete the thesis. It is recommended that students start to work on their thesis in their second term.

Electives

GEO 3505*	Landscape and Planning
Credits:	15
Duration:	1 term (autumn)
Lectures:	30 hours
Exam:	project/practical work + oral

Aim and description of the course
The course discusses theoretical and methodological questions concerning landscape in relation to planning. The course will consider landscape as a concept, landscape values, and theoretical and methodological problems within landscape planning and landscape management. Social Change-students will write an individual paper based on the recommended reading for the course.

Geography Master's students will participate in a project exercise in which students carry out fieldwork, interviews and document analysis of an actual planning situation in which landscape and environmental values are involved. The project work will normally be carried out as group work. The aim of the project is to give insight into how and to what extent regard for landscapes and environments will be taken into account in planning and management, and also to illustrate which landscape and environmental problems are encountered in the general planning process.

The lectures will normally be given in English. Social Change-students will write their individual paper in English. The practical coursework for Geography Master's students will be conducted in Norwegian, and the group reports will normally be written in Norwegian.

During the oral exam students will be required to give an account of/explain their work (written paper or project report), and will be questioned on the basis of this and relevant course literature. Emphasis will be placed on feedback and learning in the oral exam.

GEOG 3510*	Geographical information systems (GIS) – principles and application
Credits:	15
Semester:	1 semester (autumn). The course will be run only every second year.
Lectures:	24 hours
Practical work:	24 hours + project work
Requirements:	Min. 7.5 credits within mathematics, statistics or computing
Obligatory:	Exercises and project paper
Assessment:	Project paper and oral exam
Max. no. of students:	18
Exam:	Oral

Aim and description of the course
This is an advanced course in geographical information systems (GIS). It gives a comprehensive overview of the use of GIS-functions. It also gives a comprehensive introduction to GIS-components such as hardware, software, organization and databases. Students will become familiar with how the technology can be used in social and natural science problems. They will be introduced to different programme packages and become familiar with both methods for data collection and evaluation of the quality of the data sets they work with. Students will also be introduced to simple programming and use of GIS on the Internet.

During the semester students will complete short exercises and a more comprehensive project paper. The exercises and the project paper must be approved before the student is allowed to take the exam. The oral exam will be based on the project paper and the course material list.

GEOG 3511*	Remote sensing
Credits:	15
Semester:	1 semester (autumn). The course will be run only every second year.
Lectures:	24 hours
Practical work:	24 hours + project work
Requirements:	Min. 7.5 credits within mathematics, statistics or computing
Obligatory:	Exercises and project paper
Assessment:	Project paper and oral exam
Max. no. of students:	18
Exam:	Oral

Aim and description of the course
The course will give an introduction to the use of satellite images in geographical problems. There will be a comprehensive examination of how data collection from satellites is made. Students will be introduces to different sources (different satellites), methods for treatment and correction of digital images and different application possibilities for digital satellite images, aerial photographs and orthodox photography. An important element will be explanation of how digital images can be integrated into a geographical information system (GIS). Students will be introduced to specialist programme packages such as, for example, Idrisi.

During the semester students will complete short exercises and a more comprehensive project paper. The exercises and the project paper must be approved before the student is allowed to take the exam. The oral exam will be based on the project paper and the course material list.

GEOG 3506*	Geography, Health and Development
Credits:	7.5
Duration:	1 term (autumn)
Lectures:	20 hours
Exam requirement:	Approved assignment and presentation
Exam:	Written (4 hours)

Aim and description of the course
The course will be given in English and is designed for 3 groups:

Students taking the Master's in Social Change (anticipated to be the largest group

Other (Norwegian) Geography Master's students

Master's students studying Health in ISH who take this course as an elective (listed in the study plan as an optional course for this study).

The course provides a general introduction to geographical aspects in health, with two main focuses:

Health status, disease/injury and risk/risk factors

The geography of different levels of health services, with emphasis on demand and use, offer and accessibility, development, and treatment (self treatment, care and cure)

The course has a development perspective with emphasis on the situation in developing countries. More general international development trends are also covered. In addition to a common core curriculum, in-depth courses (curriculum options) are available: one which focuses on developing countries and one which is on western countries (focusing on the situation in Norway). The course covers studies on approaches to quantitative and qualitative methods. Part of the course will be based on individual reading, which will provide a basis for carrying out the assignment. These projects will be presented in seminars. A seminar will also be held on researching health and health geography in libraries and databases (3 hours).

GEOG 3561*	Gender and Social Change
Credits:	7.5
Duration:	1 term (autumn).
Lectures:	10 hours
Exam:	Written (4 hours)

Aim and description of the course
The course offers an introduction to the main themes of Norwegian and international social scientific research on gender, and provides a theoretical platform for further studies of gender-related issues. The course seeks to combine an interdisciplinary and subject-specific approach. It aims at outlining different perceptions of gender within different social-scientific traditions. Theoretical and methodological problems related to the use of gender as an analytical category and how these are manifested in social scientific research will be treated. The course will also include presentations of

empirical material from gender-specific research within the field of geography and other social scientific disciplines. The course will be based on a few introductory lectures and on individual study with reading lists.

SAA 14077*	Planning and construction in developing countries
Credits:	7.5
Duration:	1 term (spring)
Lectures:	30 hours
Seminars:	28 hours
Exam:	Written (6 hours)

Aim and description of the course
The course offers an introduction to issues that are important for an understanding of planning, construction and infrastructure in developing countries (ideology, cultural, social and geographical issues, economy, resources, technology, etc.). Focus will be on those features that differ fundamentally from industrialized countries, with particular emphasis on problems related to the practical implementation of projects.

Credit adjustment due to overlap in content

SVGEO350	GEOG3050	15 credits
SVGEO351	GEOG3051	15 credits
SVGEO355	GEOG3052	15 credits
SVGEO361	GEOG3561	7.5 credits

MASTER OF SCIENCE AND PHD DEGREE IN EXERCISE PHYSIOLOGY / SPORT SCIENCES

The teaching and tutoring are in English.

There are no tuition fees in this programme, but international students have to prove their ability to cover living costs before they can obtain a student visa to Norway.

Application deadlines: 1 May, to Faculty of Medicine, NTNU, NO-7489 Trondheim, Norway for students from abroad. For Norwegian students the application deadline is 1 June.

The MSc degree in Exercise Physiology is a two-year full time programme.

Admission requirements to the MSc programme are a bachelor's degree or an equivalent 3-year university or college education, normally with a major in Exercise Physiology, Sport Sciences, Exercise Science, Biology, Physiotherapy, Nursing, Biochemistry, Occupational therapy or similar fields. A firm foundation in human biology is required within the Bachelor's degree.

The PhD programme is a 3 year full-time programme requiring a Master'sDegree in a related field.

10 students will be admitted to the programme every year.

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Internet address: http://www.ntnu.no/

Master of Science in Exercise Physiology / Sport Sciences programme

The MSc is a research and thesis-based integrated graduate degree programme in Exercise Physiology at Faculty of Medicine. This is a 120-credit, two-year period of study. It is exclusively concerned with basic research training and comprises compulsory courses together with optional courses dependent upon the research specialization of students. The programme is connected to ongoing research and has a focus on training interventions and its basic mechanisms as well as effects in preventive medicine, treatment, rehabilitation and ageing, and in sports performance.
The Master of Science degree is a requirement for further research work at PhD level within the Exercise Physiology programme. Teaching and tutoring is given in English.

Year 1:
EP 3010 Medicine for non-MD's.
7.5 credits, autumn term
Functional anatomy and physiology from cell to organ, health and activity related diseases, ethical aspects in medicine and research.
EP 3020 Training circulation and oxygen consumption.
7.5 credits, autumn term
Circulatory function, supply and demand. Limitations and adaptations in patients and athletes
EP 3030 Training muscle and force production.
7.5 credits, autumn term
Muscle architecture, changes, neural adaptations, limitations and functional adaptations in patients and athletes. Motor skill.
EP 3040 Environmental adaptations
7.5 credits, autumn term
Diving, high altitude, exercise in cold and hot environments

EP 3050 Research methods in Exercise Physiology
15 credits, Spring term
Introduction to theories of science and basic statistics.
EP 3060 Specialisation in Exercise Physiology
15 credits, Spring term
Specialization within the area of research planned for the thesis. Review of research literature, and writing a review article in the area of specialization for the thesis.
Compulsory literature: A minimum of 30 articles from peer-reviewed scientific journals.

Year 2:
EP 3070 Research Apprenticeship in Exercise Physiology
15 credits, autumn term
This course contains the most usual data collection techniques in the area of Exercise Physiology. The student report consists of a pilot experiment to ensure that data collection techniques or methods planned for the thesis are reliable and valid
EP 3901 Thesis in Exercise Physiology
45 credits
The thesis should be within the area of the research competence among the available tutors. The theme has to build upon the specialization in EP 3060, and the research apprenticeship in EP 3070, and will be subject to approval by the board of professors. The thesis is to be in the format of an article in a peer reviewed research journal, and will be subject to external evaluation.

Ph.D. DEGREE IN EXERCISE PHYSIOLOGY / SPORT SCIENCES

The Ph.D. programme is a 3-year full time qualification for research at a high scientific international level. The course programme is equivalent to half a year, or 30 credits. The main part of the Ph.D. programme is a research based thesis, normally consisting of 4-6 high quality published or publishable articles in international peer-reviewed research journals.

Scientific staff within the Exercise Physiology field:
Professor, Dr. polit. Jan Helgerud. MSc in Sport Sciences, PhD in Exercise Physiology. Main areas are aerobic endurance and strength testing and training with special interest in Cross country skiing and Soccer.
Professor, Dr. Philos Jan Hoff. MSc in Sport Sciences, PhD in Exercise Physiology. Main areas are strength and endurance training and testing, special interests in Alpine skiing and Soccer.

Associate Staff:
Researcher, PhD, Ulrik Wisløff working with endurance training for heart failure patients and in animal models.
Researcher, Cand.Scient. Eivind Wang working with training effects on atherosclerotic processes.
Research grant holder, Cand.Polit. Øivind Rognmo, working with training interventions in patients with angina pectoris.

Research themes in the Exercise Physiology group:
There are two main goals for the research group. One is to examine basic mechanisms for central and peripheral limitations connected to supply and demand of oxygen transport, and identify training responses within the different mechanisms. Similarly to examine the basic mechanisms for muscular and neural limitations to strength, power and coordination, and identify training responses within the possible mechanisms. The prescription of effective endurance and strength training and the different effects of these mechanisms on top sport performance is one of the aims for the research programme. The second aspect of the research programme is based upon the fact that the fastest developing diseases within the population such as obesity, atherosclerosis, diabetes II and osteoporosis are related

to inactivity. Effective training interventions based on basic biological adaptations have given proven positive effects and are an effective treatment with a high socio-economic, as well as quality of life outcomes. Other patient groups such as lung disease patients also seem to be able to benefit considerably from new developments in the understanding of limitations to oxygen transport and specific training interventions.

Selected publications:

Helgerud J, Engen LC, Wisløff U, Hoff J (2001) Aerobic endurance training improves soccer performance.
Med Sci Sports Exerc, 33:11:1925 - 1931

Haaland, E., Hoff J.(2003) Non-dominant leg training improves the bilateral motor performance of soccer players. Scandinavian Journal of Medicine & Science in Sport , 13: 1-6

Helgerud J, Vik JT, Hoff J (2001) The effect of maximal strength training on endurance performance in upper body for highly trained male cross-country skiers. Corpus, Psyche & Societas, 8:1-2:90.

Hoff J, Wisløff U, Engen LC, Kemi OJ, Helgerud J (2002) Soccer specific aerobic endurance training. Br J Sport Med, 36:3.

Hoff J, Svendsen LH, Helgerud J (2001) Lactate production and elimination in ice-hockey players during an elite series match. Corpus, Psyche & Societas, 8:1-2, 45.

Hoff, J., Helgerud, J. and Wisløff, U. (1999) Maximal strength training improve work economy in trained female cross-country skiers. Med Sci Sports Exerc, 31(6) 870-877

Hoff J, Helgerud J Wisløff U (2002) Endurance training into the next Millenium; Muscular strength training effects on aerobic endurance performance. A review. The Am J Medicine & Sports, IV:I:58-67.

Wisløff U, Helgerud J, Hoff J. (1998) Strength and endurance of elite soccer players. Med Sci Sport Exerc, 30:3: 462-467

Almaasbakk, B. & Hoff,J., (1996), Coordination, the determinant of velocity specificity, J Applied Physiol, 80(5): 2046-2052

Lysklett, O., Whiting, H.T.A. & Hoff, J. (1998) The role of a dynamic model – informer or distractor? Corpus, Psyche et Societas, 5(1):12-24

Miyahara, M., Hoff, J., Espnes, G. & Nishida, T. (1998) Achievement Motivation in Physical Education in Japan and Norway: a Lesson on Semantic Differences, In: Hardman and Standeven (Eds) Cultural Diversity and Congruence in Physical Education and Sport, Chapter 14, 197-201.

Potrac, P., Brewer, C., Jones, R., Armour, K. and Hoff, J. (2000) Toward an Holistic Understanding of the Coaching Process. Quest, 52, 186-199.

Torvik PØ, Helgerud J (2001) The validity of the portable metabolic test system Cortex Metamax. In: Science and Skiing II. Müller E, Schwameder H (eds.) E & FN Spon, London, pp 641-654.

Wisløff U, Helgerud J (1998) Methodes for evaluating peak oxygen uptake and anerobic threshold in upper body of cross-country skiers. Med Sci Sports Exerc, 30 (6): 963-970.

Wisløff U, Helgerud J (1998) Evaluation of a new upper body ergometer for cross-country skiers. Med Sci Sport Exerc, 30 (8): 1314-1320.

Amundsen BH, Wisløff U, Helgerud J, Hoff J, Slørdahl SA (2002) Ultrasound Doppler recorded blood flow to the arm during elbow flexion exercise – characteristics and repeatability. Med Sci Sports Exerc 34:8: 1288-1293

Sandsund M, Sue-Chu M, Reinertsen RE, Helgerud J, Holand B, Bjermer L (2000) Treatment with inhaled beta2-agonists or oral leukotriene antagonist do not enhance physical performance in nonasthmatic highly trained athletes exposed to -15 degreeC. J Thermal Biol, 25: 181-185.

Sue-Chu M, Sandsund M, Helgerud J, Reinertsen RE, Bjermer L (1999) Salmeterol and physical performance at -15 degreeC in highly-trained nonastmatic cross-country skiers. Scand J Med Sci Sports, 9: 48-52.

Wisløff U, Helgerud J, Støylen A, Ellingsen Ø (2001) Atrioventricular plane displacement and left ventricular function at rest and during exercise in female athletes. Med Sci Sport Exerc 33, 9: 1503-1510.

Wisløff U, Helgerud J, Kemi OJ, Ellingsen Ø (2001) Intensity controlled treadmill running in rats: VO2max and cardiac hypertrophy. Am J Physiol, 280: H1301-H1310

Hoff J, Gran A, Helgerud J (2002) Strength and power training improve aerobic performance. Scand J Med Sci. 12: 288-295
Almåsbakk B, Whiting HTA, Helgerud J (2001) The efficient learner. Biological Cybernetics 84: 75-83.
Hoff J, Berdahl GO, Bråten S (2001) Jumping height development and body weight considerations in ski jumping. In Science & Skiing II, Müller et al (eds.) Verlag Dr. Kovac, Hamburg.
Østerås H, Helgerud J, Hoff J. (2002) Maximal strength training effects on force-velocity and force-power relationship explain improvements in aerobic performance in humans. European Journal of Applied Physiology 88: 255-263.

MASTER OF SCIENCE IN URBAN ECOLOGICAL PLANNING

Compulsory core courses:

Semester:	Subject no.:	Title:	Autumn	Spring
1st sem.	AAR4525	Urban Ecological Planning in Developing Countries. Project work	15 Cr	
1st sem.	AAR4816	Urban Ecological Planning. Method	7.5 Cr	
1st sem.	AAR4820	Urban Ecological Planning. Theory	7.5 Cr	
2nd sem.		Electives (see list)		15 Cr
2nd sem.	AAR5300	Urban Ecological Planning in Diverse Cultures		15 Cr
3rd sem.	*AAR5200*	Analysis of Field Work for MSc thesis in Urban Ecological Planning	15 Cr	
3rd sem.	AAR5310	Planning Theory	15 Cr	
2nd sem.	AAR5400	Master's thesis		30 Cr

AAR4525 Urban Ecological Planning in Developing Countries. Project Work

Course responsible: Professor Hans Christie Bjønness

Duration: 1 term (autumn semester 2003)

Credits: 15 cr

The project is accomplished through a two months intensive field work in a city in a developing country. The students are engaged in real on-site experience, through cooperation with local interest partners, together with formal and informal institutions. This is to give insight in the premises and the content of the local transformation processes, and demands for constructive solutions for improvement. Local persons are engaged to conduct a stronger and better group work. The project is presented for local users, interest partners, planners and local students and teachers. The group project is accomplished in Norway with emphasis on theory and method. Accomplishment: Group work and seminars. This is a very intensive course, where the project work is central. This is an international course with NORAD and quota students, European exchange students and Nordic students. The course gives emphasis to multi-cultural and multi-disciplinary studies.

Course material: Compendium prepared by the course responsible.

Examination: Evaluation of group work and presentation.

AAR4816 Urban Ecological Planning. Method

Course responsible: Professor Hans Christie Bjønness

Duration: 1 term (autumn semester 2003)

Credits: 7.5 cr

The method will be applied in the project work which starts with a two months intensive field work in a city in a developing country. The students are engaged with real on-site experience, through cooperation with local interest partners, together with formal and informal institutions. In this work will 'integrated action planning' be central, in addition the students will apply the "Logical Framework Approach". This is based on NORAD and UN's standard for project planning. The methodology gives emphasis to working methods which gives insight in the local background of transformation processes, and to conduct constructive solutions for improvement. How can the local community and its premises can be advocated? The project is presented for local users, interest partners, planners and local students and teachers. The group project is accomplished in Norway with emphasis on theory and method. Accomplishment: Seminars. This is a very intensive course, where the project work is the main assessment. International course with NORAD and international quota students, European exchange students and Nordic students. The course gives emphasis to multi-cultural and multi-disciplinary studies.

Course material: Compendium prepared by the course responsible.

Examination: Oral exam.

AAR4820 Urban Ecological Planning. Theory

Course responsible: Professor Hans Christie Bjønness

Duration: 1 term (autumn semester 2003)

Credits: 7.5 cr

The theory will be applied in the project work which starts with two months of intensive field work in a city in a developing country. The students are engaged with real on-site experience, through cooperation with local interest partners, together with formal and informal institutions. The theory emphasizes principles within urban ecological planning, central discussion of development and modernization paradigms, theories within alternative development, theory of sustainable use of areas and urban approaches in developing and industrialized countries. Theoretical issues within communicative and democratic planning will also be discussed. The aim is to gain understanding in the local background of transformation processes, and to conduct constructive solutions for improvement. The project is accomplished in Norway with emphasis on method and theory. Accomplishment: Seminars. This is a very intensive course, where the project work is the main assessment. International course with NORAD and international quota-students, European exchange students and Nordic students. The course gives emphasis to multi-cultural and multi-disciplinary studies.

Course material: Compendium prepared by the course responsible.

Examination: Oral exam.

AAR5300 Urban Ecological Planning in Diverse Cultures

Course responsible: Professor Hans Christie Bjønness

Duration: 1 term (spring semester 2003)

Credits: 15 cr

The course will elaborate on theories of urban ecology and on methods of urban ecological planning and management. There will be introductions to value issues in theory, and to process-oriented and system-based theory taking up conditions for urban transformation and the complexity of relationships.

Planning and management methods for sustainable urban development based on urban ecological principles will be addressed through analysis of relevant international and Nordic case studies. Issues theory and method will be discussed in relation to urban ecological planning at various levels of planning, boundaries, processes of segregation and urban transformation.

Teaching method: Concentrated lectures, seminars and project work. The students must be prepared to participate actively. The writing of an essay is required.

Course material: Compendium prepared by the course responsible.

Examination: Term paper which will be evaluated.

AAR5310 Planning Theory

Course responsible: Professor Tor Medalen

Duration: 1 term (autumn semester 2004)

Credit: 15 cr

The course seeks to give an understanding of the history of planning. Classical theories of planning, and their development until today, are presented and discussed. Practical examples and references present the theoretical material.

Teaching method: Concentrated lectures, seminars and project work. The students must be prepared to participate actively. The writing of an essay is required.

Course material: Friedmann, John (1987).

Planning in the public domain: From knowledge to action

Princeton University Press, Princeton, New Jersey

Forester, John (1989).

Planning in the face of power.

California University Press, Berkeley, California

Sager, Tore (1994)

Communicative planning theory

Avebury, Aldershot, England

Schön, Donald A (1983)

The reflective practitioner: How professionals think in action.

Basic books, New York.

Compendium with additional papers.

Examination: Term paper which counts 1/3 in the final evaluation

Written examination.

AAR5400 Master of Science thesis in Urban Ecological Planning

Course responsible: Professor Hans Christie Bjønness and /or appointed supervisors

Credits: 30 cr

The thesis consists of a scientific presentation of a chosen topic. The thesis should be about 100 pages. The student must prepare a project proposal of at least 4 pages before the 15th February in the second semester. On the basis of the project proposal, a faculty member will be appointed as supervisor in accordance with the guidelines approved by the Board of the Department. The supervisor must be kept informed about the progress of the writing. Seminars with emphasis on theoretical and practical issues related to the writing of a Master's thesis will be held during the first and the second year. Students are expected to present their thesis work for fellow students and faculty members at 2 seminars. It is recommended that students start to work on their thesis in their second semester. The last spring semester is fully devoted to the thesis.

Thesis evaluation: Thesis and presentation. The presentation is used to adjust the grade given for the thesis.

This course is only for students who are taking the full study in MSc in Urban Ecological Planning.

AAR5200 Analysis of Field Work for MSc thesis in Urban Ecological Planning

Course responsible: Professor Hans Christie Bjønness and /or appointed supervisors

Credits: 15 cr

Duration: 1 term (autumn semester 2004)

A field work plan shall be presented for and approved by the course responsible and / or the appointed supervisor prior to the field work. The field work is for a two month period during the summer between the second and the third semester. The fieldwork should preferably be in the home country of the participant from a developing country. During the third semester the field work results will be recorded, analysed and presented.

Evaluation: Evaluation based on pre-fieldwork plan, recording and analysis of field work results and presentation.

Electives:

Subject no.	Title:	Note	Autumn	Spring
DIA5098	Housing Theory and History	1	7.5 Cr	
GEOG3050	Theories of Social Change	1	15 Cr	
GEOG3561	Gender and Social Change	1	7.5 Cr	
GEOG3505	Landscape and Planning	1	15 Cr	
GEOG3506	Geography, Health and Development	1	7.5 Cr	
AAR5250	Preparation for fieldwork for Master's student	2		7.5 Cr
GEOG3052	Research Methodology	2		15 Cr
AAR4945	Planning and Construction in Developing Countries	2		7.5 Cr
DIA4091	Methods in Environmental Impact Assessments	2		7.5 Cr
DIA1094	Resource Use in Buildings	2		7.5 Cr
AAR5260	GIS in Urban Planning	2		7.5 Cr

1)Autumn:

Elective courses offered during the autumn can only be selected if a study plan tailored to the MSc thesis subject is agreed with the Faculty, and recommended by the MSc thesis supervisor and course responsible.

2)Spring:

Elective courses amounting to 15 Cr are to be selected from the above list.

AAR5250 Preparation for fieldwork for Master's students

Course responsible: Professor Linn Mo

Duration: 1 term (spring semester 2004)

Credit: 7.5 cr

The course is to give basic knowledge of research to students who are to use research methods in relation to a project.

The students learn how to write a project proposal how to carry out a research project and write a research report. The student will learn to read and evaluate research reports based on different methods and approaches.

Various research methods will be reviewed (hypothesis-testing vs. hypothesis generating, deductive vs. inductive) in relation to real projects and literature about research methods. Through presentation of their own projects, students will learn to evaluate their own and others research designs. Written presentations will be revised to become a project proposal.

It is recommended to take the course in ”Preparations for fieldwork for Master's students” or the GEOG 3052 course in ”Research Methodology”. Students are also recommended to apply for admission to ”Preparations for fieldwork for Master's students” if they apply to join GEOG 3052. Places for GEOG 3052 are limited.

Examination: Student evaluation is based on exercises and research paper.

GEOG 3052 Research Methodology

Course responsible: NN

Duration: 1 semester (spring 2004)

Course credits: 15 cr

This course is only for students who are taking the MPhil in Social Change.

Aims and description of the course:

The course will give an introduction to research methodology and different kinds of research methods, covering both qualitative and quantitative approaches. The aim of the course is to give students the necessary tools for their thesis work, concerning defining a research problem, making research design, and techniques for data collection and analysis.

The course builds on a common introductory course and a choice of modules. Each student chooses 1 out of 2 modules, one covering quantitative and one covering qualitative methodologies.

The field trip is a compulsory part of the course. One of the aims of the field trip is to give students practical training in using different methods. Participation in preparatory lectures and seminars for the field trip is compulsory. After the field trip all students must write contributions to a common report (group work). The report contributions have to be approved by the Department, but a grade will not be given.

It is recommended to take the course in ”Preparations for fieldwork for Master’s students” or the GEOG 3052 course in ”Research Methodology”. Students are recommended to apply for admission also in ”Preparations for fieldwork for Master’s students” if they apply for joining GEOG 3052. Places for GEOG 3052 are limited.

Field trip: 7-10 days (incl. preparations compulsory

Assessment: Assignment and oral exam

AAR 4945 Planning and Construction in Developing Countries

Course responsible: Professor Hans Christie Bjønness

Duration: 1 term (spring semester 2004)

Credit: 7.5 cr

The course offers an introduction to issues that are important for an understanding of planning, construction and infrastructure in developing countries (ideology, cultural, social and geographical issues, economy, resources, technology, etc.). Focus will be on those features that differ fundamentally from industrialized countries, with particular emphasis on problems related to the practical implementation of projects.

The project work, which is a compulsory part of the course, emphasizes project planning techniques, and gives an introduction to writing a project document using the UN format. The course is interdisciplinary both in content and participation. The course is offered for MPhil in Social Change students and also for other faculties of NTNU.

Course material: Compendium prepared by the course responsible.

Examination: Approved obligatory project-work and written examination.

DIA 4091 Methods in Environmental Impact Assessments

Course responsible: NN

Duration: 1 term (spring semester)

Credit: 7.5 cr

NB! This course will not be offered spring 2004.

The course deals with different methods for impact assessments. The main focus is on ex ante environmental impact assessments. Social and strategic impact assessments are included. Decision-making and uncertainty is discussed. Moreover is evaluation (ex post) approaches and techniques addressed. The Norwegian EIA system, which is co-ordinated with the European Union, exemplifies EIA as a political and societal activity. It is mandatory to write up a semester paper, which counts for 1/3 of final score. The teaching language is English.

Examination: Term paper which counts 1/3 in the final evaluation

Written examination.

DIA 1094 Resource Use in Buildings

Course responsible: Professor Anne Grete Hestnes

Duration: 1 term (spring semester)

Credit: 7.5 cr

This course will not be implemented during 2003/2004.

The aim of the course is to give an introduction to our resource situation, and to alternative possibilities for resource use in buildings. The course is a continuation of the subject “Energy and resource utilisation of buildings”, which deals with the form and technical equipment of buildings with the aim of optimising the use of resources in buildings.

The course, “Resource use in buildings and built form”, adds to this background a more general range of issues regarding our relationship to our resources. The course will discuss existing possibilities and limitations, and present methods for estimating and controlling the use of resources by grouping and designing buildings in given situations.

The following issues are to be treated: Local and global access to resources, use of resources, environmental auditing, and alternative solutions.

Course material: Compendium

Examination: Oral

AAR 5260 GIS in Urban Planning

Course responsible: Associate Professor Alf Ivar Oterholm

Duration: 1 term (spring semester 2004)

Credit: 7.5 cr

The course is an introduction to Geographical Information Systems (GIS). Theory, methods, techniques and applications are illustrated in lectures, seminars, demonstrations and practical exercises. Issues that will be covered are: the GIS concept, the raster and vector principles, data capture, data modelling, handling of attribute tabular data, spatial analysis and query, mapping layout etc.

Course material: Heywood, Ian & al., 2002: An Introduction to Geographical Information Systems.

.Examination: Oral examination

DIA 5098 Housing Theory and History

Course responsible: Professor Sven Erik Svendsen

Duration: 1 term (autumn semester)

The objective is to provide an increased understanding of the development of the shelter sector in view of historical, cultural and professional factors. A presentation of relevant theoretical and historical issues and a discussion of different typologies and of contemporary housing and settlement interventions will form the main content of the course.

Classes will be conducted as seminars based on a list of compulsory literature.

Examination: An essay, or a term report dealing with an agreed topic within the theme of the course to be written, written at the end of the course.

GEOG 3050 Theories of Social Change

Course responsible: NN

Credits: 15

Semester: 1 semester (autumn)

Lectures: 28 hours

GEOG 3050 Theories of social change is compulsory for students at the MPhil in Social Change and elective for students doing a Master's in Geography. The course serves as an introduction to the main theme of the Social Change programme. Students shall broaden their knowledge of theories of social change through an introduction to different analytical perspectives on the study of social change. The course will focus on conceptualisations of development and social change, and on themes such as the relationship between growth and poverty, globalisation and processes of marginalisation. The course will also include presentations of relevant empirical material from research within development studies. The teachers for the course represent several disciplines within the social sciences.

MSc in Urban Ecological Planning course have to apply for this course. Limited places.

Obligatory: Assignment

Assessment: Written exam (6 hours)

GEOG 3561* Gender and Social Change

Course responsible: NN

Credits: 7.5

Semester: 1 semester (autumn)

The course offers an introduction to the main themes of Norwegian and international social scientific research on gender, and provides a theoretical platform for further studies of gender-related issues. The course seeks to combine an interdisciplinary and subject-specific approach. It aims at outlining different perceptions of gender within different social-scientific traditions. Theoretical and methodological problems related to the use of gender as an analytical category and how these are manifested in social scientific research will be treated. The course will also include presentations of empirical material from gender-specific research within the field of geography and other social scientific disciplines. The course will be based on a few introductory lectures and on individual study with reading lists.

MSc in Urban Ecological Planning course have to apply for this course. Limited places.

Assessment: Written exam (4 hours)

GEO 3505* Landscape and Planning

Course responsible: NN

Credits: 15

Course duration: 1 semester (autumn)

The course discusses theoretical and methodological questions concerning landscape in relation to planning. The course will consider landscape as a concept, landscape values, and theoretical and methodological problems within landscape planning and landscape management. Social Change-students will write an individual paper based on the recommended reading for the course.

Geography Master's students will participate in a project exercise in which students carry out fieldwork, interviews and document analysis of an actual planning situation in which landscape and environmental values are involved. The project work will normally be carried out as group work. The aim of the project is to give insight into how and to what extent regard for landscapes and environments will be taken into account in planning and management, and also to illustrate which landscape and environmental problems are encountered in the general planning process.

The lectures will normally be given in English. Social Change-students will write their individual paper in English. The practical coursework for Geography Master's students will be conducted in Norwegian, and the group reports will normally be written in Norwegian.

There will be given one combined grade for the project paper and the oral exam.

MSc in Urban Ecological Planning course have to apply for this course. Limited places.

Assessment: project/practical work + oral exam

GEOG 3506* Geography, Health and Development

Course responsible: NN

Credits: 7.5

Semester: 1 semester (autumn)

The course will be given in English and is designed for 3 groups:

Students on the MPhil in Social Change (anticipated to be the largest group

Other (Norwegian) Geography Master's students

Master's students studying Health in ISH who take this course as an elective (listed in the study plan as an optional course for this study).

The course provides a general introduction to geographical aspects in health, with two main focuses:

Health status, disease/injury and risk/risk factors

The geography of different levels of health services, with emphasis on demand and use, offer and accessibility, development, and treatment (self treatment, care and cure)

Aim and description of the course:
The course has a development perspective with emphasis on the situation in developing countries. More general international development trends are also covered. In addition to a common core curriculum, in-depth courses (curriculum options) are available: one which focuses on developing countries and one which is on western countries (focusing on the situation in Norway). The course covers studies on approaches to quantitative and qualitative methods. Case studies. Part of the course will be based on individual reading, which will provide a basis for carrying out the assignment. These projects will be presented in seminars. A seminar will also be held on researching health and health geography in libraries and databases (3 hours).

Assignment and presentation must be approved before the student is allowed to take the exam.

MSc in Urban Ecological Planning course have to apply for this course. Limited places.

Obligatory: *Assignment and presentation*
Assessment: Written exam (4 hours)

MASTER OF SCIENCE DEGREE IN MATHEMATICS 2003/2004

Degree Programme
The degree programme for the Master of Science in Mathematics at NTNU is stipulated to take two years. One year of full studies corresponds to 60 credit points, i.e. in total 120 credit points are needed. The degree consists of two parts. The programme starts with course work corresponding to 82.5 credit points and concludes with writing a thesis corresponding to 37.5 credit points.

Admission requirements
To be accepted as a student to this programme one has to have:

(i) Bachelor's degree consisting of at least three years of university studies.

(ii) Studied mathematics at a university for at least 1½ years.

(iii) Reached the level and covered material equivalent to MA1101 Elementary analysis I, MA1102 Elementary analysis II, MA1201 Linear algebra and geometry, MA1202 Linear algebra with applications, MA1103 Vector calculus, MA1301 Elementary number theory, MA2201 Algebra, MA2104 Differential equations and complex function theory.

(All codes for the courses refer to the 2003/2004-course catalogue).

Aim and description of the course
The Department of Mathematical Sciences offers various courses at graduate level in addition to more specialized graduate seminars. Currently we offer three directions of study, algebra, analysis (functional analysis and complex and harmonic analysis, differential equations) and topology. All students must take at least 30 credit points amongst the courses MA3201 Rings and modules, MA3202 Commutative algebra and Galois theory, TMA4145 Linear methods, TMA4225 Foundations of analysis, TMA4190 Manifolds and MA3402 Analysis on manifolds (unless the material has been covered in previous courses).

For the algebra direction, which builds upon MA3201 Rings and modules, MA3202 Commutative algebra and Galois theory, the courses MA3203 Ring theory and MA3204 Homological algebra should be taken. Some possible areas for topics for the thesis in algebra are presently representation theory of finite dimensional algebras, Lie-algebras, homological algebra and higher dimensional rings and orders.

For the analysis direction, which builds upon TMA4145 Linear methods, TMA4225 Foundations of analysis, the courses TMA4230 Functional analysis and TMA4175 Complex analysis should be taken. Some possible areas for topics for the thesis in analysis are presently geometric function theory, function spaces, harmonic analysis, continued fractions, dynamical systems, operator theory, topological measure theory and partial differential equations.

For the topology direction, which builds upon TMA4190 Manifolds, MA3402 Analysis on manifolds, the course MA3403 Algebraic topology should be taken, and at least one more topology course. Some possible areas for the thesis in topology are homotopy theory, K-theory, generalized cohomology theories, category theory, non-linear dynamics, Lie-groups and differential geometry.

As mentioned above, the coursework will take almost 1½ year (87.5 / 60 year). All the courses in the degree must be approved by the Department of Mathematical Sciences, NTNU.

The Thesis
The thesis could contain some independent research, but could also be of purely expository nature. The student may be required to follow seminars on the topic of the thesis. These seminars will in addition to the courses help the student to obtain the necessary background needed for writing the thesis. The work with the thesis should correspond to a workload of 37.5 credit points.

Exams
The exam in each of the courses is either a written exam or an oral exam normally at the end of the semester when the course is taught. However the exam in one course should be taken as a part of the final exam after the thesis has been handed in. This exam is oral. In connection with this exam the student can also be asked questions on the content of the thesis.

Grades
For all exams and also for the thesis the scale of grading is from A (highest) to F (lowest) or Fail.

MASTER OF SCIENCE DEGREE IN PHYSICS

The Master of Science programme (MSc) in Physics at NTNU is designed to train the student in a chosen field of physics, and in scientific work and research. The student will write a Master's Thesis within a selected field of speciality.

To learn more about the MSc-programme in physics please contact the Faculty of Natural Sciences and Technology, Department of Physics.

MSC-PROGRAMME IN COASTAL AND MARINE CIVIL ENGINEERING

This Master of Science degree programme in Coastal and Marine Civil Engineering is an integrated, two year study programme for Norwegian and foreign students. Thus the programme is designed according to the current framework for engineering graduate studies at NTNU.

Norwegian students can enrol in the full MSc programme, or select individual courses from the programme in their study curriculum.

Foreign students could be admitted through the Quota Programme, with participants from developing countries and from Central and Eastern Europe. These students will be admitted in 2003. Starting from 2004 students are planned to be admitted through the NORAD Fellowship Programme. Students with other sources of financing might also be admitted to the full MSc programme.

Foreign exchange students could select individual courses from the programme, provided they have the necessary qualifications for the course.

The first year of the study consists of basic courses on graduate level. The second year provides a specialization in the following subjects:

- Port Engineering
- Coastal Engineering
- Marine Civil Engineering
- Arctic Offshore Engineering
- Marine Geotechnics

In addition to the core engineering subjects in the programme, course offers are included from other Master's degree programmes at NTNU:

- MSc in Urban Ecological Planning
- MPhil in Social Change

MSC-PROGRAMME IN COASTAL AND MARINE CIVIL ENGINEERING

First and Second Year - 2003/04 and 2004/05

Ex	Subject no	Subject title	Note	Autumn			Spring			Cr	Exam	Specialization				
				F	Ø	S	F	Ø	S			1	2	3	4	5
1h	TBA4265	MARINE PHYS ENV		3	2	7				7,5	x	o	o	o	o	o
1h	TBA5100	GEOTECH CALC METH		4	2	6				7,5	x	o	o	o	o	o
1h	TBA5110	FREIGHT TRANSP SYST	1	3	2	7				7,5	x	v	v	v	v	v
1h	TGB4235	SPREADING POLLUTION	1	3	2	7				7,5	x	v	v	v	v	v
1h	TKT5100	DUR/MAINT/REP CONCR		3	2	7				7,5	x	o	o	o	o	o
1v	TBA4115	GEOTECH STRUCTURES	2				3	3	6	7,5	x	v	v	v	v	o
1v	TBA4145	PORT/COAST FACILITY	2				3	2	7	7,5	x	v	o	v	v	v
1v	TBA4230	COASTAL ENGINEERING	2				3	2	7	7,5	x	o	v	v	v	v
1v	TBA4275	DYNAMIC RESPONSE	2				3	2	7	7,5	x	v	v	o	o	v
1v	TBA5800	EXP IN TEAM INT PROSJ						5	7	7,5	-	o	o	o	o	o
1v	AAR4230	PLAN IN DEV COUNTRY	3,4				3	1	8	7,5	x	v	v	v	-	v
		Total weighting compulsory course								37,5						
2h	TBA5700	COASTAL/MAR ENG SPEC	5	3	1	32				22,5	x	o	o	o	o	o
2h	-	ARCTIC OFFSHORE ENG	6							7,5	x	-	-	-	o	-
2h	GEOG3506	GEO HEALTH AND DEV	7							7,5	x	v	v	v	v	v
2h	DIA4001	RES METHODS FOR ARCH	7							7,5	x	v	v	v	v	v
2v		Master Thesis	8							30						

o = Compulsory courses

v = Optional courses

1h - 1. Autumn

1v - 1. Spring

2h - 2. Autumn

2v - 2. Spring

1) Select one of the subjects.

2) Select a minimum of two of the subjects.

3) Select up to one subject. Other available subjects could be selected if approved by the Professor in charge.

4) Number of participants might be restricted.

5) Specialization project work (11,25 Credits) should preferably be taken in co-operation with partner institutions. For Arctic Offshore Engineering the project might be taken at UNIS, Svalbard. Select the theory part among the course offer in subject TBA5700. Following approval by the Professor in charge, one of these might be replaced by another available theory part.

6) Course offer for students in Arctic Offshore Engineering taking the term at UNIS, Svalbard.

7) Select one subject. Other available non-technical subjects might be chosen provided approval by Professor in charge.

8) Master's thesis should preferably be taken in co-operation with partner institutions. Students in Arctic Offshore Engineering might take the Master's thesis at UNIS, Svalbard.

Specialization:

1 Coastal Engineering

2 Port Engineering

3 Marine Civil Engineering

4 Arctic Offshore Engineering

5 Marine Geotechnics

MSC-PROGRAMME IN EARTH SCIENCES AND PETROLEUM ENGINEERING

First and Second Year

Petroleum Engineering

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam	Specialization			
				F	Ø	S	F	Ø	S			1	2	3	4
1h	TPG4145	RESERVOIR FLUIDS		4	6	2				7,5	x	v	v	v	v
1h	TPG4150	RESERVOIR REC TECHN		4	4	4				7,5	x	o	o	o	o
1h	TPG4177	CARB RESERVOIR CHAR		4	2	6				7,5	x	v	v	v	v
1h	TPG4215	HIGH DEV DRILLING		4	1	7				7,5	x	v	v	o	v
1h	TPG5100	MATH/COMPUTER METHOD		2	8	2				7,5	-	o	o	o	o
1h	TPG5120	PETROPHYSICS BC	1	4	2	6				7,5	x	v	v	v	v
1v	TPG4160	RESERVOIR SIMULATION					4	4	4	7,5	x	o	v	v	v
1v	TPG4180	PETR PHYS INTERPR AC	1				4	2	6	7,5	x	v	v	v	o
1v	TPG4205	DRILL TECH PR CONTR					2	2	8	7,5	x	v	v	v	v
1v	TPG4220	DRILLING FLUID/HYDR					2	2	8	7,5	x	v	v	o	v
1v	TPG4225	FRACTURED RESERVOIR					3	2	7	7,5	x	v	v	v	v
1v	TPG4230	WELL TECHNOLOGY					3	2	7	7,5	x	o	o	o	o
1v	TPG5110	PETROLEUM ECONOMICS					3	2	7	7,5	x	v	v	v	v
		Total weighting compulsory subjects	2							22,5/ 30,0/ 37,5					
2h	TPG4185	FORMATION MECHANICS		3	3	6				7,5	x	v	v	v	v
2h	TPG4700	FORM EV-ENG SPEC				36				22,5	x	-	-	-	o
2h	TPG4705	PETR PROD SPEC				36				22,5	x	-	o	-	-
2h	TPG4710	DRILLING SPEC				36				22,5	x	-	-	o	-
2h	TPG4715	RESERVOIR ENG SPEC				36				22,5	x	o	-	-	-
		Total weighting compulsory subjects	3							22,5					
2v		Master Thesis								30					

o - compulsory subjects

v - optional subjects

1) TPG4180 requires TPG5120 or equivalent.

2) Two optional subjects must be chosen in the autumn semester (1h) in specialization 1, 2 and 4. In specialization 3 one optional subject must be chosen. Two optional subjects must be chosen in the spring semester (1v) in specialization 1, 3 and 4. Three subjects must be chosen in specialization 2.

3) One subject must be chosen in the third semester (2h). I addition to the subject listed, students can also choose from first semester, Petroleum Engineering, Petroleum Geosciences and PhD-courses if taught in English.

Specialization:

1 Reservoir Engineering

2 Petroleum Production

3 Drilling Technology

4 Formation Evaluation

MSC-PROGRAMME IN EARTH SCIENCES AND PETROLEUM ENGINEERING

First and Second Year

Petroleum Geosciences

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam
				F	Ø	S	F	Ø	S		
1h	TGB5200	PETROLEUM GEOLOGY	1	3	2	7				7,5	x
1h	TPG4150	RESERVOIR REC TECHN		4	4	4				7,5	x
1h	TPG4177	CARB RESERVOIR CHAR		4	2	6				7,5	x
1h	TPG4185	FORMATION MECHANICS		3	3	6				7,5	x
1h	TPG4195	GRAVIMETR MAGNETOMET		4	1	7				7,5	x
1h	TPG5100	MATH/COMPUTER METHOD		2	8	2				7,5	-
1h	TPG5120	PETROPHYSICS BC	2	4	2	6				7,5	x
1v	TGB4135	BASIN ANALYSIS					2	3	7	7,5	x
1v	TGB4170	DIAGENESIS/RES QUAL					2	2	8	7,5	x
1v	TPG4130	SEISMIC INTERPRET					2	3	7	7,5	x
1v	TPG4170	RESERVOIR SEISMICS					4	1	7	7,5	x
1v	TPG4180	PETR PHYS INTERPR AC	2				4	2	6	7,5	x
1v	TPG5110	PETROLEUM ECONOMICS					3	2	7	7,5	x
		Total weighting compulsory subjects	3							15	
2h	TGB5200	PETROLEUM GEOLOGY	1	3	2	7				7,5	x
2h	TPG4120	ENG/ENVIRONM GEOPHYS		2	2	8				7,5	x
2h	TPG4190	SEISMIC DATA		3	2	7				7,5	x
2h	TPG4720	PETR GEOSCIENCE SPEC				36				22,5	x
		Total weighting compulsory subjects	4							30,0 /22,5	
2v		Master Thesis								30	

o - compulsory subjects

v - optional subjects

1) Given as self-study course combined with exercises.

2) TPG4180 requires TPG5120 or equivalent.

3) In the autumn semester (1h) TPG5100 is compulsory. In the spring semester (1v) TPG4130 is compulsory. Totally four subjects must be chosen each semester, see note 4.

4) In addition to the subjects (listed 2h), students can choose from 1h Petroleum Engineering, 1h Petroleum Geosciences and PhD-courses taught in English.

Specialization and compulsory subjects within these:

Seismics: TGB5200 Petroleum Geology (1h), TPG4130 Seismic Interpretation (1v), TPG4170 Reservoir Seismics (1v) and

TPG4190 Seismic Data (2h).

Reservoir Geology: TPG4180 Petrophysics, Interpretation of Well Data AC (1v), TGB5200 Petroleum Geology (1h),

TGB4170 Diagenesis/Res.Qual. (1v) and TPG4190 Seismic Data (2h).

Formation Evaluation: TPG4180 Petrophysics, Interpretation of Well Data AC (1v), TPG4130 Seismic Interpretation (1v) and

TPG4185 Formation Mechanics (1h).

MSC-PROGRAMME IN HYDROPOWER DEVELOPMENT

Term 1, 2, 3 and 4

HYDROPOWER DEVELOPMENT

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam
				F	Ø	S	F	Ø	S		
1h	TVM5100	HYDROPOWER PLAN 1 BC		8	8	8				15	x
1h	TVM5110	HYDROPOWER PLAN 2 BC		8	8	8				15	x
1v	TVM5120	HYDROPOWER PLAN 3 BC					8	8	8	15	x
1v	TVM5130	HYDROPOWER PROJECT						12	12	15	-
		Total weighting			48			48		60	
2h	TGB5100	ROCK ENGINEERING AC		3	2	7				7,5	x
2h	TVM5150	RIVER SYSTEM ANAL AC		3	2	7				7,5	x
2h	TVM5160	HEADWORKS AND SED AC		3	2	7				7,5	x
2h	TVM5170	SOCIAL IMPACT ASS AC		3	2	7				7,5	x
		Total weighting			48					30	
		Master Thesis	1							30	

Ex 1h = Term 1, Exam Autumn

Ex 1v = Term 2, Exam Spring

Ex 2h = Term 3, Exam Autumn

1) The Master's Thesis is to be submitted in term 4 (spring term).

MSC-PROGRAMME IN LIGHT METALS PRODUCTION

First and Second year - 2003/04 and 2004/05

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam
				F	Ø	S	F	Ø	S		
1h	MT8104	ELECTR LIGHT METAL 1		4	2	6				7,5	x
1h	MT8301	CARBON MAT TECHN		2	2	8				7,5	x
1h	MT8303	THERMODYN HIGH TEMP	1	5	5	14				15	x
1v	MT8300	ELECTR LIGHT METAL 2					3	2	7	7,5	x
1v	TMT4270	REFINING METALS AC					3	2	7	7,5	x
1v	TMT4160	HIGH TEMP CHEM PROJ					2	4	6	7,5	x
1v	TMT4150	REFRACTORIES					4	2	6	7,5	x
		Total weighting		11	9	28	12	10	26	60	
2h	TMT4295	ELECTROLYTIC PROCESS		3	2	7				7,5	x
2h	TMT4750	MATERIALS DEV/SPEC				36				22,5	x
		Total weighting		3	2	43				30	
2v		Master Thesis								30	

1) Elective. May be substituted with 2 subjects à 7.5 credits from MSc-subjects or PhD-subjects.

MSC-PROGRAMME IN MARINE TECHNOLOGY

Term 1 (May-July 2003)

Term 2 and 3 (Autumn 2003 and Spring 2004)

Term 4 (Autumn 2004 to February 2005)

MARINE STRUCTURES

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam
				F	Ø	S	F	Ø	S		
		Compulsory subjects:									
1a	TMR5140	MARINE STRUCT BC		3	6	3				7,5	x
1a	TMR5150	MARINE DYNAMICS BC		3	6	3				7,5	x
1a	TMR5190	MARINE HYDRODYN BC		4	6	2				7,5	x
		Weighting compulsory courses		10	18	8				22,5	
		Compulsory subjects:									
2h	TMR4190	ELEM METHODS STRUCT		3	6	3				7,5	x
2h	TMR4215	SEA LOADS		3	6	3				7,5	x
2h	TPG5100	MATH/COMPUTER METHOD	1	2	8	2				7,5	-
		Weighting compulsory courses		8	20	8				22,5	
		Optional subjects:									
2h	TMR4200	FATIGUE/FRACTURE	2	3	6	3				7,5	x
2h	TMR4235	STOCH THEORY SEALOAD	2	3	6	3				7,5	x
2v	TMR4195	DESIGN OFFSHOR STRUC	3				3	6	3	7,5	x
2v	TMR4205	BUCKLING/COLLAPS STR	3				3	6	3	7,5	x
2v	TMR4220	NAVAL HYDRODYNAMICS	3				3	6	3	7,5	x
2v	TMR4225	MARINE OPERATIONS	3				3	6	3	7,5	x
2v	TMR4230	OCEANOGRAPHY	3				3	6	3	7,5	x
2v	TMR5160	MARIN STRUCT PROJECT	4					12		7,5	-
2v	TMR5200	MARINE HYDRO PROJECT	4					12		2,5	-
3h	TMR5170	MAR STRUC SPEC SUBJ	5	4	4	4				7,5	x
3h	TMR5220	MAR HYDRO SPEC SUBJ	5	4	4	4				7,5	x
3h		Master Thesis								30	

Ex 1a = Term 1, Exam August

Ex 2h = Term 2, Exam Autumn

Ex 2v = Term 3, Exam Spring

Ex 3h = Term 3, Exam Autumn, the Master's Thesis is to be submitted in February 2005.

1) Exercises with examples from marine technology topics.

2) Select 1 of the subjects.

3) Select 3 of the subjects.

4) Select 1 of the subjects.

5) Select 1 of the subjects, so that the total weighting of the programme contains 120 credits (Cr.).

MSC-PROGRAMME IN MARINE TECHNOLOGY

Term 1 (May-July 2003)

Term 2 and 3 (Autumn 2003 and Spring 2004)

Term 4 (Autumn 2004 to February 2005)

MARINE SYSTEMS ENGINEERING

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam
	no.			F	Ø	S	F	Ø	S		
		Compulsory subjects:									
1a	TMR5100	MAR DESIG/MAR ENG BC		4	6	2				7,5	x
1a	TMR5190	MARINE HYDRODYN BC		4	6	2				7,5	x
1a	TMR5270	OPERATION TECHN BC		3	6	3				7,5	x
		Weighting compulsory courses		11	18	7				22,5	
		Compulsory subjects:									
2h	TMR4115	DESIGN METHODS		3	6	3				7,5	x
2h	TMR4290	DIESEL-EL PROP SYST		3	6	3				7,5	x
2h	TMR5120	DESIGN MAR VEHICLES			12					7,5	-
2v	TMR4130	RISK ANALYSIS SAFETY					2	8	2	7,5	-
2v	TMR4280	INTERNAL COMB ENGINE					3	6	3	7,5	x
		Weighting compulsory courses		6	24	6	5	14	5	37,5	
		Optional subjects:									
2h	TMR4275	MOD/SIM/AN DYN SYST	2	3	6	3				7,5	x
2h	TPG5100	MATH/COMPUTER METHOD	1,2	2	8	2				7,5	-
2v	TMR4125	BUILD SHIPS/PLATFORM	3				3	6	3	7,5	x
2v	TMR4220	NAVAL HYDRODYNAMICS	3				3	6	3	7,5	x
2v	TMR5110	MAR DESIGN PROJECT	4					12		7,5	-
2v	TMR5280	MAR ENGINEER PROJECT	4					12		7,5	-
2v	TMR5290	TECH OPERAT PROJECT	4					12		7,5	-
3h	TMR5130	MAR DESIGN SPEC SUBJ	5	4	4	4				7,5	x
3h	TMR5300	MAR ENG SPEC SUBJ	5	4	4	4				7,5	x
3h	TMR5310	TECH OP SPEC SUBJ	5	4	4	4				7,5	x
3h		Master Thesis								30	

Ex 1a = Term 1, Exam August

Ex 2h = Term 2, Exam Autumn

Ex 2v = Term 3, Exam Spring

Ex 3h = Term 3, Exam Autumn, the Master's Thesis is to be submitted in February 2005.

1) Exercises with examples from marine technology topics.

2) Select 1 of the subjects.

3) Select 1 of the subjects.

4) Select 1 of the subjects.

5) Select 1 of the subjects, so that the total weighting of the programme contains 120 credits (Cr.).

MSC-PROGRAMME IN MARINE TECHNOLOGY

Term 1 (May-July 2003)

Term 2 and 3 (Autumn 2003 and Spring 2004)

Term 4 (Autumn 2004 to February 2005)

MARINE CONTROL SYSTEMS

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam
				F	Ø	S	F	Ø	S		
		Compulsory subjects:									
1a	TMR5140	MARINE STRUCT BC	1	3	6	3				7,5	x
1a	TMR5150	MARINE DYNAMICS BC		3	6	3				7,5	x
1a	TMR5190	MARINE HYDRODYN BC		4	6	2				7,5	x
		Weighting compulsory courses		10	18	8				22,5	
		Compulsory subjects:									
2h	TMR4215	SEA LOADS		3	6	3				7,5	x
2h	TMR5180	CONTROL ENGINEERING		3	6	3				7,5	x
2h	TMR4240	MARINE CONTROL SYST					3	6	3	7,5	x
2v	TTK4130	MODELLING/SIMULATION					4	4	4	7,5	x
2v	TTK4190	GUID/NAVIGATION/CONT					3	2	7	7,5	x
		Weighting compulsory courses		6	12	6	10	12	14	37,5	
		Optional subjects:									
2h	TMR4190	ELEM METHODS STRUCT	2	3	6	3				7,5	x
2h	TMR4275	MOD/SIM/AN DYN SYST	2	3	6	3				7,5	x
2h	TTK4150	NONLINEAR CONTR SYST	2	4	4	4				7,5	x
2h	TTT4140	FUND OF NAVIGATION	2	4	2	6				7,5	x
2v	TMR4220	NAVAL HYDRODYNAMICS	3				3	6	3	7,5	x
2v	TMR4225	MARINE OPERATIONS	3				3	6	3	7,5	x
2v	TMR4230	OCEANOGRAPHY	3				3	6	3	7,5	x
2v	TTT4150	NAVIGATION SYSTEMS	3				4	2	6	7,5	x
3h	TMR5210	CONTR SYST SPEC SUBJ	4	4	4	4				7,5	x
3h	TTK5100	GUID/NAV SYST SPEC	4	4	4	4				7,5	x
3h		Master Thesis								30	

Ex 1a = Term 1, Exam August

Ex 2h = Term 2, Exam Autumn

Ex 2v = Term 3, Exam Spring

Ex 3h = Term 3, Exam Autumn, the Master's Thesis is to be submitted in February 2005.

1) Can be replaced by the subject Calculus 4.

2) Select 2 of the subjects.

3) Select 1 of the subjects.

4) Select 1 of the subjects, so that the total weighting of the programme contains 120 credits (Cr.).

MSC-PROGRAMME IN MARINE TECHNOLOGY

Term 1 (May-July 2003)

Term 2 and 3 (Autumn 2003 and Spring 2004)

Term 4 (Autumn 2004 to February 2005)

NAUTICAL SCIENCE

Ex	Subject no.	Subject title	Note	Autumn			Spring			Cr	Exam
				F	Ø	S	F	Ø	S		
		Compulsory subjects:									
1a	TFY5100	CALCULUS 4		4	2	6				7,5	x
1a	TMR5150	MARINE DYNAMICS BC		3	6	3				7,5	x
1a	TMR5190	MARINE HYDRODYN BC		4	6	2				7,5	x
		Weighting compulsory courses		11	14	11				22,5	
		Compulsory subjects:									
2h	TMR4215	SEA LOADS		3	6	3				7,5	x
2h	TMR5230	NAUTICAL SCIENCE BC		3	6	3				7,5	x
2h	TTT4140	FUND OF NAVIGATION		4	2	6				7,5	x
2v	TMR5240	NAUTICAL SCIENCE AC					3	6	3	7,5	x
2v	TMR5250	NAUTICAL SC PROJECT						12		7,5	-
2v	TTT4150	NAVIGATION SYSTEMS					4	2	6	7,5	x
		Weighting compulsory courses		10	14	12	7	20	9	45,0	
		Optional subjects:									
2h	TMR4235	STOCH THEORY SEALOAD	1	3	6	3				7,5	x
2h	TMR5180	CONTROL ENGINEERING	1	3	6	3				7,5	x
2v	TMR4130	RISK ANALYSIS SAFETY	2				2	8	2	7,5	-
2v	TMR4220	NAVAL HYDRODYNAMICS	2				3	6	3	7,5	x
2v	TMR4225	MARINE OPERATIONS	2				3	6	3	7,5	x
2v	TMR4230	OCEANOGRAPHY	2				3	6	3	7,5	x
2v	TMR4240	MARINE CONTROL SYST	2				3	6	3	7,5	x
2v	TTK4190	GUID/NAVIGATION/CONT	2				3	2	7	7,5	x
3h	TMR5260	NAUTIC SC SPEC SUBJ	3	4	4	4				7,5	x
3h		Master Thesis								30	

Ex 1a = Term 1, Exam August

Ex 2h = Term 2, Exam Autumn

Ex 2v = Term 3, Exam Spring

Ex 3h = Term 3, Exam Autumn, the Master's Thesis is to be submitted in February 2005.

1) Select 1 of the subjects..

2) Select 1 of the subjects.

3) The subject must be chosen so that the total weighting of the programme contains 120 credits (Cr.).

SUBJECTS IN CIVIL AND ENVIRONMENTAL ENGINEERING

TVM5100 HYDROPOWER PLAN 1 BC

Hydropower Planning 1, Basic Course

Vannkraftplanlegging 1, grunnkurs

Coord.: Professor Haakon Støle

Weekly hours: Autumn: 8F + 8Ø + 8S = 15Cr

Exam: Autumn 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is offered in English to the students in the first year in the MSc programme "Hydropower Development". The course covers the basics in geo-subjects and dam engineering for civil engineers.

Prerequisites: Admission to the HPD MSc programme requires as a minimum 3 year BSc in civil engineering or Water resources engineering.

Contents: Each topic is lectured as full-day seminar over one or two weeks and the course covers: Engineering geology, rock blasting and tunnelling, properties of concrete, soil mechanics, embankment dams and concrete dams.

Teaching methods: Each topic is taught over one or two weeks. Lectures and exercises are integrated. The lecturers come from the university and the hydropower industry, all with international experience. All lectures and exercises are given in English.

Course material: Books from the series Hydropower Development and supplementary lecture notes (English).

Type of examination: Written 100%.

TVM5110 HYDROPOWER PLAN 2 BC

Hydropower Planning 2, Basic Course

Vannkraftplanlegging 2, grunnkurs

Coord.: Professor Haakon Støle

Weekly hours: Autumn: 8F + 8Ø + 8S = 15Cr

Exam: Autumn 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is offered in English to the students in the first year in the MSc programme "Hydropower Development". The course covers the basics in hydro-subjects for civil engineers.

Prerequisites: Admission to the HPD MSc programme requires as a minimum 3 year BSc in civil engineering or Water resources engineering.

Contents: Each topic id lectured as full-day seminar over one or two weeks and the course covers: Basic and applied hydrology, fluid mechanics, hydraulic design, scour protection and sediment transport, turbines and surge tanks, hydraulic steel works and power house design.

Teaching methods: Each topic is taught over one or two weeks. Lectures and exercises are integrated. The lecturers come from the university and the hydropower industry, all with international experience. All lectures and exercises are given in English.

Course material: Books from the series Hydropower Development and supplementary lecture notes (English).

Type of examination: Written 100%.

TVM5120 HYDROPOWER PLAN 3 BC

Hydropower Planning 3, Basic Course

Vannkraftplanlegging 3, grunnkurs

Coord: Professor Haakon Støle

Weekly hours: Spring: 8F + 8Ø + 8S = 15Cr

Exam: Spring 2004 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is offered in English to the students in the first year in the MSc programme "Hydropower Development". The course covers the basics in economics, environmental issues and project management for civil engineers.

Prerequisites: Admission to the MSc programme requires as a minimum 3 year BSc in civil engineering or water resources engineering.

Contents: Each topic is lectured as full-day seminar over one or two weeks and the course covers: Economic design criteria, project management, investment and socio-economic analysis, contracts implementation of hydropower and water resources projects, environmental impact studies, construction management and small scale hydropower.

Teaching methods: Each topic is taught over one or two weeks. Lectures and exercises are integrated. The lecturers come from the university and the hydropower industry, all with international experience. All lectures and exercises are given in English.

Course material: Books from the series Hydropower Development and supplementary lecture notes (English).

Type of examination: Written 100%.

TVM5130 HYDROPOWER PROJECT

Hydropower Plants, Project Work

Vannkraftverk, prosjekt

Lecturer: Professor Haakon Støle

Weekly hours: Spring: 12Ø + 12S = 15Cr

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The project assignment objectives are the application of integrated planning, covering technical, economic and environmental issues.

Prerequisites: The project work assumes completion of the basic courses: Hydropower Planning 1, 2 and 3.

Contents: The project work covers a pre-feasibility study for an actual river system.

Teaching methods: Lectures, covering the planning process and supervision throughout the project period as required by the students.

Course material: Maps, date on hydrology and geology, cost data, etc.

Type of examination: Exercises 100%.

TVM5150 RIVER SYSTEM ANAL AC

River System Analysis, Advanced Course

Hydrofysiske vassdragsstudier, videregående kurs

Lecturer: Professor Ånund Killingtveit, Assistent Professor Knut Alfredsen

Coord.: Professor Ånund Killingtveit

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Exam: Autumn 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is offered in English to the students in the second year in the MSc programme "Hydropower Development" and to *master i teknologi*/*siv.ing.*students in the study programme "bygg og miljøteknikk". The course objective is extended knowledge of computer and numerical model applications in river system studies.

Prerequisites: The course assumes completion of the basic course TVM5110 Hydropower Planning 2 in the first year of the MSc programme or TVM4105 Hydrology.

Contents: Discussion and application of the main computer models for river system analysis. Applied separately or integrated (River System Simulator).

Teaching methods: Lectures, workshops, computer model applications, both as exercises and applied on actual rivers.

Course material: Å. Killingtveit and N.R. Sælthun: Hydrologi. Articles, reports and computer model descriptions.

Type of examination: Oral 100%.

TVM5160 HEADWORKS AND SED AC

Headworks and Sedimentation Engineering, Advanced Course

Dammer og inntak i sedimentførende elver, videregående kurs

Coord.: Professor Haakon Støle

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Exam: Autumn 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is offered in English to the students in the second year in the MSc programme "Hydropower Development" and to *master i teknologi*/*siv.ing.* students in the study programme "bygg og miljøteknikk". The course covers planning, design and operation of headworks in sediment carrying rivers.

Prerequisites: The course assumes completion of the basic course TVM5110 Hydropower Planning 2 in the first year of the MSc HPD programme or TVM4115 Fluid Mechanics and preferably TVM4125 Water Resources Engineering.

Contents: Extended discussion of sediment transport theory and use of water resources in sediment loaded rivers, reservoir sedimentation, headworks for run-of-river hydropower plants, sediment handling techniques, sediment sampling programmes and analysis of sediment data.

Teaching methods: Lectures, workshops, assignments and laboratory study.

Course material: Lysne, Glover, Støle and Tesaker: Hydraulic Design. Vanoni: Sedimentation Engineering. Støle: Withdrawal of Water from Himalayan Rivers, World Commission on Dams: Dams and Development and hand-out literature with supplementary articles, cases and lecture-notes (English).

Type of examination: Oral 100%.

TVM5170 SOCIAL IMPACT ASS AC

The Process of Social Impact Assessment, Advanced Course

Sosiale konsekvenser - Utredning og tiltak, videregående kurs

Lecturer: Professor Haakon Støle

Weekly hours: Autumn: 5Ø + 7S = 7.5Cr

Exam: Autumn 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is offered in English to the students in the second year in the MSc programme "Hydropower Development". The objectives are to improve the knowledge of the different stages of the process of socio-economic assessment, including strategic priorities and national guidelines, and to improve tools for planning projects in the best possible way on a national, regional and local level.

Prerequisites: The course assumes completion of the basic course TVM5120 Hydropower Planning 3 in the first year of the MSc programme.

Contents: The course consists of 15 modules, and one new module is presented every week. The course consists of 15 modules: 1: Background and development of SIA, 2: Social impact assessment methodologies, 3: Baseline data and mitigation measures, 4: Stakeholder consultation process, 5: Ethnic minorities and cultural heritage issues, 6: Health issues, 7: Education and training, 8: Gender issues, 9: The role of NGOs and CBOs, 10: Resettlement, 11: Livelihood development and food securities, 12: Environmental and technical issues (catchment management), 13: Monitoring, 14: Institutional strengthening and capacity building and 15: Finance and budget issues.

Teaching methods: The main core of the course is a distance-learning course on the Internet. The introduction to the course will be in a classroom setting and advisors will be available on a weekly basis in order to facilitate discussions and assistance to the students related to the weekly quiz or set of multiple-choice questions in each module and writes short reports. Evaluation will be based on each students workbook, containing all weekly reports etc. and an oral exam.

Course material: All the course material is available for the participants on the Internet (English).

Type of examination: Oral 100%.

TGB5100 ROCK ENGINEERING AC

Rock Engineering, Advanced Course

Anvendt ingeniørgeologi, videregående kurs

Lecturer: Professor Einar Broch, Professor Bjørn Nilsen

Coord.: Professor Einar Broch

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Exam: Autumn 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is offered in English to the students in the second year in the MSc programme "Hydropower Development" or to *master i teknologi*/*siv.ing*..students in the study programme "teknisk geologi" and "bygg og miljøteknikk". The course objective is extended applied knowledge in rock engineering.

Prerequisites: The course assumes completion of the basic course TVM5100 Hydropower Planning 1 in the first year of the MSc programme or TGB4185 Engineering geology, basic course.

Contents: Extended coverage of priority topics such as tunnels, underground caverns, rock slope, stability, etc.

Teaching methods: Lectures, workshops, field studies, literature survey (English).

Course material: Bjørn Nilsen and Alf Thidemann: Rock Engineering, supplementary articles, cases, reports (English).

Type of examination: Oral 100%.

SUBJECTS IN EARTH SCIENCES AND PETROLEUM ENGINEERING

TGB4135 BASIN ANALYSIS

Basin Analysis

Bassenganalyse

Lecturer: Professor Stephen Lippard

Weekly hours: Spring: 2F + 3Ø + 7S = 7.5Cr

Time: Spring: As agreed

Exam: May 19 Exam support: D Exercises: O Grade: Grade in letters

Aims and descriptions of the course
Objectives: To give an overview of the formation and development of sedimentary basins.

Prerequisites: BSc.

Contents: Characterization of sedimentary basins according to tectonic environment. Formation of different basin types and the factors effecting sediment infilling. Methods to evaluate the burial and thermal histories of basins.

Teaching methods: Lectures and exercises.

Course material: P.A. Allen & J.R. Allen: Basin Analysis, Principles and Applications, Blackwell Scientific Publications.

Type of examination: Oral 100%.

TGB4170 DIAGENESIS/RES QUAL

Diagenesis/Reservoir Quality

Diagenese/reservoarkvalitet

Lecturer: NN

Weekly hours: Spring: 2F + 2Ø + 8S = 7.5Cr

Time: Spring:

F th 08-10 OPAUD Ø mo 15-17 OPAUD

Exam: June 5 Exam support: D Exercises: O Grade: Grade in letters

Aims and descriptions of the course
Objectives: Processes determining reservoir rock quality like porosity, permeability, pressure and kerogenity.

Prerequisites: BSc.

Contents: Physical and chemical changes in deep buried sediments. Main emphasis is put on processes leading to preservation and destruction of porosity, and formation of secondary porosity in potential reservoir rocks for hydrocarbons. Silicates. Carbonates. Interpretation of "Cases".

Teaching methods: Lectures and exercises.

Course material: Articles and compendium.

Type of examination: Written 100%.

TGB5200 PETROLEUM GEOLOGY

Petroleum Geology

Petroleumsgeologi

Lecturer: Associate Professor Sverre Ola Johnsen

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Time: Autumn: As agreed

Exam: Dec 5 Exam support: D Exercises: O Grade: Grade in letters

Aim and descriptions of the course
Objectives: The course gives geological knowledge of a variety of basin types of different ages, development stages and petroleum potential.

Prerequisites: BSc.

Contents: Plate tectonics of basin classification and formation. Rift, passive margin and foreland-type basins with examples from northwest Europe, Canada and the Middle East. The geological development of other hydrocarbon provinces in the world.

Teaching methods: Lectures, exercises and seminars. Video films will be used in some parts of the course. Given as self-study course combined with exercises for Master's students.

Course material: Selected articles and books.

Type of examination: Written 100%.

TPG4120 ENG/ENVIRONM GEOPHYS

Engineering and Environmental Geophysics

Ingeniør- og miljøgeofysikk

Lecturer: Professor Ole Bernt Lile

Weekly hours: Autumn: 2F + 2Ø + 8S = 7.5Cr

Time: Autumn:

F mo 15-17 OPAUD Ø th 17-19 OPAUD

Exam: Dec 16 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Understanding of how different geophysical methods can contribute to mapping of the subsurface for geological, hydrogeological, geotechnical and environment purposes, e.g. mapping of uncompacted overburden, rock, ground water, pollution etc.

Prerequisites: Course SIG4002 Physics and geophysics or equivalent basic course in Applied Geophysics.

Contents: Electrical methods. Resistivity (RP). Profiling. Vertical electric distinction (VES). Electromagnetic methods (VLF). Geo-radar (GPR). Refraction seismics. Reflection seismics. Nuclear/Proton magnetic resonance (NMR, PMR). Logging methods.

Teaching methods: Project work (PBL) through the semester. Interpretation. Field demonstrations and measurements. Lectures. The semester project counts 60% on grade stipulation.

Course material: John M. Reynolds: An Introduction to Applied and Environmental Geophysics (Wiley) or Telford, Geldart, Sheriff: Applied Geophysics, Cambridge. Course notes. NGU-reports.

Type of examination: Oral 40% + exercises (project) 60%.

TPG4130 SEISMIC INTERPRET

Seismic Interpretation

Seismisk tolkning

Lecturer: Associate Professor Egil Tjåland

Weekly hours: Spring: 2F + 3Ø + 7S = 7.5Cr

Time: Spring:

F	tu	08-10	P2	Ø	fr	12-15	P1

Exam: May 28 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course gives knowledge of advanced interpretation and modelling of reflection seismic data by use of computers.

Prerequisites: None.

Contents: Interpretation of two-dimensional and three-dimensional seismic data on graphic workstations. Seismic time maps. Depth conversion of seismic time maps (both from stacked and time-migrated seismic sections). Post-stack inversion of seismic data. Three-dimensional seismic modelling using dynamic ray theory. Design of seismic surveys using seismic modelling.

Teaching methods: Lectures and exercises on workstation. Exercises count 60% on final grade. PBL.

Course material: Course notes.

Type of examination: Oral 40% + exercises 60%.

TPG4145 RESERVOIR FLUIDS

Reservoir Fluids and Flow

Reservoarfluider og strømning

Lecturer: Professor Curtis H. Whitson

Weekly hours: Autumn: 4F + 6Ø + 2S = 7.5Cr

Time: Autumn:

F	mo	12-14	P2	Ø	we 10-11		P2
	we	08-10	P2		5 hours as agreed		

Exam: Dec 10 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Reservoir fluid's physical behaviour during well flow, and depletion performance.

Prerequisites: None.

Contents: Hydrocarbon phase behaviour; PVT-lab.analysis; PVT-data in reservoir estimation; steady state flow conditions; radiel flow; gas material balance.

Teaching methods: Lectures and exercises. Exercises account for 50% of final grade. Project Work. PBL.

Course material: Parts of Phase Behaviour SPE-monograph (Whitson and Brule). Handout notes and articles.

Type of examination: Written 50% + exercises 50%.

TPG4150 RESERVOIR REC TECHN

Reservoir Recovery Techniques

Reservoarutvinningsteknikk

Lecturer: Professor Jon Kleppe

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: Autumn:

F	we	08-10	P1	Ø	fr	14-15	P1
	th	12-14	P1	3 hours as agreed			

Exam: Dec 8 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course gives thorough knowledge of physical properties, principles and methods regarding recovery of oil and gas from reservoirs.

Prerequisites: SIG4010 Porous media/fluidmechanics, SIG4015 Reservoir Property Determination or equivalent.

Contents: The course deals with internal and external energy sources, and the effects of such energies on the recovery of oil and gas from various types of petroleum reservoirs. Subjects covered are: Oil, gas and gas condensate fluid systems; single porosity and dual porosity reservoirs; microscopic and macroscopic displacement efficiencies; internal drive mechanisms; injection of water and gas; material balance equations; fluid flow equations; well patterns; introduction to improved recovery methods.

Teaching methods: Lectures and obligatory exercises. Exercises account for 40% of final grade. PBL.

Course Material: To be decided.

Type of examination: Written 60% + exercises 40%.

TPG4160 RESERVOIR SIMULATION

Reservoir Simulation

Reservoarsimulering

Lecturer: Professor Jon Kleppe

Weekly hours: Spring: 4F + 4Ø + 4S = 7.5Cr

Time: Spring:

F	mo	12-14	P1	Ø	tu	17-18	P1
	th	13-15	P1	3 hours as agreed			

Exam: May 14 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course provides fundamental knowledge of mathematical simulation of the fluid flow in petroleum reservoirs.

Prerequisites: Course SIG4038 Reservoir Recovery Techniques.

Contents: The course develops the partial differential equations required for single-phase and multi-phase fluid flow in porous media, and numerical methods for solving the equations using finite difference methods. Subjects covered are: Summary of rock and fluid properties; development of

PDEs; numerical solution of non-linear and linear systems of equations; reservoir simulation model types.

Teaching methods: Lectures and obligatory exercises. Exercises account for 40% of final grade. PBL.

Course Material: Lecture notes.

Type of examination: Written 60% + exercises 40%.

TPG4170 RESERVOIR SEISMICS

Reservoir Seismics

Reservoarseismikk

Lecturer: Professor Bjørn Ursin, Professor Rune M. Holt

Coord: Professor Bjørn Ursin

Weekly hours: Spring: 4F + 1Ø + 7S = 7.5Cr

Time: Spring:

F	mo	08-10	P2	Ø	fr	08-09	P2
	th	13-15	P2				

Exam: May 22 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Understanding seismic methods used in reservoir geology and in reservoir engineering.

Prerequisites: SIG4024 Seismic Interpretation.

Contents: P- and S-waves in isotropic and anisotropic rocks. Measurement of acoustic wave velocities in the laboratory. Simple rock-physical models based on the Biot-Gassman model and critical porosity. Observed and modeled relationships between seismic velocities and porosity, lithology, fluid content and mechanical stresses/pressure. Seismic amplitude variations as a function of source - receiver distance (AVO). Inversion of zero-offset seismic data. Well data vs. seismic data. Reservoir monitoring. Ocean bottom seismics.

Teaching methods: Lectures and exercises.

Course Material: Compendium and articles from journals.

Type of examination: Written 100%.

TPG4177 CARB RESERVOIR CHAR

Carbonate Reservoir Characterization

Karbonat reservoarkarakterisering

Lecturer: Assistent Professor Helge Langeland

Professor May-Britt Mørk

Coord.: Assistent Professor Helge Langeland

Weekly hours: Autumn: 4F + 2Ø + 6S = 7.5Cr

Time: As agreed

Exam: Dec 16 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: This course is offered to provide an introduction to carbonate reservoir evaluation through use of academic and industry source material.

Prerequisites: Basic knowledge of geology and petrophysics.

Contents: Carbonate reservoirs are considered to be the most significant source of hydrocarbon production for this century. This course is offered to provide an introduction to carbonate reservoir evaluation through use of academic and industry source material. The following subjects will be covered in the course: Basic terminology and concepts. Necessary terminology and concepts will be taught through lectures and self study assignments. This material will be focused to form a foundation for the reminder of the course. The challenge of carbonate reservoirs. A variety of contrasting carbonate reservoirs will be used to demonstrate the importance of integrating subsurface geoscience disciplines in effective reservoir management. The integration of geology and integration will be stressed through lecture and selfstudy assignments. Practical case studies. Practical data sets will be provided for class and self study to teach the methods of "how to evaluate a carbonate reservoir". Review. A review session will be provided to place the course into a wider context.

Teaching methods: Lectures, exercises and self study assignments.

Course Material: Relevant reference material will be provided during the course. A Good basic background overview is found in: Schole, P. A., Bebout, D.G., and Moore, C.H., eds. Carbonate depositional environments.

Type of examination: Written 50% + exercises 50%.

TPG4180 PETR PHYS INTERPR AC

Petrophysics, Interpretation of Well Data, Advanced Course

Petrofysikk, tolking av brønndata, videregående kurs

Lecturer: Assistent Professor Helge Langeland, Professor Rune M. Holt, Adjunct Professor Terje Eidesmo

Professor Ole Bernt Lile

Coord.: Assistent Professor Helge Langeland

Weekly hours: Spring: 4F + 2Ø + 6S = 7.5Cr

Time: Spring:

F	tu	10-12	P1	Ø	th	11-13	P1
	th	10-11	P1				

1 hour as agreed

Exam: May 24 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Give a deeper understanding of data from boreholes, measurement methods used in boreholes, the information potential of these data and use in integrated evaluation of reservoirs.

Prerequisites: The course builds on course SIG4050 Formation Evaluation, basic course, MSG4150 Petrophysics, basic course, or similar knowledge.

Contents: The course focuses on selected topics from well data acquisition methods and the interpretation of these data, extending the concepts taught in the basic course in petrophysics. There will be project exercises connected to the Gullfaks database. The students will learn to use computer based interpretation software. Integration with other data types. Basic petrophysical relations and points of view. Radiometric methods in open and cased boreholes: Spectrometry of natural and

induced gammarays, neutron lifetime logging (saturation behind casing), mud logging. Nuclear magnetic resonance, NMR. Properties of clay and shale. Water saturation models in shaly formations. Uses of core data. Pressure measurements. Acoustic and mechanical properties of rocks. Properties of carbonates.

Teaching methods: Lectures, obligatory exercises, well data analysis software laboratory. Project based learning methods (PBL) and group work is used. Semester tests count 25% on the exam. The course is given in English when MSc-students are attending.

Course Material: Articles, lecture notes and other relevant literature.

Type of examination: Written 75% + midterm 25%.

TPG4185 FORMATION MECHANICS

Formation Mechanics

Formasjonsmekanikk

Lecturer: Professor Rune M. Holt

Weekly hours: Autumn: 3F + 3Ø + 6S = 7.5Cr

Time: Autumn:

F	tu	08-10	P2	Ø	mo	10-12	P2
	fr	11-12	P2		1 hour as agreed		

Exam: Dec 20 Exam support: B Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: This subjects aims at giving a better understanding and an introduction to the use of rock mechanics in petroleum (reservoir, drilling and production) technology.

Prerequisites: Basic mechanics.

Contents: Reservoir geomechanics: Introduction to poroelasticity theory. Reservoir compaction, linear elastic model, inelastic effects. Reservoir stress path. Compaction as a drive mechanism. Stress dependence of porosity and permeability. Geomechanically coupled reservoir simulation.

Borehole stability: Diagnostics. Critical limits for mud weight to prevent hole collapse and lost circulation. Effect of temperature and mud composition on borehole stability. Stability of deviated and horizontal holes. Effect of plasticity. Modelling of borehole stability.

Sand- and particle production: Basic mechanisms. Sand control. Sand prediction. Volumetric sand production. Hydraulic fracturing: Initiation and growth of hydraulic fractures. Thermal fracturing during water injection. Use of fracturing for stimulation, stress determination, and for waste storage.

Teaching methods: Lectures and exercises. PBL. The students are to complete a project with subsequent oral and written presentation of their results. This work counts 25% of the mark. Lectures are given in English if non-Norwegian MSc students follow the course.

Course Material: To be specified.

Type of examination: Written 75% + exercises 25%.

TPG4190 SEISMIC DATA

Seismic Data Acquisition and Processing

Seismisk datainnsamling og prosessering

Lecturer: Professor Martin Landrø

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Time: Autumn:

F	th	14-17	P1	Ø	tu	08-10	P1

Exam: Dec 8 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course gives and introduction to the acquisition and processing of data in reflection seismics. Prerequisites: Subjects Seismic Wave Propagation and Geophysical Signal Analysis.

Contents: Seismic data acquisition. Energy sources, sensors and recording instruments. Seismic arrays. Spatial sampling. Seismic modelling and data processing. Data formats and plotting. Deconvolution. Velocity analysis and stack. travel time computations. Two-dimensional filters. Dip move-out. Wave equation migration. Three-dimensional seismic methods. Processing of vertical seismic profiles. Seismic inversion. Amplitude versus offset.

Teaching methods: Lectures and project based learning. The project work includes processing of a seismic line, and counts 40% on the final grade.

Course Material: Lecture notes. O. Yilmaz: Seismic data processing, SEG, Tulsa.

Type of examination: Written 60% + exercises 40%.

TPG4195 GRAVIMETR MAGNETOMET

Gravimetry and Magnetometry

Gravimetri og magnetometri

Lecturer: Adjunct Professor Jan Reidar Skilbrei

Weekly hours: Autumn: 4F + 1Ø + 7S = 7.5Cr

Time: Autumn: As agreed

Exam: Dec 20 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Giving the students knowledge of modern processing and interpretation techniques of potential field data.

Prerequisites: Course MSG4120 Fundamentals of Petroleum Geoscience.

Contents: Potential field theory. Measurements and corrections. Filtering methods in space domain and frequency domain. Image processing. Anomaly separation. Direct and indirect interpretation methods; depth to magnetic basement interpretation: Euler deconvolution, Werner deconvolution and Autocorrelation method, Talwani 2D and 2.5D. Petrophysics, magnetic properties and densities. Geographical Information Systems. Available potential field data from Norway. Exercises include use of Oasis Montaj software.

Teaching methods: Lectures and exercises. At course start, notification on the compulsory exercises will be given.

Course Material: Introduction to Geophysical Prospecting (by Milton B. Dobrin & Carl H. Savit). Lecture notes, articles or John M. Reynolds: An Introduction to Applied and Environmental Geophysics (Wiley).

Type of examination: Written 100%.

TPG4205 DRILL TECH PR CONTR

Drilling Technique - Pressure Control

Dypboringsteknikk - trykkontroll

Lecturer: Associate Professor Pål Skalle

Weekly hours: Spring: 2F + 2Ø + 8S = 7.5Cr

Time: Spring: As agreed

Exam: June 1 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the courses
Objectives: Provide a summary over the most important safety elements that constitute a drilling programme; evaluations and initiatives to avoid or solve problems.

Prerequisites: Subject Drilling engineering.

Contents: Pressure in sedimentary formations, prediction of pore and fracture pressure, setting and cementation of casing, conventional pressure control (detection of unstable hole, well shut-in, killing procedures), mud transport of free gas and gas in solution, security aspects concerning drilling in deep water, cold environment, lowfracture gradients, high kick-frequency, hydrate formation, shallow gas and water currents.

Teaching methods: Lectures and PBL-teamwork. The exercises will count 25% on grade stipulation. The lectures will be held in English if Master's students attend.

Course Material: SPE book: Applied Drilling Engineering. Compendium.

Type of examination: Written 75% + exercises 25%.

TPG4215 HIGH DEV DRILLING

High Deviation Drilling

Høyavviksboring

Lecturer: Professor Arild Rødland

Weekly hours: Autumn: 4F + 1Ø + 7S = 7.5Cr

Time: Autumn:

F	mo	08-10	P1	Ø	tu	14-15	P1
	we	10-12	P1				

Exam: Dec 12 Exam support: A Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course gives an introduction to high deviation and horizontal drilling, methods and equipment, identifies parameters and conditions which are of importance to such drilling and provides insight into calculations and planning procedures for the boreholes.

Prerequisites: BSc.

Contents: Deviation drilling, history and background. Basic equipment and methodology for drilling of deviated boreholes, axial movement, rotation and pumping, also basic methodology for borehole integrity maintenance, mud and casing programmes. Hole direction management and control. Calculation of borehole patterns, for achieving accuracy. Drillstring in tension and compression, buckling and buckling criteria. Use of drillbit thrusters. Slimhole drilling and -strings. Coiled tubing drilling.

Teaching methods: Lectures and voluntary exercises. Exercises account for 25% of final grade.

Course Material: Dedicated compendium. Additional textbooks will be identified during the course.

Type of examination: Written 75% + exercises 25%.

TPG4220 DRILLING FLUID

Drilling Fluid

Boreslam

Lecturer: Associate Professor Pål Skalle

Weekly hours: Spring: 2F + 2Ø + 8S = 7.5Cr

Time: Spring:

F	tu	08-10	P2	Ø	mo	10-12	P2

Exam: May 27 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Provide insight how the drilling fluid and hydraulic elements in the drilling programme are decided.

Prerequisites: Basic subjects in drilling.

Contents: Different types of drilling fluid and selection of these; drilling fluid rheology, density and filter properties, clay mineralogy and the clay's reaction with water, polymers, oil-based drilling fluid, chemical and mechanical hole stability; laminar and turbulent pressure loss in pipes, hydraulic optimization, cement slurry properties.

Teaching methods: Lectures and PBL-teamwork. The exercises will count 25% on grade stipulation. The lectures will be held in English if Master's students attend.

Course Material: SPE book: Applied Drilling Engineering. Compendium.

Type of examination: Written 75% + exercises 25%.

TPG4225 FRACTURED RESERVOIRS

Fractured Reservoirs

Oppsprukne reservoarer

Lecturer: Professor Ole Torsæter

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring: As agreed

Exam: May 19 Exam support: A Exercises: O Grade: Grade in letters

Aim and description of the course

Objectives: The course gives thorough knowledge of methods for analysis of flow in fractured reservoirs.

Prerequisites: Knowledge of basic principles of reservoir engineering.

Contents: Classification of and concepts for fractured reservoirs. Modelling. Geological reasons for fracturing. Detection, evaluation and characterization of fracture systems. One phase flow: Well tests, storage effects, type curves. Drive mechanisms: capillary forces, gravity, viscous forces, diffusion. Production models: Water drive - and gas cap drive - models, modified material balance models and numerical simulation models.

Teaching methods: Lectures and exercises.

Course Material: Papers and lecture notes.

Type of examination: Written 100%.

TPG4230 WELL TECHNOLOGY

Well Technology

Brønnteknologi

Lecturer: Professor Michael Golan

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring:

F	fr	14-17	P2	Ø	mo	16-18	P2

Exam: June 4 Exam support: B Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To extend and deepen the knowledge of the mechanics, hydraulics, performance and design of oil and gas wells.

Prerequisites: BSc.

Contents: Production system layout-Wells, gathering system and surface processing. Well and field performance in a nutshell. Connectivity between wells and payzone. Flow in wells and production systems. Well construction and intervention. Well equipment and mechanical analysis. Well operations (stimulations). Introduction to artificial lift. Deep sea well completions and operations.

Teaching methods: Lectures and exercises.

Course Material: To be announced by the teacher before the course starts.

Type of examination: Written 60% + exercises 40%.

TPG4700 FORM EV-ENG SPEC

Formation Evaluation - Engineering, Specialization

Formasjonsevaluering - teknologi, fordypningsemne

Lecturer: Professor Ole Torsæter, Professor Curtis H. Whitson, Professor Jon Kleppe, Professor Tom Aage Jelmert, Adjunct Professor Terje Eidesmo, Professor Rune M. Holt, Assistent Professor Helge Langeland,

Professor Ole B. Lile

Coordinator: Professor Ole Torsæter

Weekly hours: Autumn: 36S = 22.5Cr

Time: Autumn: As agreed

Exam: Dec 15 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The specialization project should give thorough knowledge within selected parts of Formation Evaluation through independent project work combined with individual supervision and studies of the supporting courses.

Prerequisites: The students must fulfil the requirements for selecting specialization project in Formation Evaluation. These requirements are either stated in the degree programmes or can exceptionally be approved by the lecturer.

Contents: This project area is multi-disciplinary, combining elements of geoscience and engineering. Knowledge of rock and fluid properties and fluid flow from reservoir engineering is combined with knowledge in petrophysics and seismics in order to get a better understanding of reservoir composition and behaviour under production.

The following supporting courses to the semester project are offered:

Pertrophysics, selected Theory, Methods or Software (Lile/Langeland/Eidesmo) - (3.75 Cr)

Rock Acoustics (Holt) - (3.75 Cr)

PVT/EOR/GAS (Whitson) - (3.75 Cr)

Reservoir Evaluation (Jelmert) - (3.75 Cr)

Fractured Reservoirs (Torsæter) - (3.75 Cr)

Reservoir Simulation (Kleppe) - (3.75 Cr)

Reservoir Physics (Torsæter) - (3.75 Cr)

Teaching methods: The subject is divided into two parts, a project work of 15 Cr and a course study of 7.5 Cr. The final grade of the specialization project is a weighted average of the exam (1/3) and the project work (2/3).

Course Material: Information at start of semester.

Type of examination: Oral 33%+ exercises (project work) 67%.

TPG4705 PETR PROD SPEC

Petroleum Production, Specialization

Petroleumsproduksjon, fordypningsemne

Lecturer: Professor Harald Asheim, Professor Michael Golan, Professor Jon-Steinar Gudmundsson, Professor Sigbjørn Sangesland

Coordinator: Professor Harald Asheim

Weekly hours: Autumn: 36S = 22.5Cr

Time: Autumn: As agreed

Exam: Dec 15 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To develop deeper knowledge of selected area of production technology. This will be achieved through supervised and guided self-study. The particular topic from the specified list will be selected in collaboration with the teacher.

Prerequisites: Complete all the obligatory courses in production technology specialization as specified in the degree plan and had been approved by the teacher.

Contents: The topics are related:

1) Total asset modelling; from the reservoir to the process and production optimization, 2) Multiphase flow, steady state and transient problems, 3) Well performance, damage and stimulation, vertical, horizontal and inclined wells, 4) Separation, 5) Well construction and well equipment, subsea wells, 6) Artificial lift methods, 7) Gas production and transport.

The following supporting courses to the semester project are offered:

Modelling and simulation of production processes (Golan) - (3.75 Cr)

Flow in production Wells (Asheim) - (3.75 Cr)

Well Technology (Sangesland) - (3.75 Cr)

Natural gas technology (Gudmundsson) - (3.75 Cr)

Processing and flow of petroleum (Gudmundsson) - (3.75 Cr)

Teaching methods: The topics are divided into two, one project work corresponding to 15 Cr and a specialized study corresponding to 7.5 Cr. The final grades will be determined by a combination of an exam (1/3) and the project work (2/3).

Course Material: Information at start of semester.

Type of examination: Oral 33% + exercises (project work) 67%.

TPG4710 DRILLING SPEC

Drilling, Specialization

Boring, fordypningsemne

Lecturer: Associate Professor Pål Skalle, Professor Sigbjørn Sangesland, Professor Arild Rødland, Professor Rune M. Holt

Coordinator: Associate Professor Pål Skalle

Weekly hours: Autumn: 36S = 22.5Cr

Time: Autumn: As agreed

Exam: Dec 15 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The drilling specialization will focus on developing special knowledge within selected topics based on self-studies combined with support from the lecturers. The offered subtopics will be selected in cooperation with the lecturer.

Prerequisites: The student must have completed all listed subtopics required for the specialization in drilling, or approval must have been given by the lecturer.

Contents: Drilling technology is a functional, engineering subject. It spans over a wide range of interests like mechanics, hydraulics, corrosion, mechanical construction, measuring techniques, chemistry and petroleum technology.

The following subtopics are offered:

Drilling Fluid Technology (Skalle) - (3.75 Cr)

Formation Mechanics (Holt) - (3.75 Cr)

Underbalanced Drilling (Rødland) - (3.75 Cr)

Geoenergy: Drilling Engineering (Rødland) - (3.75 Cr)

Deep Water Technology (Sangesland) - (3.75 Cr)

Teaching methods: The specialization is divided in two parts, a project work corresponding to 15 Cr and a specialized study corresponding to 7.5 Cr. The final mark will be based on a combination of examination (1/3) and a project work (2/3).

Course Material: Information at start of semester.

Type of examination: Oral 33% + exercises (project work) 67%.

TPG4715 RESERVOIR ENG SPEC

Reservoir Engineering, Specialization

Reservoarteknikk, fordypningsemne

Lecturer: Professor Ole Torsæter, Professor Curtis H. Whitson, Professor Jon Kleppe, Professor Tom Aage Jelmert

Coordinator: Professor Tom Aage Jelmert

Weekly hours: Autumn: 36S = 22.5Cr

Time: Autumn: As agreed

Exam: Dec 15 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The specialization project should give through knowledge within selected parts of Reservoir Engineering through independent project work combined with individual supervision and studies of the supporting courses. The supporting courses are selected in cooperation with the supervisor. Teaching methods.

Prerequisites: The student must fulfil the requirements for selecting specialization projects in Reservoir Engineering. These requirements are either stated in the degree programmes or can exceptionally be approved by the lecturer.

Contents: The Reservoir Engineering discipline includes physical properties of petroleum reservoirs and reservoir fluids, single-phase and multi-phase flow of fluids in porous media, evaluation of reservoir size and production potential, recovery of hydrocarbons from reservoirs, and reservoir modelling using mathematical and physical models. One basis for a semester project may be studies of basic phenomena aimed at improving the understanding of recovery mechanisms in porous media. Another may be studies of specific recovery processes, for instance by using numerical reservoir simulation models. Physical laboratory experiments may in both cases be important for verification of theories.

The following supporting courses to the semester project are offered:

Geoscientific Field Course at Svalbard (Tjåland) - (3.75 Cr)

PVT/EOR/GAS (Whitson) - (3.75 Cr)

Reservoir Evaluation (Jelmert) - (3.75 Cr)

Fractured Reservoirs (Torsæter) - (3.75 Cr)

Reservoir Simulation (Kleppe) - (3.75 Cr)

Reservoir Physics (Torsæter) - (3.75 Cr)

Teaching methods: The subject is divided into two parts, a project work of 15 Cr and a course study of 7.5 Cr. The final grade of the specialization project is a weighted average of the exam (1/3) and the project work (2/3).

Course Material: Information at start of semester.

Type of examination: Oral 33% + exercises (project work) 67%.

TPG4720 PETR GEOSCIENCE SPEC

Petroleum Geosciences, Specialization

Petroleumsgeofag, fordypningsemne

Lecturer: Associate Professor Egil Tjåland

Weekly hours: Autumn: 36S = 22.5Cr

Time: Autumn: As agreed

Exam: Dec 15 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The specialization project should give through knowledge within selected parts of Petroleum geosciences through project work combined with individual supervision and studies of the supporting courses. Specialization topics serve also a preparation for the thesis through the learning of common scientific working methods.

Prerequisites: It is assumed that the students have acquired the necessary knowledge to choose specialization within petroleum geosciences. The study can be according to the Study plan or to a study progress that has been approved by the teacher.

Contents: Petroleum geoscience includes application and development of all geophysical and geological methods of importance for petroleum drilling, mapping and description of petroleum reservoirs and all types of measurements in wells.

Specialization can be done within: Seismic data acquisition and processing/Inversion and analysis of 4C and 4D seismic data/Interpretation of seismic, magnetometric and gravimetric data/Basin modelling/Sedimentologic studies/Maturing and migration studies/Special methods for measurements in wells and application of other well data. Relevant subtopics can be:

Rock Acoustics (Holt) - (3.75 Cr)

Geoscientific Field Course at Svalbard (Tjåland) - (3.75 Cr)

Seismic Topics (Tjåland) - (3.75 Cr)

Gravimetry and Magnetometry (Skilbrei) - (3.75 Cr)

Fractured Reservoirs (Torsæter) - (3.75 Cr)

Petroleum Geology (Johnsen) - (3.75 Cr)

Sedimentology (Johnsen) - (3.75 Cr)

Regional Petroleum Geology (Lippard) - (3.75 Cr)

Structure Geology (Lippard) - (3.75 Cr)

Petrophysics, selected theory, methods or software (Lile/Langeland/Eidesmo) - (3.75 Cr)

Plate Tectonics and Basin Formation (Torsvik) - (3.75 Cr)

Reservoir Seismics (Ursin) - (3.75 Cr)

Seismic Mapping of Sedimentary Layers, Field Course (Landrø/Johnsen) - (3.75 Cr)

Teaching methods: The specialization is divided into two parts, a project work corresponding to 15 Cr and a specialized study corresponding 7.5 Cr. The final grade will be based on a combination of examination (1/3) and a project work (2/3).

Course Material: Information at start of semester.

Type of examination: Oral 33% + exercises (project work) 67%.

TPG5110 PETROLEUM ECONOMICS

Petroleum Economics

Petroleumsøkonomi

Lecturer: NN

Coord.: Associate Professor Pål Skalle

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring: As agreed

Exam: Not decided Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Enhance understanding of the principal economic framework within petroleum sector.

Prerequisites: BSc.

Contents: Oil price model; An introduction to the economic theory of exhaustible resources. Capital budgeting techniques and decision analysis: The main methods of evaluation of investment projects - including the effects of taxes and price variations, cost of capital and the main principles in economic risk analysis.

Teaching methods: Lectures and exercises.

Course Material: Detailed information will be given at the beginning of the course.

Type of examination: Written 100%.

TPG5120 PETROPHYSICS BC

Petrophysics, Basic Course

Petrofysikk, grunnkurs

Lecturer: Professor Ole Bernt Lile, Seniorforsker Ton Loermans, Assistent Professor Helge Langeland

Coordinator: Professor Ole Bernt Lile

Weekly hours: Autumn: 4F + 2Ø + 6S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Acquire knowledge and understanding of the basic concepts and techniques in petrophysics, to a degree sufficient to EITHER continue study petrophysics at a more advanced level OR continue study in those disciplines which might not require more petrophysics competence than acquired from the basic course.

Prerequisites: BSc in an engineering discipline, including some geoscience study.

Contents: Introduction to geology and petrology. Physical characterization of rocks, including porosity, permeability and fluid saturation. Fluid flow through porous media. Capillary pressure concepts. Methods of pp data acquisition including, mudlogging, coring, wireline and fewd logging. Principles of measuring techniques, incl. gamma ray, density, neutron, sonic, formation pressure testing, resistivity, pulsed neutron, nuclear magnetic resonance, borehole, casing and production measurements. Practical experience with cores. Basic log interpretation methods, Archie equation. Practical log evaluation methods in simple situations and predominately siliciclastic environments. Influence of shale, rudimentary concepts on interpretation of shaly formations.

Teaching methods: Lectures and exercises. Semester tests count 50% of final grade. Exercises must have been completed to enter exam.

Course Material: Lecture notes, Western Atlas: Introduction to Well Log Analysis, Schlumberger: Log Interpretations Principles/Applications.

Type of examination: Written 50% + midterm 50%.

SUBJECTS IN MARINE TECHNOLOGY

TFY5100 CALCULUS 4K

Calculus 4K

Matematikk 4K

Lecturer: NN

Weekly hours: Summer: 4F + 2Ø + 6S = 7.5Cr

Time: Summer: As agreed

Exam: Not decided Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To introduce the students to the theory of functions of a complex variable and the theory of Fourier series and integral transforms, and to make the students able to use these techniques to solve ordinary and partial differential equations.

Prerequisites: Mathematical subjects equivalent to 21 credits from engineering colleges or similar.

Contents: Laplace transform and solving ordinary differential equations and integral equations. Fourier series, Fourier transform and solving partial differential equations, complex functions, complex integration, series expansions and residue calculus.

Teaching methods: Lectures and exercises.

Course Material: E. Kreyszig: Advanced Engineering Mathematics, 8. ed., Wiley.

Type of examination: Written 100%.

TMR4115 DESIGN METHODS

Design Methods

Prosjekteringsmetoder

Lecturer: Professor Torbjørn Digernes

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Autumn:

F	th	14-15	T1	Ø	th	15-17	T1
F	fr	12-14	T1	Ø	4 hours as agreed		

Exam: Dec 20 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Teach the students to use operation research and methods in designing ships and other marine systems with focus on functional conditions and modelling as tools in the design process.

Prerequisites: Subject Marine Design and Marine Engineering, Basic course.

Contents: Design process as conversion of users requirements to the system solution. Identification of the key problems in design. Design models and methods of modelling. Operation research. Linear programming.

Teaching methods: Lectures and exercises.

Course Material: Hiller & Liberman: Introduction to Operation Research.

Type of examination: Written 50%, exercises 30% and midterm 20%.

TMR4125 BUILD SHIPS/PLATFORM

Building of Ships and Platforms

Bygging av marine konstruksjoner

Lecturer: Adjunct Professor Chris M. Braathen

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	fr	11-14	T2	Ø	mo	17-19	T2
				Ø	4 hours as agreed		

Exam: June 1 Exam support: D Exercises: O Grade: Grade in letters

Aim and descriptions of the course
Objectives: Provide the general knowledge which most of the marine students ought to have about building of ships and platforms.

Prerequisites: Subject Marine design and Marine Engineering, Basic course.

Contents: Introduction to building of ships and platforms from the very first beginning of the building project to termination. Both management of the activities and the technical accomplishment are included.

Teaching methods: Lectures and exercises.

Course Material: Lecture notes.

Type of examination: Written 50% + exercises 50%.

TMR4130 RISK ANALYSIS SAFETY

Risk Analysis and Safety Management of Maritime Transport

Risikoanalyse og sikkerhetsledelse i maritim transport

Lecturer: Professor Svein Kristiansen

Weekly hours: Spring: 2F + 8Ø + 2S = 7.5Cr

Time: Spring:

F	mo	12-14	T2	Ø	8 hours as agreed

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and descriptions of the course
Objectives: Present the basic issues relating to the improvement of safety at sea. Give the theoretical and practical basis for risk analysis of maritime systems. Discuss central ideas on how safety can be improved through organization and management controls.

Prerequisites: Subject Marine design and machine knowledge, Basic Course, or equivalent.

Contents: The risk concept. What is an accident? Risk picture. Accident statistics. Preventive and ameliorating measures. Safety mangement - monitoring of the risk level. Risk objectives and data. Statistical analysis of safety oriented decision alternatives. Maritime traffic models. Probability of grounding and collision. Risk analysis methods: Hazard analysis, FTA, ETA, FMECA, HazOp. Formal safety assessment (FSA). Cost-benefit analysis of safety measures. Analysis and modelling of ship casualties. Benefit-cost analysis of controls. Analysis and modelling of ship accidents. Human reliability and error mechanisms. Catastrophe behaviour, evacuation and rescue. Training, drills and

human-machine simulation. Regulation and official control of maritime safety. National and international control authorities. Safety and quality management. ISO standards. Auditing. Safety Case.

Teaching methods: Lectures and 4 assignments.

Course Material: S. Kristiansen: Risk analysis and safety management of maritime transport. Lecture notes.

Type of examination: Exercises 100%.

TMR4190 ELEM METHODS STRUCT

Finite Element Methods in Structural Analysis

Elementmetoden anvendt i konstruksjonsanalyse

Lecturer: Professor Torgeir Moan

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Autumn:

F	tu	11-13	T1	Ø	th	12-14	T1
F	th	10-12	T1	Ø	3 hours as agreed		

Exam: Dec 16 Exam support: C Exercises: O Grade: Grade in letters

Aim and descriptions of the course
Objectives: The objectives of the course is to provide an introduction in the theoretical basis of the finite element method and how the method can be used to model and analyse marine structures and how computational results can be evaluated.

Prerequisites: Subject Marine Structures, BC and subject Marine Hydrodynamics, BC or similar.

Contents: Energy principles and their application in the derivation of stiffness and load properties of elements. Beam, membrane and plate elements as well as superelement and substructure techniques are covered. The application to typical components in marine structures and numerical problems associated with practical use of the method are discussed. Exercises covering theoretical issues as well as the practical use of computer programmes are given.

Teaching methods: Lectures and compulsory exercises.

Course Material: Various textbooks in English (further information in the first lecture).

Type of examination: Written 70% + exercises 30%.

TMR4195 DESIGN OFFSHOR STRUC

Design of Offshore Structures

Havkonstruksjoner

Lecturer: Professor Torgeir Moan

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	tu	10-12	T7	Ø	th	11-12	T7
F	th	09-11	T7	Ø	4 hours as agreed		

Exam: May 26 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The objectives of the course are to give students instruction in the conceptual design of structures used in exploiting hydrocarbons and other resources offshore; as well as to determine scantlings and inspection plans for such structures.

Prerequisites: Subject Marine Structures, BC or equivalent.

Contents: Overview of structural concepts. Serviceability and safety requirements, especially accidental collapse limit state. Fabrication and installation requirements. Inspection planning. Review of loads, load effects and (system) strength analysis and dimensioning. Load carrying behaviour of alternative structural layouts. Use of steel, aluminium and other materials. Selection of system layout (hull, positioning and riser system).Service vessels.

Teaching methods: Lectures, exercises. Some of the exercises count 40% in the grading.

Course Material: Lecture notes, papers.

Type of examination: Written 60% + exercises 40%.

TMR4200 FATIGUE/FRACTURE

Fatigue and Fracture of Marine Structures

Utmatting og brudd i marine konstruksjoner

Lecturer: Professor Stig Berge

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Autumn:

F	tu	13-14	T1	Ø	we	08-10	T1
F	th	08-10	T1	Ø	4 hours as agreed		

Exam: Dec 8 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The students shall learn theory and methods for design against fatigue and fracture of ships, platforms and other structures, methods for operation and maintenance of load carrying structures.

Prerequisites: Basic materials science and strength of materials.

Contents: Linear elastic and elastic plastic fracture mechanics, materials characterization, methods for assessment of defects and cracks in structure, failure assessment diagram. Cyclic loading and fatigue of metals, fracture mechanics analysis of fatigue, cumulative damage, stress corrosion cracking, corrosion fatigue, design rules and practices. Materials for marine structures: Steel, aluminium, titanium, composite, polymer. Strength properties with emphasis on fracture mechanics properties. The course is directed towards marine structures. However, the theory and methods which are taught are used also for design of other types of dynamically loaded structures, like bridges, cranes, pressure vessels, pipelines, aircraft, rotating machinery etc.

Teaching methods: Lectures, exercises, laboratory demonstrations. 70% of the exercises must be completed for admission to the exam. The course is taught in English, and is common for *master i teknologi*/*siv.ing.*students and MSc. students. Mid term test will count 50% of the grade.

Course Material: Compendia, exercises.

Type of examination: Written 50% + midterm 50%.

TMR4205 BUCKLING/COLLAPS STR

Buckling and Collapse of Marine Structures in Steel and Aluminium

Knekking og sammenbrudd av marine konstruksjoner i stål og aluminium

Lecturer: Professor Jørgen Amdahl

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	fr	11-14	T7	Ø	mo	17-19	T7
				Ø	4 hours as agreed		

Exam: June 1 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Give an understanding of the physical principles and basic theory of buckling and plastic collapse of structures. Provide methods for analysis and design of marine structures to prevent such failures.

Prerequisites: Basic knowledge in Mechanics (Statics and Strength of Materials), Materials Technology and Structural Analysis on BSc/BEng-level or similar.

Contents: Design principles for limit state of ultimate collapse, codes and quidelines (Eurocode, API, Veritas ship rule, DnV RPC2011, Effect of initial distortions, welding residual stresses and "soft" (HAZ) zones on buckling capacity, Yield hinge theory and mechanism analysis of beams and frames. Incremental plastic analysis. Bending moment axial force interaction stiffness matrix for beams with axial force computer programme (USFOS) for advanced buckling and collapse analysis of trussworks, frames and stiffened plates. Buckling of columns, beam-column and frames. Buckling of stiffened plates in steel and aluminium under uniaxial or multiple loads. Plate girders in post-critical range. Buckling of stiffened cylindrical shells.

Teaching methods: Lectures, compulsory exercises, hand calculation, computer analysis, laboratory demonstrations.

Course Material: Compendia, lecture notes and T.H. Søreide: Ultimate Load Analysis of Marine Structures, Tapir, 1981.

Type of examination: Written 40%, exercises 30% + midterm 30%.

TMR4215 SEA LOADS

Sea Loads

Sjøbelastninger

Lecturer: Professor Odd Faltinsen

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Autumn:

F	mo	08-10	T1	Ø	we	12-14	T1
F	we	11-12	T1	Ø	4 hours as agreed		

Exam: Dec 3 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course

Objectives: To generate physical understanding and to make use of simple methods for an early design stage, for marine operation planning or for checking practical computer results or model experiments.

Prerequisites: Subject Marine hydrodynamics, BC or similar.

Contents: Motions, accelerations and wave loads on high-speed vessels. Mean and slowly varying motions of moored structures in waves, wind and current. Slamming.

Teaching methods: Lectures and compulsory exercises.

Course Material: O.M.Faltinsen: Sea Loads on Ships and Offshore Structures, Cambridge University Press, 1990.

Type of examination: Written 75% + exercises 25%.

TMR4220 NAVAL HYDRODYNAMICS

Naval Hydrodynamics

Skipshydrodynamikk

Lecturer: Professor Knut Minsaas

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	mo	08-10	T1	Ø	tu	16-18	T1
F	th	08-09	T1	Ø	4 hours as agreed		

Exam: June 5 Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: To make the students familiar with procedures for calculations of resistance, propulsion and evaluation of manoeuvring and steering ability of high speed craft and conventional ships. To make the students familiar with selection and design of proper propulsion and manoeuvring systems.

Prerequisites: Subject Marine hydrodynamics, BC or corresponding knowledge.

Contents: Application of lifting line and lifting surface theory in the design of propulsers, rudders, foils etc. Application of theory and experimental methods in calculation of resistance and in calculation of hydrodynamic characteristics of waterjets, tunnel thrusters and rotatable thrusters. Propeller induced vibration and noise. Influence of fouling, wind and waves on resistance and propulsion. Horizontal stability and manoeuvrability characteristics of conventional ships.

Teaching methods: Lectures and voluntary exercises.

Course Material: Knut Minsaas: Compendium Naval Hydrodynamics.

Type of examination: Oral 50% + midterm 50%.

TMR4225 MARINE OPERATIONS

Marine Operations

Marine operasjoner

Lecturer: Adjunct Professor Finn Gunnar Nielsen

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	fr	08-11	T1	Ø	th	12-15	T1

					Ø	3 hours as agreed		

Exam: May 15 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Provide insight into how marine operations are executed and how motions, loads and regularity of operations can be calculated. Emphasis is given to description of how waves and current influence the operations.

Prerequisites: Subjects Marine Structures, BC and Stochastic Theory of Sealoads or similar.

Contents: Marine- and subsea operations related to installation and operation of offshore oil and gas fields are operations, oil recovery and regularity will be towing of structures. Further, issues related to design and operations of subsea vehicles are discussed. Main focus is on dynamic and hydrodynamic problems. Methods for estimating loads and responses in waves and current are discussed.

Teaching methods: Lectures and exercises.

Course Material: F.G. Nielsen: Lecture Notes. Marine Operations 2002. T.E. Berg: Lecture Notes on Under Water Vehicles. O.M. Faltinsen: Sea Loads on Ships and Offshore Structures, Cambridge University Press.

Type of examination: Written 100%.

TMR4230 OCEANOGRAPHY

Oceanography

Oseanografi

Lecturer: Professor Dag Myrhaug

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	mo	10-11	T1	Ø	mo	11-14	T1
				Ø	tu	18-19	T1
				Ø	4 hours as agreed		

Exam: June 2 Exam support: C Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: The emphasis will be on the physical understanding of phenomena contributing to the interaction between the atmosphere and ocean, and which also contribute to the motions in the ocean.

Prerequisites: Subject Marine hydrodynamics.

Contents: Properties of seawater. Conservation equations. Equations of motion. Coriolos effect. Geostrophic current. Inertial current. Planetary boundary layer flow. Wind-induced current. Bottom currents. Circulation. Tides. Global and local wind description. Mean wind. Wind gust. Wave forecast. Surface waves. Wave refraction. Non-linear waves. Breaking waves. Wave-current interaction.

Teaching methods: Lectures and exercises.

Course Material: Myrhaug, D: Lecture notes on wind and waves. Mellor, G.B.: Introduction to Physical Oceanography, American Institute of Physics, 1996.

Type of examination: Oral 50% + midterm 50%.

TMR4235 STOCH THEORY SEALOAD

Stochastic Theory of Sealoads

Sjøbelastningsstatistikk

Lecturer: Professor Dag Myrhaug, Professor Bernt Leira

Coord.: Professor Dag Myrhaug

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Autumn:

F	tu	08-10	T7	Ø	th	17-19	T1
F	fr	08-09	T7	Ø	4 hours as agreed		

Exam: Dec 10 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The principles and methods which are used to describe stochastic processes will be explained. The emphasis will be on the applications to sealoads and motions of marine systems, and to make the students able to use such principles and methods.

Prerequisites: Basic knowledge in statistics on BSc/BEng-level. Subjects Marine Hydrodynamics, BC and Marine Dynamics, BC.

Contents: Transformation of random variables. Monte Carlo simulation. Probability distributions for response. Parameter-estimation. Extreme-value statistics. Stochastic processes. Auto- and cross-correlation functions. Spectra and cross-spectra. Differentiation of stochastic processes. Excitation-response of stochastic processes. Equivalent linearization. Response-statistics.

Teaching methods: Lectures and exercises.

Course Material: D.E. Newland: An introduction to random vibrations, spectral and wavelet analysis, 3rd edition, 1993. D. Myrhaug: Lecture notes. B. Leira: Probabilistic Modelling and Estimation, Lecture notes.

Type of examination: Oral 50% + midterm 50%.

TMR4240 MARINE CONTROL SYST

Marine Control Systems

Marine reguleringssystemer

Lecturer: Professor Asgeir Sørensen

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	fr	11-14	T1	Ø	mo	17-19	T1
				Ø	4 hours as agreed		

Exam: June 1 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Marine control systems will give an introduction to design and development of control systems for positioning, marine automation and electrical power generation and distribution in diesel-electrical systems for ships and floating marine structures.

Prerequisites: Subjects Control Engineering and Electric Circuits, Control Engineering, or similar. It is recommended to study this course together with subject Guidance Navigation and Control.

Contents: Mathematical modelling, analysis and control of marine operations, ship motions, machinery systems and propulsion systems for ships and marine structures. This involves dynamically positioning, thruster assisted position mooring, marine auxiliary systems, loading systems, machinery systems, propellers, rudders and electrical power generation and distribution in diesel electrical systems. Typical application areas will be found in the fields of offshore oil and gas exploration and exploitation, shipping, and fishery and aquaculture. Introduction to design of linear SISO and multivariable (MIMO) control methods based on conventional ID control, LQG etc. will be emphasised. Furthermore, observers for state estimation such as Kalman filtering will also be presented. New research results from nonlinear control theory whereof nonlinear recursive Lyapunov analysis including adaptive methods will be treated. Industrial design principles for realisation of stand-alone and integrated systems will also be discussed from a performance and safety point of view.

Teaching methods: Lectures. Project (compulsory) will count 25% in the grading.

Course Material: Lecture notes. Marine Cybernetics: Modelling and Control, 3. ed., Department of Marine Technology.

Type of examination: Written 40%, exercises 30% + midterm 30%.

TMR4275 MOD/SIM/AN DYN SYST

Modelling, Simulation and Analysis of Dynamics Systems

Modellering, simulering og analyse av dynamiske system

Lecturer: Associate Professor Eilif Pedersen

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Autumn:

F	mo	10-12	T1	Ø	tu	10-11	T1
F	we	14-15	T1	Ø	we	15-16	T1
				Ø	4 hours as agreed		

Exam: Dec 5 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Give the student knowledge of how to formulate mathematical models for quantitative analysis of physical systems, and how to carry out analysis of dynamic systems.

Prerequisites: Subject: Marine Design and Marine Engineering, Basic Course, or similar.

Contents: Models in the basic tool for an engineer. All computations he/she performs are based on a model of the real world. All decisions he/she makes are based on a representation of the real world through some kind of model. This is a course about learning mathematical modelling of physical systems by using a graphical systematic and unified method. Based on a generalized set of variables, a set of basic elements is developed, which will be used for modelling of mechanical, hydraulic, thermal and electrical systems. The developed models will be state models, which are useful for numerical solution by computer. Extensive use of numerical analysis and simulation by computer will be performed on a number of different systems.

Teaching methods: Lecture and compulsory exercises. (Calculation, data and laboratory exercises), mid-term test and project carried out in groups.

Course Material: Lecture notes.

Type of examination: Written 50%, exercises 25% + midterm 25%.

TMR4280 INTERNAL COMB ENGINE

Internal Combustion Engines

Forbrenningsmotorer

Lecturer: NN

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Spring:

F	th	12-15	T7	Ø	fr	08-10	T7
				Ø	4 hours as agreed		

Exam: May 19 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Provide knowledge about characteristics of internal combustion engines, operation and emissions.

Prerequisites: Subject Marine Design and Marine Engineering, Basic Course.

Contents: Survey of heat engines and internal combustion engines. Characteristics of piston engines. Working cycles for otto- and diesel engines: Combustion, rate of heat release and fuel supply. Gas exchange, turbocharging. Fuel requirements. Emission and emission control. Mechanical and thermal load on main engine components. Wear and maintenance.

Teaching methods: Lectures and calculation exercises, project and laboratory exercises.

Course Material: Lecture notes.

Type of examination: Written 50%, exercises 25% + midterm 25%.

TMR4290 DIESEL-EL PROP SYST

Diesel-Electric Propulsion Systems

Dieselelektriske framdriftssystemer

Lecturer: Professor Lars Norum, NN

Coord.: Professor Harald Valland

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Autumn:

F	tu	08-10	T1	Ø	th	17-19	T2
	fr	08-09	T1	Ø	4 hours as agreed		

Exam: Dec 10 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Give the students an introduction to electrical engineering of importance for design and analysis of electrical systems on ships and platforms.

Prerequisites: Subject: Marine Design and Marine Engineering, Basic Course.

Contents: Module 1: Introduction to electrical engineering: Characteristics of electrical systems, power generation, distribution and voltage levels on maritime systems, moment and power characteristics of electrical motors etc. Module 2: Electrical propulsion systems: Criteria for system design and optimal dimensioning of system and components, optimal operation. Introduction to basic methods for technical and economical analysis and evaluation of electrical systems. Safety requirements.

Teaching methods: Lecture, exercises (calculation and data exercises) and mid-term test.

Course Material: Lecture notes.

Type of examination: Written 60% + midterm 40%.

TMR5100 MAR DESIG/MAR ENG BC

Marine Design and Marine Engineering, Basic Course

Marin prosjektering og maskinerikunnskap

Lecturer: Professor Harald Valland and Assistent Professor Bjørn Sillerud

Coord.: Professor Harald Valland

Weekly hours: Summer: 4F + 6Ø + 2S = 7.5Cr

Time: Summer: Not decided

Exam: August 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Provide the basic knowledge in marine design and marine engineering which is necessary for studies in the MSc-programme.

Prerequisites: Basic knowledge in Thermodynamics on BSc/BEng-level.

Contents: Hydrostatics and stability. System based design. Machinery propulsion and auxiliary systems.

Teaching methods: Lectures and exercises.

Course Material: Lecture notes.

Type of examination: Written 100%.

TMR5110 MAR DESIGN PROJECT

Marine Design, Project

Marin prosjektering, prosjekt

Lecturer: Professor Torbjørn Digernes, Professor Anders Endal

Coord.: Professor Anders Endal

Weekly hours: Spring: 12Ø = 7.5Cr

Time: Spring: Not decided

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introductory and preparatory studies for the thesis work within the area of marine design.

Prerequisites: Various courses within the area of marine system engineering, dependent of the topic of the thesis.

Contents: Search study of relevant literature references, reporting of a state-of-art prestudy, including a work plan for the thesis work.

Teaching methods: Supervised project.

Course Material: Not decided.

Type of examination: Exercises (Project report) 100%.

TMR5120 DESIGN MAR VEHICLES

Design of Marine Vehicles

Fartøyprosjektering

Lecturer: Professor Anders Endal

Weekly hours: Autumn: 12Ø = 7.5Cr

Time: Autumn: Not decided

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Provide practice in design of a complete marine vehicle, with subsystems.

Prerequisites: Subject: Marine Design and Marine Engineering, Basic course, and subject: Marine Hydrodynamics, Basic Course.

Contents: Participate in and co-ordinate detailed design of a marine vehicle specified by the supervisor. The design should include drawings and specification of the complete vehicle as well as its subsystems.

Teaching methods: The students are supposed to work in teams of 2-4 participants, with supervision in colloquia.

Course Material: Specification of the vehicle and a programme for the design process.

Type of examination: Exercises 100%.

TMR5130 MAR DESIGN SPEC SUBJ

Marine Design, Specialization Subject

Marin prosjektering, spesialiseringsemne

Lecturer: Professor Anders Endal

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Marine Systems Engineering.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes.

Type of examination: Oral 100%.

TMR5140 MARINE STRUCT BC

Marine Structures, Basic Course

Marine konstruksjoner, grunnkurs

Lecturer: Professor Jørgen Amdahl

Weekly hours: Summer: 3F + 6Ø + 3S = 7.5Cr

Time: Not decided

Exam: August 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course gives the students the basic knowledge in marine structures which is necessary for studies in the MSc programme in marine technology.

Prerequisites: Basic knowledge in statics and strength of materials at BSc/BEng-level or similar.

Contents: The precourse deals with structural design and methods of analysis for ships and other types of marine structures. The following main topics are covered: Stress analysis of plates. Buckling of beams and plates. Stochastic analysis. Design and analysis of ships, semisubmersibles and compliant platforms. Design philosophy and criteria. Rules and regulations.

Teaching methods: Lectures and compulsory exercises.

Course Material: Lecture notes.

Type of examination: Written 100%.

TMR5150 MARINE DYNAMICS BC

Marine Dynamics, Basic Course

Marin dynamikk, grunnkurs

Lecturer: Professor Carl Martin Larsen, Professor Bernt Leira

Coord.: Professor Bernt Leira

Weekly hours: Summer: 3F + 6Ø + 3S = 7.5Cr

Time: Not decided

Exam: August 2003 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The principles and methods relevant to dynamic response of marine structures will be explained.

Prerequisites: Basic knowledge in dynamics at BSc/BEng-level or similar.

Contents: One degree of freedom systems and modelling of continuous systems using generalised co-ordinates. Eigenfrequency-calculation of beams using the differential equation energy method.

Calculation of forced response in time and frequency domain modal superposition. Response in ship-hill and motion of typical floating structures e.g. floaters, and tension leg platforms. Irregular waves and wave spectra, short-time and long-time statistics of waves. Transfer functions and response statistics. Separation of virtices. Anchor lines.

Teaching methods: Lectures and exercises.

Course Material: Lecture notes.

Type of examination: Written 100%.

TMR5160 MARIN STRUCT PROJECT

Marine Structures, Project

Marin konstruksjonsteknikk, prosjekt

Lecturer: Professor Bernt Leira

Weekly hours: Spring: 12Ø = 7.5Cr

Time: As agreed

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introductory and preparatory studies for thesis work within the area of marine structures.

Prerequisites: Various courses within the area of marine structures and marine hydrodynamics, dependent of the topic of the thesis.

Contents: Literature search, study of relevant literature references, reporting of a state-of-art pre-study including a work plan for the thesis work.

Teaching methods: Supervisor project.

Course Material: -

Type of examination: Exercises (Pre-project report) 100%.

TMR5170 MAR STRUC SPEC SUBJ

Marine Structures, Specialization Subject

Marin konstruksjonsteknikk, spesialiseringsemne

Lecturer: Professor Bernt Leira

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Marine Structures.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes.

Type of examination: Oral 100%.

TMR5180 CONTROL ENGINEERING

Control Engineering and Linear System Theory

Reguleringsteknikk med lineær systemteori

Lecturer: NN

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Not decided

Exam: Not decided Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introduction to basics in control engineering.

Prerequisites: Mathematics: Laplace, Fourier.

Contents: Linear system theory, frequency analysis, stability analysis, PID controller design, observer design based on Kalman filter, design of multivariable controllers like LQG, LTR, Hinf and H2.

Teaching methods: Lectures and compulsory exercises. Midterm test.

Course Material: International text book (tbd).

Type of examination: Written 45%, exercises (project) 25% + midterm 30%.

TMR5190 MARINE HYDRODYN BC

Marine Hydrodynamics, Basic Course

Marin hydrodynamikk, grunnkurs

Lecturer: NN

Weekly hours: Summer: 4F + 6Ø + 2S = 7.5Cr

Time: Not decided

Exam: August 2003 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Give the basic knowledge in marine hydrodynamics and ocean environment which is necessary for studies in the MSc programme in marine technology.

Prerequisites: Basic knowledge in fluid mechanics on BSc/BEng-level or similar.

Contents: Review of important parts of fluid dynamics. Introduction to marine hydrodynamics. Potential flow. Linear waves. Wave induced forces on fixed and floating bodies. Motion of floating bodies.

Teaching methods: Lectures and compulsory exercises.

Course Material: Lecture notes.

Type of examination: Oral 100%.

TMR5200 MARINE HYDRO PROJECT

Marine Hydrodynamics, Project

Marin hydrodynamikk, prosjekt

Lecturer: Professor Dag Myrhaug

Weekly hours: Spring: 12Ø = 7.5Cr

Time: As agreed

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introductory and preparatory studies for thesis work within the area of marine hydrodynamics.

Prerequisites: Various courses within the area of marine hydrodynamics, dependent on the topic of the thesis.

Contents: Studying necessary literature references and working out a plan of progress for the thesis work.

Teaching methods: Supervised project.

Course Material: -

Type of examination: Exercises 100%.

TMR5210 CONTR SYST SPEC SUBJ

Marine Control Systems, Specialization Subject

Marine reguleringssystemer, spesialiseringsemne

Lecturer: Professor Asgeir Sørensen

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Marine Control Systems.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes

Type of examination: Oral 100%.

TMR5220 MAR HYDRO SPEC SUBJ

Marine Hydrodynamics, Specialization Subject

Marin hydrodynamikk, spesialiseringsemne

Lecturer: Professor Dag Myrhaug

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Marine Structures.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes

Type of examination: Oral 100%.

TMR5230 NAUTICAL SCIENCE BC

Nautical Science, Basic Course

Nautisk vitenskap, grunnkurs

Lecturer: Associate Professor Egil Pedersen

Weekly hours: Autumn: 3F + 6Ø + 3S = 7.5Cr

Time: Not decided

Exam: Not decided Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide a basic knowledge in maritime technology with emphasis on navigational safety at sea, operational efficiency of nautical operations and the importance of a link between developers and end-users of nautical systems.

Prerequisites: None.

Contents: Dimensional analysis with nautical applications. Theory and applications of collision and grounding avoidance at sea. Shipboard weather routing. Astronomic navigation without dead reckoning nor GMT. Basic quality control in marine navigation. Cable mechanics with nautical applications. Evaluation of various nautical operations (vessel transit, anchoring/mooring, marine geophysical exploration, minesweeping, cable laying, sub-sea etc.) and nautical systems (ARPA, DP, ENC/ECDIS, AIS, integrated positioning etc.).

Teaching methods: Lectures and compulsory exercises. Case studies. A project exercise will count 1/3 in the grading. Ship handling simulator exercises to demonstrate and evaluate nautical operations and systems. (Simulator exercises to be carried out at the full-mission ship handling, simulator centre at Ålesund College).

Course Material: Compendium, lecture notes, technical/scientific papers.

Type of examination: Oral 70% + exercises (project) 30%.

TMR5240 NAUTICAL SCIENCE AC

Nautical Science, Advanced Course

Nautisk vitenskap, videregående kurs

Lecturer: Adjunct Professor Tor Einar Berg, Associate Professor Egil Pedersen

Coord.: Adjunct Professor Tor Einar Berg

Weekly hours: Spring: 3F + 6Ø + 3S = 7.5Cr

Time: Not decided

Exam: Not decided Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Utilize approximations and simplified methods for critical assessment of navigational safety at sea and evaluation of operational efficiency of nautical operations.

Prerequisites: MSN1585 Maritime Technology, Basic Course.

Contents: Modelling and analysis of the plotting performance due to errors in the pointing targets in ARPA systems. Theory and applications of a radar plot and display technique for time-efficient and precise anti-collision assessment of multiple targets. Environmental stress model for evaluation of ship handling difficulty in restricted manoeuvring area and traffic congestion. Advanced collision and grounding avoidance system that emphasizes the human ability in processing critical information as supplied by radar, ECDIS and AIS. Advanced shipboard weather routing. Interaction effects in towed marine seismic multiple cable operations. Ship handling and manoeuvrability in open and restricted waters. Advanced position and quality control methods in offshore operations.

Teaching methods: Lectures and compulsory exercises. Case studies. A project exercise will count 1/3 in the grading. PC based ship handling simulator training.

Course Material: Compendium, lecture notes, technical/scientific papers.

Type of examination: Oral 70% + exercises (project) 30%.

TMR5250 NAUTICAL SC PROJECT

Nautical Science, Project

Nautisk vitenskap, prosjekt

Lecturer: Adjunct Professor Tor Einar Berg, Associate Professor Egil Pedersen

Coord.: Adjunct Professor Tor Einar Berg

Weekly hours: Spring: 12Ø = 7.5Cr

Time: Not decided

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introductory and preparatory studies for thesis work within the area of maritime technology.

Prerequisites: Various courses within the area of maritime technology, dependent on the topic of the thesis.

Contents: Studying necessary literature references and working out a plan of progress for the project work.

Teaching methods: Supervised project.

Course Material: Not decided.

Type of examination: Exercises (project work) 100%.

TMR5260 NAUTIC SC SPEC SUBJ

Nautical Science, Specialization Subject

Nautisk vitenskap, spesialiseringsemne

Lecturer: Adjunct Professor Tor Einar Berg

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Nautical Science.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes

Type of examination: Oral 100%.

TMR5270 OPERATION TECHN BC

Operation Technology, Basic Course

Driftsteknikk, grunnkurs

Lecturer: Professor Magnus Rasmussen

Weekly hours: Summer: 3F + 6Ø + 3S = 7.5Cr

Time: As agreed

Exam: Not decided Exam support: A Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Provide the basic knowledge in operation technology which is necessary for studies in the MSc-programme.

Prerequisites: BSc/BEng in marine technology related areas or in mechanical engineering.

Contents: Overview of organization and management systems. Failure- and degradation mechanisms and their effect on performance, cost, safety and environment. Methods for condition monitoring and inspection. The maintenance function. The concept for Reliability Centered Maintenance (RCM). Risk and safety analysis.

Teaching methods: Lectures and project work.

Course Material: Lecture notes.

Type of examination: Written 60% + exercises (project) 40%.

TMR5280 MAR ENGINEER PROJECT

Marine Engineering, Project

Marint maskineri, prosjekt

Lecturer: Professor Harald Valland

Weekly hours: Spring: 12Ø = 7.5Cr

Time: As agreed

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introductory and preparatory studies for the thesis work within the area of marine engineering.

Prerequisites: Various courses within the area of marine system engineering, dependent of the topic of the thesis.

Contents: Search study of relevant literature references, reporting of a state-of-art prestudy, including a work plan for the thesis work.

Teaching methods: Supervised project.

Course Material: Not decided.

Type of examination: Exercises (project report) 100%.

TMR5290 TECH OPERAT PROJECT

Technical Operations of Marine Systems, Project

Driftsteknikk, prosjekt

Lecturer: Professor Magnus Rasmussen

Weekly hours: Spring: 12Ø = 7.5Cr

Time: As agreed

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introductory and preparatory studies for the thesis work within the area of technical operations of marine systems.

Prerequisites: Various courses within the area of marine system engineering, dependent of the topic of the thesis.

Contents: Search study of relevant literature references, reporting of a state-of-art prestudy, including a work plan for the thesis work.

Teaching methods: Supervised project.

Course Material: Not decided.

Type of examination: Exercises (project report) 100%.

TMR5300 MAR ENG SPEC SUBJ

Marine Engineering, Specialization Subject

Marint maskineri, spesialiseringemne

Lecturer: Professor Harald Valland

Weekly hours:Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Marine Systems Engineering.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes

Type of examination: Oral 100%.

TMR5310 TECH OP SPEC SUBJ

Technical Operations, Specialization Subject

Driftsteknikk, spesialiseringemne

Lecturer: NN

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Marine Systems Engineering.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes

Type of examination: Oral 100%.

TPG5100 MATH/COMPUTER METHOD

Applied Mathematics and Computer Methods in Petroleum

Anvendt matematikk og datateknikk i petroleumsfag

Lecturer: Professor Jon Kleppe

Weekly hours: Autumn: 2F + 8Ø + 2S = 7.5Cr

Time: Autumn: As agreed

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Review of important mathematical concepts and develop skills in numerical techniques and computer applications used for solving petroleum related technical problems.

Prerequisites: None.

Contents: The course covers methods for curve fitting, numerical differentiation, integration, interpolation, solution of equations, solution of systems of equations, statistical methods, numerical solution of differential equations etc. With applications to typical problems in petroleum engineering and geoscience. Emphasis is put on individual programming and use of software packages on the department computers.

Teaching methods: Lectures and Fortran programming exercises.

Course Material: W.H. Preuss and S.A. Teukolsky: Numerical Recipes in Fortran (2nd edition), Cambridge University Press, Cambridge, 1992. Fortran textbook to be announced.

Type of examination: Exercises 100%.

TTK4130 MODELLING/SIMULATION

Modelling and Simulation

Modellering og simulering

Lecturer: Professor Olav Egeland

Weekly hours: Spring: 4F + 4Ø + 4S = 7.5Cr

Time: Spring:

F	we	10-12	EL3	Ø	mo	17-18	EL3
F	th	14-16	EL3	Ø	3 hours as agreed		

Exam: May 28 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Introduction in methods for modelling and simulation of physical processes in control applications.

Prerequisites: Subject Control Engineering or similar.

Contents: Mathematical modelling: Models based on state-space, transfer functions, networks models with unilateral interconnections. Analysis based on frequency response, energy-based methods and passivity. Signal-flow versus energy-flow for interconnection of models. Development and interconnection of subsystem models in a modular approach to modelling. Models for electrical motors, hydraulics, friction, vehicles and manipulators, balance equations for mass, momentum and energy in control volume, isentropic gas dynamics, and compressor dynamics. Simulation of state-space models, Runge-kutta methods, stiff systems, stability. Brief introduction to the simulation of partial differential equations using finite elements (FEM) and finite volumes (CFD).

Teaching methods: Lectures and exercises (5 calculation exercises and 3 data exercises must be approved).

Course Material: O. Egeland/S.T. Gravdahl: Modelling and Simulation for Automatic Control, Marine Cybernetics 2003.

Type of examination: Written 100%.

TTK4150 NONLINEAR CONTR SYST

Nonlinear Control Systems

Ulineære systemer

Lecturer: Associate Professor Kristin Y. Pettersen

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: Autumn:

F	mo	12-13	EL2	Ø	mo	13-14	EL2
F	fr	09-12	EL2	Ø	3 hours as agreed		

Exam: Dec 13 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Give knowledge about analysis and design of nonlinear, dynamic systems, with special focus on control applications.

Prerequisites: Subject Control Engineering or similar.

Contents: The course includes methods for analysis and control of nonlinear dynamic systems. In particular: Mathematical models of nonlinear systems and fundamental differences between linear and nonlinear systems behaviour. Equilibrium points, limit cycles, general invariant sets and stability properties of to these. The analysis methods Phase plane analysis, Describing functions method, Lyapunov analysis and Passivity. Nonlinear control design by describing functions method, feedback linearization techniques, gain scheduling, Lyapunov's direct method and energy-based control.

Teaching methods: Lectures and exercises (6 exercises and a laboratory exercise must be approved).

Course Material: Information will be given at the beginning of the semester.

Type of examination: Written 70% + Midterm 30%.

TTK4190 GUID/NAVIGATION/CONT

Guidance, Navigation and Control

Navigasjon og fartøystyring

Lecturer: Professor Thor Inge Fossen

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring:

F	tu	12-15	EL1	Ø	mo	10-12	EL6

Exam: May 19 Exam support: A Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Modelling of vessel movements and design/analysis of guidance systems for ships and underwater vehicles.

Prerequisites: Subject Control Engineering and TTK4150 Nonlinear Control Systems or similar.

Contents: Methods for design and implementation of industrial GNC systems for ships, underwater, vehicles, high-speed vehicles and spacecraft. This includes mathematical modelling of marine vessels and the environment (waves, currents and wind) in 6 Emphasis is placed on kinematics (Euler angles and unit quaternions), rigid-body dynamics, hydrodynamics and vectorial mechanics. Control theory and synthesis in terms of linear quadratic optimal control and state estimation (Kalman filtering),

nonlinear observer the control with extensions to nonlinear systems, Lyapunov methods, sliding mode control, feedback linearization, backstepping designs, observer-based feedback, and integration filters for satellite and strapdown navigation systems.

Teaching methods: Lectures, compulsory problem sets and project work (with grading). The problems sets count for 30% of the finale grade.

Course Material: Thor I. Fossen: Marine Control Systems: Guidance, Navigation and Control of Ships, Rigs and Underwater Vehicles (Marine Cybernetics, Trondheim) ISBN 82-92356-00-2.

Type of examination: Written 70% + exercises 30%.

TTK5100 GUID/NAV SYST SPEC

Guidance and Navigation Systems, Specialization Subject

Fartøystyring og navigasjon, spesialiseringemne

Lecturer: Professor Thor I. Fossen

Weekly hours: Autumn: 4F + 4Ø + 4S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Supporting topics within the area of the thesis work.

Prerequisites: Compulsory subjects in the MSc-programme in Marine Control Systems.

Contents: Two topics selected from a list presented for the students in connection with the project work.

Teaching methods: Lectures and voluntary exercises.

Course Material: Lecture notes.

Type of examination: Oral 100%.

TTT4140 FUND OF NAVIGATION

Fundamentals of Navigation

Navigasjon

Lecturer: Professor Børje Forssell

Weekly hours: Autumn: 4F + 2Ø + 6S = 7.5Cr

Time: Autumn:

F	tu	15-17	EL4	Ø	th	14-15	EL4
F	fr	10-12	EL4	Ø	1 hour as agreed		

Exam: Dec 4 Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Give knowledge about fundamental geodetic, mathematical and statistical conditions for application of navigation systems.

Prerequisites: Calculus 1 or similar.

Contents: Geodetic and geophysical fundamentals of navigation, positioning, localisation and survey. Subjects dealt with are the shape and physics of the Earth, reference and coordinate systems, mapping and map projections, calculations on the surface of the Earth, satellite orbits, accuracy calculations, tides, and optimum utilisation of navigational data, particularly Kalman filtering.

Teaching methods: Lectures and voluntary exercises.

Course Material: B. Forssell: Radionavigation Systems, Prentice Hall 1991.

Type of examination: Written 100%.

TTT4150 NAVIGATION SYSTEMS

Navigation Systems

Navigasjonssystemer

Lecturer: Professor Børje Forssell

Weekly hours: Spring: 4F + 2Ø + 6S = 7.5Cr

Time: Spring:

F	mo	15-17	EL4	Ø	th	16-17	EL4
F	tu	08-10	EL4	Ø	1 hour as agreed		

Exam: June 4 Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Objectives: Give the students knowledge about principles and conditions for design and application of navigation systems.

Prerequisites: Calculus 1-4 and basic knowledge in electronics.

Contents: Spatial and atmospherical wave propagation and along the Earth's surface, hyperbolic navigation, terrestrial radionavigation systems such as LORAN-C and direction finding, satellite navigation systems such as GPS, GALILEO and GLONASS, special systems for aircraft navigation and landing, radar and inertial navigation.

Teaching methods: Lectures and voluntary exercises.

Course Material: B. Forssell: Navigation System, Prentice Hall 1991.

Type of examination: Written 100%.

SUBJECTS IN LIGHT METAL PRODUCTION

MT8104 ELECTR LIGHT METAL 1

Electrolysis of Light Metals 1

Lettmetallelektrolyse 1

Lecturer: Professor Geir Martin Haarberg

Weekly hours: Autumn: 4F + 2Ø + 6S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course

Contents: The fundamental theory for reduction processes for production of light metals is presented with emphasis on Aluminium and Magnesium electrolysis. The subjects is the foundation for MT8300 Light Metals Electrolysis 2 in which raw materials and operational aspects are treated. Phase diagrams, structure and thermodynamics of the electrolyte, physical-chemical properties, electrode reactions, current efficiency, metal solubility and inert electrodes are treated. By appointment other processes may be treated, i.e., production of Titanium, Sodium, etc. re treated.

Teaching methods: Lectures and voluntary exercises.

Course Material: Selected parts of the following books: Thonstad, J., Fellner, P., Haarberg, G.M., Hives J., Kvande, H. and Sterten, Å., "Aluminium Electrolysis. Fundamentals of the Hall-Heroult Process", 3rd ed., Aluminium Verlag, Dusseldorf, 2001. Thonstad, J., "Aluminium Electrolysis, Electrolyte and Electrochemistry", in "Advances in Molten Salt Chemistry", 6th ed., Mamantov, G., Ed., Elsevier 1987. Kipouros, G.J. and Sadoway, D.R., "The Chemistry and Electrochemistry of Magnesium Production", in "Advances in Molten Salts Chemistry", 6th ed, Mamantov, G., Ed., Elsevier 1987. Høy Pettersen, N., Aune, T., Andreassen, K., Øymo, D., Haugerød, T. and Skåne, O., "Magnesium", in "Ullmann's Encyclopedia of Industrial Chemistry, VCH, Weinheim, 15A (1990) 559-580. Lecture notes, relevant literature articles and patent descriptions.

Type of examination: Oral 100%.

MT8300 ELECTR LIGHT METAL 2

Electrolysis of Light Metals 2

Lettmetallelektrolyse 2

Lecturer: Adjunct Professor H. Kvande

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course

Prerequisites: MT8104 Electrolysis of Light Metals 1 or equivalent. MT8300 Electrolysis of Light Metals 2 is an extension of MT8104 Electrolysis of Light Metals 1 with emphasis on industrial applications.

Contents: Practical application of the theory for light metal electrolysis, mainly the aluminium electrolysis process. The main items are:

Energy balance and thermochemistry

Bath chemistry, additives and the physical-chemical properties of the bath

Alumina, properties and solubility in the bath, alumina feeding

Current efficiency and energy consumption

Magnetic fields

Process control

Environmental aspects

Operation of industrial cells

Process improvement past, present and future

Teaching methods: Lectures and voluntary exercises.

Course Material: K. Grjotheim and H. Kvande, "Understanding the Hall-Heroult Process", 2nd ed., Aluminium-Verlag, Düsseldorf; "Introduction to Aluminium Electrolysis", 1993.

Type of examination: Oral 100%.

MT8301 CARBON MAT TECHN

Carbon Materials Technology

Karbonmaterialteknologi

Lecturer: Adjunct Professor M. Sørlie

Weekly hours: Autumn: 2F + 2Ø + 8S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Contents: Industrially applied carbon materials are treated with special emphasis on fundamental principles and properties that have given carbon its broad industrial application. Raw materials, the carbonization process, graphitizing, the refractory properties of carbon materials, oxidation processes, carbon electrodes in metallurgical and electrometallurgical industry, carbon fibres and carbon-carbon composites, active carbon, intercalation compounds, synthetic diamonds and fullerenes are treated. New carbon technology areas of high scientific interest are presented.

Teaching methods: Lectures, exercises and laboratory exercises. The mandatory laboratory exercises will include material characterization by opticla microscopy, scanning electron microscopy, image analysis, porosimetry, etc.

Course Material: Selected parts of relevant textbooks and literature articles.

Type of examination: Oral 100%.

MT8303 THERMODYN HIGH TEMP

Thermodynamics of High Temperature Systems

Høytemperatursystemers termodynamikk

Lecturer: Adjunct Professor H. Kvande

Weekly hours: Autumn: 5F + 5Ø + 14S = 15 Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: D Exercises: F Grade: Grade in letters

Aim and description of the course
Contents: The theoretical base for the thermodynamics of gases and melts at high temperatures is treated. The corresponding state and conformal solutions are the fundament for simple statistical thermodynamics applied to ionic mixtures. The thermodynamics of binary and ternary mixtures is presented. Especially, ternary reciprocal systems diluted in two components are treated. Calculation of solubility products. Concentrated reciprocal salt mixtures. Calculation of ternary phase diagrams. Gas-solid reactions with gaseous products, chemical gas transport in a temperature gradient and the chemistry of gaseous complexes. Gas phase metallurgy, the principle for high temperature discharge lamps and aspects of gas phase corrosion at high temperatures are treated.

Teaching methods: Lectures and voluntary exercises.

Course Material: T. Østvold, "Molten Salt Chemistry". Thermodynamics of Liquid Salt Mixtures and their Vapours", Dept. of Inorganic Chemistry, 1994.

Type of examination: Oral 100%.

TMT4150 REFRACTORIES

Refractories

Ildfaste materialer

Lecturer: Associate Professor Kjell Wiik

Weekly hours: Spring: 4F + 2Ø + 6S = 7.5Cr

Time: Spring:

F	mo	08-10	145-K2	Ø	th	14-15	145-K2
F	fr	08-10	145-K2	Ø	1 hour as agreed		

Exam: May 15 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide a background for choice of refractories for use in industrial furnaces and combustion installations.

Prerequisites: None.

Contents: The production processes for refractory bricks, pastes and carbon materials. Thermal and thermomechanical properties, structure, chemical composition and mineral composition of industrially important refractory materials. Chemical degradation of refractories and thermal shock resistance.

Teaching methods: Lectures and exercises are combined. A project work will be included.

Course Material: A. Seltveit, "Ildfaste materialer", Tapir 1991.

Type of examination: Written 80% + exercises 20%.

TMT4160 HIGH TEMP CHEM PROJ

High Temperature Chemistry, Project Work

Høytemperatur kjemi, prosjektarbeid

Lecturer: Associate Professor Dagfinn Bratland

Weekly hours: Spring: 2F + 4Ø + 6S = 7.5Cr

Time: Spring:

F	th	15-17	145-K2	Ø	mo	12-14	145-K2

Ø 2 hours as agreed

Exam: May 28 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide an introduction to basic high temperature chemistry techniques and synthesis of inorganic materials.

Prerequisites: None.

Contents: Measurement and control of temperature, vacuum techniques and work in inert atmosphere, ceramic work techniques, synthesis of inorganic materials, thermal analysis, powder X-ray diffraction, electron- and optical microscopy, FTIR spectroscopy of inorganic compounds.

Teaching methods: The subject is based in obligatory project work, which includes the most important techniques and inorganic synthesis. Theory is presented in lectures. The grade for the project work constitutes 50% of the final grade.

Course Material: Collection of lecture notes.

Type of examination: Written 50% + exercises 50%.

TMT4270 REFINING METALS AC

Refining and Recycling of Metals, Advanced Course

Raffineringsmetallurgi og resirkulering, videregående kurs

Lecturer: Professor Thorvald A. Engh

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring:

F	tu	10-12	B-451	Ø	th	17-19	B-451
F	fr	15-16	B-451				

Exam: May 24 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide a theoretical treatment of the field of treatment of molten metals, bridging extractive metallurgy and casting. To connect mechanical properties to the treatment of melts and emphasize the importance of recycling.

Prerequisites: TMT4235 Refining and Recycling Metals or similar.

Contents: The dependence of mechanical properties on dissolved elements and inclusions. A survey of refining problems for primary Fe, Al, Mg, SiFeSi and recycled Fe, Al and Mg. Thermodynamics of dissolved elements in liquid metals and slags. Removal of inclusions (particles) from liquid metals, filtering, alloying. Production of high purity metals.

Teaching methods: Lectures, exercises and project work.

Course Material: Engh, T.A., "Principles of Metal Refining", Oxford University Press.

Type of examination: Written 100%.

TMT4295 ELECTROLYTIC PROCESS

Electrolytic Processes

Elektrolyseprosesser

Lecturer: Professor Geir Martin Haarberg

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Time: Autumn:

F	mo	12-14	R4	Ø	fr	15-17	R6
F	th	14-15	R4				

Exam: Dec 9 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide an introduction to the principles for reductive production of metals, inorganic compounds and gases and to give a review of the most important industrial reduction processes in aqueous solutions and molten salts.

Prerequisites: TMT4250 or equivalent.

Contents: The subject provides the basic theory for reduction processes, principles for cell design, choice of materials, energy and heat balances and operational aspects of reduction processes. Plating, batteries and fuel cells are treated. The main aquatic reduction processes (Zn, Ni, Cu, CI2, etc.) are described. An introduction to molten salt electrolysis is provided and the important processes for AI, Mg and Na are described. Aluminium electrolysis is treated in detail. A plant excursion is arranged.

Teaching methods: Lectures and exercises.

Course Material: Lecture notes.

Type of examination: Written 100%.

TMT4750 MATERIALS DEV/SPEC

Materials Development and Specialization

Materialutvikling og videreforedling, fordypningsemne

Lecturer: Professor Hans Jørgen Roven

Weekly hours: Autumn: 36S = 22.5Cr

Time: Autumn: As agreed

Exam: Dec 15 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide knowledge and practical experience in project work related to downstream processes for metal refining, casting, cold and hot forming and joining techniques. The materials include metals, polymers and composites.

Prerequisites: The subject is based on the multi-faculty programme: Application of Materials or relevant background.

Contents: Project work (15 Cr) and a supporting subject module (7.5 Cr). The project work is selected from topics given by Professors at Institute of Materials Technology in cooperation with the Institute of Machine Construction and Materials Technology; Mechanics, Thermo- and Fluid Dynamics; Physics, and Construction Technology. Understanding the relation between process parameters and the properties of the finished component is emphasized. The use of computer programmes and other

information technology is an integral part of the project work. The project work may be performed in cooperation with industry and the candidates themselves may suggest projects of interest. The subject part (module) is selected in cooperation with the supervisor for the project work: Downstream Processing - Forming and Casting (7.5Cr).

Teaching methods: The project module is carried out under supervision of one of the Institute’s Professors. The teaching in the subject module is lectures or colloquia, seminars and literature studies with active student participation.

Course Material: Collection of text books, lecture notes and literature articles.

Type of examination: Oral 33% + exercises (project) 67%.

SUBJECTS IN COSTAL AND MARINE CIVIL ENGINEERING

TBA4115 GEOTECH STRUCTURES

Geotechnics, Structures

Geoteknikk, konstruksjoner

Lecturer: Professor Steinar Nordal

Weekly hours: Spring: 3F + 3Ø + 6S = 7.5Cr

Time: Spring:

F	mo	15-16	B-049	Ø	mo	16-18	B-049
F	fr	15-17	B-049				

Exam: June 3 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course should give the students basic knowledge and practical skills in use of computer programmes for use on geotechnical related problems. At the same time hand calculations should be carried out and compared with the numerical results.

Prerequisites: B.Sc in Civil Engineering or equivalent. The course is based on TBA4100 Geotechnics and geology, TBA4105 Geotechnics design methods and TBA4110 Geotechnics material properties or equivalent. These courses are not necessary, but recommended.

Contents: Finite element method. Numerical analysis of stability, settlements, groundwater flow, tunnels etc. Mostly the exercises will be based on use of PLAXIS.

Teaching methods: Lectures, calculation by hand and by use of PLAXIS.

Course Material: Information at start of term. Lecture notes.

Type of examination: Oral 67% + exercises 33%.

TBA4145 PORT/COAST FACILITY

Port and Coastal Facilities

Kyst og havnefasiliteter

Lecturer: Adjunct Professor Svein Fjeld

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring:

F	tu	12-14	003MTI	Ø	th	17-19	003MTI
	fr	13-14	003MTI				

Exam: May 21 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide applicable knowledge and background for planning, design, construction and operation of marine facilities with focus on concepts and principles involved.

Prerequisites: TBA4265 Marine physical environment.

Contents: Guidelines and principles in marine civil engineering. Approach navigation channels, ports and harbours. Terminal facilities. Marine structures in port and coastal engineering; quays, including moorings and fenders, breakwaters, coastal defence works etc. Dredging, handling and deposition of clean and polluted materials.

Teaching methods: Lectures and exercises.

Course Material: Textbook, lecture notes and selected papers.

Type of examination: Written 100%.

TBA4265 MARINE PHYS ENV

Marine Physical Environment

Marint fysisk miljø

Lecturer: Professor Sveinung Løset

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Time: Autumn:

F	mo	10-12	B-049	Ø	tu	17-19	B-049
F	fr	16-17	B-049				

Exam: Dec 17 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: Knowledge and skills dealing with action and action effects from environmental processes as wind, currents, waves and ice in a marine environment.

Prerequisites: B.Sc in Civil Engineering or similar. Basic course in Fluid Mechanics.

Contents: Marine physical processes. Description of waves, currents, wind and formation and mechanics of ice. Resulting consequences for marine activities. Fundamentals of statistical methods used in physical marine environment and an introduction to spreading processes. Special note: For students from developing countries, the ice topics are replaced by topics of particular interest for these students.

Teaching methods: Lectures and exercises.

Course Material: Information at start of term. Textbook and lecture notes.

Type of examination: Written 100%.

TBA4270 COASTAL ENGINEERING

Coastal Engineering

Kystteknikk

Lecturer: Associate Professor Øivind A. Arntsen and Professor Eivind Bratteland

Coord.: Associate Professor Øivind A. Arntsen

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring: As agreed

Exam: May 27 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course

Objectives: To provide insight to coastal zone management and understanding and description of processes caused by waves, tides, or currents in the coastal zone, giving the student a good background for planning and working in the coastal zone.

Prerequisites: TBA4265 Marine physical environment, or similar.

Contents: Use of the coastal zone, planning, environment, rules and guidelines. Description of the coastal zone physical environment; wave transformation, currents, wind, sand transport, erosion and accretion, scour and scour protection.

Teaching methods: Lectures and exercises.

Course Material: Compendium, selected papers.

Type of examination: Written 100%.

TBA4275 DYNAMIC RESPONSE

Dynamic Response to Irregular Loadings

Dynamisk respons på uregelmessige laster

Lecturer: Professor Geir Moe

Weekly hours: Spring: 3F + 2Ø + 7S = 7.5Cr

Time: Spring:

F	mo	08-10	137MTI	Ø	tu	14-16	137MTI
F	th	14-15	137MTI				

Exam: May 24 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To familiarise the students with state-of-the-art methods to describe the environmental loads and responses to these, e.g. displacements of structures.

Prerequisites: TBA4265 Marine physical environment and some knowledge of structural dynamics.

Contents: Environmental loadings (wind, waves, earthquakes) will be modelled as irregular time series, and considered as input to a system the produces environmental forces as output, and then in the next step the environmental forces will be considered as input and e.g. structural displacements may be found as output. This is done by means of transfer functions, which determine variance spectra of the output. From these spectra vital quantities such as the average numbers of peaks on various levels, average frequencies and expected extremes will be estimated.

Teaching methods: Lectures and exercises.

Course Material: Textbook, lecture notes and selected papers.

Type of examination: Written 100%.

TBA5100 GEOTECH CALC METH

Geotechnical Engineering, Calculation Methods

Geoteknikk, beregningsmetoder

Lecturer: Associate Professor Arnfinn Emdal

Weekly hours: Autumn: 4F + 2Ø + 6S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course is designed to develop basic skill in geotechnical design methods for slope stability, earth pressure, bearing capacity of foundations and piles as well as assessments of settlements and displacements.

Prerequisites: BSc degree in Civil Engineering or equivalent. Basic courses in geology and geotechnics.

Contents: Relevant stress fields based on the theory of plasticity, basic elements and combinations. Principles and recipes for performing short-hand calculations of settlements, slope stability, earth pressure and bearing capacity of foundations and piles. The course aims at creating basic understanding through classical analysing tools and hand calculations as well as demonstrations of real design cases.

Teaching methods: Lectures, calculation and laboratory exercises and a minor project work.

Course Material: Information at start of term, lecture notes.

Type of examination: Written 100%.

TBA5110 FREIGHT TRANSP SYST

Freight Transport System

Transportsystemer

Lecturer: Professor Tore Sager

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide knowledge and understanding of the freight transport systems and developments and the related logistics in the integrated transportation chain.

Prerequisites: BSc degree in Civil Engineering or equivalent.

Contents: Infrastructure for all transport modes, terminals and actors responsible for carrying out the transport functions are described and characterised from a basic transport economic perspective. Key elements are market development, transport policy, competition and organization. Special characteristics of road, rail, sea and air freight as part of the general logistics and supply chain are considered. An introduction to cost-benefit and other economic methods for transport analysis will be introduced.

Teaching methods: Lectures and exercises.

Course Material: Textbook, lecture notes and selected papers.

Type of examination: Written 100%.

TBA5700 COASTAL/MAR ENG SPEC

Coastal and Marine Civil Engineering, Specialization

Marin byggteknikk, fordypning

Lecturer: Programme staff and external supervisors

Coord.: Professor Eivind Bratteland

Weekly hours: Autumn: 3F + 1Ø + 32S = 22.5Cr

Time: Autumn: As agreed

Exam: Dec 15 Exam support: D Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The specialization will give the student an in-depth theoretical knowledge and competence within a selected subject area of the field. It will improve the student ability to do independent engineering/research work, and provide training in planning of projects, systematic processing of information and report writing.

Prerequisites: Exams in the required basic courses necessary for the chosen specialization subjects.

Contents: The specialization in Coastal and Marine Civil Engineering is divided into 5 subject areas: Coastal Engineering, Port Engineering, Marine Civil Engineering, Arctic Offshore Engineering and Marine Geotechnics. The specialization consists of a project work equivalent to 11,25 Cr and normally three selected specialization subjects listed below summing up to 11,25 Cr. For each subject area one of the specialization subjects is compulsory. The specialization subjects are:

Coastal Engineering II (3.75Cr, compulsory for Coastal Engineering, (Professor Øivind A. Arntsen)

Port Engineering (3.75Cr, compulsory for Port Engineering, (Professor Eivind Bratteland)

Flow-Induced Vibrations (3.75Cr, compulsory for Marine Civil Engineering, (Professor Geir Moe)

Marine Geotechnics (3.75Cr, compulsory for Marine Geotechnics, (Professor Lars Grande)

Safety and Reliability (3.75Cr, (Professor Arvid Næss)

For Arctic offshore engineering there are two options:

1. Study at NTNU with the following subject as compulsory: Structures in Ice-Infested Waters (3.75Cr, (Professor Sveinung Løset)

2. Study at UNIS, Svalbard with the following subject as compulsory: Arctic Offshore Engineering (7.5Cr,

(Professor Sveinung Løset).

Apart form the compulsory subject given, a specialization normally requires at least one of the other subjects listed to be included. The Professor in charge for the project work will inform about this. If the Professor in charge approves it, the student could choose one subject given by others. The project work should include problems related to research and development within the chosen subject areas. Whenever possible the project should be linked to local problems and challenges and preferably have a local supervisor. The project may comprise theoretical, numerical, experimental or field studies. If possible, field work should be included. The specialization project will normally be a starting point for the thesis work in the spring term. The student can work individually or in a team.

Teaching methods: Supervised project work. Depending on the number of participants the specialization subjects may be lectured, given as seminars or taken as a self-study.

Course Material: Lectures, selected texts from text books, papers etc.

Type of examination: Project report and its oral presentation (50%) and oral examination in the specialization subjects (50%).

TBA5800 EXP IN TEAM INT PROJ

Experts in Team, Interdisciplinary Project

Eksperter i team, tverrfaglig prosjekt

Lecturer: Professor Eivind Bratteland

Weekly hours: Spring: 5Ø + 7S = 7.5Cr

Time: Spring: As agreed (Wednesdays)

Exam: - Exam support: - Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: In this interdisciplinary project work, the student will develop knowledge, attitudes and skills in a result-oriented teamwork where the team members have different professional background and various approaches towards the problem-solving and the techniques to be used. A challenging problem will facilitate development of knowledge, and the student must take responsibility for adequate use of his/hers knowledge in the common work of the team.

Prerequisites: None.

Contents: The students will work in a so-called "village" on a thematic problem area representing an open problem approach. The project will represent an actual and realistic problem where the students shall produce an answer, a solution or a product. If possible there should be external (out-side University) "ownership" of the problem. The project should be highly interdisciplinary, preferably across faculty borders. Each team develops its own project within the village. The interdisciplinary project should be defined so widely that it can not be solved individually, but requires knowledge and competence from the whole team. The students develop knowledge and skills in team-processes and team-work.

Teaching methods: Teamwork with documentation of the work. Project meetings are compulsory.

Course Material: To be decided according to subject chosen.

Type of examination: Written report on the project 60%, process report 40% and oral presentation.

TGB4235 SPREADING POLLUTION

Spreading of Pollution

Spredning av forurensning

Lecturer: Professor Sveinung Løset and Professor Knut Lyng Sandvik

Coord.: Professor Knut Lyng Sandvik

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Time: Autumn:

F	th	14-17	OPAUD	Ø	we	08-10	OPAUD

Exam: Dec 18 Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course aims to give students an introduction to mechanisms for dispersion and transport of pollution in various recipients (water, soil and air).

Prerequisites: BSc degree in Civil Engineering or similar. Elementary knowledge in hydrodynamics and hydrogeology.

Contents: Ocean dispersion: Tidal currents, air driven currents, coastal currents. An overview of principles for calculation of currents in oceans and coastal waters. Dispersion in the atmosphere: Geostrophic wind, vertical wind profile, topographic influence. Mixed processes: Spreading by shear, turbulent diffusion, density driven diffusion (in plumes). Statistical methods and modelling. Degradation processes (oil): Evaporation, emulsion formation, dispersion, solubility in water, biological and photo-chemical degradation. Airborne dust: Spreading and retention times.

Teaching methods: Lectures and exercises.

Course Material: Lecture notes and selected papers. To be announced at start of course.

Type of examination: Written 100%.

TKT5100 DUR/MAINT/REP CONCR

Durability, Maintenance and Repair of Concrete Structures

Bestandighet, vedlikehold og reparasjoner av betongkonstruksjoner

Lecturer: Professor Øystein Vennesland

Weekly hours: Autumn: 3F + 2Ø + 7S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide an understanding of degradation mechanism and general principles and methods for maintenance and repair.

Prerequisites: BSc degree in Civil Engineering or equivalent.

Contents: A short description of the main construction materials and mechanisms of degradation - with special emphasise on degradation mechanisms of steel and concrete structures. Methods for structural assessment, both in field and in laboratory. Planning and execution of structural assessment. Maintenance and repair of steel and concrete structures, including electrochemical techniques.

Teaching methods: Lectures, exercises and laboratory.

Course Material: Textbook, lecture notes and selected papers.

Type of examination: Written 100%.

AAR4230 PLAN IN DEV COUNTRY

Planning and Construction in Developing Countries, Advanced Course

Planlegging og bygging i utviklingsland, videregående kurs

Lecturer: Professor Hans Christie Bjønness

Weekly hours: Spring: 3F + 1Ø + 8S = 7.5Cr

Time: Spring: As agreed

Exam: Not decided Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: To provide the students with understanding and applicable knowledge on sustainable planning and development of infrastructure in a society.

Prerequisites: BSc in Civil Engineering or similar.

Contents: The subject gives an introduction to issues that are important for understanding planning, construction and infrastructure management in developing countries (ideology; cultural, social and environmental issues, economy, resources and technology etc.). Focus will be on those features that differ from industrialised countries, with emphasise on problems related to planning and management of the implementation of projects. The project work emphasises project planning and evaluation techniques, and given an introduction to writing project documentation using the UN format.

Teaching methods: Lectures and exercises/projects.

Course Material: Textbooks, lecture notes and selected papers/reports.

Type of examination: Written 100%.

DIA4001 RES METHODS FOR ARCH

Research Methods for Architects and Planners

Forskningsmetoder for arkitekter og planleggere

Lecturer: Professor Linn Mo

Weekly hours: Autumn: Not decided (7.5Cr)

Time: Autumn: Not decided

Exam: Not decided Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The course will improve the ability to make use of research methods and research designs in current and future project works.

Prerequisites: None.

Contents: The course is to give basic knowledge of research to students who are to use research methods in relation to a project. The student learns how to write a project proposal, how to carry out a research project and write research report. The student will learn to read and evaluate research reports based on different methods and approaches. Both statistical and qualitative methods (case studies) will be taught. Various research methods will be reviewed (hypothesis-testing vs. hypothesis-generating, deductive vs. inductive) in relation to real projects and literature on research methods. There may be contributions from quest lectures from different research traditions (physical planning, architecture, social science). By presentation of their own projects, students will learn to evaluate their own and others research designs. Written presentations will be revised to become project proposal.

Teaching methods: Lectures and project.

Course Material: To be decided.

Type of examination: Written 100%.

GEOG3506 GEO HEALTH AND DEV

Geography, Health and Development

Geografi, helse og utvikling

Lecturer: Associate Professor Stig H. Jørgensen

Weekly hours: Autumn: 4F + 1Ø + 7S = 7.5Cr

Time: Autumn: As agreed

Exam: Not decided Exam support: C Exercises: O Grade: Grade in letters

Aim and description of the course
Objectives: The student will improve knowledge and understanding of health conditions and health services. Factors influencing the systems will be discussed.

Prerequisites: "Mellomfag" in Geography. Other relevant background can be accepted if approved by the department.

Contents: The course addresses aspects and problems related to health conditions and health services in developing countries. The general health situation and specific diseases will be examined against background factors of the physical as well as socio-economic and cultural environment. A model for health transition and other dynamic approaches will be applied to analyse changes in health conditions in different developing countries. An understanding of economic limitations and interactions between traditional and modern health services will be emphasized in order to describe current health systems.

Teaching methods: Lectures and seminar presentation.

Course Material: To be decided.

Type of examination: Written 100%.

SUMMARY OF SUPPORTING COURSES

TPG4700 Formation evaluation - Engineering,

Teachers:

Specialization:

Supporting courses:

Reservoir Simulation
Professor Jon Kleppe

Rock Acoustics Professor
Rune M. Holt

Geoscientific Field Course at Svalbard
Associate Professor Egil Tjåland

Fractured Reservoirs
Professor Ole Torsæter

Reservoir Physics
Professor Ole Torsæter

Petrophysics, Selected Theory, Methods or Software
Professor Ole B. Lile/Assistent Professor Helge

Langeland/Adjunct

Professor Terje Eidesmo

PVT/EOR/GAS
Professor Curtis H. Whitson

Reservoir Evaluation
Professor Tom Aage Jelmert

TPG4705 Petroleum Production, Specialization:

Supporting courses:

Well Technology
Professor Sigbjørn Sangesland

Geoscientific Field Course at Svalbard
Førsteamanuemsis Egil Tjåland

Modelling and Simulation of Production Processes
Professor Michael Golan

Natural Gas Technology
Professor Jon-Steinar Gudmundsson

Production Laboratory Techniques
Professor Harald Asheim

Flow in Production Wells
Professor Harald Asheim

TPG4710 Drilling, Specialization:

Supporting courses:

Drilling Fluid Technology
Associate Professor Pål Skalle

Well Technology
Professor Sigbjørn Sangesland

Deep Water Technology
Professor Sigbjørn Sangesland

Formation Mechanics
Professor Rune M. Holt

Geoscientific Field Course at Svalbard
Associate Professor Egil Tjåland

Geoenergy: Drilling Engineering
Professor Arild Rødland

Underbalansert boring
Professor Arild Rødland

TPG4715 Reservoir Engineering, Specialization:

Supporting courses:

Reservoir Simulation
Professor Jon Kleppe

Geoscientific Field Course at Svalbard
Associate Professor Egil Tjåland

Fractured Reservoirs
Professor Ole Torsæter

Reservoir Physics
Professor Ole Torsæter

PVT/EOR/GAS

Professor Curtis H. Whitson

Reservoir Evaluation
Professor Tom Aage Jelmert

TPG4720 Petroleum Geoscience, Specialization:

Supporting courses:

Rock Acoustics Professor Rune M. Holt

Geoscientific Field Course at Svalbard
Associate Professor Egil Tjåland

Seismic Topics Associate Professor Egil Tjåland

Gravimetry and Magnetometry
Adjunct Professor Jan Reidar Skilbrei

Fractured Reservoirs
Professor Ole Torsæter

Petroleum Geology
Associate Professor Sverre Ola Johnsen

Sedimentology Associate Professor Sverre Ola Johnsen

Regional Petroleum Geology
Professor Stephen Lippard

Structure Geology
Professor Stephen Lippard

Petrophysics, Selected Theory, Methods or Software
Professor Ole B. Lile/Assistent Professor Helge Langeland/Adjunct Professor Terje Eidesmo

Plate Tectonics and Basin Formation
Adjunct Professor Trond Torsvik

Reservoir Seismics
Professor Bjørn Ursin

Seismic Mapping of Sedimentary Layers, Field Course
Professor Martin Landrø/Associate Professor Sverre Ola Johnsen

REGULATIONS FOR THE MASTER OF SCIENCE PROGRAMMES IN TECHNOLOGICAL STUDIES AT THE NORWEGIAN UNIVERSITY OF TECHNOLOGY AND SCIENCE (NTNU)

Approved by the Senate on 27 April 1999 Effective as of the academic year 1999/2000

General
Students taking a Master of Science degree programme in technological studies at NTNU are to comply with the Examination Regulations at NTNU (approved by the Senate on 19 June 1997) and the Regulations for the Degree of sivilingeniør at NTNU (approved by the Senate on 16 September 1998) in so far as these regulations have relevance for the Master's programmes.

Specific regulations relating to the clauses in the Examination Regulations at NTNU and the Regulations for the Degree of sivilingeniør at NTNU:

§1. Objectives
In addition to the specifications in the Examination Regulations at NTNU and the Regulations for the Degree of sivilingeniør at NTNU the following also applies for registered students with non-Norwegian educational backgrounds who have been admitted to a Master of Science degree programme in technological studies at NTNU.

§3. Organization of the programme
3.1 Programme content.

The Master of Science degree programme comprises two years of full-time study that is divided into four semesters.

3.2 Programme duration and level

One semester's study will normally be worth 10 credits and the entire degree programme 40 credits. The taught courses in the degree will normally comprise three semesters and the Master's thesis one semester. The courses will be a combination of compulsory and elective subjects.

Teaching can be part of separate courses or it can be integrated into the courses for the sivilingeniør (Master's-level) degree or equivalent.

3.3 Approval of curriculum

The faculty with the disciplinary responsibility for the particular Master's programme is the body to approve the curriculum for students.

3.4 Thesis

If the thesis does not receive a pass mark, it is permitted to submit a new thesis once only.

When a thesis that has received a pass mark, a student cannot submit a second thesis on a voluntary basis.

§4. Part-time study
It is not permitted to take a Master of Science degree programme on a part-time basis.

§6. Time of examination

Students who fail to pass an ordinary examination or have valid grounds for absence (documented illness etc.), are automatically registered for the re-sit examination. Students who do not attempt to sit the ordinary examination will not be registered for the re-sit examination. In subjects that are taught in the summer semester, the ordinary examination will be held in August. If students do not pass the ordinary examination, a re-sit examination will be arranged in October. In subjects that are taught in the autumn semester, the ordinary examination will be held in the autumn examination period and the re-site examination will be arranged in January. In subjects that are taught in the spring semester, the ordinary examination will be held in the spring examinational period and the re-site examination will be arranged in August.

§10. Number of examination attempts
10.1 Limits to the number of examinations

A student is not normally permitted to take an examination in the same course more than three times. This stipulation comes into force in the academic year 2000/2001 and any attempts to pass examinations before then are not considered.

A student that has not passed an examination in one course in the degree after the maximum number of attempts, has his or her place withdrawn from the Master of Science degree programme.

The Committee for Degree of sivilingeniør at NTNU is empowered to grant exemptions from this clause regarding the number of examination attempts.

Appeals to the decision of this committee can be addressed to the University Appeals Board.

10.2 Maximum duration for thesis work

A student is not normally permitted to be registered for thesis work for more than two years after he/she is qualified to start work on a Master's thesis.

The Committee for Degree of sivilingeniør at NTNU is empowered to grant exemptions from this clause regarding the maximum duration for thesis work.

Appeals to the decision of this committee can be addressed to the University Appeals Board.

10.3 Transfer to the second year

Transfer to the second year of the programme is between the second and third semester. This transfer is only permitted for students that have passed at least half of the required credits in the first two semesters.

§11a. Permitted languages in examinations
11.1 Teaching language

All teaching is to be given in English.

11.2 Languages in exercises and examinations

In joint courses with students taking the degree of sivilingeniør, all examination question papers and topics for exercises are to be in both English and Norwegian.

§18. Exemption
Students with four years or more of relevant university education can apply for one semester's exemption of the Master of Science degree programme. All applications for exemption are to be handled in accordance with the Examination Regulations at NTNU and the Regulations for the Degree of sivilingeniør at NTNU.

§26. Effectuation

The above regulations for the Master of Science Degree Programmes in Technological Studies at NTNU come into force as of the academic year 1999/2000 and replace the previous Regulations for Master of Science Degrees Programmes at NTH of 19 February 1994.

EXAMINATION REGULATIONS AT THE NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY (NTNU)

Adopted by the Board of NTNU on 11 February 2003 in accordance with the Act of 12 May 1995 relating to Universities and Colleges, no. 22 §§ 40, 46, 47, 48, 49, 50 and 52.

Chapter 1 Scope, Purpose and Definitions

§ 1 Scope and Purpose

The regulations are valid for all studies at the Norwegian University of Science and Technology (NTNU).

2. The regulations contain rules about the organization of studies, examinations and assessment, requirements for the award of degrees, and regulations concerning the rights and obligations of the University and students at NTNU. The regulations are to ensure that studies and examinations at NTNU are properly carried out.

§ 2 Definitions

final examination	A type of assessment that normally follows at the end of the semester under conditions that can be controlled. The final examination generally is the concluding assessment of the student in a course or a group of courses.
course	The smallest unit in which the student can receive an assessment and course grade. The extent of the course is measured in credits. The course involves activities that form the basis for assessment. The activities may be compulsory.
subject	A collection of courses in one group in the programme catalogue.
main profile	Courses in the programme catalogue which are defined as belonging to the same discipline which can supplement each other and build on foundation course level in a programme of study. In case a Master's degree is based on a completed Bachelor's degree, the main profile contains the academic qualifications required for admission to the Master's degree.
grade	The grade given in a course or group of courses. It is based on the assessments that count during that course. The weighting of the grades in assessments during the course is stated in the course description.
credits	Measure of the study workload. The normal workload in one academic year is 60 credits.
programme of study	A group of courses that forms one academic entity that students can apply for admission to, receive the right to study, and leads to a degree.
area of study	A specialization within a programme of study, which is described in the programme catalogue for that programme of study.
assessment	The evaluations a student receives on the basis of his/her performance in a course, or a group of courses and that lead to a grade.

When these regulations refer to the Act relating to Universities, this means the Act of 12 May 1995 relating to Universities and Colleges, no. 22, including amendments, the last of which are passed as an Act, dated 28 June 2002 no. 62.

Chapter 2 Admission and curriculum

§ 3 Admission
The valid admission regulations are the relevant regulations adopted by the Ministry of Education and Research and NTNU's own admission regulations.

§ 4 The right to study and study progress
Admission involves the right to take the courses in the programme of study or separate courses which the student has gained admission to. The right to study provides the opportunity to take the courses specified in the education plan or in accordance with the study progress approved by the Faculty. The right to study is valid from the day NTNU receives confirmation of the student's acceptance of his/her admission.

The right to take the programme of study which the student has been admitted to, ceases when

the student fulfils the criteria allowing him/her to receive a certificate after completing the programme of study

the student's performance (study progress) is insufficient, according to the definition given in § 4 subsection 3

the student himself/herself confirms that he/she has withdrawn from the programme of study before it is completed.

In programmes of study that are divided into year courses/ years, a student cannot take the next year if he/she has an outstanding deficit of more than 22.5 credits from the two previous years. Students who want to take the 4th year cannot have any unfinished courses from the 1st year. Students who want to take the 5th year cannot have any unfinished courses from the 1st and 2nd years, and students who want to take the 6th year cannot have any unfinished courses from the 1st, 2nd, and 3rd years.

The student loses the right to study a programme of study if he/she has an outstanding deficit of more than 22.5 credits. No student is permitted to use more than 2 academic years to take the same year in a programme of study. The time spent in each year should be adjusted according to any leave that has been granted, and any possible reductions in the study progress (part-time studies) that have been approved in the education plan, ref. §§ 5, 7, and 8.

It is to be evident from the programme catalogue whether the programme of study is divided into years, ref. § 14 subsection 1.

The Faculty is to decide whether the right to study should be terminated in accordance with the above regulations. The Faculty may grant exemptions from the regulations in § 4 subsection 3 in cases of illness, serious family problems, when the main part of the studies has already been completed, extraordinary conditions related to the subject (taking the next year) or other reasons found to warrant special treatment. Where the Board of NTNU has established an inter-Faculty board for a group of programmes of study, the latter board is authorized to reach decisions in cases related to exemptions.

A student who has gained admission to a programme of study and has had normal study progress (without adjustment for leave or reduced study progress), is not to be affected by changes in the disciplinary objectives, level and structure of the programme while completing his/her work on the programme. The student nevertheless has to accept that there may be changes in the courses and the structure of the programme of study that will not cause a delay in his/her study progress.

A student who has gained admission to a programme of study or individual courses at NTNU, has the right to follow other courses he/she is qualified to take and receive assessment of his/her performance in these courses. The student also has the right to follow lectures in courses outside the programme of study, if there are no restrictions on the admission to the courses. The student maintains these rights also after having completed the programme of study.

§ 5 Education plan

The Faculty together with students who have gained admission to study for 60 credits or more are to agree on an education plan before the end of the first semester. The plan can be amended in agreement with the Faculty. The education plan is a mutual agreement between the student and NTNU concerning the duties and responsibilities of each party for study progress as well as the duties and responsibilities of each student towards his/her fellow students. The education plan gives the content and progress of the planned studies, cf. § 6 subsection 2.

§ 6 Registration

Students with the right to study at NTNU have to register for study and pay the semester fee at NTNU every semester before the deadline set by the University Director. The deadlines are given in the programme catalogue and on the Internet pages of NTNU.

For students who have agreed to an education plan, this registration is to determine and confirm the information in the plan for the current semester concerning

which courses the student will attend

which courses the student is to be given assessment in

other possible activities determined in the programme of study which the student follows

other information where adjustments are possible and which is relevant for the student's progress in his/her studies.

Students who are not obliged to agree on an education plan or who have not yet agreed on their education plan also have the duty to register. This registration is to indicate which courses the student will attend and receive assessment in.

The registration gives access to the resources offered by NTNU in order to enable the student to complete his/her courses that semester.

§ 7 Leave

The Faculty is to handle applications for leave. Leave from study is primarily given for one academic year. For shorter periods, leave can be given until the end on the semester. A student must have completed more than 30 credits in the courses included in the programme of study in order to apply for leave without stating a reason.

The Faculty may accept an application for leave for more than one academic year if there are special circumstances or pressing reasons, such as illness, extensive demands for child-care etc., military service or civilian service.

The student must accept that there may be changes in the programme of study during a period of leave.

§ 8 Part-time studies
Studies at NTNU may be taken on a part-time basis following agreement with the Faculty. The percentage of the normal study progress is to be included in the education plan.

§ 9 Students without the right to study
Those who have not been granted admission to study, have the right to receive assessment in a course in accordance with the Act relating to Universities § 40. The Faculty decides whether the requirements for registration have been fulfilled and may specify further regulations concerning the access to assessment in the absence of normal admission.

The University Director may decide upon a special deadline for registration for this type of assessment. The University Director can also decide that those who have not been admitted as students should pay an examination fee in order to cover the extra cost to the University in order to carry out such assessments.

§ 10 Education – delegation of authority in accordance with the Act relating to Universities § 44a
The Faculty has the authority to reserve certain lectures just for the students of the University or specified groups of students if the nature of the lectures makes this necessary, cf. the Act relating to Universities § 44a subsection 2.

The Faculty has the authority to allow people who are not following normal courses to attend lectures and participate in exercises whenever there is sufficient space, cf. the Act relating to Universities § 44a subsection 3.

§ 11 Suspension, exclusion – delegation of authority in accordance with the Act relating to Universities § 42 subsection 1
In cases where a student behaves in a way that seriously disturbs the work of fellow students or the general activities of the University, the Faculty has the authority to give a written warning stating that a continuation of such behaviour will lead to a suspension recommendation being presented to the Board. In cases that are not specifically related to an individual Faculty, this authority rests with the University Director.

The Faculty has the authority to give a written warning to a student that an exclusion recommendation will be presented to the Board that unless the suspension decision made by the Board is respected. In cases that are not specifically related to an individual Faculty, this authority rests with the University Director.

Complaints about decisions involving a written warning should be sent to the University Appeals Committee

Chapter 3 Organization of studies

§ 12 The academic year

The academic year consists of 40 weeks and is divided into two semesters. The autumn semester extends over 19 weeks and finishes before the end of the year. The spring semester lasts 21 weeks.

The Board of NTNU may approve an NTNU programme of study that deviates from the ordinary structure described in §12 subsection 1 if the duration of the programme is more than 40 weeks and has teaching and/or studies which can be pursued independently of the other studies at NTNU.

§ 13 Programme of study

Programmes of study at NTNU are organized along different lines, in the sense that they:

lead to a Bachelor's degree which subsequently forms the basis for a Master's degree.

result in integrated study progress which eventually may result in a Master's degree or a professional degree

lead to a Master's degree which is based on a completed Bachelor's degree or something that is equivalent.

The Board establishes and closes each programme of studies at NTNU. When the Board creates a new programme of study, it should simultaneously decide which Faculty is to administer the programme.

Each programme of study has a main profile, which gives disciplinary specialization of at least 80 credits. All programmes of study involving 5-year integrated Master's degrees should also satisfy the requirements of the Bachelor's degree.

Each programme of studies consists of different courses. The courses offered should each be of 7.5 credits or a multiple of that. The courses given in the programme of study are either compulsory or optional. The Faculty establishes new courses and closes old ones. Where an inter-Faculty board has been created for a group of programmes of study, this authority is vested in this board.

All programmes of study leading to a lower degree as well as integrated programmes of study leading to a higher degree or a professional degree, should contain three introductory courses:

Course 1 of 7.5 credits should be a first semester course common for all students.

Course 2 of 7.5 credits could either consist of courses that are potentially interesting for all groups of students or courses representing a field that differs from those included in the programme of study which the student has gained admission to. This course should primarily be included in the first or second semester.

Course 3 of 7.5 credits is specific for the relevant Faculty. It should be included in the first semester and form a part of the main profile.

§ 14 Programme catalogue and course description

Each programme of study is to be described in a programme catalogue. The Faculty administering the programme of study is to approve the programme catalogue. Where an inter-Faculty board has been established by NTNU to cover a group of programmes of study, this board is responsible for compiling the programme catalogue. The programme catalogue should contain information about possible admission requirements and ranking regulations for the programme of study. The programme catalogue should stipulate:

the teaching objectives and professional objectives of the programme of study

any preliminary knowledge that is recommended to take the programme of study

which Faculty is to administer the programme of study

which courses are included in the programme of study

how many credits the programme of study is worth

what course combination meets the main profile requirements

the structure of the programme of study, whether the programme of study has been divided into years, the areas of study, which are the introductory courses, what are compulsory and optional courses, and the ranking of the courses

the possibilities for student exchanges abroad

other decisions which affect the implementation and quality assurance

transitional arrangements as a result of the introduction of the Quality Reform

All courses are to be presented in a course description. Each Faculty is to provide a description of its own subject areas. Each course description should include:

teaching objectives

the qualifications necessary to gain admission to the course

the content of the course

teaching methods

how many credits the course is worth

the extent of the education

possible compulsory education

which activities are included, their extent and which of them are compulsory, for instance courses in methodology, exercises, work experience, field courses, excursions, laboratory work, group exercises, semester papers and other written exercises, artistic performances

the requirements for receiving assessment

activities that will be subject to on-going assessment and which of them will count in towards the course grade

the organization of a possible final examination (how often, when in the semester, date and similar information)

what examination aids can be used

the form of assessment and grading scale for the assessments during the course

the weighting of assessments during the course that are to count in the course grade

§ 15 Recognition of external studies/practical experience
The Faculty is to handle applications concerning recognition of external studies or practical experience in accordance with the Act relating to Universities §§ 47, 48 and 49. A condition is that the external education has been approved as education at university or college level.

The Faculty is to handle applications concerning the approval of an equivalent degree or education in accordance with the Act relating to Universities § 48 subsection 2.

§ 16 Exemption from assessment
The Faculty is to grant exemption from the final examination, test or other assessment in cases where the student can document that similar assessment has already been done by NTNU or another

institution. The Faculty may also grant exemption on basis of other recognized examinations, tests or other kinds of assessment, or on basis of documented practical experience, in accordance with the Act relating to Universities § 49. When processing such applications for exemption, the Faculty should take both a student's previous education into account, as well as the assessment in terms of level, extent and content.

The student is to send such an application to the Faculty that administers the programme of study in which he/she has the right to study.

§ 17 Reduction of credits
If a student receives assessment in courses where the content wholly or partially overlaps, the total of credits for these courses should be reduced accordingly. The Faculty decides the extent of the reduction in each separate case. If some of the courses to which the student has gained admission to are compulsory, the reduction should take place in the optional courses. The reduction should be done in a way that provides the student with the best grade that has been awarded. The basis for the reduction should be evident from the transcript or certificate.

Chapter 4 Degrees

§ 18 Awarding degrees
The Faculties award degrees with their respective titles in accordance with their delegated responsibility from the Board when the latter approves a new programme of studies.

§ 19 Bachelor's degree
The Faculty awards the Bachelor's degree on basis of a completed programme of study or a free selection of courses in cases where the student has completed a total of 180 credits. The 180 credits should include:

a main profile of at least 80 credits, where the programme catalogue defines the requirements of the main profile

introductory courses of 22.5 credits, ref. § 13 subsection 4.

If the Bachelor's degree is not based on an established programme of study, the Faculty that awards the degree is to cover the area where the main profile of the disciplinary content belongs. If the student has a degree where more than one main profile is included, the student can decide which of the relevant faculties should award the degree.

§ 20 Master's degree
In order to gain admission to a Master's programme which is based on a lower degree, the student must

have been awarded a Bachelor's degree or its equivalent

have received a passing degree in courses corresponding to 80 credits in the subject area of the relevant Master's degree, as specified in the programme catalogue for the relevant Master's programme

have fulfilled the other requirements for admission, as specified in the programme catalogue for the Master's programme.

When admission to a Master's programme is based on experience, the second point is not valid. Instead, at least 2 years of relevant professional experience is demanded.

In order to receive a Master's degree, the student must

either satisfy the admission criteria of the Master's programme and in addition have passed relevant studies corresponding to 120 credits, where the programme catalogue may allow 30 credits to be replaced by relevant practical experience

or have completed a course of studies corresponding to 300 credits, where the requirements of the Bachelor's degree are included.

In the Master's programme described in § 20 subsection 2, a Master's thesis corresponding to at least 30 credits, but no more than 60 credits, should be included.

In order to receive a Master's degree corresponding to less than 90 credits, the specified requirements relevant for such a degree programme must have been met.

§ 21 Candidata/candidatus medicinae
In a programme of studies leading to the degree candidata/candidatus medicinae, introductory courses as defined in § 13 subsection 4 are included. The degree is based on a coherent course of study corresponding to 360 credits. The Faculty of Medicine will decide the content of the programme of study as well as additional criteria for awarding the degree.

§ 22 Candidata/candidatus psychologiae
In a programme of studies leading to the degree candidata/candidatus psychologiae, introductory courses as defined in § 13 subsection 4 are included. The degree is based on a study of 60 credits and a subsequent, coherent professional study corresponding to 300 credits. The Faculty of Social Sciences and Technology Management will decide the content of the programme of study as well as additional criteria for awarding the degree.

Chapter 5 Assessment

§ 23 Assessment
In all courses or groups of courses included in a programme of study, the possibility for assessment and subsequent grading of the knowledge and skills of the students should be available each academic year. The assessment should be given as a final evaluation, or possibly an evaluation based on different types of on-going assessments described in the programme catalogue.

In order to receive assessment, the student must have registered that same semester, and also meet the academic requirements for assessment given in the course description.

A student who has handed in a paper in an assessment cannot prevent the assessment from being done. The student cannot block an assessment if the examination began with an oral test.

§ 24 Examination periods
Final examinations take place at the end of each semester. The University Director decides the time of the examination periods. The dates are given in the programme catalogue. The University Director may decide to organize the examinations outside the regular examination periods, if practical considerations related to the courses or other things make this necessary.

§ 25 Final examination
The course description states whether the course is to be concluded with a final examination and what requirements the student has to satisfy in order to sit the final examination. A grade is always awarded at the final examination.

§ 26 Instructions at final examination
The University Director can issue general instructions for

students who are allowed to sit a final examination

invigilators

the presence of teaching staff during a written final examination.

These instructions are found in the programme catalogue.

§ 27 Legitimate leave of absence at final examination
If a student is unable to sit a final examination due to illness or other pressing reasons, an application for approved absence has to be submitted to the Division of Student and Academic Affairs. The application, which has to be submitted at the latest one week after the first final examination to which the absence applies, has to contain information about which final examinations the application concerns. Documentation should be included in the application. The period of absence is to be indicated on the medical certificate.

A student who is taken ill during a final examination should notify the principal invigilator in the examination hall or the external examiner/internal examiner at oral examinations. The student subsequently has to see a doctor quickly and submit a medical certificate, as stated in the regulations in § 27 subsection 1.

§ 28 Re-sit examination
In a course where the final examination is to be held only once in the academic year, a re-sit examination is to be arranged before the next normal examination. Students with an approved absence may take the re-sit examination. This also applies to students who have not passed the initial examination.

Students must register for the re-sit examination within the deadline stated by the Faculty or in the supplementary regulations.

The Faculty can in agreement with the University Director decide to organize the re-sit examination during the same period as the normal examination, in the next examination period or at a later time outside the examination period. For certain programmes of study, the time of the re-sit examination will be a standard arrangement that can be stated in the supplementary regulations.

During a re-sit examination, the quality of the assessment should correspond to the one given at the normal final examination. Alternative forms of assessment at re-sit examination should be stated in the course description.

§ 29 Approved absence from other types of assessment than final examination
The Faculty should, if practically possible, ensure that students with approved absence from other types of assessment than in the final examination can be assessed during the semester and before any possible final examination in the course.

§ 30 Re-examination
A student who has failed to pass the examination in a course has the right to repeat the examination and receive a new assessment. The course description or the supplementary regulations determine what areas have to be repeated after a student has failed to pass an examination.

The student has the right to complete a second period of practical work experience if he/she failed to pass the first period of practical work experience.

If the student has passed an examination, he/she has the right to repeat that examination once in one course every academic year in order to improve the grade. In this case, the best grade will count. In cases where the grade is based on a number of partial assessments, all the different components have to be repeated.

§ 31 New assessment of Master's thesis
A student may submit a new or revised Master's thesis once in cases where the thesis has not been awarded a passing grade. If the thesis has been given a passing grade, there is no opportunity for a new assessment in the same programme of study.

§ 32 Syllabus at new assessment/re-sit examinations
In case of new assessment and re-sit examinations, the syllabus of the course at the time of the new assessment or the re-sit examination is to be valid. In cases of changes in the national framework plans, the Ministry may decide upon special arrangements. If there are significant changes in the syllabus, there is to be a possibility to be assessed according to the former syllabus for at least one year, but no more than two years after the introduction of the changes.

§ 33 Adjusted forms of assessment
In order to give all students approximately the same working conditions when receiving assessment, students with particular requirements that have been sufficiently documented may apply for an adjusted form of assessment. Such an assessment does not imply any reduction in the general degree requirements.

The adjusted forms of assessment may be practically oriented in order to allow the use of special aids or extended time. In particular cases, types of assessment that differ from the normal one may also be accepted.

If the requirements of the student are permanent, the use of special aids may be allowed throughout his/her studies.

An application, including documentation, should be sent to the Division of Student and Academic Affairs before the registration deadline. The application is to be decided by the University Director.

Applications for different forms of assessment from the one given in the course description are to be decided by the University Director in consultation with the Faculty.

Students with sudden acute requirements should as far as possible be given the same rights with regard to assessment as described above. An application containing sufficient documentation should be sent to the Division of Student and Academic Affairs as soon as possible after the acute situation has arisen.

§ 34 Form of language/language by written assessment
Arrangements with regard to the form of language used in examination papers are given in Regulations concerning forms of language in examination papers of 7 July 1987. The regulations are in accordance with the Act of 11 April 1980 no. 5 concerning the use of forms of language in the public services.

Examination papers written in Norwegian should contain a version in the other form of the language (*bokmå*l and *nynorsk*). The exception is examination papers in the subject Norwegian. In case all the students prefer the same form of language, the examination papers may only be written in this form. The students choose their form of language as they register for an examination.

If the lectures are given in a non-Scandinavian language, the examination paper should also include a version in the language that has been used in the lectures. Applications requesting the examination paper to be in a language different from Norwegian or that used in teaching are to be decided by the Faculty.

If a significant portion of the curriculum of the course is written in a language that is different from the one used in lectures, the Faculty may decide that the examination paper should contain a version in this language as well.

§ 35 Oral examinations behind closed doors
At the request of the student, the Faculty may decide against making an oral examination public in cases where there are pressing reasons, ref. the Act relating to Universities § 50 no. 3. The Faculty should ensure that the assessment in these cases also satisfies the normal academic level in the programme of study.

§ 36 Cheating/attempts at cheating
In cases of cheating/attempts at cheating, the University Appeals Committee may cancel the assessment in accordance with the Act relating to Universities § 54. The same applies to the recognition of courses, credits or education, as well as exemption from assessment.

In accordance with the Act relating to Universities § 42 subsection 3, the University Appeals Committee may expel a student who has behaved contrary to the regulations for up to one year. The student may also lose his/her right to sit for examinations within institutions affected by the ruling for up to one year.

More detailed information about reactions to cheating is given in Guidelines for reactions to cheating/attempts at cheating at examinations at NTNU of 30 May 2001.

Chapter 6 Determination of grades

§ 37 Examiners
The Faculty appoints the examiners, ref. the Act relating to Universities § 50 subsection 2. The examiners are appointed for 3 years at a time.

At least two examiners are to be present at oral examinations and assessment of vocational training or other activities of a type that cannot be subsequently checked. At least two examiners, of whom at least one should be external, should be present at the assessment of Master's theses, ref. the Act relating to Universities § 50 subsection 2.

The Faculty determines the guidelines regarding external participation at the assessment, whether general or a specific programme of study. This could be done by external participation in each separate assessment or through an external evaluation of the assessment procedures.

§ 38 Deadlines for determination of grades
In accordance with the Act relating to Universities § 50 subsection 4, the deadline for determination of grades is 3 weeks following the examination, unless special reasons make it necessary to use more time. When special reasons occur, a new deadline should be announced. The deadline for assessment of the Master's thesis is 3 months after the thesis has been handed in.

Chapter 7 Grades

§ 39 Grading scales
Assessment is given on basis of grading, either through a scale ranging from A to F or on the basis of Passed/Not Passed. Grade A is the highest pass grade, while Grade E is the lowest pass grade. The grading scale is based on the following definitions and general qualitative descriptions:

Grade	Definition	General, qualitative description of assessment criteria
A	Excellent	Excellent performance that makes the candidate outstanding. Shows a substantial degree of independent thinking.
B	Very good	Very good performance well above average. Shows some degree of independent thinking.
C	Good	Average performance that is adequate in most areas.
D	Satisfactory	Below average performance, the candidate has clear gaps in knowledge.
E	Sufficient	Performance that satisfies the minimum requirements, but no more.
F	Fail	Performance that does not satisfy the minimum requirements.

Passed/Not Passed is used where assessment is not required.

The Faculty should work out descriptions of the assessment criteria that are specific for each subject.

§ 40 Grade Point Average
The Grade Point Average can be estimated as long as letter grades have been given for at least 75% of the credits. When estimating the Grade Point Average, all grades in each separate course should be included. The Grade Point Average is determined as follows:

Each letter grade is replaced by its equivalent number, A=5, B=4, C=3, D=2, E=1.

The numerical equivalent is multiplied by the number of credits in the course, and the separate sums of credits and numerical equivalents are added up for all courses that are included.

This total is subsequently divided by the total number of credits included in all the courses.

The quotient is calculated to one decimal place.

The Grade Point Average is the letter degree which represents the equivalent of the full number of the quotient after the normal rounding-up rule has been applied.

§ 41 Final grade
Whether or not a final grade is to be given is decided by supplementary regulations.

The final grade means the overall grade for the entire programme of study at the award of degree. The grade is a weighted average based on the letter grades in the courses included in the degree. In order to get a final grade the student must have a pass mark in courses at NTNU corresponding to at least 120 credits, and at least 75% of these must have been given a letter grade. The method for calculating the final grade is the same as that described for the Grade Point Average in § 40.

§ 42 Explanations and appeals
Cases involving the explanation of grades and complaints about them are to be handled in accordance with the Act relating to Universities § 52. Requests for an explanation of grades and complaints should be forwarded to the Faculty. If written guidelines for determining grades have been issued, these are to be made available for students after the grade has been decided, ref. the Act relating to Universities § 52 subsection 3.

If there is a new assessment of a grade, at least two new examiners, including at least one external, are to be involved, ref. the Act relating to Universities § 50 subsection 5. The new examiners should not have any information about the initial grade, the explanation for it or the basis of the student's complaint.

When on-going assessment is used, the student cannot lodge a complaint until he/she has received the grade in the relevant course or group of courses. Although the student cannot lodge a complaint following each separate assessment, he/she has the right to an explanation of the grading for each separate assessment.

Complaints against procedural errors can be submitted in accordance with the Act relating to Universities § 51. The complaint is to be sent to the Faculty. In accordance with § 51 of the Act relating to Universities, complaints can only be made about on-going assessments which will be included in the certificate or that count as part of the final grade.

Complaints about the grading of group work, where a common grade is given, all participating students must agree and sign the complaint. The same applies to complaints about procedural errors in these cases.

Chapter 8 Certificates and transcripts

§ 43 Certificates
Certificates are issued after the completion of a degree or an educational programme. A certificate is normally issued only once for the same degree/education. The certificate is to contain information about the programme of study the degree is based on. The certificate should show the semester and year the degree/educational programme was completed. The final grade (if applicable) is to be given on the certificate. Diploma supplements form a part of the certificate. A transcript of grades showing the courses the student has passed should be attached to the certificate.

In order to receive a certificate for a completed degree at NTNU, at least 60 credits have to been taken at NTNU. Of the 60 credits, at least 30 must belong to the main profile. With regard to a higher degree, the Master's thesis must be part of the 60 credits.

§ 44 Transcript
Upon request, students are to receive a transcript confirming their passing grades. The transcript should show the grades given in each course, the year and semester in which the grades were obtained, as well as the title and number of credits for the courses.

Chapter 9 Supplementary regulations and implementation

§ 45 Supplementary regulations
The Faculty has the authority to add supplementary regulations to these regulations. With inter-Faculty programmes of study, the supplementary regulations are to be accepted by all faculties involved. When an inter-Faculty board has been established by the Board of NTNU for a group of programmes of study, the supplementary regulations should be decided by the inter-Faculty board.

§ 46 Implementation
These regulations are to come into force from the academic year 2003/2004.