COURSE CATALOG 2007/2008

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WELCOME TO NEW STUDENTS

Founded in 1859 as the only Norwegian agricultural post-graduate college, the Norwegian University of Life Sciences (UMB) has broadened it's perspectives and is now recognised as a leading international centre of knowledge focused on higher education and research within environmental- and biosciences, as well as development studies, business studies, land use and natural resource management and engineering.

UMB offers an increasing range of Master programmes in English, as well as the Bachelor in Developmental Studies. Whether you wish to study food in production, utilisation, trade or for the benefit of your health or simply want a business degree; there are numerous opportunities at UMB for students who care about sustainable development in the world to obtain valuable knowledge. About 1/3 of our courses are offered in English, also within Norwegian programmes. This means that you are able to choose elective courses also outside the core your own study programme.

I encourage you to study what we have on offer in this pamphlet. I bid you welcome to UMB in case you choose to apply and are chosen to become one of our students.

Happy reading!

Trine Hvoslef-Eide
Prorector for Studies at UMB

STUDYING AT UMB

UMB offers a broad range of study programmes that closely correspond with major research issues related to food and environmental sciences, biology, land use and natural resource management. UMB is Norway's leading institution of higher education in its field.

High professional quality, a high degree of teacher-student interaction and a pleasant social and physical environment characterise education at UMB. A broad range of study programmes are offered at the Bachelor's, Master's and PhD level.

About 180 of the 600 courses at the Bachelor's and Master's level are taught in English, as well as many PhD level courses. Seven Master's level programmes are conducted entirely in English. Besides theoretical and scientific education, emphasis is placed on practical training. Around 30% of UMB students conduct part of their studies abroad. In addition, the Continuing Education Programme offers research-based courses geared towards the public and private sectors.

Study programmes
UMB's study programmes and courses are research-based, maintain a high degree of scientific and pedagogical quality and are described, conducted and evaluated in accordance with the intentions of the Norwegian Quality Reform of Higher Education. Focus is placed on strengthening staff-student interaction, increasing the scope of study and assessment methods, promoting internationalisation, and improving the students' general learning environment.

Internationalisation
In total, there are some 2,800 students at UMB, of which more than 10% are international students. UMB has exchange agreements with approximately 50 universities worldwide, including 6 Nordic, 44 European and 8 North American institutions. Moreover, UMB has various institutional partnerships with universities in southeastern Europe and in developing countries in the South. These partnerships are mainly carried out through the Department of International Environment and Development Studies/Noragric.

Continuing education
UMB's activities in the field of continuing education are coordinated by the Centre for Continuing Education (SEVU), which uses up-to-date information technology as a distance-learning tool for its students.

Overview of academic calendar 2007/2008

Autumn semester 2007
Introduction Week for new international students: 6-10 August
Registration period for new students: 11 - 12 August
Semester start: Monday week 33
August block: 13 August – 4 September
Matriculation (for degree students): Friday 17 August, 13:00 , Aud. Max.
Deadline for registration/withdrawal from August block: Friday 17 August
Introduction course for new students: Wednesday, 15 August from 12:00

Examinations in August block: Wednesday 5 September
Autumn parallel period: 10 September – 7 December
Deadline for registration for Autumn parallel: 15 September
Deadline for Semester fee payment: 15 September
Deadline for registration for re-examinations in January: 15 September
Deadline for withdrawal of Master's thesis: 15 November
Deadline for withdrawal from Autumn parallel: 24 November
General student assembly: 28 November, 12: 000 - 16:00
Deadline for submission of Master's thesis: 15 December
Examination period in Autumn parallel: 10 - 20 December
Semester ends: 21 December

Spring semester 2007
Re-examination period: 2-4 January
Semester starts: Monday 7 January
January block: 7 -29 January
Deadline for registration/withdrawal for January block: 11 January
Examinations in January block: Wednesday 30 January
Spring parallel: 31 January – 16 May
Deadline for Semester fee payment: 15 February
Deadline for registration for Spring parallel/June block/re-examinations in May: 15 February
Deadline for withdrawal of Master's thesis: 15 April
General meeting for student : 29 April
Deadline for withdrawal from Spring parallel/June block: 30 April
Deadline for submission of Master's thesis: 15 May
Examination period Spring parallel: 19 30 May
June block: 2 - 26 June and 4 - 8 August
Semester ends: 27 June

If the above dates fall on a Saturday, Sunday or public holiday, dates and deadlines are postponed to the next working day. There is no teaching from Monday before Easter until Easter Monday; teaching starts again on the first Tuesday after Easter. There is no teaching on Whit Monday.

SiT – Student information (www.umb.no/sit)

The Student Information Centre answers most of the questions from UMB's potential students, students, and graduates. In addition to SiT, there are student advisors on all study programmes.

For general questions:
- Semester registration
- Registration for exams
- Course catalogue
- Student advising
- Student exchange programs
- Etc.


Photo: Håkon Sparre

Please contact the Student Information Centre at:

Phone: (+47) 64 96 61 00/64 96 59 73.
Email: sit@umb.no

RULES AND REGULATIONS

On the SiT website (www.umb.no/sit) you will find all study regulations and guidelines for the Norwegian University of Life Sciences (UMB). You will also find an English-Norwegian, Norwegian-English list of administrative terminology used in academia.

The terminology list is approved by the Norwegian Council for Higher Education.

Rules and Regulations
UMB's revised regulations as of 01 August 2006:

- Admission Regulations.
- Regulations for Studies
- Regulations for Examinations
- Regulations for awarding the Bachelor's Degree
- Regulations for the Degree Philosophiae Doctor (PhD)
- Regulations for the Degree dr.philos
- Regulations for the Doctor Scientiarum Degree

The actual regulation for awarding Master's degrees has not yet been translated by the Ministry of Education and Research.

Guidelines:

- Guidelines for Internal and External Examiners at UMB
- Guidelines for the use of Personal Computers in Centrally Administered, Written and Supervised Examinations at UMB
- Examinee Guidelines for Centrally Administered, Written and Supervised Examinations at UMB
- Examinee Guidelines for Centrally Administered, Oral Examinations at UMB
- Invigilation Guidelines for Centrally Administered, Written Examinations at UMB

Internal routines:

- Procedures for Handling Cases of Cheating
- Exam Declaration

Semester registration
In order to follow lectures, sit for examinations, submit a thesis or use student and campus facilities, students have to register each semester. Semester registration is performed online: www.StudentWeb.no

Teaching schedule
You will find the teaching schedule on the SiT website for:

Exams, grading system and re-examination
Information about how to register for an exam, the exam schedule, closing date for withdrawing from an exam, where to find the exam results etc.

Evaluation and exams
All courses have their own exams. Exams are held as a continuous assessment and/or a final examination at the end of the course. There may also be mandatory activities, e.g. seminars or excursions, that have to be completed before the exam.

The grading system
The course descriptions shall state whether a course uses the ”pass/fail” or letter marking system. Letter marks range from A to F, where A is the highest pass mark and E the lowest pass mark. The letter F is used to designate ”fail”. The letter grades and their general evaluation criteria are described below:

A	Excellent	An excellent performance, clearly outstanding. The candidate demonstrates excellent judgement and a high degree of independent thinking.
B	Very good	A very good performance. The candidate demonstrates sound judgement and a very good degree of independent thinking.
C	Good	A good performance in most areas. The candidate demonstrates a reasonable degree of judgement and independent thinking in the most important areas.
D	Satisfactory	A satisfactory performance, but with significant shortcomings. The candidate demonstrates a limited degree of judgement and independent thinking.
E	Sufficient	A performance that meets the minimum criteria, but no more. The candidate demonstrates a very limited degree of judgement and independent thinking.
F	Fail	A performance that does not meet the minimum academic criteria. The candidate demonstrates an absence of both judgement and independent thinking.

If ”pass/fail” is used, the limit for what is considered ”pass” must be determined by the course responsible and external examiner. A ”pass” mark shall express that the examinee has a satisfactory level of knowledge in the course.

When using an external examiner, the ”pass” mark can only be given if the person responsible for the course and the external examiner agree. If there is disagreement to whether or not the effort was satisfactory, the ”fail” mark is given.

Criteria for lower- and upper division courses and master level courses at UMB
Students must qualify for university-level studies in Norway (”General study competance”) in order to be allowed to register for any courses beginning at the 100-level. The following rules have been set by the UMB Committee for Academic Affairs for classification of courses at the 100-, 200-, 300- and 400 level (unofficial translation):

During UMBs course approval process, the responsible academic department has to ensure that the course meets the university's rules for academic offerings, including the above rule about criteria for assigning a course level code. However, the rule is not strictly enforced through criteria for required prerequisites for 200- and 300-level courses. The course descriptions state what previous knowledge it is assumed that students taking the course have. The students are responsible for ensuring that they have this necessary background.

In practice the following general distinctions can be made between courses at the 100-, 200- and 300 level at UMB:

(Lower division courses)
100-level courses focus on basic knowledge and working skills within a subject, as a basis for further studies or work.

(Upper division bachelor courses)
200-level courses develop a critical and more in-depth understanding of the field. These courses require a greater level of independent thinking and initiative. It is assumed that students have a basic knowledge of the subject at an introductory level before taking the course.

(Master level courses)
300-level courses require a greater amount of high-level intellectual skill such as synthesis of knowledge from different fields, evaluation and the ability to conduct critical analysis. Master level courses focus on specific in-depth knowledge, skills and attitudes relevant for research and development work in the field of study. 300-level courses require a high level of independent thinking and initiative.

UNIVERSITY LIBRARY

The Norwegian University Library of Life Sciences (UBMB) offers documentary- and lending services to staff and students at UMB. It also acts as the National Agricultural Library of Norway. Each of the departments at the University has its own library, and these collections are registered in the University Library's catalogue, searchable on the BIBSYS database. The Library participates in the AGRIS/CARIS Network coordinated by FAO.

STUDENT WELFARE AND POLITICS

While studying, you should live your life in the best possible way. What kind of student facilities and accommodation are offered? What about social activities for students?

University Foundation for Student Life in Ås (SiÅs)
Internet address: http://www.siaas.umb.no/eng-ind.htm
All students in Norway must pay a semester fee to a student union. When studying at UMB, you must pay NOK 340 to the University Foundation for Student Life in Ås. This includes NOK 20 to the Norwegian Students and Academics International Assistance Fund (SAIH).

The University Foundation for Student Life in Ås was established in 1955, pursuant to the Act of 28.06.96 of Student Unions. The University Foundation for Student Life in Ås is the students' welfare organization at UMB, and shall:
- provide the students with good and reasonable welfare services
- promote the students' interests
- contribute to UMB being an attractive place to study and work

The University Foundation for Student Life in Ås is in charge of student accommodation, sports centre, book shop, print shop, restaurant and cafeterias, nursery, kiosk and room booking. SiÅs will do its best to make your every-day life as a student enjoyable. You can read more about this on the SiÅs website or in the guide «ABC for Thorvald og Thora», which all students receive when they start studying at UMB.

Studentsamfunnet in Ås (Student Community)
Internet address: http://samfunnet.umb.no/
The student community at UMB consists of 60-70 different clubs and societies that provide students a broad range of unique social activities. Studentsamfunnet in Ås is the oldest and most influential society at UMB. Studentsamfunnet owns the building that houses most of the social activities.

Student Board
Internet address: http://www.umb.no/?avd=52
The Student Board (NSU Ås) deals with student democracy, including the daily contact with SiÅs and contact with the different student representatives in various boards, assemblies and committees. The Student Board is the administrative head of the Student Parliament, but the Student Parliament is in charge of day-to-day operations. The Student Committee consists of elected representatives from each department + elected members of the Student Board. The highest body in the student democracy is the general assembly (Allmøtet). Here, all students have meeting and voting right. Elections to the University Board take place here. Representatives to the Student Board are elected at the general assembly, which is held each autumn and spring. The representatives to the University Board are also elected here. At the departments' general assemblies, student representatives on department level are elected. All students have meeting and voting rights on their departments' general assemblies.

UMB FACTS

The Norwegian University of Life Sciences comprises 8 departments. High professional quality, a high degree of teacher-student interaction and a pleasant social and physical environment characterise education at UMB. UMB is recognised as a leading international centre of knowledge, focused on higher education and research within environmental- and biosciences. The university's main specialisation areas are:

- Biology
- Environment
- Food
- Land use and natural resource management

Together with other research institutes established on and around the "Campus Ås", UMB provides state-of-the-art knowledge based on a broad range of disciplines. Study programmes offered at the Bachelor's, Master's and PhD level include:

- Animal Science
- Aquaculture
- Biotechnology
- Chemistry
- Applied Mathematics and Statistics
- Physics
- Spatial Planning
- Biotechnology
- Environment and Natural Resources
- Plant Science
- Forestry
- Ecology and Natural Resource Management
- Food Science
- Landscape Architecture
- Economics and Resource Management
- Development Studies
- Teacher Education in Natural Science

About 180 of the 600 courses at the Bachelor and Master level are taught in English, as well as many PhD level courses. Seven Master level programmes are conducted entirely in English, and one Bachelor programme is fully conducted in English every other year. Besides theoretical and scientific education, emphasis is placed on practical training. Around 30% of UMB students conduct part of their studies abroad. For detailed information on UMB's study programmes, see the Programme Descriptions for Prospective Students.

Meeting tomorrow's challenges
UMB was established in 1859 as the only Norwegian agricultural post-graduate college, primarily as an educational institution. Research then received a primary function in 1897. On 1 January 2005 the institution was awarded Norwegian university status. UMB, under Norwegian law and in follow-up to the European Bologna Declaration, is implementing a quality reform and has restructured its courses, credits and degrees to meet European standards.

In total, UMB has some 2,800 students of which nearly 300 are PhD students. Annually, the University confers about 40 PhD degrees upon successful candidates. There are many different nationalities at UMB; international students making up more than 10% of all students. Of the 870 University staff, more than half hold scientific positions.

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Studyprogrammes Bachelor

Bachelor in Development Studies

Language of instruction: English.

Credits: 180

For information, contact: Department of International Environment and Development Studies - Noragric

Admission requirements:

Higher Education Entrance Qualification;

Relevance for society:

In an increasingly globalised world there is a growing need for knowledge about developing countries and North-South cooperation. The problems faced by developing countries are multifaceted, and require solutions that draw on a wide range of approaches. The programme's unique combination of natural and social science approaches is tailored to meet this need.

Degree awarded: Bachelor

The degree qualifies students for (further studies / jobs):

The Bachelor's degree provides the graduates with the opportunity to work in international organisations, with development aid and in primary schools (with an additional pedagogical education). The Bachelor's degree also provides opportunities for further education, including the Master's programmes Development Studies (DS), International Environment Studies (IES) and Agroecology (AE), offered at UMB. By selecting given combinations of courses it is also possible to qualify for the English Master's programmes Development and Natural Resource Economics, and Ecology, and the Norwegian Master's programmes Management of Natural Resources, Forest, Environment and Industry, and Nature-based Development and Innovation, all offered at UMB. The Bachelor's degree also gives a basis for applying to similar programmes at other higher education institutions in Norway or abroad.

Internationalisation:

An international focus is an integral part of the programme, both thematically and institutionally. Most courses offered are concerned with international issues, several will be offered in English, and students will spend one semester at a partner university in a developing country. The programme also aims to attract international students.

Cooperation with other institutions:

Noragric has broad international competence and this is reflected in the programme. UMB has established institutional cooperation with several universities in developing countries. Students will be offered exchange for one semester at one of our partner universities. It is also possible to take parts of the programme in other European countries.

Possibilities for study abroad:

As an integral part of the programme, the students will spend the 4th semester at a university in a developing country. It will also be possible to extend the stay to undertake field work for the Bachelor's project.

Learning outcomes:

Students will acquire an overview of the basic problems facing developing countries and the factors influencing development processes. Students should become knowledgeable about both social and natural science approaches to the study of development, and be able to combine different approaches. The programme gives students a basis for critical and academic thinking. Students should also acquire skills in collecting and analysing information, and presenting findings orally and in writing.

Learning and teaching methods:

The programme utilises a wide range of teaching and evaluation methods. Because working with development often involves adapting knowledge to new situations, many courses use case-oriented teaching and group work. This ensures that students take an active interest in their own learning.

Student Assessment:

The Bachelor's programme consists of courses offered by Noragric and other departments. The courses offered utilise a wide range of teaching and learning approaches.

Contents:

The programme consists of 75 ECTS compulsory courses, in addition to exchange of 25 ECTS and a 15 ECTS bachelor thesis and 60 ECTS of elective courses. English-speaking students have little flexibility for the elective, and will choose courses with in development and environment studies, ecology or economy.
Students must have an approved study plan. To be approved, the elective part of the programme should follow an example plan within one of 7 thematic areas or demonstrate an academic focus in another area of the student's choice. The student must take a minimum of 100 credits at the 200 level. Supervisors will provide guidance regarding the choice of electives. The thematic focus areas are: Institutions and Social Theory, Development Economics, Pollution, Water and Soils, Agroecology, Ecology and Genetic Resources.

Student guidance:

Students will receive guidance from staff at Noragric. Supervision will be given in connection with semester assignments and the final thesis. Each student must tailor his or her own study plan, stating which courses will be included in the degree. The plan has to be approved by Noragric within the first two months of the programme. Individual guidance will be provided in this process.

Quality assurance:

The programme adheres to UMB policy and evaluates all courses anonymously after completion. Results from the evaluations will play a major role in future revisions of the programme.

Studyprogrammes Master 2-year English

Master in Agroecology

Language of instruction: English.

Credits: 120

For information, contact: Department of Plant and Environmental Sciences (IPM), www.umb.no/ipm

Admission requirements:

Applicants must demonstrate English language ability in accordance with the UMB regulations for programmes taught in English. Applicants must hold a Bachelor's degree or equivalent qualification from university-level studies in agriculture, ecology, biology or a relevant social science. 5-20 students are admitted per year.

Relevance for society:

Farming and food systems are ecologically, economically and socially important in all societies. Worldwide there is a need for graduates who can deal with such systems, which are characterised by complexity, multifunctionality and rapid change. The Master's degree programme in Agroecology provides a scientific and holistic basis for describing, analysing, and improving farming and food systems. Topics include environmental, production-related, economic and social challenges in farming and food systems; interdisciplinary approaches to dealing with complex processes of change; sustainable development in a local and global context; ecological organic agriculture. The programme prepares students for a wide range of positions within conventional and organic agriculture and food systems, e.g., within the advisory service, development projects, industry sales and technical support, management of agricultural and natural resources, environmental protection, and education.

Degree awarded: Master

The degree qualifies students for (further studies / jobs):

Graduates may be employed in the agricultural, rural development, resource management or educational sectors.

Internationalisation:

The programme has an international profile and most of the students are non-Norwegian. The programme is Nordic (NOVA University network) and international by nature and is taught in English. Teachers from NOVA member institutions and the USA contribute in the first semester. There is also cooperation with other UMB departments and other Norwegian institutions.

Cooperation with other institutions:

The programme is part of the NOVA University network cooperation and two evaluation- and planning meetings are held annually with Nordic partners. In 2003 the programme underwent an external programme evaluation by an international expert committee.

Possibilities for study abroad:

There are good opportunities for students to study abroad within the normal time frame of the programme. The second and third semester of the programme can be completed in Norway or another country. The Network for Agroecology and Ecological Agriculture (NOVA and Socrates) offer courses that may be integrated into the elective part of the programme in the second and third semester. The most important cooperating universities are in Sweden, Denmark, Finland, Wales, Italy, Germany, France, Netherlands and the USA.

Learning outcomes:

As general learning goals, the graduates of the programme should: - Have knowledge of farming and food systems - Have the ability to handle complexity and change - Have the ability to link theory to real-life situations - Be good communicators and facilitators - Be autonomous and lifelong learners. Knowledge goals: - Agroecosystem/food system structure and functioning - Methods for dealing with complex issues in agriculture and the wider food system, including systems analysis and assessment of overall system sustainability - Specific features of ecological agriculture (organic farming) Skills goals: - Action competence: how to manage complexity and change, bridge the gap between knowing and doing, transform knowledge into action and link theory to practical situations - Teamwork - Communication - Autonomous, life-long learning (learning how to learn). Attitudes goals: - Learning to deal with ethics and personal and cultural values - Personal attitudes such as being open-minded, critical, spirited, determined, approachable, exploring and communicative.

Learning and teaching methods:

The programme starts with a semester introducing the students to the structures and functions of agroecosystems, methodology for describing, analysing and improving such systems, and individual and group-based learning. The didactic approach is experience-based learning supported by lectures, seminars and supervision related to project work on real-life cases. The instruction methods in later semesters depend on which courses are chosen.

Student Assessment:

The evaluation of students learning is an integral part of the learning process. The evaluation emphasises the student's ability to develop action competence by linking theory and practice. In the first semester, this is evaluated on the basis of written group and individual assignments, the student's contribution to the class and oral exams. Evaluation in later semesters depends on the courses chosen.

Contents:

The program consists of the following parts: 1. An elective introduction to agroecology: The ecology of food and farming systems (5 credits) (PAE301), web-based 2. Core courses in agroecology emphasising farming and food systems (30 credits) (PAE302 and PAE303).

Student guidance:

The courses in the first autumn semester are based on facilitated project work. Students are also advised regarding their study plan and future thesis work. Later these issues are followed up during seminars about every two weeks (for students who stay on the UMB campus) or by e-mail (students who choose to continue elsewhere).

Quality assurance:

The department and teachers make active use of the students' feedback from the UMB web-based course evaluation system to improve the courses, and they report on actions taken. In addition, regular evaluation meetings are held between students and teachers in the first semester, and a written evaluation report is produced.

Master in Aquaculture

Language of instruction: English.

Credits: 120

For information, contact: Department of Animal and Aquacultural Sciences (IHA), www.umb.no/iha

Admission requirements:

Bachelor's degree that includes minimum: 10 credits mathematics, 10 credits chemistry/physics, 10 credits statistics and 60 credits biology courses. English at a level equivalent to the requirements set by the TOEFL test or similar, with results approved by the International Student Office of UMB. Applicants must have university level courses with a total of 180 credits in basic knowledge in nutrition, chemistry and physics .

Relevance for society:

The aquaculture industry is growing both in Norway and abroad. The industry requires leading knowledge of breeding, nutrition, engineering, product quality and economics at the Master's degree level.

Degree awarded: Master

The degree qualifies students for (further studies / jobs):

The degree gives opportunities for positions within the field of Aquaculture and related areas like the feed production industry. The degree qualifies for Ph.D. studies within Aquaculture.

Internationalisation:

The study programme is open for both Norwegian and international students.

Cooperation with other institutions:

Akvaforsk, Department of Economics and Resource Management, Department of Mathematical Sciences and Technology.

Possibilities for study abroad:

Sections of the programme may be completed abroad. 20 credits are optional courses, and 35 credits are aquaculture related topics at minimum 200 level. The NOVA University network: All aquaculture and freshwater fisheries courses that are registered at any of the other participating universities are available for the students.

Learning outcomes:

Students will specialise in fish nutrition, fish breeding and technique. They will then be able to apply their knowledge to solve practical problems, participate in development projects and keep themselves up-to-date in scientific literature and news. Students should be able to solve practical problems based on their acquired specialised knowledge and be able to place practical solutions into a broader social perspective regarding general values within society, such as utilisation of resources, environment and animal welfare.

Learning and teaching methods:

Teaching methods are varied and include lectures, field trips, group work, independent studies and exercises and seminars by students.

Student Assessment:

Final examinations, oral or written or internal assessment.

Contents:

A Master degree in Aquaculture consists of:35 mandatory credits at the 300 level within fish-breeding, fish nutrition, special courses in aquaculture and planning and design of aquacultural plants. 35 credits at the 200 level within breeding, nutrition, techniques and environment, product quality and other related courses. 20 credits at the 200 level are electives. In addition, candidates must complete a Master's thesis worth 30 credits, which may be upgraded to 60 credits on application to the Board of Education. Students who do not have a Bachelor's degree in Aquaculture from UMB must have an individual study plan.

Student guidance:

The programme has a student adviser.

Quality assurance:

Approval of all alterations and rules in the Study Committee. Mid-semester and final course evaluations are considered by the Board. The quality and content of the programme as a whole is continually re-evaluated by the Study Committee.

Master in Development and Natural Resource Economics

Language of instruction: English.

Credits: 120

For information, contact: Department of Economics and Resource Management (IØR), www.umb.no/ior

Admission requirements:

A Bachelor degree or equivalent degree with a major or concentration in economics (minimum of 60 credits). This includes microeconomics, macroeconomics and econometrics. Introductory courses in Mathematics and statistics are also required. This general rule can be exempted from in case of other, relevant academic backgrounds.

Relevance for society:

There is a great need for policy-oriented economists who are able to integrate and apply knowledge from resource, environmental, agricultural and development economics. This program has an applied profile, and the students get knowledge, training and practical experience in using economic methodologies, as a bridge between theories and real-world problems.

Degree awarded: Master

The degree qualifies students for (further studies / jobs):

Graduates of this program may work in teaching and research institutions, in national ministries or regional departments of agriculture, forestry, environment, and development planning, or in international organizations and development/environment NGOs. Candidates also qualify for other positions where a Master's degree in Economics is required. This program qualifies for PhD studies.

Internationalisation:

This is an international Master's program with students from many parts of the world. Many students will go on field work in a developing country and/or study abroad one semester during their Mater's studies.

Cooperation with other institutions:

From the academic year 2007/2008, parts of this program will be conducted in close cooperation with "The Collaborative MSc program in Development and Natural Resource Economics". This program is a joint effort involving Makerere University in Uganda, Hawassa University and Mekelle University in Ethiopia, University of Malawi, Bunda College, in Malawi and the Norwegian University of Life Sciences (UMB) in (Norway). The cooperation with the collaborative master program relies on funding from the NOMA scholarship program.

Possibilities for study abroad:

The students on this Master's program will have the opportunity to go to Makerere University in Uganda the second semester in this master's program (spring 2008). However, this fully relies on UMB receiving full funding for "The Collaborative MSc program in Development and Natural Resource Economics". A mandatory part of this program is to do field work for the thesis research in a developing country in a developing country-preferably during the summer between the second and third semester. This field work is a core aspect of this Master's program. It enables the students to get first hand experience with working and doing research in a developing country.

Learning outcomes:

The course aims to give the students: - a solid basis in economic theory, with a specialisation in development and resource economics; - knowledge, training and practical experience with economic methodologies, as a bridge between theories and policy relevant problems; - deeper insights into the links between the social well-being of rural people, their natural resource base, and the underlying causes of poverty and environmental degradation; - insight into relevant policies for poverty reduction, promotion of economic development and conservation of the natural resource base.

Learning and teaching methods:

The program relies on varied learning methods, including lectures, tutorials, group assignments, presentations and fieldwork. The program has an emphasis on student participation and on problem based learning, with a special focus on developing the students' ability to apply economic theory and methodology to real world problems.

Student Assessment:

A variety of evaluation methods is used, including final examinations, semester papers and assignments.

Contents:

The program consist of mandatory subjects in the following fields of study: Mathematics for Economists, Econometrics, Micro Economics, Resource and Environmental Economics, Research in Development Economics, Decision Modelling, Development Economics Micro, Development Economics Macro, Development and Environment Economics. This comes in addition the mandatory field work, Master's Thesis and elective subjects.

Student guidance:

The students will have access to departmental advisors regarding administrative, social, practical and academic affairs. An academic advisor is assigned to each student in connection with the Master's Thesis and with larger assignments.

Quality assurance:

This program adheres to the UMB quality assurance system. In addition, the close dialogue between the students and the departmental staff motivates for constant feed back throughout the semesters.

Master in Development Studies

Language of instruction: English.

Credits: 120

For information, contact: Department of International Environment- and Development Studies - Noragric, www.umb.no/noragric

Admission requirements:

Bachelor 's degree or equivalent education in any field relevant to development studies, economics, political science, biology, teaching, anthropology, resource management, journalism, geography, etc.

Relevance for society:

The programme looks at global and local problems related to poverty, environment and social conflicts. The programme offers a broad understanding of social science perspectives in societies, development, and change, as well as more specialised approaches to poverty reduction, conflict avoidance, and sustainable resource management.

Degree awarded: Master

The degree qualifies students for (further studies / jobs):

Graduates will be eligible to apply for further studies at the Ph.D. level within the field, both nationally and internationally. Noragric offers a Ph.D. programme within Development Studies that is well suited.

Internationalisation:

This is by its very nature an international programme, and many if not most students are international. Most students spend their third semester abroad at a cooperating university in a developing country, such as the University of Makerere in Uganda, the Tribhuvan University in Nepal or Egerton University in Kenya. This is a programme within the field of international development studies, and all students write Master's theses on international problems. Most students also do fieldwork in a developing country.

Cooperation with other institutions:

15 credits are normally taken at a co-operating university in a developing country.

Possibilities for study abroad:

See 'cooperation with other institutions'.

Learning outcomes:

One of the aims of the programme is to help students to understand and appreciate values related to human and societal variation and diversity. These values will be emphasised in group work, in lectures, and of course also in the interdisciplinarity which forms the foundation of the programme. After having completed the programme, the students are expected to have developed attitudes that reflect respect and humility towards the diversity of values and worldviews that exist. General learning outcomes are: - understanding an interdisciplinary approach to global and local development issues; - cross-cultural and interdisciplinary communication competence; - knowledge of relationships between technological challenges and social factors; - understanding of learning as change and change as a learning process. Students will also: be capable of identifying and analysing causal relationships between social conditions and events related to conflict, economic development, poverty, and rights; possess knowledge of key elements of different development theories and their associated literature; indentify policy instruments and measures that have been applied to development and poverty challenges and the results these have generated in the past.

Learning and teaching methods:

The overarching approach to learning in the programme is problem-based and process-oriented. This implies that in many of the core courses, the students themselves will be given responsibility for developing assignments, finding information, and deciding on the form of the presentation. Problem-based work will usually take place in a group setting. The development of collaborative and communicative skills is a central topic in the programme, and problem-based learning within groups is an effective means of learning in this context. This type of work will also form the basis for continual evaluation of students. However, most of the courses will not solely rest on problem-based and process-oriented learning, but will include a mixture of teaching and learning methods and approaches. These will include lectures, seminars, tutorials, and individual work. Teaching and learning methods will also vary somewhat according to the specialisation the student is following. Some courses will consist of lectures with a final examination.

Student Assessment:

Most courses aim at a mixture of evaluation approaches. In many, students' work is evaluated continuously on a pass/fail basis, while the final grade is determined by a final examination or semester assignment. A certain level of variation exists, however, and some courses will only have a final examination, or one single hand-in of a semester assignment.

Contents:

The programme is of two-year duration. The programme consists of a handfull of required core courses. One of the core courses is within the field of development theory. Other core courses include political ecology and a research methodology course. As a default, students are expected to hand in a Master's thesis of 30 credits, but students with course experience from earlier studies and with academic ambitions may be permitted to complete a thesis of 60 credits. Students are otherwise free to choose from a limited list of accepted courses, dominated by social science topics given at UMB. It may also be possible to select courses given via the Internet or given at other universities or colleges, but these will be considered on an individual basis.

A minimum of 30 credits should be at 300 level. An introductory block has been developed that aims to introduce the students to main themes and central concepts pertinent to the programme, such as interdisciplinarity, as well as providing an introduction to the different specialisations. Moreover, the students are encouraged to participate in relevant seminars that are held at UMB and elsewhere. A limited amount of economic support will be provided to stimulate students' social activities that may also be of relevance academically.

Student guidance:

During the first core course, Development Studies I, students are involved in several individual and group assignments under the close supervision by staff involved in the course. In their final year, the students will be assigned a Master's thesis supervisor who is involved in the development and finalisation of the Master's thesis project.

Quality assurance:

The main basis for programme evaluation is student evaluations of the different courses. These will be discussed in the Noragric Education Committee. In addition, informal evaluations are undertaken for most of the courses. Finally, both formal and informal input will be sought from external examiners associated with the various courses.

Master in Ecology

Language of instruction: English.

Credits: 120

For information, contact: Department of Ecology and Natural Resource Management (INA), www.umb.no/ina

Admission requirements:

The applicants must have obtained a Bachelor's degree or equivalent in Natural Sciences (biology, ecology, agricultural or environmental sciences).

Relevance for society:

Challenges due to human impact on the environment require a deep knowledge of ecology. The study programme educates graduates with a high competence in ecology, with the idea to facilitate this competence through teaching and cooperation with other professional groups, and by using it in research and development work.

Degree awarded: Master

The degree qualifies students for (further studies / jobs):

In Norway and Europe, this education provides the competence to obtain positions within public management, non-governmental business organisations and organisations with the need for employees with high competence in ecology. With pedagogical training, graduates can also work in the Norwegian school system. In developing countries, the opportunities include jobs in protected areas, positions in ministries and regional/local offices, NGOs, consultancies, teaching, environmental/rural/agro development agencies or working as planners and conservationists. The programme qualifies graduates for Ph.D. studies in ecology in Norway and abroad.

Internationalisation:

This is an English taught Master's program with students from Asia, Africa, Latin America and Europe.All courses in this programme are taught in English, and the programme focuses on international questions in ecology and natural resource management.

Cooperation with other institutions:

INA has close collaborations with many universities and other institutions abroad. A number of the students on the program come from collaborating institutions in Asia and Africa.

Possibilities for study abroad:

The course allows for the possibility of studying abroad, provided the student takes the obligatory subjects in the Master's degree programme. These subjects can be taken at UMB or at another college or university abroad, subject to approval. The field work in tropical ecology and management of natural resources is conducted in a tropical or sub-tropical area and lasts for 3-6 months.

Learning outcomes:

The candidate will through an in-depth understanding of ecological and evolutionary processes, and a solid basis in scientific methodology and statistics, be able to analyse current ecological issues in a critical and thorough manner. The students choose between two main directions.1) General Ecology The candidate will have advanced theoretical knowledge of ecological science and the possibility to specialise in topics like evolutionary ecology, population ecology, behavioural ecology or botanical ecology. Upon completion the candidate has conducted an independent research study analysing the results using scientific methods. 2) Tropical Ecology and Management of Natural Resources The candidate will have advanced knowledge of tropical ecosystem and how these are managed from an ecological as well as human perspective. Upon completion the candidate will know the importance of biodiversity for ecosystem functions, how to manage biodiversity and the main treats to species extinction.The students will gain in depth knowledge and understanding of species interactions within and between trophic levels. The candidate should be able to apply knowledge on harvesting of wildlife and fishery resources. The candidates will have knowledge about recent theories applications of community based natural resource management and be able to apply biological principals in restoring terrestrial and aquatic ecosystems. Upon completion the candidate has conducted an independent study in a tropical area and analysed the results using scientific methods.

Learning and teaching methods:

Teaching and evaluation methods consist of lectures, student assignments, study groups, seminars, and oral and written presentation of work, fieldwork and completion and reporting of the individual research project (Master's thesis).

Student Assessment:

The types of evaluation include written and oral exams, semester assignments, participation in and reporting from obligatory activities, and student presentations. The Master's thesis and the special syllabus related to it are defended with an external examiner present.

Contents:

The following courses are obligatory for all students. Conservation Biology (NATF300), Ecological Scientific Methodology (ECOL300) and for students lacking statistical background, Statistics (EDS220/STAT100). In addition for students that follow the study direction General Ecology: Global Change Ecology (ECOL310), Genetic Basis of Biodiversity (GEN220) and at least one of the following 300-level courses: Photobiology (BOT340), Pollination and Reproductive Ecology of Plants (BOT350), Molecular Evolution (GEN340), Ecological Entomology (ZOOL300), or Behavioural and Population Ecology (ZOOL310). In addition for students that follow the study direction Tropical Ecology and Management of Natural Resources: Tropical Ecosystems and Biodiversity (ECOL250), Ecology and Management of Natural Resources in the Tropics (NATF320), Restoration Ecology (ECOL350) and Community Based Natural Resource Management (NATF350).

Student guidance:

Students receive supervision in the programme from a study advisor employed by the Dept. of Ecology and Natural Resource Management. A scientific employee at the university is responsible for guidance throughout the entire Master's thesis process, such as project planning, execution, data analysis, writing of the thesis and potential publishing of the results.

Quality assurance:

Students evaluate the courses through UMB's web-based system. These evaluations are processed annually by the teachers and by the department's Curriculum Committee. The teacher must write comments on the evaluations with suggestions for improvement. These must be approved by the Curriculum Committee. Both external and internal evaluations of the program are carried out at regular intervals. The last such evaluation was carried out in 2006-2007. A curriculum group at the Department is responsible for the programme and works continuously to maintain the programme's quality and professional relevance.

Master in Feed Manufacturing Technology

Language of instruction: English.

Credits: 120

For information, contact: Department of Animal and Aquacultural Sciences (IHA), www.umb.no/iha

Admission requirements:

Candidates with academic qualifications at BSc level or similar may apply. Furthermore, applicants must document knowledge in written and spoken English at a level equivalent to the requirements set by the TOEFL test or similar, with results approved by the International Student Office of UMB. Applicants must have university level courses with a total of 180 credits in basic knowledge in nutrition, chemistry and physics .

Relevance for society:

Feed manufacturing is an enormous global industry. Industry needs expertise of feed manufacturing technology for maximum use of limited feed resources.

Degree awarded: Master

The degree qualifies students for (further studies / jobs):

The study qualifies for relevant leading positions within the feed manufacturing industry. The Master degree also gives possibilities for Ph.D. studies within feed manufacturing technology.

Internationalisation:

The programme of study is open for Norwegian and international students.

Cooperation with other institutions:

Lectures and lab. experiments are in cooperation with Centre for Feed Technology, Department of Mathematical Sciences and Technology and Department of Chemistry, Biotechnology and Food Science.

Learning outcomes:

The main aim for the Master's programme in Feed Manufacturing Technology is to provide a quality education for higher-level management in feed manufacturing and related industries. Students must have higher-level knowledge of the interactions between nutrition, chemistry and feed processing. Students will be able to practically manage a feed processing plant and optimise feed production according to sustainable standards.

Learning and teaching methods:

The programme applies a wide range of teaching methods, such as laboratory practice, lectures, independent studies, exercises and seminars by students.

Student Assessment:

Examinations, individual studies and group work.

Contents:

3 semesters of teaching and a final semester with thesis work of 30 credits. The programme is based on a series of mandatory core subjects (75 credits). Students may complete the remaining 15 credits by choosing other subjects offered at the Norwegian University of Life Sciences (UMB).

Student guidance:

The programme has a student adviser.

Quality assurance:

All courses are evaluated by students at the end of the semester. The evaluations are processed by the Study Committee. The entire study programme is evaluated every second year.

Master in International Environmental Studies

Language of instruction: English.

Credits: 120

For information, contact: Department of International Environment and Development Studies - Noragric.

Admission requirements:

Bachelor's degree or equivalent education in fields relevant to natural and social aspects of environmental studies (e.g., ecology, agriculture, wildlife management, economics, development studies, political science, sociology, geography, etc.)

Relevance for society:

All humans depend on the Earth's ecosystems and the services they provide, for food production, water supply, a healthy environment, suitable climate, spiritual well-being and aesthetic pleasure. The rate at which people have changed the ecosystems during the last fifty years is by many considered alarming. In this situation a sustainable future will depend not only on our ability to understand the ecosystems, but also on our realisation of how human societies interact with the environment. Thus, sustainable development depends on competent analytical and management capacity both in the public sector and in civil society. To build the capacity needed to ensure long-term ecosystem services, students will explore complex relationships between society and the environment. Graduates are expected to contribute with integrated and innovative solutions to far-reaching problems, fostering action and change to meet socio-economic and bio-physical challenges. Job opportunities can be found in government agencies, environmental organisations, private consulting companies, and national and international development agencies.

Degree awarded: Master

The degree qualifies students for (further studies / jobs):

Graduates are qualified to apply for Ph.D. programmes in the area of environment, development and governance.

Internationalisation:

By nature, this programme has an international profile, and the great majority of students are international. The study programme deals with global development problems related to natural resource management. The students focus their thesis on global problems in these fields and do their fieldwork in southern countries. During the third semester (1 August-31 September), the students take a 15-credit course at Noragric's regional partner institutions, for example Makerere University in Uganda and at Tribuwan University, Institute of Forestry, Pokhara, Nepal.

Cooperation with other institutions:

Elective and recommended courses for the programme are given by six other departments at UMB. Language courses are offered through Østfold University College.

Possibilities for study abroad:

Most students do thesis research in developing countries. During the third semester (Aug.-Sep.), students attend a 15-credit course at partner institutions in Africa and Asia (with an option to study in Latin America).

Learning outcomes:

The programme educates graduates who can contribute actively to sustainable development processes both locally, nationally and globally. The ability to implement changes is seen as a result of their combined understanding of natural and social systems as well as good communication skills. Graduates shall develop the capacity to link theoretical analyses to practical actions. To obtain this, students must learn about relevant concepts, analytical approaches and gain in-depth knowledge about causes and effects of global environmental problems related foremost to climate change, loss of biodiversity, desertification, and water and land degradation. The program must moreover facilitate the creation of an in-depth understanding of how gover¬nance structures and power relations influence present trends and engage in analyzing how urgent problems can be solved through various strategies. Poverty alleviating and health issues are also core aspects of sustainable development with strong links to environmental qualities. Hence, the issue of empowering marginalized poor people, justice and rights-based approaches, conflict and conflict resolution represents core issues. Similarly, students shall aquire insights into the functioning of key global environment and develop¬ment organisations, policy arenas and processes, international conventions and agree¬ments. Understanding the linkages between challenges at global, national and down to local levels of gover¬nance and natural resource management is important.

Learning and teaching methods:

Teaching methods in the IES programme include lectures, problem-based learning, Internet-supported teaching, group work, fieldwork and seminars. Inreased emphasis is placed on communication skills and ability to search for and evaluate information. Seminars allow students to develop skills in analysing, applying and presenting ideas. Student interaction for constructive critisism and praise is considered important for preparing them for effective, cross-cultural work situations. Case studies given by guest lecturers and study of current research articles provide an up-to-date learning environment.

Student Assessment:

Courses are evaluated through various combinations of final examinations, term papers, and oral presentations.

Contents:

The Master's programme is a two-year, full-time programme of study consisting of required and elective course work, one semester of field study (for most students at a co-operating university in a developing country), and writing of an individual, 30- or 60-credit research thesis. The course work consists of two groups of mandatory subjects. The first group constitutes a foundation for understanding social and natural environmental issues consisting of EDS235 Political Economy-Institutions and the Environment (10 cr.) and EDS260 Global Environmental Change (5 cr.). The second group constitutes a foundation for independent thesis research consisting of EDS220 Statistical Analysis and EDS300 Research Methods. After receiving a common theoretical and methodological platform, students can branch off into optional directions by combining Noragric courses and courses offered by other UMB departments with a clear plan to support thesis research.

A minimum of 40 elective credits should be at 300 level, and a minimum of 30 elective credits should be taken at Noragric. Maximum 10 elective credits can be at 100 level. Apart from the above requirements, the study programme is open, although subject to approval. Two study paths within the programme with focus on environmental policy or sustainable land use are timetable secured.Students are encouraged to participate in relevant professional fora/seminars elsewhere. Noragric has a tradition of supporting social activities that can also be of professional interest/relevance.

Student guidance:

Immediately after arrival, students will receive personal guidance in order to make their individual plan of study. The students have access to advisors regarding administrative, social, practical and academic affairs. Concerning research, each student is assigned a relevant academic supervisor during the second semester of the programme, and the supervisor advises the student throughout this year. The student is also assigned a local supervisor during field research. This person helps the students with both practical and academic issues and ensures that the research questions are relevant in the given field situation. Efforts are made to ensure that research topics chosen relate closely to research and development activities in the institutions with which Noragric has institutional co-operation, if possible.

Quality assurance:

The administration has regular meetings with students throughout the semester and IES students participate in the electronic student evaluations carried out by the UMB central administration at the end of each semester. Teaching staff and study administration analyse the student evaluations and agree on relevant actions. The programme follows up the intentions of the Quality Reform by utilizing varied learning- and evaluation methods, utilizing the entire academic year, providing a semester of study in a relevant foreign country and giving students a high degree of flexibility in constructing their study plans. The programme has been revised in 2006/07 to remain in the forefront of current issues and to further increase the students' flexibility in choice of courses. The programme maintains the 60-point thesis option for students with strong backgrounds. The recent changes complete the recommended revisions provided in 2005 by an external evaluation of Noragric's master programmes.

Master in Radioecology

Language of instruction: English.

Credits: 120

For information, contact: Department of Plant and Environmental Sciences

Admission requirements:

Bachelor's degree (BSc) og equivalent education in any field relevant to the environemnt (e.g. chemistry, ecology, biology, resourse management, agriculture, environmental sciences, environmental engineering, geography etc.) Applicants must at least have passed English ("A-language") in upper secondary school, have equivalent skills from their home country (cf. SIS list) or a computer-based TOEFL score of at least 170, or equivalent results from other tests.

Relevance for society:

Strengthening the competence within the nuclear field is consistent with the EU aim to produce an educated workforce that is able to meet the future economic and social needs. Radiological protection of the environment, including man, has also become a matter of significant public concern. It follows that the establishment of public confidence in nuclear technologies will depend upon the availability of well-educated personnel and independent experts / advisors within the fields of radiochemistry, radioecology and radiation protection. Skills in these areas are required not only to deal with currently installed nuclear capacity and decommissioned facilities, but also to meet the needs presented by likely new-build nuclear capacity. As recently stated by several EU politicians and experts, there are increasing pressures to build new nuclear power stations in many EU member nations. This pressure comes from the need to meet Kyoto greenhouse gas emission targets at a time when many currently installed, CO2-clean, and nuclear power stations are coming to the end of their useful lives. They also come from the decreasing stocks of domestic fossil fuels, with an increasing reliance upon politically unstable nations for the provision of oil and gas and from the increasing prices of domestic and imported fuels. Finally, the pressures are facilitated by new improved reactor systems that are being developed in Europe and the USA. Therefore, the need for nuclear competence is probably greater now than was earlier anticipated. Students will have an understanding of the properties of radionuclides and emitted ionising radiation, the use of radioactive tracers and simple measurement methods as well as radiation protection. The courses will provide the students with working permission related to the use of open, ionising radiation sources in their future work.

Degree awarded: Master

Other qualifications or certification:

The courses will provide the students with working permission related to the use of open, ionising radiation sources in their future work.

The degree qualifies students for (further studies / jobs):

Students will have an understanding of the properties of radionuclides and emitted ionising radiation, the use of radioactive tracers and simple measurement methods as well as radiation protection. The courses will provide the students with working permission related to the use of open, ionising radiation sources in their future work. The programme prepares the students for a wide range of positions related to nuclear energy industry and authorities responsible for the national legislation e.g., within government, service, development projects, nuclear energy industry, technical support and consultancy, management of natural radioactive resources, environmental protection, research, and education.

Internationalisation:

Four course modules will be held in Norway, using the best European teachers within their field of expertise. Two of the course modules will be held in France.

Cooperation with other institutions:

The course modules will be held at UMB and at collaborating European universities. Course modules will be presented by highly competent Norwegian and European teacher within the different fields of study, and in close cooperation with other European Universities.

Possibilities for study abroad:

Two of the course modules will be held in France, and therefore, the students must be prepaired for a stay of some months in France. The student should also hold their Master project in an European University, if possible.

Learning outcomes:

The students will be trained in radioecology and be able to conduct experimental radioecological studies. The students will have knowledge on radioactive sources and understand the transport and spreading of radioactive substances in various ecosystems. They will understand the basis for assessing environmental impact and risks, and will be able to conduct radioecological studies using tracer techniques, radiochemical separation techniques and advanced measurement methods. The students will after the courses be able to assess environmental impact and risks from radioactive contamination and be able to evaluated alternative countermeasures and clean-up strategies, and thereby contribute to national preparedness associated with nuclear accidents and contamination of different ecosystems.

Learning and teaching methods:

In a diverse learning process, you will gain knowledge about radiochemistry, the nuclear industry and waste management, project management and research methods, the behaviour of radionuclides in the environment, together with risk assessment and management. The learning will take place as lectures, intensive courses, laboratory work, group work, real-life case studies with interdisciplinary approach, and through reflection on links between real-life situations and theory.

Student Assessment:

Courses with a large amount of practical field and laboratory exercises will to a certain degree have continuous evaluation (field reports, laboratory journals, etc.) both in groups and individually. Semester assignments (with continuous evaluation) are given in many courses, and represent part of the grade. Many of the courses will have a final exam (written). The Master's thesis will be evaluated, and a final grade will be given after an oral discussion.

Contents:

In a diverse learning process, you will gain knowledge about radiochemistry, the nuclear industry and waste management, project management and research methods, the behaviour of radionuclides in the environment, together with impact and risk assessment and countermeasures. The learning will take place as lectures, intensive courses, laboratory work, group work, real-life case studies with interdisciplinary approach, and through reflection on links between real-life situations and theory. Study program structure: The study consists of two years of academic work. The master programme is developed using the framework provided by the Bologna Convention and will be taught within a network of collaborating universities. The degree comprises three basic modules (3 x 10 ECTS credits), three specialist modules (3 x 10 ECTS credits) and a research project (1 x 60 ECTS credits). The first year provides a theoretical basis to start research work as well as the initiating of the research project; the second year is dedicated to specialist courses, data collection and analysis, i.e. finalizing the thesis. 1 semester: Course work at UMB, Norway. 2 semester: Course work at UMB or at collaborating universities, initiating of the research project at UMB or at the home university. 3 semester: Course work at UMB and project work at UMB or home university. 4 semester: Project work and finalising the thesis at UMB or at the home university. Course modules will be presented by the best Norwegian and European teacher within the different fields of study, and in close cooperation with other European Universities.
Chemistry from bachelor level

Student guidance:

Students receive guidance from the study advisor team, leader of the teaching committee, the contact person in the study committee, plus scientific members of staff in their respective fields.

Quality assurance:

In addition to UMB's central routine for course evaluations, there are plans for the evaluation of the programme (courses and programme) with partner universities in Europe. Input/feedback from students and external sources is important. The latter can be professionals in the research environment in foreign institutions.

AKA251 General Aquaculture Breeding and Genetics

General Aquaculture Breeding and Genetics

Credits: 5 **Language:** English
Staff/institute: Hans Magnus Gjøen/ IHA
Teachers: Bjarne Gjerde, Ingrid Olesen, Kari Kolstad
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Group work, written or oral presentation of semester assignment.
Prerequisites: BSc in life science or ongoing BSc studies at UMB.
Credit reduction: AKX250 100%
Type of course: 25 hours of lectures + colloquium and semester assignment
Contents: The students will learn about the major principles underlying the design of breeding schemes, the biological restrictions for species involved, tagging methods and economical considerations. Simple breeding programmes with relatively low costs involved for commercial operators of various species will be described.
Learning outcomes: Students will learn the basic aquaculture genetics and breeding, in addition to some major aquaculture breeding programmes. The students will set up a simple cost-efficient breeding programme for fish.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The written exam and the individual project will contribute 80% and 20%, respectively, to the final grade.

AKA260 Aquaculture - breeding and genetics

Aquaculture - breeding and genetics

Credits: 5 **Language:** English upon request
Staff/institute: Hans Magnus Gjøen/ IHA
Teachers: Bjarne Gjerde, Ingrid Olesen, Kari Kolstad, Øyvind Andersen and Dag-Inge Våge
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Submission/presentation of group work/case.
Prerequisites: General knowledge of animal breeding, AKA251
Type of course: 36 hours of lectures + group work
Contents: Lectures will cover the following topics: breeding strategies, breeding methods and breeding goals, estimation of breeding values, genotype by environment interactions and the application of modern DNA tools in aquaculture.
Learning outcomes: Students are to acquire sound knowledge in the use of traditional and modern fish breeding methods. The students are to gain skills in the evaluation of various strategies and methods and be able to understand the principles of estimating various breeding parameters. As a conclusion of the course, the students will be able to suggest a breeding program for a fish breeding company with given breeding goals and restrictions.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: No calculator, no other examination aids

AKA350 Optimisation of fish breeding programs

Optimisation of fish breeding programs

Credits: 10 **Language:** English upon request
Staff/institute: Hans Magnus Gjøen/ IHA
Start term: Autumn parallel
Terms: Autumn parallel

Prerequisites: AKA260
Type of course: 40 hours of structured group work + 12 hours lectures
Contents: Use and interpretation of various simulation software for optimisation of breeding schemes for aquaculture species will be covered. A larger case study on consequences of concrete options at hand when planning a breeding program will be a major part of the course.
Learning outcomes: The student will be able to understand and make sensible use of various simulation software for optimisation of breeding schemes for aquaculture species.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: In addition to the semester assignment, there will be emphasis on contributions during the group work.

AKE251 General Aquaculture - Nutrition

General Aquaculture - Nutrition

Credits: 5 **Language:** English
Staff/institute: Anders Kiessling/ IHA
Teachers: Researchers from Akvaforsk and from Aquaculture Protein Centre, School of Veterinary Science.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises
Prerequisites: BSc in life science or ongoing BSc studies at UMB.
Credit reduction: Overlapping with HFE200: 5 credits.
Type of course: Lectures: 4 hours per week. Group work: 2 hours per week.
Contents: The course consists of lectures and demonstrations of programs for feed composition, feed ration and growth simulation. The student will use these programs in order to solve exercises.
Learning outcomes: The aim of the course is to provide students with a basic understanding of nutrition with emphasis on monogastric animals such as fish. The student should reach an understanding of the main components of the diet and their interrelationships and importance for the animal. The student will also be given an introduction to feed composition, feed evaluation and calculation of feed rations.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The written exam and the individual project will contribute 80% and 20%, respectively, to the final grade.

AKE310 Aquaculture Nutrition

Aquaculture Nutrition

Credits: 10 **Language:** English
Staff/institute: Anders Kiessling/ IHA
Teachers: Researchers from Akvaforsk and from Aquaculture Protein Centre, School of Veterinary Science.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Practical feed project (written and oral group presentation)
Prerequisites: Knowledge of nutrition at the 200 level (BSc).
Type of course: 2-6 hours of lectures and theoretical exercises per week. 2-6 hours of practical projects per week. Remaining time spent on the individual project, literature preparation etc. Activity level: 50 % of full time.
Contents: The course is project-based. Student groups are responsible for a long-term project, including diet formulation, chemical analysis and biological evaluation in a growth and digestibility experiment. The interrelationship between growth, environmental factors and diet will be highlighted by including water quality measurements during the experiment. The student will receive support in the form of lectures by specialists in feed formulation, nutrient sources, fish nutrition and growth. The

student will carry out an individual project in the form of a literature review with the focus on a specific fish nutrition related subject. The result will be presented both in writing as a small report in the form of a scientific paper and orally in the form of a power point presentation.
Learning outcomes: Students will gain both theoretical and practical experience of feed formulation and biological feed evaluation. The student will also obtain a theoretical understanding of the principles behind feed formulation and nutrition physiology, thus allowing an understanding of the economical, technical and biological challenges of today,s and tomorrow's aquaculture industry from a feed management perspective.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written presentation of individual project: 40 %, Oral examination: 60 %.

AKX251 General Aquaculature - Anatomy and Health in Farmed Fish

General Aquaculature - Anatomy and Health in Farmed Fish
Credits: 5 **Language:** English
Staff/institute: Anders Kiessling/ IHA
Teachers: Ragnar Salte and teachers from the Norwegian School of Veterinary Science.
Start term: August block
Terms: August block
Mandatory activities: Exercises, demonstrations, field week and project.
Prerequisites: BSc in life science or ongoing BSc studies at UMB.
Credit reduction: AKX250, 100 %
Type of course: The course starts the August block with a two week full-time lecture session combined with short exercises. This introduction block is followed by a one-week field course either in the final week of the August block or first week of the autumn semester. The variation in time depends on that the field week is synchronized with the other partners of the NOVA network. The field week is followed by 1-2 weeks lecture session ended with a written exam. During the second lecture time period, 4 hours of lectures are expected per week. The course will not have lectures for the rest of the autumn semester or the January block. Teaching will resume in the spring semester with a project assignment and discussion classes (1 hour per week averagely). Full-time lectures will start early in the June block and end with a field week in late May/early June, again synchronized with the other partners of the NOVA network. The project will be finalized during the June field week.
Contents: The course consists of a theoretical part with lectures and demonstrations with the aim to give the student basic knowledge in the subject. The student gets to practice his or her theoretical knowledge in small assignments or projects during the field weeks. In the final project, the student has to actively seek knowledge outside the given in lectures and demonstrations.
Learning outcomes: The first aim of the course is to give the student a theoretical base in fish physiology, anatomy and health. The second aim is to give the student a practical experience of this knowledge. The final aim is to create a situation allowing the student an insight in to the consequences of implementing biological knowledge in a production situation.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: The limit to pass the written exam is set to 60 %.

AKX253 Product Quality in Aquaculture

Product Quality in Aquaculture
Credits: 5 **Language:** English
Staff/institute: Magny S. Thomassen/ IHA
Teachers: Anders Kiessling, Hans Magnus Gjøen, Turid Mørkøre, Mia Rørå, Kjell-Arne Rørvik, Ragnar Salte, Ingrid Olesen, Bente Ruyter
First time the course is offered: SPRING 2008
Start term: June block
Terms: June block

Mandatory activities: Approved excursion report
Prerequisites: Basic knowledge of chemistry and biochemistry
Type of course: Lectures: 45-50 hours. Excursion: 4 days.
Contents: Central and current topics on quality of aquaculture products are presented during lectures. The industry's focus on product quality, problems and improvements will be addressed during excursion and visit to applied research institutions. The student is expected to present her/his impressions in the excursion report which has to be approved before the exam.
Learning outcomes: The student will during the course have gained a solid theoretical understanding of quality and the components responsible for quality of aquaculture products. The student will also gain insight into different analytical methods and possibilities for influencing/improving important quality parameters. The student is presented to the basic principles of quality, definitions and the needs for appropriate analytical methods and ways of influencing quality. The students are further expected to gain detailed knowledge related to central sensory, nutritionally and processing related quality parameters, as well as the importance of ethical and hygienically safe products. Insight into the main focus on quality in practical production will be gained through the excursion and visit to applied research institutions.
Methods of examination: Final Written exam **Grading:** Pass/Fail
Assessment methods: Multiple choice
Examination aids: No calculator, no other examination aids

AKX300 Aquaculture, Special Course

Aquaculture, Special Course
Credits: 5 **Language:** English
Staff/institute: Kjell-Arne Rørvik/ IHA
Teachers: Several
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Presentations
Prerequisites: Bachelor's degree in aquaculture
Type of course: 2-4 hours per week
Contents: The course starts with the identification of areas of current interest for the fish farming industry. Based thereupon, topics are decided for student-prepared discussions, lectures given by teachers or guest lectures from the industry.
Learning outcomes: Students will acquire an interdisciplinary understanding and technical independence in the area of aquaculture.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral presentation of project counts 100%.

AOS232 Strategic Management and Organisation Design

Strategic Management and Organisation Design
Credits: 10 **Language:** English upon request
Staff/institute: Carl Brønn/ IØR
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Other - The course will not be given in autumn parallel 2007Emnet gis ikke høsten 2007
Prerequisites: AOS120, AOS130, BUS100.
Credit reduction: AOS233: 10 credits.
Type of course: Approximately 80 hours, divided between lectures, group discussions, case presentations and exercises.
Contents: The course presents an integrated treatment of organisation design and strategic management. The topics covered in the course include: sense-making and the role of cognition in strategic decision making; issues in organisation design as they relate to strategy; types of strategising; internal and external analyses; the dynamic resource based view; systems thinking and strategic modelling in complex environments; strategic communications - reflection, inquiry and advocacy; scenarios and strategic conversations.

Learning outcomes: The course has the following objectives: ·To enable the student to explain how cognition influences the strategic decision making process and to identify actions for overcoming these effects in a strategic analysis. ·To identify and explain the distinguishing characteristics of the main organisation structure types and to discuss their relative strengths and weaknesses. ·To be able to diagnose an organisation and its environment and to make recommendations for an appropriate structure. ·To explain the important characteristics of the main schools of strategic thought. ·To be able to conduct internal and external strategic analyses. ·To use the language of systems thinking to represent organisational processes and structures for strategic analysis, decision making and implementation.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Term paper (60%). Case studies and presentations (40%).

AOS233 Strategic Processes and Decision-Making

Strategic Processes and Decision-Making
Credits: 10 **Language:** English
Staff/institute: Carl Brønn/ IØR
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Odd years
Prerequisites: General knowledge of economics and organisation theory concepts.
Credit reduction: AOS232: 10 credits.
Type of course: Approx. 50 hours.
Contents: Definition of strategy and a historical perspective. Strategy and issues in development studies - the case of unintended consequences. Cognitive influences on perception and issue definition. Stakeholder analysis. Modelling dynamic resource systems and the strategic architecture. Alternate futures, scenarios and flight simulators. Implementation - politics and negotiations.
Learning outcomes: The objectives in this course are threefold. First, we review the impact of the cognitive dimension on strategic diagnosis and decision-making. We investigate how this dimension influences the activities that affect the organisation in developing strategy. The second objective is to provide a conceptual framework for understanding complex organisational structures as systems. This involves a review of different perspectives on strategic decision-making and the factors that influence the process. The two theoretical platforms that support this second objective are information feedback theory and behavioural decision theory. These theories provide insights into the different possible perceptions of the strategic development problem and serve as valuable learning and communication tools. These views are combined into the unified approach called systems thinking. This perspective gives the decision maker a powerful method for investigating and communicating the long-term consequences of strategic planning activities.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The assessment is based on a term paper, case analyses and presentations. Term paper: 60%. Cases and presentations: 40%.

APL104 Introduction to the Professions of Land Use Planning and Land Consolidation

Introduction to the Professions of Land Use Planning and Land Consolidation
Credits: 5 **Language:** English upon request
Staff/institute: Sølve Bærug/ ILP
Teachers: Sigmund Asmervik, Hans Sevatdal, August Røsnes, Erik Aas jr, Sølve Bærug.
Start term: August block
Terms: August block
Mandatory activities: It is assumed that students take part in class excursions and surveys.

Type of course: Lectures: 30 hours Seminars/study groups with the teacher present: 30 hours Group work/projects/exercises: 80 hours
Contents: Supervision and study adjustments will be available. An excursion of 2-3 days will be arranged. During the excursion, there will be focus on technical approaches to land use planning and land consolidation, through lectures given by local experts, technical discussions, practical exercises and presentations. Lectures and local inspections will give an introduction to architecture and planning expressions. Students will participate in a case-related group work which includes a presentation.
Learning outcomes: The new students receive their first introduction to professionals and professional studies in land use planning and land consolidation. This is partly in order to contribute to professional development through study, and partly in order to understand the progress of study through the more basic technical courses, and to increase the motivation by completing these. Students will get to know their fellow students and teachers in a connection relevant for further studies. The students will acquire basic competence in working methods and presentations common in the professions. The students will become able to describe phenomena and problems related to land use planning and tenure. The students will be introduced to ethical and interpersonal problem issues that characterise the work within the professions. The students will be introduced to typical expressions from architecture and city planning. The students will, via cooperation and exercises, acquire practice in respecting fellow students and teachers within a work and learning situation.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Compulsory written assignment to be handed in at the end of the teaching period. Participation in excursion and oral report in class. The evaluation will be based on presentations and group work. Immediate evaluation.

BIN300 Statistical Genomics

Statistical Genomics

Credits: 10 **Language:** English
Staff/institute: Theo Meuwissen/ IHA
Teachers: Odd Arne Rognli (IKBM), Åsmund Bjørnstad (IPM)
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: All independent assignments.
Prerequisites: STAT200 or HFX300
Type of course: 52 hours
Contents: - Mapping of single genes and markers - mapping of Quantitative Trait Loci (QTL) - fine scale mapping of QTL based on linkage disequilibrium - analysis of DNA sequence data, sequence comparisons, and gene detection
Learning outcomes: Students should be able to judge the pros and cons of: - alternative mapping methods for genes and QTL - alternative designs and methods of analysis for the fine scale mapping of genes - alternative methods for the analysis of sequence data and gene detection. The students should acquire sufficient knowledge to follow more advanced courses in these fields.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: Simple calculator, specified other examination aids

BIN310 Models and Algorithms in Bioinformatics

Models and Algorithms in Bioinformatics

Credits: 10 **Language:** English upon request
Staff/institute: Lars-Gustav Snipen/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Introduction to bioinformatics equivalent to BIN210. Programming knowledge equivalent to INF110. Statistics equivalent to STAT250.
Type of course: Lectures: 26 hours. Computer lab exercises: 44 hours.
Contents: There are weekly lectures and supervised exercises in the computer lab. It is important that students try to solve the exercises prior to attending the supervised computer lab. The computer lab can then be used to clarify difficult topics.

Learning outcomes: Students must be able to explain the theory behind central scoring models for sequence alignments, and thereby understand the basis of statistically based conclusions. The students will understand the optimal algorithms for sequence alignments, and implement variants of them in a high-level language. Students will know the principles behind commonly used heuristic algorithms for pairwise and multiple sequence alignments. Markov models, and other probabilistic models, and how these are used for sequence analysis, are central to the course. Students will process large data sets in a modern scripting language, and retrieve relevant information from searches in international databases.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam.

BIN350 Genome Analysis, Methodology

Genome Analysis, Methodology

Credits: 5 **Language:** English upon request
Staff/institute: Dag Inge Våge/ IHA
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: BIN210. In addition at least one of the courses: BIO210, HFM200 or BIO220
Type of course: Weeks 36-49: 2 hours per week (28 hours total)
Contents: Lectures linked to the knowledge goals of the course are given in combination with practical exercises where the students learn to find and use different tools to analyse information in databases. During the semester, three obligatory assignments will be given, which will be the basis for the students' final grade. Technical contents: Overview of genomic resources in the form of publicly available databases. Actual areas of usage for this information. Important tools for working with such information. Practical exercises covering the use of these tools.
Learning outcomes: Students shall be able to give an overview of important genome resources, explain how these are organised in information databases, and on an individual basis be able to evaluate which of these resources are most relevant in real-life cases.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The three home assignments count 1/3 each, and are evaluated collectively at the end of the course.

BIN400 Analysis of Microarray Data

Analysis of Microarray Data

Credits: 5 **Language:** English upon request
Staff/institute: Lars-Gustav Snipen/ IKBM
First time the course is offered: SPRING 2007
Start term: January block
Terms: January block
The course is offered: Other - The course is only offered if enough interested students and if the resource situation allows it.Emnet tilbys bare ved tilstrekkelig interesse og dersom ressurssituasjonen tillater det.
Prerequisites: Bioinformatics equivalent to BIN210. Statistics equivalent to STAT300/310.
Type of course: Lectures: 24 hours, exercises: 24 hours.
Contents: The course contains both lectures and exercises.
Learning outcomes: Students will know the principles and technology behind a selection of microarray platforms. They will learn a selected set of standards for storing microarray data, and use the BASE system for documentation. They are to understand the consequences of various forms of pre-processing of microarray data. They will know a selected set of methods for clustering and data reduction and be familiar with the consequences of different choices of metrics and scalings. They will understand the theory behind some selected methods for testing for differentially expressed genes, and correction for multiple testing. They will also be able to conduct some analyses of variance on microarray data and design simple experiments. The software package R is the major tool for this course.
Methods of examination: Final Oral exam **Grading:** Pass/Fail

Assessment methods: Assessment is based on an oral exam.

BIO220 Eucaryot Molecular Biology

Eucaryot Molecular Biology

Credits: 5 **Language:** English upon request
Staff/institute: Hilde-Gunn Opsahl Sorteberg/ IPM
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Study groups and semester assignment presentations (at least 80% attendance).
Prerequisites: BIO120.
Type of course: Lectures: 23 hours. Work in study groups and a presentation: 15 hours.
Contents: Theory with elements of problem-based learning, oral presentation of parts of the material and regular lectures. The course covers how gender is decided genetically, a survey of genome sequencing and the use of organisms' DNA. Gene regulation including GMO and the genetic component of cancer.
Learning outcomes: Here, we will guide the students from a genetic understanding to application of their genetic knowledge (theory and practical experience from laboratory experiments) and analysis. The knowledge they are to gain is on eucaryote genetics and on the understanding of genes and genomes. This course should supply a basis for further studies within biotechnology, livestock breeding, food, plant breeding, bioinformatics and medicine. It is also an aim for students to learn how to use literature for finding a solution to a problem, with elements of problem-based learning in colloquia, and writing a special semester assignment (giving 5 credits in addition to BIO220).
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The written exam counts 70% and the semester assignment presentation counts 30 %. Both must be passed.

BIO221 Biodiversity and Breeding of Domsticated Plants

Biodiversity and Breeding of Domsticated Plants

Credits: 5 **Language:** English upon request
Staff/institute: Åsmund Bjørnstad/ IPM
Teachers: Anne Guri Marøy.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: BIO120 Introduction course in Genetics or equivalent.
Type of course: Lectures: 42 hours (3x14).
Contents: Does ecological farming require its own species? Is gene modification different from the old methods of acquiring new breeds? What is your advice for a farmer who wishes to use hybrid seeds. These questions require insight into genetics. The course places genetics within the frame of Plant Science. Up to 1900, plant production focused on increased areas. Since the discovery of Mendel's laws, increased production has taken place on the same areas. Genetic improvements have played a part in this development. Up to 2020, grain production will increase by 40%. We need species adapted to different environments and with different characteristics. Will this be possible? The course is intended to give the students insight into genetics. The cultivation of domestic plants is based on the same principles as evolution: mutation, selection, genetic recombination, immigration. Man control these processes to such a degree, that domesticated plants may be difficult to identify based on their relatives. The lectures cover topics such as: resistance breeding, quality, overwintering, yield, etc. The students should have some prior knowledge of Mendel's laws, chromosomes, DNA structures etc, but these topics will also be covered in the lectures.
Learning outcomes: The first chapter of Charles Darwin's 'origin of Species' dealt with the genetic diversity - the genetic variation - of domesticated plants and animals. Genetics have since been based on the domesticated plants and this part of biodiversity is protected by the Convention on Biological Diversity. How did man's influence and selection result in this enormous variation? What is its role in future food supply? The cultivation of domestic plants is based on the same principles as evolution: mutation, selection, genetic recombination, immigration. Man control these processes to such a degree, that domesticated plants

may be difficult to identify based on their relatives. The lectures will cover such topics as cultivation for resistance, quality, yield etc. Up to 2020, grain production will increase by 40%. We need species adapted to different environments and with different characteristics. Is there sufficient genetic diversity for this to succeed? Does ecological farming require its own species? Do we need to increase genetic diversity through gene modification? What are the requirements for owning and approving a new species? It is recommended that the students also follow the practical course BIO221. The course gives the student deeper insight into plant genetics.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination: 3 hours.
Examination aids: No calculator, no other examination aids

BIO222 Biodiversity in Breeding of Domisticated Plants; practicals

Biodiversity in Breeding of Domisticated Plants; practicals

Credits: 5 **Language:** English upon request
Staff/institute: Åsmund Bjørnstad/ IPM
Teachers: Anne Guri Marøy.
Start term: January block
Terms: January block
Mandatory activities: Attendance is compulsory (maximum 2 days missed).
Prerequisites: BIO120 or equal. If you have passed this in December you may get a hands-on in plant genetics in Jjanuary and then plant breeding (PGN210, classical and molecular methods) in February.
Type of course: Exercises: 4 hours per week for 14 weeks in laboratory and nursery.
Contents: The course comprises 12 exercises with journals. The exercises are based on a population of barley, but also wheat properties and the development of domesticated plants. The Internet resources include www.barleyworld.org, www.graingenes.org and www.wheatbp.net and a compendium is also used.
Learning outcomes: To give the students an understanding of genetic principles and genetic diversity. The course is based on exercises in the laboratory and nursery. The Internet is used in addition to discussions and assignments.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Journal (100%).

BIO240 Plant Propagation - Traditional and Biotechnological Methods

Plant Propagation - Traditional and Biotechnological Methods

Credits: 10 **Language:** English upon request
Staff/institute: Trine Hvoslef-Eide/ IPM
Teachers: Anne Kjersti Uhlen and others.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Fundamental knowledge about plant physiology is an advantage.
Credit reduction: A student is only awarded credits for BIO240 and BIO242 (15 credits total). Then there is no point in taking BIO241 as it is a combination of half of BIO240 and all of BIO242.
Type of course: Variable: Lectures: 2-4 lectures per week. Exercises: 2-3 hours per week. Time is set aside to write the semester assignment.
Contents: The course is designed with a theoretical part (lectures) and a practical part (exercises) on the following topics: Genetic, physiological and environmental factors as a basis for plant propagation. Seed propagation (generative propagation): seed anatomy and development, ripening, cleaning and storage. Seed dormancy, delayed germination, germination. Vegetative propagation: Tuber propagation, propagation through cuttings, grafting. Micro-propagation, stock solutions, and nutrient media, selection of plant material, disinfections, axillary and adventitious shoots, somatic embryogenesis, bioreactors for mass propagation of plants, root formation and transfer to soil. The thematic essay is carried out in groups and presented to the class.

Learning outcomes: After completing the course, the student will be familiar with traditional and biotechnological propagation of plants and able to explain important conditions for successful propagation of plants in different plant groups. Through writing journals and working with topic projects, the students gain knowledge and a good understanding of plant propagation. The students acquire skills in practical propagation through their own work, the presentations of the topic projects and through working in small groups. The pedagogic methods gives a good foundation for in depth professional discussions that also include attitudes.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Assessment of the reports from exercises (50%) and the semester assignment (50%). Both parts have to be passed.

BIO241 Plant Biotechnology in Depth

Plant Biotechnology in Depth

Credits: 10 **Language:** English upon request
Staff/institute: Trine Hvoslef-Eide/ IPM
Teachers: Odd Arne Rognli, Magnor Hansen, Tone Melby and others.
Start term: Spring parallel
Terms: Spring parallel
Credit reduction: BIO240 and BIO241 are each reduced by 5 credits. If a student wants in-depth knowledge of propagation by traditional and biotechnology as well as plant biotechnology for breeding purposes, he/she should take BIO240 and BIO242 without reduction in credits, a total of 15 credits.
Type of course: Lectures: 2-4 hours per week. Exercises: 2-3 hours per week.
Contents: The course consists of a theoretical part (lectures) and a practical part (exercises) with the following topics: nutrient media, sterile technique, anther/microspore cultures, somatic embryogenesis, suspension and callous cultures, bioreactors for mass propagation of plants, gene expression, transformation methods and root formation and transfer into soil. Risk evaluations. The laws and regulations of genetic engineering in Norway and internationally. Thematic project. The course is a combination of the biotechnology part of BIO240 and the whole of BIO242.
Learning outcomes: After completing the course, the students should be able to participate in debates on GMOs. They should be familiar with the techniques of cell and tissue culture that are used for mass propagation and in plant breeding. Through the writing of reports and work on a thematic project, the students acquire knowledge of and a good understanding of plant biotechnology. The students gain skills through their own effort in the laboratory and the presentations of the thematic projects, as well as through working in groups. This is a good basis for academic discussions that also deal with attitudes. Ethics and risk evaluation are a natural part of the course, since genetic engineering is covered.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written examination, 3 hours: 1/3. Journal: 1/3, and semester assignment: 1/3. All parts have to be passed.

BIO242 Plant Biotechnology

Plant Biotechnology

Credits: 5 **Language:** English upon request
Staff/institute: Trine Hvoslef-Eide/ IPM
Teachers: Odd Arne Rognli, Magnor Hansen, Tone Melby and others.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Group work, laboratory exercises.
Credit reduction: BIO241 is reduced by 5 credits.
Type of course: Lectures: 2 hours per week. Exercises: 2-4 hours per week.

Contents: The course has a theoretical part (lectures) and a practical part (exercises) on the following topics: Nutrient media, sterile technique, anther/microspore cultures, transformation methods, gene expression. Risk evaluations. Ethics. Social benefits. The law of genetic engineering and regulations in Norway and internationally. Laboratory exercises with a report.
Learning outcomes: After completing the course, students are to be familiar with the working methods in and central problems of cell and tissue culture techniques used in mass propagation and plant breeding, including GMOs. Through journal writing and academic discussion in class, the students gain knowledge and a good understanding of plant biotechnology. Students gain skills through their own efforts in the laboratory. This way of working gives a solid foundation for good, academic discussion that also deals with attitudes. Ethics is a natural part of the course, since genetic engineering is covered by the course.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written examination, 3 hours: 50%. Laboratory report: 50%. Both parts have to be passed.

BIO300 Microscopy Techniques

Microscopy Techniques

Credits: 10 **Language:** English upon request
Staff/institute: Trygve Krekling/ IPM
Teachers: Elin Ørmen.
Start term: January block
Terms: January block Spring parallel
Mandatory activities: Exercises, demonstrations.
Type of course: Lectures: 10-12 hours per week. Demonstrations: 2-3 hours per week. Training: 4-8 hours per week Exercises: 10-15 hours per week. Additional lectures: Internet-based individual study and journals. Practical work ends with a review of the exercises/journals. Summary and discussion of the course readings.
Contents: Lectures on general optics covering the following topics: Electromagnetic radiation, resolution ability, magnification, refractive index, diffraction, phase shifting, interference. Special optics: The general ray paths in LM, CLSM, SEM and TEM, various depiction methods and optical methods for increasing the contrast in LM, SEM, CLSM and TEM. Sample treatment: general methods in LM, SEM, CLSM and TEM (fixation methods, dehydration, castings, drying, cryomethods) general and special colouration methods, immune marking. Demonstrations, teaching and exercises give a thorough introduction to the use of the microscopes and their various depiction techniques. Exercises where the students are to learn to make critical evaluations of the most appropriate methods to apply based on the problem and the nature of the sample.
Learning outcomes: Students will acquire theoretical and practical knowledge in optics, sample treatment and image formation to be able to: 1) explain central optical terms. 2) describe ray paths and image formation in various microscope types. 3) make rational choices concerning sample treatment and imaging methods based on sample type and the problem to be solved. 4) evaluate and interpret micrographs. Students should be able to: A) Diagnose, adjust and use the following microscopes: 1) Light microscopes - LM, with various types of optics (bright fields, dark fields, polarisation, phase, DIC and fluorescence). 2) Confocal Laser Scanning Microscope - CLSM. 3) Scanning Electron Microscope - SEM, in various imaging modes (SEI and BEI) and for element determination (X-ray analysis). B using the following equipment for sample treatment: 1) Ultramicrotrome for cutting in LM and TEM. 2) Cryostate for cutting in LM and SEM. 3) Coating-units (Sputter and High vacuum) in SEM. 4) Critical point drying (CPD) in SEM. C) Using a selection of methods in connection with sample treatment, colouring/marking and simple image treatment (will vary somewhat from one year to the next).
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The following will be evaluated: An approved journal: 1/3 of final grade. An oral examination: 2/3 of final grade. Both parts have to be passed. The students' qualifications are tested through: a) results of every exercise, b) course journal with deadline for submission 3 weeks after the end of the laboratory course. Student's theoretical knowledge and understanding are tested by a final oral examination, with an external examiner present. The journal must be approved before one can take the final examination.

BIO320 Development Biology

Development Biology

Credits: 5 **Language:** English upon request
Staff/institute: Hilde-Gunn Opsahl Sorteberg/ IPM
Teachers: Stein Erik Lid.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Odd years
Mandatory activities: Presentation of one's own semester assignment and the presentation of the other semester assignments (students must be present at at least 70 % of the presentations).
Prerequisites: BIO220 or equivalent.
Type of course: 12 lectures, writing and presentation of own semester assignment, and attendance at the presentations of the other semester assignments
Contents: Examples of model organisms in development biology are covered, with emphasis on the fruit fly and Arabidopsis. Principles of development and the significance of genetic regulation are illustrated by these examples. Two semester assignments, one of which is of the students' own chioce, as well as a project where students go in-depth into a particular area (project title selected in collaboration with teacher), make the course up-to-date and varied through the use of recent primary research articles.
Learning outcomes: Understanding advanced gene regulation underlying the specification of different cell types in multicellular organisms. Students are to gain insight into recent research in the field of model organisms such as the fruit fly and Arabidopsis. The students are to gain a deeper understanding of one topic in development biology through the title/topic for the semester assignments. Another aim is for students to be able to develop an understanding of choice of methods and research approaches used to solve problems and questions in developmental biology.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The semester assignments make up 40% of the grade, while the oral examination (ca. 25 minutes) makes up the other 60%. Both parts must be passed.

BIO321 Population Genetics and Molecular Evolution

Population Genetics and Molecular Evolution

Credits: 10 **Language:** English upon request
Staff/institute: Odd Arne Rognli/ IPM
Teachers: Heidi Rudi, Simen Rød Sandve, Anna Lewandowska.
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: BIO120 - Introduction to Genetics, MATH010/MATH100 - Introductory Mathematics, STAT100 - Statistics.
Type of course: Lectures: 2 hours per week for 12 weeks. Arithmetic exercises/study groups: 3 hours per week for 12 weeks.
Contents: Topics: Genetic Variation; The Hardy-Weinberg Principle; Recombination, Linkage and Disequilibrium; Basic Models for Natural Selection; Mutation; Genetic Drift; Inbreeding and Non-random Mating; Population Subdivision and Gene Flow; Molecular Population Genetics; Molecular Evolution and Phylogenetics; Advanced Models for Natural Selection; Quantitative Genetics.
Learning outcomes: The students should be able to understand the dynamics of the evolutionary changes that happen at the molecular level, the evolutionary forces behind such changes and the evolutionary effects of different molecular mechanisms on genomes, genes and gene products. The students should also gain theoretical insight and practical skills in methods used in comparative and phylogenetic analyses based on molecular data. The students should develop a critical approach towards the interpretation of this type of data, and a level of knowledge sufficient to understand cutting edge research articles on the subject. The students should be able to plan their own research on the subject and apply relevant methods in order to analyse and present the results.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: The final written examination counts 60%. Two mid-semester exams counting 15% and 25% respectively. All parts must be passed.

BIO322 Molecular Genomics

Molecular Genomics

Credits: 10 **Language:** English upon request
Staff/institute: Dag Inge Våge/ IHA
Teachers: Teachers at IHA and IPM.
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: BIO210/211, BIO220 or HFM200
Type of course: Weeks 36-49: Lectures/Student presentations of review papers.
Contents: The course content is the construction and regulation of complex genomes including techniques used to study these. More specifically, this includes central methodology on functional genome research, comparative genome analysis, genetic and physical mapping of genomes, genome sequencing, gene expression and methods for proteome analysis. Lectures related to the learning goals are held during the whole semester.
Learning outcomes: After completing the course, students are to have established a good understanding of how higher-level eucaryote genomes are built up and regulated. The students are to be able to describe and explain the most important methods used to study genomes, transcriptomes and proteomes, including the evaluation of the strengths and weaknesses of the methods.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The written exam counts 2/3, the semester assignment counts 1/3. The semester assignment is evaluated by the supervisor through a written report, and there is a final evaluation simultaneously with the final written exam.

BIO323 Evolution in Host-Pathogen Systems; Plant Breeding for Resistance

Evolution in Host-Pathogen Systems; Plant Breeding for Resistance

Credits: 10 **Language:** English
Staff/institute: Åsmund Bjørnstad/ IPM
Teachers: Helge Skinnes, Morten Lillemo.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Even years
Mandatory activities: All practicals.
Prerequisites: BIO221 or similar level, PLV220.
Type of course: The course is divided in greenhouse experiments and group discussions/lectures.
Contents: Host-pathogen interaction is characterized by rapid evolutionary adaptation, particularly in man-made environments. It was discovered that resistance in plants follow Mendel's laws, opening the door for homogeneous resistant variants. Such resistance has in many cases proved short-lived because it has triggered a selection benefiting virulence in the pathogen. There are, however great variations in host/pathogen systems. Incomplete resistance or the use of heterogenity can be more stable, but is the farmer or the consumer ready to accept this? How can we control the resistance in natural resources in a sustainable manner? The course will use practical exercises and review articles on different systems to draw the line from Mendel to molecular genetics and genetic modification.
Learning outcomes: The students shall understand the evolutionary genetics of host-pathogen interactions and how it may be affected/manipulated through breeding of resistant cultivars. Sustainable use of resistance genes in plants as part of IPM strategies. Inoculation and disease-assessment techniques, analysis of resistance in plant populations. To understand that (1)

pathogens can rarely be exterminated, (2) that low levels may be acceptable and (3) plant protection strategies based on resistance that expose the pathogen to extreme selection pressures are not sustainable.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written examination (50%) and assessment of the report (50%).

BIO330 Environmental Microbiology

Environmental Microbiology

Credits: 10 **Language:** English upon request
Staff/institute: Åsa Helena Frostegård/ IKBM
Teachers: Rolf Arnt Olsen, Lars Bakken
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: 8 seminars (2 hours each). Must attend at least 7 of the 8 seminars.
Prerequisites: Basic Microbiology equivalent to BIO130, Microbial Physiology, Genetics, and Systematics equivalent to BIO230.
Type of course: Lectures: 2 hours, 2 times per week (40 hours in total). Study groups where questions related to the course readings will be discussed: 2 hours every other week. Seminars: 2 hours per week.
Contents: Taking a series of environmental problems of current interest as the point of departure, central topics in aquatic and terrestrial microbial ecology are dealt with: *the interaction between micro-organisms and between eucaryotes and micro-organisms; *interaction of micro-organisms with their surroundings; *kinetics of microbial growth and nutrient uptake, starvation; *transport; *biogeochemically relevant functional groups; *molecular methods in microbial ecology. Applied topics: the bioremediation, spread and establishment of pathogens, genetically modified microorganisms, biological control. The course is based on lectures on selected topics, literature seminars and group discussions related to the curriculum. The lectures cover the most central topics in the textbook. Primary scientific articles are used for the literature seminars. The students are to comment on these and discuss them in plenary.
Learning outcomes: The main aim is to give students: - A basic insight into microbial processes and interactions that play central roles in the functioning of ecosystems. - The theoretical foundation necessary for acquiring knowledge in the subject field by reading primary scientific literature. - An understanding of methods, with main emphasis on the role of molecular biology in microbial ecology. - Intellectual skills that may be used for solving environmental problems.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Contribution to seminars is evaluated during the semester. Final written exam that has to be graded E or better. Grade weight for seminars: 3/10. Grade weight for written exam: 7/10 . The written exam is 3.5 hours.

BIO332 Experimental Molecular Microbiology

Experimental Molecular Microbiology

Credits: 10 **Language:** English upon request
Staff/institute: Åsa Helena Frostegård/ IKBM
Teachers: Sigve Håvarstein, Ingolf Nes
First time the course is offered: SPRING 2008
Start term: January block
Terms: January block Spring parallel
Mandatory activities: Lectures, seminars and laboratory exercises.
Prerequisites: Biochemistry equivalent to KJB200. General microbiology equivalent to BIO230. Molecular biology equivalent to BIO210.
Type of course: Lab. work: 120 hrs. Seminars/lectures: 18 hrs. Self-study: 162 hrs.
Contents: The course is an intensive laboratory course during weeks 2-5. A few lectures will be given. In addition, a number of scientific primary articles relevant for the experimental work will be discussed in seminars during the first part of the spring

semester. The students write a report from the laboratory exercises, in which relevant scientific literature is referred. The laboratory exercises cover methods used for: - measurement of biological diversity in various ecosystems - characterisation and identification of bacteria - horizontal gene transfer - genetic regulation - micro array analyses Interpretation of results and discussions on the various methods. Students write an individual, final report.
Learning outcomes: The students will become familiar with techniques used in microbiological research, with emphasis on molecular methods. Students will become aware of the contexts in which the different methods are used, and the strong and weak points of the various methods will be discussed. In addition, they will learn how to interpret and evaluate biological data, and gain experience in reading and using scientific primary literature.
Methods of examination: Final **Grading:** Pass/Fail
Assessment methods: The lab. report will be evaluated internally. The students write an extensive report from the laboratory exercises which should include introduction, materials and methods, results and discussion, plus references to relevant scientific articles. Each student hand in an independent assignment. Grade C or better on the assignment: Pass.

BIO333 Mycology

Mycology
Credits: 10 **Language:** English upon request
Staff/institute: Rolf Arnt Olsen/ IKBM
Teachers: Arne Tronsmo, Linda Hjeljord
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Mandatory activities: Active participation in at least 80 % of the seminars and the laboratory exercises.
Prerequisites: General microbiology equivalent to BIO130. General genetics equivalent to BIO120. Microbial physiology equivalent to BIO230.
Type of course: Lectures: 4 hours per week. Seminars or experimental work: 2 hours per week.
Contents: The course covers modern fungal systematics, cell biology, metabolism and genetic regulation. The sexual and asexual propagation of lower and higher fungi will also be covered. In addition, a thorough introduction to fungal physiology is given. Interactions between fungi and the use of fungi in biological control of fungal diseases, as well as fungal biotechnology are focused upon.
Learning outcomes: The students will have an overview over basic fungal systematics, -genetics, -physiology and -ecology. Students will have acquired knowledge of industrial uses of fungi, their applications in the biological control of plant diseases and knowledge of the production of mushrooms for consumption. The students should be able to consider possible positive and negative effects of fungi, and suggest actions to limit any possible risks.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Continuous evaluation of performance during the seminars and report from the experimental work count 4/10, and the oral exam counts 6/10.

BIO340 Bioethics

Bioethics
Credits: 5 **Language:** English upon request
Staff/institute: Sissel Rogne/ INA
Teachers: Deborah Oughton.
Start term: January block
Terms: January block
Mandatory activities: Compulsory participation in lectures.
Prerequisites: General bio- and gene technology or solid competence in general biology.
Type of course: Lectures and discussions: 20 - 30 hours.

Contents: Lectures will be held intensively for the first week of the course with the following topics: 1: Legislation. 2: Risk evaluation and ethical considerations. 3: Ethics and ethical evaluations. During the rest of the course, the students are to write a semester assignment on an independently chosen topic.
Learning outcomes: Students are to be familiar with the legislation in the field and who the central participants that researchers need to take into consideration in this connection are. Since the legislation requires consequence and risk evaluation as well as ethical argumentation, this must also be known to the students. Students are to be capable of holding a discussion on the ethical and social consequences of the use of modern biotechnology in the way it is required in cases of applications for exposing or performing field experiments on genetically modified organisms or for conducting clinical research on genetic engineering.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Semester assignment.

BIO350 In Situ RNA Hybridisation Techniques

In Situ RNA Hybridisation Techniques
Credits: 5 **Language:** English upon request
Staff/institute: Trine Hvoslef-Eide/ IPM
Teachers: Trygve Krekling.
Start term: January block
Terms: January block
Mandatory activities: Practicals in the laboratory.
Type of course: There will normally be activities from 9am-4pm each day, with some modifications depending on how much time is spent.
Contents: The course consists of lectures to give the theory, but mostly practicals to illustrate the whole process. The students can bring their own biological material to the first day of class, in agreement with the teacher, so that preparations can be made. The students have to hand in a lab journal that has to be approved.
Learning outcomes: The students shall be able to harvest their plant or animal material, fix it, wax-embed it, section it in a microtome, transfer to a pre-coated slide, make probes of potentially interesting gene sequences, hybridise with the probes, develop and examine under the microscope. One is able to see which genes are active (expressed) at any given time in a developmental process. The students should be able to see the potential and the limitations for the technique in plant sciences.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Submitted laboratory report.

BIO351 Geneticallly Modified Plants - Case Study

Geneticallly Modified Plants - Case Study
Credits: 5 **Language:** English upon request
Staff/institute: Trine Hvoslef-Eide/ IPM
Teachers: Odd Arne Rognli.
Start term: Autumn parallel
Terms: Autumn parallel
Type of course: 2 lecture hours each week, either lecture or self-study depending on the students' needs.
Contents: The course is focused on problem-based learning, where only a few lectures will be given. The students will spend most of their time working in pairs using material supplied through Classfronter and web links. The first part of the course will be spent writing a proposal to the authorities for deliberate release of a particular GMO. Then the students swap cases and evaluate each other,s proposals, as if they were the authorities. Two reports will be made during the course, one of which will also be given as an oral presentation to the class.
Learning outcomes: The students shall learn something about the techniques used to create genetically modified plants. Through groupwise case studies, they are to consider all aspects of GMOs; how will it affect health and environment?, is this

a product/project that is useful for society?, will it lead to a more sustainable development?, is it ethically justifiable? By going through these case studies, they will acquire knowledge and qualifications to enable them to participate in the public debate on GMOs. They will also be aware of Norwegian and international law within the field and the international agreements and conventions applicable.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: 2 reports: the first (application for deliberate release) accounts for 60% and the second (evaluation by the competent authority) counts 40%. Presentation for the class. Both parts have to be passed.

BIO420 Advanced Developmental Biology

Advanced Developmental Biology

Credits: 10 **Language:** English upon request
Staff/institute: Hilde-Gunn Opsahl Sorteberg/ IPM
Teachers: Odd-Arne Olsen.
First time the course is offered: SPRING 2007
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Odd years
Mandatory activities: The students are required to attend at least 50% of the presentations and discussion groups.
Prerequisites: BIO220.
Credit reduction: BIO320 - 5 credits.
Type of course: 20 lectures, semester assignment, discussion groups for presentations and writing of semester assignment.
Contents: Model organisms in developmental biology are covered, i.e. the fruit fly and Arabidopsis. Principles of development and the significance of genes in controlling this. The project gives the students depth in one topic and ensures that the syllabus changes every year due to updated primary articles, which act as a point of departure for assigned projects.
Learning outcomes: Understanding of the advanced gene regulation which determines the specification of different types of cells in multicelled organisms. The students are to gain insight into recent research in the field of model organisms such as the fruit fly and the Arabidopsis. The students will achieve this depth by being assigned a broad field in which to conduct a project and a smaller field of their own choosing in developmental biology (may well be connected with own research). This depth is designed to lead students to an analysis of material and synthesis by drawing their own conclusions based on the syllabus. It is great if the course can help students to consider the application of developmental biology in research. It is also a goal for the students to be given an introduction to bioethics and thereby develop a certain understanding of different fundamental views so that they are able to argue for or against these and draw conclusions for instance on how to view research on genetic engineering.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The semester assignment counts 33%. Continuous assessment for the student and the oral examination make out the rest of the evaluation. The oral examination is expected to last 25 minutes. Evaluation of activities in the course, presentation and semester assignment, and a final oral examination.

BIO421 Population Genetics and Molecular Evolution

Population Genetics and Molecular Evolution

Credits: 15 **Language:** English upon request
Staff/institute: Odd Arne Rognli/ IPM
Teachers: Heidi Rudi, Simen Rød Sandve, Anna Lewandowska.
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: BIO120 - Introduction to Genetics, MATH010/MATH100 - Introductory Mathematics, STAT100 - Statistics.

Credit reduction: Credit reduction in proportion to BIO321: 10 credits.
Type of course: Lectures: 2 hours per week for 12 weeks. Math exercises/study groups: 3 hours per week for 12 weeks. Presentation and discussion of semester assignment: 1 hour.
Contents: Topics: Genetic Variation; The Hardy-Weinberg Principle; Recombination, Linkage and Disequilibrium; Basic Models for Natural Selection; Mutation; Genetic Drift; Inbreeding and Nonrandom Mating; Population Subdivision and Gene Flow; Molecular Population Genetics; Molecular Evolution and Phylogenetics; Advanced Models for Natural Selection; Quantitative Genetics.
Learning outcomes: The students should be able to understand the dynamics of the evolutionary changes that happen at the molecular level, the evolutionary forces behind such changes and the evolutionary effects of different molecular mechanisms on genomes, genes and gene products. The students should also gain theoretical insight and practical skills in methods used in comparative and phylogenetic analyses based on molecular data. The students should develop a critical approach towards the interpretation of this type of data, and a level of knowledge sufficient to understand cutting edge research articles on the subject. The students should be able to plan their own research on the subject and apply relevant methods in order to analyse and present the results.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The semester assignment counts 33.3%, final written exam 40%, the first small exam 16.7% and the second small exam 10%. All exam parts must be passed.

BIO422 Nordic Postgraduate Course in Plant Breeding

Nordic Postgraduate Course in Plant Breeding

Credits: 5 **Language:** English
Staff/institute: Åsmund Bjørnstad/ IPM
Teachers: Nordic teachers and invited teachers.
Start term: June block
Terms: August block June block
Mandatory activities: Colloquia on literature, submission of abstract of assigned talk.
Prerequisites: Basic courses in genetics and plant breeding, preferably also at 300-level. To have costs covered the student should have the course as part of the Ph.D. study plan (not restricted to students having plant breeding as the major topic).
Type of course: Lectures/colloquia: 2-4 hours/week on a 500 pages long compendium of selected papers. Intensive course week.
Contents: Compendium with original literature. Topic given before lecture. Participation in the course week.
Learning outcomes: To get an understanding of the role of molecular genetics and genomics in plant production. To be able to present and discuss professional scientific topics in English.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Intensive course, 1 week. Abstract and 45 minute lecture on an assigned topic within the course agenda. Active participation in discussions. Abstract and lecture count 100%.

BOT230 Plant Ecology

Plant Ecology

Credits: 10 **Language:** English upon request
Staff/institute: Ørjan Totland/ INA
Teachers: Stein Joar Hegland (stein.hegland@umb.no).
Start term: August block
Terms: August block Autumn parallel
Mandatory activities: Participation in the August semester and hand-in of field reports.
Prerequisites: BOT100 and ECOL100.

Type of course: Demonstrations/lectures in the field: 40 hours. Lectures: 40 hours.
Contents: Field demonstrations, field teaching, independent field work exercises, lectures, colloquia, semester assignment.
Learning outcomes: The course is based on the fact that plants, as opposed to most animals, cannot move. The plants must therefore handle biotic and abiotic environmental conditions where they grow. The course focuses on the consequences that this has for the reproduction, nutrient uptake, life-history strategies, anti-herbivore defence, population dynamics and distribution of plants, and for the structure of plant communities. The main part of the course takes place in the field and gives students good insight into the integration between ecological theory and field methodology. The course gives students a solid foundation of knowledge which is useful in further studies in ecology and nature management and also relevant to students in other plant-related disciplines.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam, 3.5 hours, counts 3/5 of the grade. Semester assignment counts 2/5 of the grade. All of the evaluated elements in the course must be passed to pass the course.

BOT250 Plants and Health

Plants and Health

Credits: 5 **Language:** English
Staff/institute: Kåre Lye/ INA
Teachers: Knut Asbjørn Solhaug and Torunn Stangeland.
First time the course is offered: AUTUMN 2008
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Even years
Mandatory activities: Lab classes and field excursions.
Prerequisites: BOT100.
Type of course: Lectures: 20 hours; field excursion and lab classes: 20 hours.
Contents: The course will present an introduction to the use of plants in various alternative methods of healing, the history of medication, and how various plants are used to alleviate or heal diseases of the respiratory tract, the gastro-intestinal tract, the reproductive and urinary tract, the cardiovascular system, the nervous system as well as diseases of joints, muscles and skin. There will also be focus on toxic plants and natural product chemistry.
Learning outcomes: The students shall achieve a good understanding of how plants in different parts of the world are used to treat ailments and diseases, knowledge of important natural product chemicals, and advantages and disadvantages of traditional medicine compared to scholastic medicine.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: The written examination lasts 3 hours and counts 100 % of the grade.
Examination aids: No calculator, no other examination aids

BOT320 Advanced Course in Plant Development Physiology

Advanced Course in Plant Development Physiology

Credits: 15 **Language:** English
Staff/institute: Christiaan Van Der Schoot/ IPM
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Approved lab reports and a seminar on 1-2 recent scientific publications.
Prerequisites: BOT200.
Type of course: Lectures: 20 hours. Colloquia: 12 hours. Lab classes: 60 hours.
Contents: The course focuses on the growth and organisation of higher plants, including plant developmental physiology and cell biology. Particular attention is given to organisation of life processes, including transport and signalling processes. The course includes lectures, lab classes and colloquia.

Learning outcomes: The course provides opportunities to develop skills and insight into the growth and internal organisation of plants, and into their responses to spontaneously generated or climate-induced signals. The course stimulates the development of skills in experimentation as well as in presenting and discussing experimental and theoretical results.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Continuous assessment: -Oral examination counts 50 % of the grade. -An assignment counts 25 % of the grade. -An oral presentation counts 25 % of the grade.

BOT340 Photobiology

Photobiology

Credits: 10 **Language:** English upon request
Staff/institute: Knut Asbjørn Solhaug/ INA
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Prerequisites: BOT130 and BOT240.
Type of course: The will be approximately 20 hours of lectures, 30 hours of seminars/study groups and 50 hours of laboratory work. In addition, the students receive individual guidance in presenting their results in the form of a poster/oral presentation/research article.
Contents: In the lectures, photosynthesis will be thoroughly covered and emphasis will be placed on plants' adaptation to UV-radiation. The laboratory exercises will be arranged as a project where the students, under guidance, learn how to use modern photosynthesis-measurement equipment and present the results as a scientific article, a poster and a short lecture. Parts of the syllabus will be presented in groups/colloquia. The contents and the arrangement of the course can, to a certain extent, be adapted to the interests of the students.
Learning outcomes: The aim is for the students to achieve a good understanding of the photobiology of plants. This includes a thorough introduction to photosynthesis. In addition, great emphasis will be placed on plants' adaptation to UV-radiation. The students will learn to use different methods for measuring photosynthesis (chlorophyll fluorescence, measurement with oxygen electrodes and infrared gas analysis) and in addition learn to measure the spectral composition and light strength for both daylight and artificial light (spectrometers, sensors, data loggers etc. will be used). The contents of the course can, to a certain extent, be adapted to the interests and needs of the students.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The oral exam of 40 minutes counts 2/3 of the grade. Presentation of the lab results counts 1/3 of the grade. The presentation of results will consist of an oral presentation, a poster and a scientific article. All of the evaluated elements in the course must be passed to pass the course.

BOT350 Pollination and Reproductive Ecology of Plants

Pollination and Reproductive Ecology of Plants

Credits: 5 **Language:** English upon request
Staff/institute: Ørjan Totland/ INA
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Prerequisites: BOT230, ECOL200.
Type of course: Lectures: 14 hours. Colloquia: 14 hours.
Contents: Lectures, colloquia, semester assignment. Field demonstrations if possible.
Learning outcomes: The course gives advanced knowledge of the pollination and reproductive ecology of plants. There will be special focus on: adaptations to various pollen vectors, pollinator behaviour, pollination limitation to reproduction, natural

selection of pollination traits, evolution of pollination adaptations, the connection between pollination and reproductive strategies, the evolution of reproductive strategies, and management. The course makes students capable of doing Master's and PhD degrees on the pollination and reproductive ecology of plants, and gives students with Master's degrees in other plant sciences useful additional knowledge for their projects. The course is problem-based and provides the students with critical attitudes towards the existing knowledge within the field.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The oral exam counts 3/5 of the grade and the semester assignment counts 2/5 of the grade. All of the evaluated elements in the course must be passed to pass the course.

BUS230 Management Science - Principles

Management Science - Principles
Credits: 10 **Language:** English upon request
Staff/institute: Marie Steen/ IØR
Teachers: Teaching assistants. Guest lecturers.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Introductory courses in mathematics, statistics and microeconomics.
Credit reduction: BUS231 - 10 credits, BUS232 - 5 credits.
Type of course: Lectures: 2 hours per week. Class hours for exercises: 2 hours per week.
Contents: Introduction to modelling, extensive use of spreadsheets in quantitative decision making models, linear programming, integer programming, network modelling, non-linear modelling, goal programming. Relationship to other courses: The Master's level courses BUS330 and ECN350 require knowledge in Management Science.
Learning outcomes: To give students a solid basis for using quantitative decision-making methods, where linear programming will be central, in solving economic problems. The main focus of the course will be on formulation and solution of different problems. As well, the economic significance of the results will be central. There will be focus on discussing the strengths and weaknesses of the different methods and the fact that models will always be a simplification of reality. The course will to a certain degree focus on issues connected to agriculture and resource management.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam counts 100%.
Examination aids: Simple calculator, no other examination aids

BUS231 Management Science - Principles

Management Science - Principles
Credits: 10 **Language:** English
Staff/institute: Marie Steen/ IØR
Teachers: Teaching assistants. Guest lecturers.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Introductory courses in mathematics, statistics and microeconomic theory.
Credit reduction: BUS230 - 10 credits, BUS232 - 5 credits.
Type of course: 2 hours of lectures and 2 hours in the computer lab per week.
Contents: Introduction to models and modelling, spreadsheet modelling, linear programming, integer programming, network models, non-linear programming, multi-objective programming. Relationship to other courses: The Master's level courses BUS330 and ECN350 require knowledge in Decision modelling.
Learning outcomes: The course shall give the students a solid basis for the use of important quantitative decision methods, where linear programming is the most important, to analyse economic and business problems. The main emphasis will be on formulating and solving different types of problems. Furthermore, the economic interpretations of the results are central. The importance of the strengths and weaknesses of the different methods will be discussed, as well as the fact that a model will

always be a limited representation of reality. The course will to a certain degree be aimed towards agriculture and resource management problems.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam counts 100%.
Examination aids: Simple calculator, no other examination aids

BUS232 Management Science - Fundamentals

Management Science - Fundamentals

Credits: 5 **Language:** English
Staff/institute: Marie Steen/ IØR
Teachers: Teaching assistants. Guest lecturers.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Introductory courses in mathematics, statistics and microeconomic theory.
Credit reduction: BUS230 - 5 credits, BUS231 - 5 credits.
Type of course: 2 hours of lectures and 2 hours in the computer lab per week.
Contents: Introduction to models and modelling, spreadsheet modelling, linear programming, multi-objective programming. Relationship to other courses: The Master's level courses BUS330 and ECN350 require knowledge in Decision modelling.
Learning outcomes: The course shall give the students a basis for the use of important quantitative decision methods, where linear programming is the most important, to analyse economic and business problems. The main emphasis will be on formulating and solving different types of problems. Furthermore, the economic interpretations of the results are central. The importance of the strengths and weaknesses of the different methods will be discussed, as well as the fact that a model will always be a limited representation of reality. The course will to a certain degree be aimed towards agriculture and resource management problems.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam counts 100%.
Examination aids: Simple calculator, no other examination aids

BUS233 Management Information Systems

Management Information Systems

Credits: 5 **Language:** English
Staff/institute: Ole Gjølberg/ IØR
Teachers: Joe Valacich is the George and Carolyn Hubman Distinguished Professor of MIS at Washington State University. His teaching interests include systems analysis and design, IT project management, and the management of information systems. He has conducted numerous corporate training and executive development programs for organizations, including: AT&T, Boeing, Dow Chemical, EDS, Exxon, FedEx, General Motors, Microsoft, and Xerox. He previously served on the editorial boards of MIS Quarterly (two terms) and Information Systems Research, and is currently serving on the boards at Decision Science and Small Group Research. His primary research interests include technology-mediated collaboration, human-computer interaction, mobile and emerging technologies, e-business, and distance education. He is a prolific researcher, with more than 60 journal publications in numerous prestigious journals. He is also the co-author of several the best-selling textbooks and is a leader in designing national curricula and accreditation standards for the information systems discipline.
First time the course is offered: SPRING 2008
Start term: June block
Terms: June block
Prerequisites: BUS133 - Excel for Business
Contents: We will examine how organizations choose technological innovations and investments, manage and design the information system architecture, enable commerce using Internet technologies as well as gain business intelligence by acquiring, designing, and securing their information systems investments. In addition, the course will examine how information systems influence numerous ethical issues facing organization and society such as data privacy and ownership as well as how information systems are enabling computer crime and cyber terrorism.

Learning outcomes: Today, information systems are an integral part of all business activities and careers. This course is designed to introduce students to contemporary information systems and demonstrate how these systems are used throughout organizations. Most notably, the course will extensively examine how information systems are fueling globalization-making the world smaller and more competitive-in virtually every industry and at an ever-increasing pace. We will focus on the key components of information systems-people, software, hardware, data, and telecommunications, and how these components can be integrated and managed to create competitive advantage.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Multiple Choice, more details will come on the ClassFronter.

BUS321 Empirical Analyses of Financial and Commodity Markets - Theory

Empirical Analyses of Financial and Commodity Markets - Theory
Credits: 5 **Language:** English
Staff/institute: Ole Gjølberg/ IØR
Teachers: Prof. Frank Asche; Assoc. Prof. Olvar Bergland; Prof. Alan Love
Start term: June block
Terms: June block
Prerequisites: ECN202 or equivalent
Credit reduction: 5 credits reduction against the former BUS320 (10 credits).
Type of course: Lectures and organised exercises: approx. 60 hours.
Contents: Different topics will be dealt with in the course. These may be different from year to year, based on current research at the department such as foreign exchange, energy markets (oil, electricity, bioenergy), soft commodities, metals etc. The course includes the following activities: 1. Lectures. 2. Econometric exercises.
Learning outcomes: The aim of the course is to develop the student's ability to read empirical analyses based on problem issues and data from the finance and commodity markets and also develop skills that enable the student to conduct his/her own empirical analyses. This aim shall be accomplished through combining economic theory and hypotheses of these markets with applied econometric methods and data. Central issues, methods and results from the research literature will be presented in the lectures.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam, 3.5 hours
Examination aids: Any calculator, no other examination aids

ECN111 Introduction to Economics - Micro

Introduction to Economics - Micro
Credits: 5 **Language:** English
Staff/institute: Sigurd Rysstad/ IØR
Teachers: Department teachers
First time the course is offered: SPRING 2007
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Higher education entrance qualification, in Norway.
Credit reduction: ECN110 - 5 ECTS.
Type of course: Lectures: 26 hrs. Exercises: 26 hrs. Reading literature etc.: 98 hrs.
Contents: The course consists of the following subjects: The behaviour of the consumer. The behaviour of the producer. Different markets, especially free competition and monopoly. Welfare theory, especially about market success and failure.
Learning outcomes: The course is an introductory course. Students should learn principles of the theory of microeconomics. More specifically, the aim of the course is to give the students (i) an overview over the most important concepts and models in microeconomics, ii) the first training to formulate and solve microeconomic problems and (iii) good qualifications for further studies in economics.

Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam, 3.5 hours.
Examination aids: Simple calculator, no other examination aids

ECN121 Introduction to Economics - Macro

Introduction to Economics - Macro

Credits: 5 **Language:** English
Staff/institute: Ragnar A. Øygard/ IØR
Teachers: Department teacher
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Two exercise sets must receive the pass grade
Prerequisites: Higher education entrance qualification in Norway and ECN111 (Introduction to economics, micro) or similar.
Credit reduction: ECN120 - 100%.
Type of course: Lectures: 2 hours per week. Exercises: 2 hours per week parts of the semester
Contents: Part 1: Free market economic theory, 2 weeks. Part 2: Macroeconomics, 12 weeks.
Learning outcomes: Students are expected to learn and be able to utilise central terminology and theories within macro economics, including how these can be used to analyse the effects of economic policy and other influences on the economy. Among the topics covered are: the national accounts; what factors determine macro economic variables such as production, unemployment, inflation, interest rates, and exchange rate; simple Keynes models; effects of economic policies; budgets and saving; economic growth. The theories will be applied in the context of current policy issues, in both OECD countries and developing countries.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written 3.5 hours.
Examination aids: Simple calculator, no other examination aids

ECN150 Introduction to Development Economics

Introduction to Development Economics

Credits: 5 **Language:** English upon request
Staff/institute: Carl Erik Schulz/ IØR
Teachers: Arild Angelsen, Stein Holden.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Writing of one semester assignment. This paper will not be graded.
Prerequisites: ECN110 or ECN111.
Type of course: Lectures: 4 hours per week.
Contents: Who are the poor? What is growth and development? Why are some countries poor and some rich? Classical and recent theories on growth and development. Poverty and dissimilarities. Population growth. Urbanisation and migration from the countryside. Education and health. Agriculture and developments in the countryside. Environment and development. Globalisation, poverty and environment.
Learning outcomes: After completing the course, the students should have an overview of: 1) Typical distinctive characteristics of developing countries. 2) Important theories and models for economic development and reduced poverty. 3) Relevant development problems and possible means for solving these.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3 hour written exam.
Examination aids: No calculator, no other examination aids

ECN201 Econometrics

Econometrics

Credits: 10 **Language:** English
Staff/institute: Kyrre Rickertsen/ IØR
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Compulsory term paper. Students must receive a passing grade for the term paper to be allowed to take the final exam.
Prerequisites: Mathematics (MAT100), statistics (STAT100), and microeconomics (ECN210/ECN212).
Credit reduction: The course partly overlaps with ECN202 and STAT200. There is reduction in credits for ECN202 (5 credits) and STAT200 (5 credits).
Type of course: There are four hours of lectures and/or exercises per week or a total of about 50 hours of structured time. The lectures will take about 60% of the structured time and the exercises about 40% of the structured time.
Contents: The lectures in ECN201 cover two- and multiple-variable regression analysis, OLS, hypothesis testing, violations of OLS assumptions, GLS, dummy independent variables, and the use of the econometric program SHAZAM. In addition, there are problem sets, computer exercises, and a semester assignment.
Learning outcomes: ECN201 gives an introduction to econometric methods. The focus is on applied and not theoretical econometrics. There are two specific goals. First, the course aims at giving students practice in reading and understanding empirical works in economics and other social sciences. That includes knowledge of ordinary least squares (OLS) and its assumptions, the consequences of violating these assumptions, and how to detect and correct misspecification in econometric models. Second, the students will do their own econometric analysis, which includes formulating the problem to be investigated, developing an econometric model based on economic theory, obtaining the required data, estimating the econometric model, testing and correcting for misspecification in the estimated model, describing the empirical findings, and discussing their relevance for the investigated problem. The second specific goal also includes learning to use an econometric program such as SHAZAM.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: The final grade will be based upon a 3.5 hour written exam.
Examination aids: Simple calculator, no other examination aids

ECN230 International Economics

International Economics

Credits: 5 **Language:** English
Staff/institute: Roberto J. Garcia/ IØR
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises, which can be either optional or compulsory, requiring a passing grade.
Prerequisites: Basic knowledge in macro- and microeconomics ECN120, ECN220 and ECN210.
Type of course: 4 hours per week.
Contents: This course is designed to bridge international economic theory and applied agricultural economics, providing a review of issues in development, policy, trade, and welfare.
Learning outcomes: The student is expected to develop: an understanding of why nations trade and under which conditions trade occurs; knowledge of the role of supply and demand factors in determining the gains from trade; the ability to evaluate the welfare effects of protectionist trade policies, free trade, managed trade, and the economic implications of other forms of government intervention to foster development; a conceptual framework for evaluating international competitiveness, comparative advantage, and foreign investment and strategic behaviour.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3 hour written exam.
Examination aids: No calculator, no other examination aids

ECN270 Resource and Environmental Economics

Resource and Environmental Economics

Credits: 5 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Teachers: Ståle Navrud, Ragnar Øygard.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: 5 exercises
Prerequisites: Microeconomics at the level of ECN212 or ECN210/211.
Credit reduction: ECN170, ECN273 and EDS240 reduced respectively with 3, 2 and 3 credits.
Type of course: 4 hours lectures, seminars and exercise review per week.
Contents: Lectures and exercises will address the following issues: Welfare theory, economy - ecology interactions, sustainable development, cost-benefit analysis, optimal management of renewable and non-renewable resources, pollution, biodiversity conservation, land degradation and deforestation, valuation of environmental resources and accounting for the environment, international environmental agreements. The course will emphasise issues, cases and perspectives of particular relevance to developing countries.
Learning outcomes: Candidates should be able to apply economic theory to analyse environmental and natural resource management issues. These issues include: economy - ecology interactions, sustainable development, optimal managment of renewable and non-renewable resources, optimal pollution, biodiversity conservation, land degradation and deforestation, valuation of environmental resources and accounting for the environment, and international environmental agreements.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam, 3 hours: 100 %.
Examination aids: No calculator, no other examination aids

ECN271 Project Evaluation and Environmental Valuation

Project Evaluation and Environmental Valuation

Credits: 10 **Language:** English upon request
Staff/institute: Ståle Navrud/ IØR
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: ECN170 (or ECN270), ECN210 and ECN202 or ECN201; or similar introductory courses in environmental and resource economics, econometrics and microeconomics.
Type of course: 60 hours.
Contents: The course gives an overview of theory and methods for economic appraisal of projects, in terms of cost-benefit analysis (CBA) and theory and methods for economic valuation of environmental goods; including the damage function approach, environmental and health valuation methods and benefit transfer techniques. Applications to environmental impacts from renewable and non-renewable energy investments (e.g. wind farms, hydro power plants, gas-fired power plants), noise and other impacts from transportation projects, air and water pollution policies, landscape aesthetics, biodiversity preservation, recreational fishing and hunting, marine oil spills, and health impacts from air pollution. Environmental valuation in developing countries. Laws and guidelines for CBA in Norway, EU, USA and developing countries. Welfare theoretic basis for CBA and the value judgements/assumptions made in CBA. A stepwise approach to CBA, with special emphasis on risk/uncertainty, distributional impacts, economic valuation of environmental impacts, and treatment/presentation of non-valued impacts.
Learning outcomes: After the course, students should be able to carry out, interpret and critically evaluate Cost-Benefit Analyses (CBAs) of projects and policies, including the treatment and economic valuation of environmental impacts, health impacts and impacts on cultural heritage.
Methods of examination: Final **Grading:** A-F
Assessment methods: A semester assignment, which is prepared by groups of 3-4 students. In the semester assignments the students will apply what they have learned about theory and methods to a case of their own choice, i.e. an economic analysis

of a project with environmental impacts. In the semester assignment, the students will also have to answer questions from a check list, which covers the curriculum of the course.

ECN301 Econometric Methods

Econometric Methods

Credits: 10 **Language:** English
Staff/institute: Olvar Bergland/ IØR
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Compulsory exercises and project work involving econometric analysis using computers.
Prerequisites: An introductory course in econometrics (ECN201) (or regression analysis), statistics (STAT100), microeconomics (ECN210), and linear algebra at the level of ECN302.
Credit reduction: This course replaces ECN300. A student can not be given credit for both ECN300 and ECN301.
Type of course: Class lectures: 45 hours. Laboratory work: 20 hours.
Contents: This course focuses on modern econometric methods for the analysis of microeconomic data - both cross-sectional and panel data. The following topics are covered: estimation and testing of linear regression models with stochastic and possibly endogenous regressors, panel data models, systems of equations, models with limited dependent variables, models of sample selection, and program evaluation.
Learning outcomes: The successful student should be able to conduct independent econometric analysis of micro-economic data, and to critically evaluate econometric analysis with respect to choice of model, method and interpretation of results. The analysis should be performed using a computer and appropriate software. The econometric analysis should be in accordance with current standards for scientific documentation within economics.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 4 hours final exam
Examination aids: Any calculator, any other examination aids

ECN302 Mathematics for Economists

Mathematics for Economists

Credits: 5 **Language:** English
Staff/institute: Kyrre Rickertsen/ IØR
Teachers: Dadi Kristofersson
First time the course is offered: AUTUMN 2007
Start term: August block
Terms: August block
Prerequisites: Mathematics on the level of MAT100.
Type of course: There are four hours of lectures and exercises per day. About half the time will be allocated to lectures and the remaining time will be allocated to exercises.
Contents: The course covers mathematical tools that will be assumed known in courses such as, for example, ECN311 (Microeconomics) and ECN301 (Econometrics). The course is a required course for the M.Sc. degree in Economics at IØR. Topic covered in matrix algebra include: Summation operators, types of matrixes, matrix operations, Gauss-Jordan elimination, determinants, the inverse of a square matrix, matrix differentiation, Cramer's rule, and the matrix approach to regression. Topics covered in optimization include: Elasticities, the chain rule, unconstrained optimization, equality contrained optimization (Lagrange), inequality contrained optimization (Kuhn Tucker), implicit funtion theorem, and enevelope theorem.
Learning outcomes: The course will introduce the matrix algebra required in courses in econometrics and the tools required for solving optimization problems in economics. The focus is on applying the mathematical tools rather than proving them. An important part of the course is to solve problem sets.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail

Assessment methods: Three problem sets must be completed within the deadline for each set and graded as passed to pass this class.

ECN311 Microeconomics

Microeconomics

Credits: 10 **Language:** English
Staff/institute: Kyrre Rickertsen/ IØR
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Five problem sets must be graded as passed before taking the exam.
Prerequisites: Microeconomics on the level of ECN210/ECN212. Mathematics on the level of ECN302 (Mathematics for economists).
Credit reduction: ECN310, 5 ECTS
Type of course: There are four hours of lectures and exercises per week. About 60% of the time will be allocated to lectures and 40% to exercises.
Contents: The course extends the material covered in intermediate courses in microeconomics. Special emphasis is put on duality theory in economics. The lectures cover the theory of the consumer, the theory of the producer, and behavior under uncertainty.
Learning outcomes: The theory introduced in intermediate courses in microeconomics is further developed in ECN311. The course will give the students basic training in solving economic problems related to supply, demand, and input demand. The focus is on applying rather than proving theory. The course gives a basis for further studies in, for example, development, resource, and environmental economics.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: The grades will be set on the basis of a 3.5 hours written exam.
Examination aids: Simple calculator, no other examination aids

ECN312 Industrial Organisation

Industrial Organisation

Credits: 5 **Language:** English
Staff/institute: Olvar Bergland/ IØR
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Intermediate microeconomics (ECN211). Mathematics at the level of ECN302.
Credit reduction: ECN213
Type of course: Lectures: 25 hours. Group discussions: 15 hours.
Contents: The following topics are covered: partial and general equilibrium, welfare theory, non-cooperative game theory, market power, monopoly, oligopoly, horizontal and vertical relations, and strategic behavior towards entry deterence.
Learning outcomes: The course aims at providing the students with economic concepts and analytical tools required for understanding, explaining and analyzing market behavior, market structure and market power; and the interplay between the market conditions and strategic behavior. The use of game theory is emphasized.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final exam counts 100%, 3 hours
Examination aids: No calculator, no other examination aids

ECN330 Economic Integration and Trade Liberalization

Economic Integration and Trade Liberalization

Credits: 10 **Language:** English

Staff/institute: Roberto J. Garcia/ IØR
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: There are between 4-6 exercises related to the course modules.
Prerequisites: Microeconomics, International Economics, ECN211/ECN212, ECN230, ECN 331, ECN201.
Type of course: Class will meet 6 hours per week and 42 hours total (seven weeks). This will allow time for students to work on the semester project.
Contents: The course is designed with two objectives: to complete the student's understanding of the basic economics of trade through a formal treatment of the macro economy and its relation to exchange rates, exchange regimes and policy; and to provide a practical understanding of economic integration and the importance of the multilateral trading system (the WTO in particular) as a platform to address issues or voice concerns related to trade in goods and services (with special emphasis on the Agreements on Agriculture, Sanitary and Phytosanitary measures, Technical Barriers to Trade). Finally, trade policy and agricultural programs in selected importing and exporting countries are discussed in terms of their compliance with WTO Agreements.
Learning outcomes: Students are expected to develop: · a conceptual framework for understanding the legal, political and economic implications of economic integration versus trade liberalization through a study of the development of the European Union and the multilateral trading system under the WTO; and · the ability to assess trade policies and domestic regulations affecting trade in goods, services and intellectual property (special attention is paid to agricultural programs of a country to determine whether such policy is compliant with a country's commitments under the WTO Agreements).
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final written exam, 3.5 hours, 60%. Oral exam, 40%. Students have to pass both parts of the exam

ECN331 International Economics and Finance

International Economics and Finance

Credits: 5 **Language:** English
Staff/institute: Roberto J. Garcia/ IØR
Start term: August block
Terms: August block
Mandatory activities: 4 exercises or problem sets.
Prerequisites: ECN230.
Type of course: 21 lecture hours and exercise sessions; there are seven 3-hour sessions. There is flexibility to slow down or increase the pace of meetings. Can either meet in morning sessions (09.15-12.00), afternoon sessions (14.15-17.00) or both.
Contents: Macroeconomic analysis and international trade - Balance of payments - Balance of trade - Capital account - Reserves Exchange rates - Law of one price, terms of trade, and purchasing power parity - Forecasting, speculation, hedging and arbitrage: equilibrium exchange - Modelling currency markets Money markets and interest rate determination - Money demand and money supply - Interest parity and exchange rates - Capital markets Fiscal policy, goods market equilbrium Monetary policy and asset market equilibrium Alternative exchange regimes and central bank operation Capital controls Monetary union
Learning outcomes: The course is designed to complete the students's understanding of the basic economics of trade through a formal treatment of the international macro economy and its relation to foreign exchange, foreign exchange regimes, capital movements, exchange rates and macroeconomic policy. Specifically, the student is expected to develop: (1) an understanding the relation of the microeconomics of international trade with the macroeconomics of international transactions; (2) an appreciation for the complex relationships between macroeconomic indicators and the foreign exchange marekts, and the interrelationships among assets, goods, and foreign exchange markets; and (3) an understanding of the implications of a government's (and central bank's) macroeconomic policy/objectives under fixed, flexible and managed foreign exchange regimes and the economic implications of the policy choices from each.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam, 3.5 hours.
Examination aids: No calculator, no other examination aids

ECN350 Development and Environment Economics

Development and Environment Economics

Credits: 15 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Teachers: Ragnar Øygard, Carl-Erik Schulz
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Compulsory exercises. Group work/presentations.
Prerequisites: Basic knowledge in economic theory (micro economics, macro economics, development economics, resource economics, econometrics, operations research. ECN200/201, ECN230, ECN353, ECN270.
Credit reduction: ECN450, 15 credits.
Type of course: Lectures: 4-6 hours per week. Exercises: 2-4 hours per week. Total: 8 hours per week (lectures and exercises).
Contents: Quantitative Development Policy Analysis. Economics of rural organisation. Environment and development.
Learning outcomes: To give the students deeper insights in economic theory and methodology and how to use these for the analysis of development and environment policy issues in developing countries. - Advancement of theoretical and methodological skills. - Combine theory and methodology to do applied policy analysis. - Policy analysis for poverty reduction, food security and natural resource management.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam (3.5 hours): 50%. Oral exam: 50%. The students have a number of compulsory computer exercises to submit individually (80% has to be submitted and approved in order to be able to take the exams). Participation in group exercises/presentations is compulsory.

ECN351 Research in Development Economics

Research in Development Economics

Credits: 5 **Language:** English
Staff/institute: Carl Erik Schulz/ IØR
Teachers: Arild Angelsen, Stein Holden.
Start term: January block
Terms: January block Spring parallel
Mandatory activities: Students must attend lectures and exercises and pass compulsory assignments in order to pass the course.
Prerequisites: ECN212 Microeconomics or ECN211 Microeconomics II and ECN220 Economics II, ECN200 Econometrics or ECN201 Econometrics.
Credit reduction: It is not possible to earn credits for both ECN351 and previous ECN250, as these courses overlap considerably.
Type of course: Two hours of lectures plus two hours of exercises per day for two weeks during the January block. One workshop to present the first draft of research proposals in March.
Contents: The course will cover the following topics: - How to find good research questions; - How to write a thesis and research proposal; - General writing rules; - Field research methods; - Social surveys, including sampling, surveys and analysis; - Impact studies; and - Introduction to the STATA statistical package.
Learning outcomes: In this course, students should be able to find and present a researchable topic within development economics and to write a research proposal for their thesis. In order to write a research proposal they need to be able to: - demonstrate command of existing knowledge within their research topic; - use existing knowledge to explore the issue of interest; formulate researchable research questions and/or hypotheses; - locate economic data and/or plan how to collect their own field data; and understand the methods used to compile and analyse the data.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail

Assessment methods: The semester assignment (research proposal) is due late March, and makes up 100 percent of the final grade.

ECN352 Development Economics - Macro

Development Economics - Macro

Credits: 10 **Language:** English
Staff/institute: Ragnar A. Øygard/ IØR
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Basic micro- and macroeconomic theory, e.g., ECN120, and preferably also ECN210 and ECN220.
Credit reduction: ECN252: 10 credits.
Type of course: The course will have 6 class hours per week, of which approx. 4 hours will be used for lecturing and approx. 2 hours for other activities.
Contents: The topic of the course covers a very wide area. In order to concentrate on a few topics and theories, and to avoid overlap with other courses, the course will have two main parts. The first (and largest) part deals with economic growth and development - the long-term perspective, and the second one with macroeconomics theories of economic stabilisation and management - the short/medium-term perspective. A significant share will be spent to discuss economic growth and macroeconomic policies in relation to environmental and poverty/distributional issues. Key topics of the course include: I. Economic growth (the long term perspective) - Historical overview; growth vs. development - Old Growth theories (Harrod Domar and Solow) - New growth theories (endogenous growth) - Economic growth and institutions - The growth record: Asia vs. Africa - Growth, inequality and poverty - Growth, poverty and development aid - Poverty reduction strategies and economic policies - Growth and the environment - Growth and agriculture - Growth and population II. Macroeconomic management (the short/medium-term perspective) - Closed economy models (ISLM, ADAS) - Open economy models (Mundell Fleming) - Current stabilisation and structural problems (e.g. financial crisis)
Learning outcomes: 1. To acquire knowledge about major theories and models of economic growth/development and macroeconomic management in developing countries. 2. To be able to apply these theories and models to understand and critically analyse current development, macroeconomic and global economic issues, as well as particular policies and programmes in developing countries.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The final grade will be based on: (i) two individual assignments (10 % each), (ii) an individual class presentation (10 %), (iii) a group work (10 %), (iv) a final, written exam (3 hours) (60 %).

ECN353 Development Economics, Micro

Development Economics, Micro

Credits: 5 **Language:** English
Staff/institute: Carl Erik Schulz/ IØR
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Compulsory assignments.
Prerequisites: Microeconomics on level II
Credit reduction: With ECN251, 5 ECTS
Type of course: Four hours of lectures and exercises per week. A more thorough lecture plan will be handed out at the beginning of the semester.
Contents: The course studies how microeconomic theory can be used for the study of developing countries. The focus is on the economics of farm households. We especially emphasise the difference between farm-household economics and conventional economics of the firm. The course will also study rural organisations (institutions), including market and non-market institutions and how government and trade interact with the economics of rural households.

Learning outcomes: The students should understand and be able to elaborate on: - how rural households and rural institutions adapt in developing countries; - why the behaviour of rural households and rural institutions in developing countries are different than the behaviour of firms and markets in developed countries.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: A 3.5 hour sit-in exam counts as 100 percent of the final grade. This examination arrangement might be changed.
Examination aids: No calculator, no other examination aids

ECN355 Research in Development Economics II

Research in Development Economics II

Credits: 10 **Language:** English
Staff/institute: Carl Erik Schulz/ IØR
Teachers: Arild Angelsen, Stein Holden, Ragnar Øygard
First time the course is offered: SPRING 2008
Start term: January block
Terms: August block January block Spring parallel June block
Mandatory activities: Students must attend lectures and exercises and pass compulsory assignments in order to pass the course.
Prerequisites: ECN212 Microeconomics or ECN211 Microeconomics II and ECN220 Economics II, ECN200 Econometrics or ECN201 Econometrics.
Credit reduction: ECN250: 5 credits. ECN351: 5 credits.
Contents: The course will cover the following topics: - How to find good research questions; - How to write a thesis and research proposal; - General writing rules; - Field research methods; - Social surveys, including sampling, surveys and analysis; - Impact studies; and - Introduction to the STATA statistical package. - Completing data collection through field work in a developing country
Learning outcomes: In this course, students should be able to find and present a researchable topic within development economics and to write a research proposal for their thesis. In order to write a research proposal they need to be able to: - demonstrate command of existing knowledge within their research topic; - use existing knowledge to explore the issue of interest; formulate researchable research questions and/or hypotheses; - locate economic data and/or plan how to collect their own field data; and understand the methods used to compile and analyse the data. Students will generate an original data set on which their Master thesis can be based.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Two assignments must receive a 'pass' grade in order to pass the course: 1. A term paper-a research proposal for the Master thesis - must be submitted ultimo March 2. A data set collected through own field research in a developing country must be submitted by end of August block.

ECN371 Environmental Economics

Environmental Economics

Credits: 10 **Language:** English upon request
Staff/institute: Eirik Romstad/ IØR
Teachers: Eirik Romstad.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Work on and presentation of case studies.
Prerequisites: Resource economics courses at the intermediate level, ECN271. For students without any previous courses in environmental and resource economics from their BSc, ECN270 is recommended.
Type of course: About 50 hours, together with considerable guidance in connection with group assignments. There will be additional seminars where student assignments will be presented.

Contents: The course contains three elements. A) Advanced theory concerning systems analysis, resource allocation mechanisms, risk, control, information handling, behavioural assumptions, preference changes, transaction costs, rights, effects of different policy instruments with relation to various types of environmental problems and different behavioural assumptions. B) Studying concrete environmental economic problems - application of the theories. C) Case studies, where students in groups will discuss suitable policy instruments for the environmental issue in focus.
Learning outcomes: Students shall acquire an understanding of how to create more environmentally friendly behavior among individuals and firms. The main focus is on the use of various policy instruments in environmental policy formulation. The course offers knowledge about the causes behind environmental problems and the various interactions between ecological processes and economic activity. Concerning economic behavior, the students will be educated in game theory and institutional behavioral theory. Within game theory (principal-agent models) the concept of resource allocation mechanisms and uncertainty will be emphasized. In the institutional part cooperative behavior, preference changes, and the importance of transaction costs and rights are core issues. The students shall learn to evaluate under which conditions the various theories are relevant. They shall, moreover. acquire knowledge about the effect of different policy instruments - economic, legal and informational - under different conditions.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam, 3 hours (100%). To qualify for taking the exam, students must have participated in the case studies.
Examination aids: No calculator, no other examination aids

ECN373 Environmental Accounting and Management

Environmental Accounting and Management

Credits: 5 **Language:** English upon request
Staff/institute: Ståle Navrud/ IØR
Teachers: Carl Brønn.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: ECN170 or ECN270, or an equivalent introductory course in environmental and resource economics.
Type of course: 40 hours.
Contents: The course consists of three main parts: i) Environmental accounting: The course begins with a model of the environmental requirements that private and public enterprises are faced with and the alternative strategies that they may follow in order to fulfil these requirements from various stakeholders. Basic concepts such as sustainable development, ecological efficiency, eco-efficiency are reviewed, as well as the three bottom lines: economics, environment and corporate social responsibility, CSR. Social responsibility implies that existing and new enterprises take into consideration the rights and needs of the local population and that employees work under safe conditions with regards to health, environment and security. Then various methods for environmental accounting, life cycle assessment (LCA), environmental product declarations as well as systems for environmental labelling and certification are described, criticised and exemplified. ii) Environmental management: Environmental management for sustainable development of public and private enterprises is a dynamic and complex organisational challenge which requires adaptation and a willingness to think in new ways. Therefore, management methods for working with environmental cases must be sensitive to the social as well as to the technical consequences that this has for the organisation. Systems thinking is an analytic framework for understanding complex organisational structures as systems. In this way, the course gives an introduction to the method for thinking in systems, and shows how this can be applied to an organisation using the Balance Score Card (BSC) method. iii) Sustainable development for private and public enterprises: The course seeks to show how knowledge of environmental accounting, systems thinking, the Balanced Score Card (BSC) method and Corporate Social Responsibility (CSR) can be used as management tools for environmentally friendly and sustainable public and private enterprises.
Learning outcomes: The students should be able to explain system-based management methods and practical tools for developing environmental strategies and environmental accounting systems for private and public enterprises, and be able to evaluate existing environmental accounting and management systems.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The semester assignment counts 100 % of the grade.

ECN374 Dynamic Optimisation

Dynamic Optimisation

Credits: 5 **Language:** English
Staff/institute: Olvar Bergland/ IØR
Start term: January block
Terms: January block
Prerequisites: ECN302, ECN311, ECN312, STAT100.
Type of course: About 25 hours of class-room lectures and 15 hours of group discussions.
Contents: The following tools for dynamic optimization will be covered: non-linear programming, optimal control theory, and dynamic programming. These tools will be applied to such topics as capital, time, and interest rate; efficient intertemporal resource allocation, optimal investment programs, economic growth, extraction of non-renewable resources, harvesting of renewable resources, and irreversibility and uncertainty.
Learning outcomes: The students should state, solve and interpret common dynamic optimization problems encountered in economics; and apply this knowledge and skills to independent economic analysis.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam, 3 hours
Examination aids: No calculator, specified other examination aids

ECN380 Energy Economics II

Energy Economics II

Credits: 10 **Language:** English upon request
Staff/institute: Olvar Bergland/ IØR
Teachers: Torstein Bye, Ole Gjølberg.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Approved project report. An approved project report is valid for two - 2 - years.
Prerequisites: 2007: BUS220, ECN201/ECN202, ECN211, ECN213, ECN271, ECN280. 2008: BUS220, ECN201/ECN202, ECN211, ECN280, ECN312.
Type of course: About 30 hours of lectures, and 10 hours of organized project work.
Contents: The subject covers central issues concerning risk management, market regulation, and economic analysis of energy projects and the energy sector.
Learning outcomes: The students shall acquire knowledge about and experience with the use of economic analysis tools as applied to economic and political issues in the energy sector.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam. (Note:Students have no right to complain against the marking of oral tests/examinations, in accordance with the University and College Act § 52.)

ECN450 Development Economics: Methods and Policy Analysis

Development Economics: Methods and Policy Analysis

Credits: 20 **Language:** English
Staff/institute: Stein Terje Holden/ IØR
Teachers: Arild Angelsen.
Start term: Autumn parallel
Terms:
The course is offered: Other - The course will not be given in 2007Kurset gis ikke i 2007
Mandatory activities: Exercises, group work, presentations.
Prerequisites: Master's degree in Economics or Agricultural Economics.
Credit reduction: ECN350 - 15 credits.

Type of course: Lectures: 4-6 hours per week. Exercises: 2-4 hours per week.
Contents: Teaching is combined with ECN350. Quantitative Development Policy Analysis: - Economic model building. - Production analysis and natural resources. - Demand analysis. - Household models. - Economy-wide models. - Supply response. - Econometric estimation with limited dependent variables. Economics of rural organisation. - New Institutional Economics and development. - Theories of collective action. - Market failures and externalities. - Food security and price stabilisation. - Policies for poverty reduction. Environment and development. - Market imperfections and the environment. - Poverty and land degradation. - Population, agriculture and deforestation.
Learning outcomes: Application of economic theory and methodology on development policy issues in developing countries. Combination of theory and methodology. Use of computer/software tools for policy analysis. Training in scientific writing.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam: 1/3, Oral exam: 1/3, Paper: 1/3. Written exam joint with ECN350.

ECN451 Institutions, Property Rights and Development

Institutions, Property Rights and Development

Credits: 10 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Start term: Spring parallel
Terms: August block Autumn parallel Spring parallel
The course is offered: Other - The course is offered in even-numbered years, given sufficient interest.Emnet gis annet hvert år (2006, 2008 etc.), dersom det er nok påmeldte studenter.
Mandatory activities: Class presentation.
Prerequisites: Intermediate knowledge of microeconomic theory, including basic game theory and farm household models.
Type of course: Six hours per week, divided between lecturing (4) and student presentations (2). The classes will last for 5-6 weeks, the rest of the time is for self-study and writing of semester assignment. The course will be given during the spring semester, and the timing will be agreed on by students based on their preferences (normally in March-April).
Contents: The course is, firstly, about institutional change: how do institutions emerge and change? The focus is on one particular set of institution, namely property rights, and more specifically property rights which govern the use of natural resources in developing countries. Secondly, the course looks into how property rights affect decisions regarding input use, investments, and use/management of natural resources. The course consists of six parts: 1. Introduction: Historical overview of the field, definitions of institutions, and the role of institutions in economic development. 2. Theories on the evolution of property rights. 3. Case studies of the evolution of individualised property rights, land reforms and the impact on resource management. Research methods. 4. A game-theoretic approach to collective action and common property resource management (CPRM). 5. Applications and cases of CPRM. Research methods. 6. Presentation and discussion of ideas for the semester assignment.
Learning outcomes: (1) To get an understanding and be able to critically analyse: (i) how institutions evolve and change, and (ii) how institutions determine economic behaviour and management of natural resources, with particular emphasis on property rights in developing countries. (2) To be able to do own research on institutional issues based on current theories and methodologies.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Semester assignment (100 %). The students have to write a scientific paper (7-9000 words), preferably in relation to their PhD thesis.

ECN453 Topics in Development Economics I

Topics in Development Economics I

Credits: 10 **Language:** English
Staff/institute: Ragnar A. Øygard/ IØR
Teachers: Arild Angelsen, Gerald Shively, Ian Coxhead

Start term: Spring parallel
Terms: Spring parallel June block
The course is offered: By assignment
Contents: Topics and literature will vary from year to year.
Learning outcomes: 1. To get deeper insights into key areas of development economics. 2. To be able to actively use the theories and methodologies in own research.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The exam consists of a home exam/semester assignment.

ECOL110 Tropical Ecology and Biology

Tropical Ecology and Biology

Credits: 10 **Language:** English
Staff/institute: Fred Midtgaard/ INA
Teachers: Kari Klanderud.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Field work, lab work, colloquia. Approved journals and assignments.
Credit reduction: Overlap with BOT100, ZOOL100, ECOL100. Reduced study-points for students who have: BOT100: -1 credit, ZOOL100: -1 credit, ECOL100: -3 credits.
Type of course: Lectures: ca. 40 hours. Lab work: ca. 20 hours. Field course: ca. 30 hours. Excursion: 1-2 days. Colloquia: ca. 15 hours.
Contents: Seedless vascular plants, gymnosperms, angiosperms, pollination, seed dispersal. The systematic organization of tropical animals, mode of living, and adaptations. Population genetics and natural selection, population dynamics, life-history strategies, interactions, (competition, predation, herbivory, mutualism), trophic interactions, succession, biodiversity, landscape ecology. All topics will focus on tropical ecosystems.
Learning outcomes: The course should provide the students with a basic understanding of ecological theory and animal and plant diversity within a tropical context. Students will acquire knowledge of the taxonomy of plants and animals important in tropical ecology, their environmental dependencies, and how evolutionary forces have resulted in adaptations to various ecological conditions. The course also provides an overview of tropical biomes and ecosystems. The course builds an essential basis for further studies in ecology, biology, and nature management and conservation, especially related to tropical environments.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination of 3 hours.
Examination aids: No calculator, no other examination aids

ECOL200 General Ecology

General Ecology

Credits: 10 **Language:** English upon request
Staff/institute: Knut Asbjørn Solhaug/ INA
Teachers: Jon Swenson.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: ECOL100, BOT100 and ZOOL100.
Type of course: Lectures: 4 hours per week for 10 weeks = 40 hours.
Contents: The course is presented through lectures that thematically describe different subject fields. The lectures will to a large extent be based on Scandinavian examples from our own research activity. The candidates are to read and study the syllabus through independent work and colloquia exercises.
Learning outcomes: An understanding of empirical and theoretical ecology. Good knowledge of various life-history strategies. Knowledge of the history of science in ecology and an understanding of the problems in the science of ecology, for instance to

understand why ecology is a difficult subject. The candidate should acquire good skills in the application of ideas and methodology in the subject field of ecology. The candidate should become skilled in critical thinking and in gathering and analysing information. The course seeks to develop the candidate's ability to understand and evaluate the structure and functions of ecosystems. The ethical aims are to show that ecology as an academic subject is value-neutral, as well as give an understanding of the diversity of life forms that represent different solutions to the challenges of life.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: A written examination (3 hours) at the end of the course accounts for 2/3 of the course grade. The quality of three written reports, which should be delivered during the course, accounts for 1/3 of the course grade. It is not necessary that the student passes every evaluated element in the course to pass the entire course. A passing grade is based on the overall quality of the entire evaluated material.

ECOL201 Ecology Essay

Ecology Essay
Credits: 5 **Language:** English upon request
Staff/institute: Knut Asbjørn Solhaug/ INA
Teachers: Jon Swenson.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: ECOL100, BOT100 and ZOOL100.
Type of course: Introductory lecture of 2 hours.
Contents: Independent study.
Learning outcomes: Comprehensive knowledge of a self-elected topic in ecology. The course offers a large amount of freedom of choice when it comes to topic and scientific profile, and the student will be given a good opportunity to write an essay with his or her own personal preferences as basis. The course will give an understanding of empirical and theoretical ecology. The candidate should gain skills related to literature search, the reading of original scientific works and written scientific presentation. The candidate should also acquire good skills in the application of ideas and methodology in the subject field of ecology. The course seeks to develop the candidate's ability to understand and evaulate the structure and functions of ecosystems. Ethical aims are to show that ecology is value-neutral as an academic subject, as well as to give an understanding of the diversity of life forms that represent various solutions to life's challenges.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The course is evaluated based on one independent work (semester assignment).

ECOL250 Tropical Ecosystems and Biodiversity

Tropical Ecosystems and Biodiversity
Credits: 5 **Language:** English
Staff/institute: Fred Midtgaard/ INA
Teachers: Stein R. Moe.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Seminars.
Prerequisites: ECOL200.
Type of course: Lectures/seminars/colloquia: 2 hours per day.
Contents: The course introduces students to the major tropical biomes, providing key characteristics of each. Important ecological concepts will be introduced and explored within a tropical context. Key aspects of specific ecosystems, such as limiting factors, nutrient exchange, species interactions and human-community involvement will form the basis for the course. The

students will write a semester assignment individually or in groups. The assignment forms the basis of the grade, and the course teacher will give supervision during the work.
Learning outcomes: The course provides the students with an understanding of key biological characteristics of tropical ecosystems and establish a foundation for higher-level studies in tropical ecology and natural resource management. The students should learn to identify unique characteristics of tropical biomes (e.g., desert, arid, grasslands, forests, mountain, coastal and aquatic systems). The systems are studied in view of seasonal variations, population dynamics, the adaptation of organisms and species interaction.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Semester assignment.

ECOL300 Ecological Scientific Methodology

Ecological Scientific Methodology
Credits: 5 **Language:** English
Staff/institute: Svein Dale/ INA
Teachers: Geir Sonerud, Jon Swenson, Ørjan Totland.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Exercises and group work that must be approved.
Prerequisites: Completed Bachelor's degree and approved admission to a Master's degree programme in Ecology, Management of Natural Resources or Tropical Ecology and Management of Natural Resources.
Type of course: Lectures: 15-20 hours. Exercises/group work: 10-20 hours.
Contents: The different phases of the work with a Master's thesis will be covered in weekly lectures. Topics that require effort on the part of the students in the form of writing exercises, work on a computer to get to know the statistics programs etc, will be supported by exercises and/or group work where teachers are present or available. Towards the end of the course, the students will have a basis for working independently with the individual projects.
Learning outcomes: After completing the course, students should have knowledge of how scientific studies are conducted, including all phases from planning up to publishing, and they should be able to start the work on their own Master's thesis. The course is to give students a basic understanding of how to plan a scientific study, of the collection, processing and analysis of data and of the presentation of results in a Master's degree. This is to be documented by working out a plan and a description of the student's own future Master's degree work. After completing the course, students should have the skills needed to choose problems suitable for scientific studies, gather relevant information on the problem, formulate scientific questions and hypotheses that are to be investigated, deduce predictions that are to be tested, plan how the data is to be collected in a representative and effective way, plan and conduct laboratory or field studies/experiments, process and insert data into computer programs, choose statistical analyses suitable for the data, interpret the statistical analyses, present the results in figures and tables, present, in a written form, the scientific study in the form of a Master's thesis with a summary, introduction, methods, results, discussion and references, present the material using precise, scientific formulation including scientific English, publish and distribute the Master's thesis. The course will also touch upon ethical questions related to research and give students advice on how to handle ethical problems in research.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Project assignment.

ECOL310 Global Change Ecology

Global Change Ecology
Credits: 10 **Language:** English
Staff/institute: Mikael Ohlson/ INA
Start term: Autumn parallel

Terms: Autumn parallel
Prerequisites: BOT100, BOT130, ZOOL100 and ECOL200.
Type of course: Lectures: 1 hour per week for 10 weeks = 10 hours. Seminars and discussion groups = 20 hours.
Contents: The course consists of 10 different topics. Each topic is introduced through an introductory lecture. The candidates then independently read two original, scientific works on the topic, and every candidate must submit a written summary of the respective works. The contents of the works are presented and discussed in a seminar. The candidates will have the main responsibility for this presentation.
Learning outcomes: Students will have good knowledge of cutting-edge research on global changes and their influence on various organisms and ecosystems. In addition, the students will have an understanding of the complexity and functions of ecosystems. The course will also provide the students with good knowledge of the scientific publishing process and ability to study original scientific publications. The candidate is to be able to synthesise and acquire information from material from scientific publications and be able to communicate this material orally. The candidate should have good skills in the application of the subjects, ideas and methods, as well as in analysis and interpretation of results. The course seeks to develop the candidate's ability to understand and evaluate the complexity and diversity of nature. Special emphasis will be placed on illuminating the significance of interaction between organisms, and between organisms and their environments. Ethical aims are to convey humility towards organisms' ability to survive and reproduce under harsh environmental conditions.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: An oral examination (30 min) at the end of the course accounts for 3/5 of the course grade. The performance, as regards to the presentation and discussion of original scientific publications, accounts for 2/5 of the course grade. All of the evaluated elements in the course must be passed to pass the course.

ECOL320 Tropical Field Ecology

Tropical Field Ecology
Credits: 10 **Language:** English
Staff/institute: Fred Midtgaard/ INA
Teachers: Seif Madoffe (SUA) and other teachers at SUA.
First time the course is offered: SPRING 2007
Start term: January block
Terms: January block Spring parallel
Mandatory activities: It is neccessary that the students prepare themselves for the course and follow the orientations which will be given before the course starts. The field course is compulsory.
Prerequisites: Ecology courses at 200 level.
Type of course: Lectures 10 hours, exercises 30 hours, excursions 100 hours, student presentations 30 hours, group work 50 hours, project 80 hours.
Contents: The course consists of a field course of 4 weeks in Tanzania. In the first few days there will be orientations and introductions. Then there will be a field trip of 2 1/2 weeks to different forest types (mist forest, lowland rainforest, miombo) and savannah. The last week will be used for group work on the project tasks and lectures, as well as supervision of projects at SUA.
Learning outcomes: The main goal is to give the students an understanding of how the complex connection between ecology, resource management, and culture sets limits and give possibilities for management of tropical areas. The students will get experience in data collection and analysis from field investigations by performing their own projects and by learning about on going projects. The students will get experience from cooperating in multicultural groups, in giving presentations for each other, and from developing their project report.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The students have to hand in their project reports for evaluation by May 15th.

ECOL350 Restoration Ecology

Restoration Ecology

Credits: 5 **Language:** English
Staff/institute: Jonathan Edward Colman/ INA
Teachers: Stein R. Moe.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Short reports and presentations.
Prerequisites: ECOL250 and NATF320.
Type of course: Lectures/seminars 30 hours.
Contents: The global problems on degradation of ecosystems are increasing. The course is based on both botanical and zoological examples in order to show how ecosystems may be restored. The course will also place theses problem issues in an ecological and social context. In addition to focusing on restoration of ecosystem processes and characteristics, the course will deal with help measures in connection with larger infrastructure projects.
Learning outcomes: The goal of the course is to teach how degraded ecosystems may be redeveloped into self-functioning systems once again.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The course is evaluated based on a semester assignment.

ECOL380 The Ecology and Management of Rivers and Lakes

The Ecology and Management of Rivers and Lakes

Credits: 10 **Language:** English
Staff/institute: John Edward Brittain/ INA
Teachers: Reidar Borgstrøm (INA), Maria Ystrøm, Tharan Fergus & Anja Skiple Ilbrek (NVE).
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Field trip and laboratory work.
Prerequisites: Preferably ECOL200, VANN210, NATF240 or equivalent
Type of course: Lectures: 30 hours. Seminars: 8 hours. Video presentations and discussion: 2 hours. Field work: 1 day. Laboratory work: 1 day.
Contents: The course covers the most important physical and chemical environmental variables in running waters, followed by topics such as energy flows and other major processes in freshwaters, seasonal variations and life histories of aquatic invertebrates, glacial rivers, climate change, interactions between fish and invertebrates, freshwater radioecology, invertebrates as pollution indicators, environmental impacts and remedial measures in lakes and rivers and finally watercourse management, including the EU Water Framework Directive. The students give a seminar on selected parts of the syllabus, along with a written summary. A field excursion followed by laboratory exercises provide a practical introduction to watercourse investigations.
Learning outcomes: The students should acquire good insight into the ecological processes in rivers and lakes, in addition to an understanding of relevant topics in present day watercourse management.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Seminar/report: 20%; group report: 10%; oral exam: 70%. The seminar and the report are evaluated, as is the group report from the field trip/laboratory exercise. A final oral exam (30 minutes). All of the evaluated elements in the course must be passed to pass the course.

ECOL400 Ecosystem Management

Ecosystem Management

Credits: 10 **Language:** English upon request
Staff/institute: Andreas Brunner/ INA
Teachers: Teachers from the graduate school 'Ecosystem management' and from other universities abroad.
First time the course is offered: SPRING 2008
Start term: January block
Terms: January block Spring parallel
The course is offered: By assignment
Mandatory activities: Two course periods.
Type of course: Three weeks course in January, 2 weeks course in March.
Contents: A number of different approaches to model complex systems in ecology and ecosystem management will be presented and used in exercises. The following list of topics gives some examples: - stage-structured dynamic modelling for natural ecosystems, - uncertainty and risk management, - bio-economic modelling of forest management, - natural forest dynamics, - global change impacts and mitigations, - land-use changes, - wildlife management, - wildlife-forestry, interactions, - ecotoxicology, - pest management. A limited number of examples will be chosen each year, depending on the international experts that are available in that year, but also following the interest of the students.
Learning outcomes: The course will focus on modelling the interactions between ecosystems and humans, including the dynamics of managed ecosystems and the management of natural resources from a human perspective. Mathematical models are increasingly used as decision support tools, either in the form of optimization tools or as scenarios and simulation tools. Modelling managed ecosystems is challenging since it combines two complex systems, the ecological and the socio-economical. Mathematical modelling is part of many PhD projects but often restricted to separate processes in either of the two systems rather than trying to bridge the disciplines. The course will take an inter- and multidisciplinary approach and teach methods and examples to consider interactions between the natural and the human system. The course will be given by UMB staff, supplied by internationally acknowledged teachers in ecological and ecosystem management modelling and is organized by the graduate school "Ecosystem Management" at the Department of Ecology and Natural Resource Management.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Student papers, oral presentations and exercise reports.

EDS101 Introduction to Environment, Development and Globalisation

Introduction to Environment, Development and Globalisation

Credits: 5 **Language:** English
Staff/institute: Tor Benjaminsen/ Noragric
First time the course is offered: AUTUMN 2007
Start term: August block
Terms: August block
Type of course: There will be four hours of lectures twice a week over three weeks, which means a total of 24 hours of lectures.
Contents: The course introduces the following topics: the history behind such concepts as 'sustainable development' and 'environment and development', basic ideas about 'development', globalisation, population growth and the environment, gender and development, global climate change, genetic resources, trade and the environment, water in a global perspective, conservation areas, and international migration and labor markets.
Learning outcomes: This is the introduction course for bachelor students of development studies. The chief aim is to give students a first introduction to some key topics and theories within 'environment and development'.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Three hours written exam.
Examination aids: No calculator, no other examination aids

EDS106 Development Seminar

Development Seminar

Credits: 10 **Language:** English
Staff/institute: Knut G. Nustad/ Noragric
Teachers: The course will be run by a seminar leader
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Attending at least 2/3 of the seminars
Prerequisites: Good knowledge of English
Type of course: 24 hours seminar teaching
Contents: Teaching builds on the lectures in EDS101 and consists of seminar teaching where students themselves present and discuss issues. An academic writing course will also be provided as part of the course. The seminars are organised in smaller groups and will be held for two hours per week during twelve weeks.
Learning outcomes: Students are provided with an interdisciplinary basis for further studies of development issues. The Bachelor programme in development studies includes both natural and social science approaches, and the course will therefore give students a basis in the different approaches and the major issues in development studies. Seminars will give students training in collecting, analysing and presenting information. Students will learn to present and discuss research orally as well as in writing, in groups and individually.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Term paper of maximum 15 pages

EDS111 Sosialantropologi

Sosialantropologi

Credits: 5 **Language:** English
Staff/institute: Knut G. Nustad/ Noragric
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Participation in at least 2/3 of seminars and an approved presentation of group work.
Type of course: Lectures:10 hours, seminars: 12 hours.
Contents: Lectures: Presentation of basic anthropological concepts in the study of society and culture; presentation of key exemplary anthropological analyses of society and culture. Seminars: The students will be divided into groups to prepare presentations based on readings. Students will write an individual term paper of approx. ten pages.
Learning outcomes: The students will acquire basic knowledge of anthropological approaches to the study of cultural diversity and social institutions and will become familiar with basic concepts in anthropological analyses.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Course grade is based on the term paper. Each student chooses his/her paper topic from 2-4 topics given by the teacher, and submits a paper of 8-10 pages.

EDS115 Social Science Statistics and Methods

Social Science Statistics and Methods

Credits: 10 **Language:** English
Staff/institute: Jon Geir Petursson/ Noragric

Start term: Autumn parallel
Terms: Autumn parallel
Contents: The course is divided into 3 modules. 1. Introducing social science research methods; the use of qualitative and quantitative approaches, interdisciplinary, ethics, using secondary sources, reference management. 2. Quantitative analyses and basic social science statistics: understanding basic statistics, statistical inquiry, collecting and managing data, sampling, descriptive statistics, bivariate analyses and multivariate analyses, introductory use of computer programs. 3. Qualitative analyses: Data collection, analyses and interpretation of qualitative data, key qualitative methods.
Learning outcomes: This course will give the students an introduction to statistical understanding, statistical techniques and analysis. The course introduces the students to qualitative and quantitative approaches and research methods within social science, and the relationship between the two. Identify appropriate statistical procedures to understand and perform basic analysis of quantitative data. Research ethics, critical reading and interpretation will also be in focus. This course is intended for undergraduate social science-based students without background in mathematics, statistics and research methods.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Portfolio of compulsory assignments (40%). Final written exam (60%).

EDS120 Sociology

Sociology
Credits: 10 **Language:** English
Staff/institute: Christin Mørup Ormhaug/ Noragric
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Participation in 2/3 of the seminars, presentation of readings and submission of a term paper.
Type of course: The course will consist of two hours of lectures and two hours of seminars each week for approximately 12 weeks.
Contents: The lectures will introduce the students to basic sociological concepts and some classic sociological texts. The students will be expected to prepare before the lectures and participate actively in class discussions. In the seminars all students must present course readings, and are also expected to participate in discussion of the course texts. The students will also write a paper which they will receive feedback on. This paper must be approved for them to be able to take the final written exam.
Learning outcomes: The students will learn about central sociological concepts like institutions, social patterns, agency and structure. They will learn about different research traditions and be able to distinguish texts from constructionist, rational choice and functionalist perspectives. This will be especially useful for the students when dealing with different types of social science texts in an interdisciplinary environment later. The students should develop skills in critical reading and analysis of sociological texts.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: The course grade for each student will be based on a final written exam. The term paper must receive a pass-grade for the student to qualify for the final written exam.
Examination aids: No calculator, no other examination aids

EDS200 Pedagogy of the Powerful

Pedagogy of the Powerful
Credits: 5 **Language:** English
Staff/institute: Simon Pahle/ Noragric
Teachers: Simon Pahle
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Attending at least 2/3 of the seminars.
Prerequisites: The students must have a Bachelor,s degree.

Type of course: Comprising 14 weekly seminars (2 hours each), the scheduled teaching time is 28 hours throughout the autumn parallel. Participants are expected to spend an additional 6 hours/week on reading and group work (research and writing).
Contents: Many of the political obstacles to poverty reduction, human dignity and security for the world,s poor and oppressed sit in the Global North - i.e. the way in which Northern states, corporations and ultimately its citizenry perpetuate inequality, power asymmetries and a consumerist attitude to the world. The course comprises feature documentaries and visiting speakers from the fields of academia, media, NGOs and arts to critically explore the way in which Northern civil society seeks to engender a ,pedagogy of the powerful, that may affect political change in the North itself.
Learning outcomes: A successful course graduate has 1) attained understanding of the ways in which a diverse range of actors seek to affect decisions in the Global North so as to create conditions which promote development; and a basic ability to critically assess Northern advocacy activities in terms of relevance, efficacy and ethics. 2) Furthermore, she has required additional skills in the following fields: Teamwork; searching-managing-sharing information; and writing. 3) She has attained enhanced self-reflexivity, and is acquainted with different normative approaches to development politics.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Evaluation is based on a group assignment on a self-designated title first presented in plenary, and eventually submitted as a written essay (3000 words) by the end of the term

EDS201 Introduction to Development Studies

Introduction to Development Studies

Credits: 5 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Several teachers at Noragric will participate.
Start term: August block
Terms: August block
Credit reduction: No credit is given in combination with EDS320.
Type of course: The course will be run full time from Monday-Friday, 9-15, during the three weeks of the August block period.
Contents: The course combines analysis of current issues in environment and development studies with improvement of written and oral communication skills. Working methods include skill-building sessions, group work and guest lectures. Focus will be placed on motivating students and developing their skills for further work in an interdisciplinary field. The course will cover sustainable development in the context of the North and South and the need for a global approach to development.
Learning outcomes: Students will understand and be able to explain and discuss the scope of environment and development issues in a concise written and oral language. They will become motivated for further study through presentation of current issues and experience from presentation techniques. Students will get a better understanding of what is expected of them as a master student at UMB. They will acquire skills in group work, presentation, computer work and the learning platform ClassFronter. They will become oriented about UMB libraries and the use of English as a language of study. Students will meet with advisors and develop an individual plan of study.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: The assigned grade (pass/fail) will be based on a student portfolio including: -a group report on a global issue in environment and development -an oral presentation of the report -course journal in which the students report on their attendance at skills workshops, lectures and discussions, and reflections on what they have learned.

EDS202 Introduction to Environmental Studies

Introduction to Environmental Studies

Credits: 5 **Language:** English
Staff/institute: Bishal K. Sitaula/ Noragric
Teachers: Jens Aune, Kjell Esser, Thor S. Larsen, Arild Vatn
First time the course is offered: AUTUMN 2007

Start term: August block
Terms: August block
Mandatory activities: Signed plagiarism declaration
Credit reduction: Reduction for EDS201: 2 credits
Type of course: 18 hours lectures and 20 hours group work and 37 hrs colloquia
Contents: Discussions of the students' different backgrounds, interests and expectations. Presentation of the ideas behind the IES programmme and its progression. Linkages between main global environmental challenges (climate change, biodiversity and land degradation). Introduction to global environmental changes and challenges. Fundametals of ecology/ecosystem dynamics. First week is given jointly with EDS201.
Learning outcomes: The students will have an understanding of the structure and progression of the programme. They will be familiar with-and appreciate-their fellow students' position for environmental analysis. They will know options and challenges regarding interdisciplinary environmental studies. Furthermore, the students will have basic knowledge about ecology, global environmental challenges and see the needs to seek solutions including ecological, social and economic factors.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: one group assignment (40 %) plus final exam (60 %).

EDS205 Development Theory and Policy

Development Theory and Policy

Credits: 15 **Language:** English
Staff/institute: Poul Wisborg/ Noragric
Teachers: Poul Wisborg, N. Shanmugaratnam, Darley Jose Kjosavik and others (including guest lecturers)
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: To participate in group work and individual assignments.
Prerequisites: BSc/BA or equivalent.
Type of course: The scheduled teaching time is ten hours (10 X 45 minutes) per week. This is tentatively distributed between 4 hours lectures; 2 hours teacher-led discussion; 2 hours of work in groups; and 2 hours of presentation and discussion in class (of group work etc.). This is subject to variation, for example when guest lectures or other special events take place. Participants are expected to spend additional time on group work and self-directed study.
Contents: The course covers: Introduction to Development Studies (historical background, values and policy challenges). Exploration of selected theories and policies related to: Economic development, poverty and distribution; Environment, livelihoods and health; Social justice and human rights. Conclusions, connections and discussion.
Learning outcomes: The course gives an introduction to Development Studies as an interdisciplinary and problem oriented study of social, political, economic and environmental dimesions of societal change. The emphasis is on development theory and policy. The course goals are: 1: To give knowledge about major approaches in Development Studies and strengthen skills using theories and concepts in critical discussion and analysis development policy issues. 2: To develop skills in: working in interdisciplinary teams; searching, managing and sharing information; presenting and debating themes in development policy; writing as a means of learning, reflection and communication in an international setting. 3: To develop awareness of values and normative approaches in development including considering cultural diversity and human rights.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The examination is based on a portfolio of (i) group exercises including a group project report and (ii) individual writing assignments. All the assignments are mandatory. Selected assignments from the portfolio are given a grade (A-F). To get a pass in the course one must get a passing grade (E or better) in each of the graded assignments. The overall grade is set in the following manner: Two out of three smaller, individual writing assignments: (1) Letter to the editor, (2) Book review and (3) Essay. Two combined count 20%. The participant selects which two shall count. (4) A group project and report counts 30%. (5) An individual term paper counts 40%. (6) Participation and overall assessment counts 10%. Grades on the smaller individual assignments (1-3) will be set during the semester (a maximum of threee weeks after submission). Grades on

the Group Project (4), Term Paper (5) and Participation/overall assessment(6) will be set during the exam period following the general rules. Further information on the assignments will be given in the course plan and in class.

EDS215 Sustainable Agriculture and the Environment

Sustainable Agriculture and the Environment

Credits: 5 **Language:** English
Staff/institute: Jens Bernt Aune/ Noragric
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Signed plagiarism declaration.
Type of course: The course is divided into eight parts lasting one week each. Students are expected to submit responses to short assignments at the end of every week. The last week is set aside for a term paper. Students are also expected to engage actively in the virtual discussion forums.
Contents: The course deals with agricultural practices in developing countries in tropical regions. It begins with an introduction to the evolution and classification of tropical agricultural systems and continues to describe diverse water and soil management practices and policies. The environmental effects of low and high input agriculture are discussed, and the potential for sustainable agricultural intensification in marginal areas is explored within a development framework. Attention is also paid to the relevance of international conventions to agriculture and the environment in developing countries.
Learning outcomes: The students shall understand essential features of agricultural systems in developing countries, how different systems have evolved, and how agricultural practices influence environment and development in low-income countries.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Students will be evaluated on the basis of weekly short assignments and a final term paper. All assignments must be handed in prior to submitting the term paper.

EDS220 Statistical Analysis

Statistical Analysis

Credits: 10 **Language:** English
Staff/institute: Ellen Sandberg/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Compulsory assignments/exercises.
Prerequisites: Bachelor's degree or equivalent.
Credit reduction: STAT100
Type of course: Lectures: 2 hours per week. Exercises: 2 hours per week. Computer exercises: 2 hours per week.
Contents: Basic concepts, descriptive statistics, probability, statistical distributions, expectations and variance, binomial and normal distributions, estimation, confidence intervals and hypothesis-testing, regression, T-tests, one-way and two-way analysis of variance, chi-square tests.
Learning outcomes: Students will acquire knowledge of basic statistical models and methods that are used in applied research.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written examination.
Examination aids: Any calculator, any other examination aids

EDS225 Linking Ecological and Social Resilience

Linking Ecological and Social Resilience

Credits: 10 **Language:** English
Staff/institute: Ian Bryceson/ Noragric
Start term: Autumn parallel

Terms: Autumn parallel
Mandatory activities: One group mid-term paper.
Prerequisites: ECOL110
Type of course: The class will meet for four hours per week (two double hours). Most weeks will be devoted to lectures and class discussions, but three weeks will be set aside for group-work and writing a mid-term paper.
Contents: - The concept of resilience - Resilience and vulnerability in ecological and social systems - 'Old' and 'new' scientific ideas and approaches - The adaptive cycle as a conceptual framework - Linked ecological-social conceptual approaches - Systems approach and social-ecological linkages - Change and uncertainty in social-ecological systems - Nurturing diversity for resilience - Local/traditional resource management systems - Combining different types of knowledge for learning - Resilience of property rights institutions - Adaptive management - Self-organization towards social and ecological sustainability - Resilience as an analytical approach - A range of international case studies - Examples of MSc research projects utilising 'resilience'
Learning outcomes: 'Linking Ecological and Social Resilience' will provide a basis for understanding both ecological systems and social systems, emphasising the interlinkages and interdependence between environmental and social processes of change. Emphasis is placed upon: - learning to live with change and uncertainty; - nurturing diversity for resilience; - combining different types of knowledge for learning; - creating opportunity for self-organization towards social and ecological sustainability. The course will provide students with an innovative conceptual framework, and explain how to use it as an analytical approach when investigating questions of sustainability and development with interdisciplinary perspectives. A variety of case studies from developing countries in an increasingly globalised world will be used to illustrate the theories. Several students have successfully utilised 'resilience' as a conceptual framework for their thesis in recent years. Course participants who would like advice on this will be assisted additionally.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam.
Examination aids: No calculator, no other examination aids

EDS234 Environmental economics - the role of institutions

Environmental economics - the role of institutions

Credits: 5 **Language:** English
Staff/institute: Arild Vatn/ Noragric
Teachers: Gunnvor Berge
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: The students are asked to write two short papers. These papers must be graded 'pass' for the student to be allowed to stand for the exam.
Prerequisites: Some basic competence in micro economics (e.g., ECN111)/environmental economics (e.g., ECN170) and/or social sciences (e.g., AOS130/AOS210)
Credit reduction: Credits are not given for both EDS234 and EDS235
Type of course: Lectures and seminars: 21 double hours
Contents: 1) The theory of institutions and institutional foundation of economic systems, including core concepts like systems theory, rights, conflict, cooperation, transaction costs, rationality, values and power. Different positions within institutional theory. 2) How do institutions influence perceptions and behavior and thereby the use and misuse of environmental resources. 3) The state and its role in the management of environmental resources. 4) How are institutions formed as a response to human needs, interests, values and power relations? 5) What characterizes different economic spheres? 6) How can we evaluate institutions? 7) Which institutional structures govern the use of environmental resources and how can we study these institutions and the problems they create? 8) Resource regimes. 9) Institutional perspectives on environmental valuation.
Learning outcomes: This course covers the theoretical part of EDS235. Students shall acquire insight into core aspects of the functioning of the economy as a system of institutions, social relations and power. The students will learn how economic and social institutions and the political environment are structured and influence each other. Students shall also acquire insights about how the economy and other institutional structures influence the use of environmental resources. They shall specifically acquire insight into the institutional conditions for human behavior and learn to apply this knowledge to understand behavior

related to use and preservation of natural resources. The aim is finally to support the students in their understanding of important ethical questions linked to the use and protection of environmental resources.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: No calculator, no other examination aids

EDS235 Political economy - institutions and the environment

Political economy - institutions and the environment

Credits: 10 **Language:** English
Staff/institute: Arild Vatn/ Noragric
Teachers: Gunnvor Berge
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Presentation of paper in seminar. Presentation of term paper sketch.
Prerequisites: The course is adapted to the background of the students enrolled in the M_IES program. For those that have not yet completed a bachelor, it is recommended to have some background in social sciences/economics/environmental economics.
Credit reduction: Students cannot get credits for both EDS235 and EDS234
Type of course: Lectures: 22-24 double hour lectures. Seminars: 5 double hours. Group work with supervision
Contents: The course is split in two parts: a theoretical part and the study of a concrete case. The theoretical part covers the following elements: 1) The theory of institutions and institutional foundation of economic systems, including core concepts like systems theory, rights, conflict, cooperation, transaction costs, rationality, values and power. Different positions within institutional theory. 2) How do institutions influence perceptions and behavior and thereby the use and misuse of environmental resources. 3) The state and its role in the management of environmental resources. 4) How are institutions formed as a response to human needs, interests, values and power relations? 5) What characterizes different economic spheres? 6) How can we evaluate institutions? 7) Which institutional structures govern the use of environmental resources? How can we study these institutions and the problems they create and how can we make them better? 8) Resource regimes. 9) Institutional perspectives on environmental valuation and policy. The case study will be organized as group work where the focus is on writing a paper. The groups will choose topics themselves within the focus of the course.
Learning outcomes: Students shall acquire insight into core aspects of the functioning of the economy as a system of institutions, social relations and power. The students will learn how economic and social institutions and the political environment are structured and influence each other. Students shall also acquire insights about how the economy and other institutional structures influence the use of environmental resources. They shall specifically acquire insight into the institutional conditions for human behavior. Students shall moreover acquire the capacity to use the theory to study concrete cases concerning management of environmental resources. Political economy is an interdisciplinary field drawing on economics, sociology, anthropology, law and political science. Students shall develop the ability to critically evaluate the assumptions underlying the various theories and perspectives. The aim is finally to support the students in their understanding of important ethical questions connected to the use and protection of environmental resources.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Term paper counts 50 %. Written exam counts 50 %. Students must pass both.

EDS240 Economics for Environment and Development

Economics for Environment and Development

Credits: 10 **Language:** English
Staff/institute: Fred Håkon Johnsen/ Noragric
Start term: Autumn parallel
Terms: Autumn parallel
Type of course: 6 hours per week for 13 weeks.

Contents: 1. Microeconomics with emphasis on food and agricultural production. 2. Social appraisal of development projects with integration of environmental aspects. 3. Macroeconomics with focus on development. 4. Environmental and natural resource economics.
Learning outcomes: The students will be able to apply basic concepts and techniques within microeconomics, socio-economic project appraisal, macroeconomics and resource economics in interdisciplinary analysis of problems relating to environment, agriculture, development and natural resources.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: Any calculator, any other examination aids

EDS250 Agriculture and Development

Agriculture and Development

Credits: 10 **Language:** English
Staff/institute: Trygve Berg/ Noragric
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Bachelor's degree or equivalent.
Type of course: 5 lecture hours/week for 14 weeks = 70 hrs.
Contents: Understanding the farm as a production system depending on interactions with and management of the natural resource base, and also characterised by internal interactions within the system. (1) Agro-ecology and cropping systems, applying ecological principles in the analysis of an agricultural system. Cropping systems in semi-arid, sub-humid and humid tropics. (2) Livestock systems, overview of livestock systems including both mixed farming and nomadic systems. Fodder resources including fodder quality and use. Crop-livestock interaction. (3) Genetic resources for food and agriculture, genetic erosion, conservation of genetic resources ex situ and in situ, utilisation of genetic resources, international treaties and agreements on management of genetic resources, and intellectual property rights and policies. (4) Sustainable agriculture, integrated management of soil fertility, integrated pest management, integrated resource management for sustainable agriculture, and sustainable intensification. Knowledge systems and gender in agricultural development.
Learning outcomes: Understanding the farm as a system with emphasis on ecological principles (agro-ecosystems), and analysing agricultural systems with respect to environmental objectives (sustainability), productive objectives (increased food production) and social objectives (equity).
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam.
Examination aids: No calculator, no other examination aids

EDS255 Health and Development

Health and Development

Credits: 10 **Language:** English
Staff/institute: Cassandra Bergstrøm/ Noragric
Teachers: Ingrid Nyborg
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Students must particpate actively in group work to be eligible for a final grade in the course.
Type of course: The scheduled teaching time is six hours (6 X 45 minutes) per week. This is tentatively distributed between 4 hours of lectures and 2 hours of teacher-led discussion approximately six weeks of the semester. In addition, students will work within teams outside of the classroom during three weeks (3 X 1 week). Facilitators will be available for consultations during this time. In each of the weeks following the collection and analysis of data, groups will present their findings.
Contents: The course is comprised of an introduction followed by three case studies: 1. Introduction to Health and Development; 2. Poverty and well-being (HIV/AIds); 3. Acceptable levels of risk and uncertainty - who determines? (biosafety); and 4. Provision of clean water and sanitation. Cross-cutting themes are: how are environmental health and public health inter-related, how are international policy and local realities linked - or not, and how do different values and intersts of different stakeholders affect

policy and practice. Each of the three problem areas will be analyzed with respect to ecological, social and political dimensions. Each of the groups will determine whether their own members have particpated activlely in the group work. Students receive a pass from their groups to be eligible for a grade in the course. Each of the group work projects will be documented in some way. Students may chose one of these projects for grading. This will represent 40% of the student's grade. In addition, each student writes a final essay for the course demonstating her understanding of the course material and methods. This take-home exam will comprise 60% of the final grade.

Learning outcomes: The course provides an introduction to the emerging inter-disciplinary field of 'Health and Development'. Students will develop competency to use central concepts in a couple of alternative frameworks currently under development by leading development agencies. In addition to use of these frameworks, emphasis is put on understanding the differing values, beliefs and interests underlying them. This provides a basis for recognizing differing ethical positions inherent in the analyzing tools. Groups will work on cases (poverty and health, HIV/Aids, biosafety/GMOs, and provision of clean water and sanitiation) that will be presented and discussed in both oral and written forms. Students are expected to demonstrate their knowledge of concepts, their ability to collectively apply knowledge and understanding to particlar problems and to explain their weighed decision for using a particular approach.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Each of the groups will determine whether its own members have particpated activlely in the group work. Students receive a pass from their groups to be eligible for a grade in the course. Each of the group work projects will be documented in some way. Students may chose one of these projects for grading. This will represent 40% of the student's grade. In addition, each student writes a final essay for the course demonstating her understanding of the course material and methods. This take-home exam comprises 60% of the final grade.

EDS260 Global Environmental Changes

Global Environmental Changes

Credits: 5 **Language:** English
Staff/institute: Bishal K. Sitaula/ Noragric
Teachers: Jens Aune, Kjell B. Esser, Arild Vatn
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Submission and presentation of each group assignment. Signed plagiarism declaration.
Type of course: 18 hr lectures, 32 hr group exercises, 25 hr individual reading assignments.
Contents: Definition of terms, introduction to global change (systemic and cumulative), land degradation, other global challenges (water crises, wetlands, endangered species, drought and floods), ecosystem processes, potential impacts of climate change on food and agricultural systems, climate change impacts on biodiversity, global responses and local actions, human dimensions of global change, negotiations and agreements, conventions on desertification, water conventions, conventions on biodiversity, compliance with climate change conventions, international treaties, adaptation and mitigation options, initiatives to address global change issues, case studies, early responses, climate research programs, conferences on drylands and land degradation, cooperative programs on water and climate and livelihoods.
Learning outcomes: Be able to describe the major global environmental challenges. Understand the ecosystem processes relating to water, climate change, desertification, emission of greenhouse gases and their individual as well as aggregated impacts. Understand the key issues related to major global change at various context covering climate change, desertification water and biological diversity. Be familiar with relevant international conventions and agreements. Be familiar with agriculture adoption and mitigation options, methodological approaches, and policy interventions in providing adoption and mitigation options to address global change issues.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam
Examination aids: Any calculator, no other examination aids

EDS265 Anthropology of Development

Anthropology of Development

Credits: 10 **Language:** English
Staff/institute: Knut G. Nustad/ Noragric
Teachers: To be decided
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: EDS111
Contents: A combination of seminars and lectures.
Learning outcomes: Students will be introduced to the often complex relationship between anthropology and development, and learn about approaches that argue for using anthropological knowledge in development as well as approaches highly critical of development.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

EDS270 Development Aid and Politics

Development Aid and Politics

Credits: 5 **Language:** English
Staff/institute: Gunnvor Berge/ Noragric
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: 1. One presentation in class, either alone or as a group.
Type of course: 14 two-hour lectures given once a week during the autumn parallell (in all 28 hours)
Contents: The course aims at providing insight into the history of development aid, fact-based information on economic and other flows between developed and developing countries, knowledge of the main multilateral actors and arenas, major programmes (such as HIPC) and agreements (such as the Millennium Development Goals or the Paris consensus), main tools (such as Basket funding, Budget support, and conditionalities), and insights into different political opinions and analyses of development aid. The course further aims at providing insight into the effectiveness of aid in promoting poverty reduction and development.
Learning outcomes: 1. The course provides insight into central global processes relating to the relationship between developed and developing countries, with an emphasis on development aid. Knowledge of flows of aid, funds and other statistics highlighting the relationship between developing and developed countries will be taught. The history of development aid, actors in development aid, main trends in development aid, and approaches and tools used will be presented within a broader framework of international collaboration. 2) The students will increase their capacity to comprehend and analyse multilateral and bilateral aid and development processes, to find information about international relations and analyse these, to strengthen their ability to present an argumentation in front of the class, and gain experience from team-work. 3) The course aims at providing students with better insight and improved ability to argue for their views on development aid and international collaboration
Methods of examination: Final **Grading:** A-F
Assessment methods: One term paper, individual or in group

EDS275 Writing Seminar

Writing Seminar

Credits: 5 **Language:** English
Staff/institute: Knut G. Nustad/ Noragric
Teachers: The course will be run by a seminar teacher
First time the course is offered: SPRING 2008

Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Eligibility for university admission
Contents: This course gives the students an opportunity to present written work that will form part of their final thesis to their fellow students and a teacher. Participants in the course will read through a student text before each seminar and prepare comments. After a short oral presentation, fellow students and the seminar teacher will offer comments and suggestions for improvements of the text.
Learning outcomes: The seminars aim at helping students with their written work by suggesting improvements; to develop the skill of orally presenting own material; and to develop the skill of constructively commenting other students' work.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Pass / Fail based on participation

EDS280 Land Rights: An Introduction to Theory, Applications, and Policy

Land Rights: An Introduction to Theory, Applications, and Policy
Credits: 5 **Language:** English
Staff/institute: Espen Olav Sjaastad/ Noragric
Teachers: Hans Sevatdal, Stein Holden, Håvard Steinsholdt, Darley Kjosavik
First time the course is offered: SPRING 2007
Start term: January block
Terms: January block
Type of course: Lectures: 50 hours Group work: 50 hours Individual assignments: 50 hours
Contents: The course is divided into five components: 1. Basic concepts and theories 2. Land tenure systems 3. Property transactions 4. Property formalisation and registration 5. Policy instruments
Learning outcomes: After completing the course, students should: - Be familiar with fundamental property rights concepts and theories - Be able to identify distinguishing features of different tenure systems - Be able to describe different modes of property transactions and their implications - Possess knowledge of different forms of property formalisation and their motivations - Be able to analyse the effects of various instruments relevant to the politics and management of property relations
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Student evaluation will consist of three assignments: two group assignments and one individual assignment.

EDS290 Development Classics

Development Classics
Credits: 10 **Language:** English upon request
Staff/institute: Kjell Bjørgen Esser/ Noragric
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Participation in group presentation and attendance in two-thirds of the lectures and seminars are mandatory.
Type of course: Class hours: 4 hours of lectures, group discussions, presentations, class discussions and guidance per week for approximately 12 weeks.
Contents: The course Development Classics will include lectures, group presentations and discussions with the intention of familiarising the students with selected books that can be considered as classics that mark certain milestones in development thinking. The books selected will be heavy on the theoretical side and the students are expected to decipher and discuss the books with the guidance of the course teacher. The students are expected to take an active role in presentations and discussions throughout the course. Students will be expected to work in groups to learn to thrash out ideological and theoretical differences

in relation to the practice of development. Group guidance will be given to students for presentations and individual guidance will be given for term paper writing.
Learning outcomes: A major learning objective of the course is to develop skills in critical reading, analysis, presentation and discussions of classical books on development thinking. The course is also expected to enable the students to understand the interconnectedness of theoretical ideas and policy practices in the arena of development through history.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The course grade for each student will be based on an individual, written term paper (that counts 100 % of the grade), to be submitted at the end of the semester.

EDS300 Research Methods

Research Methods

Credits: 15 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Darley Jose Kjosavik, Ingrid Nyborg and others.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Bachelor's degree or equivalent.
Type of course: 50 hours of lectures including some group work - two double lectures per week spread over 12 weeks.
Contents: The course will include discussions on the following topics: Ontological and epistemological underpinnings in research methods, Research questions, formulation of research proposals, the research process-from formulation of research question to final publication (with the help of case studies), research strategy and design, use of qualitative and quantitative methods, data collection, analysis and interpretation of qualitative data (participatory observation, interview, focus groups and use of language), collection and analysis of qualitative data, use of secondary data, interdisciplinary research, practical field work, introductory use of SPSS and research ethics.
Learning outcomes: To enable the students to grasp the theory and practice of research methods in general and to enable them to apply relevant research methods in environment and development studies.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Term paper (50 %) and final written exam (50 %).

EDS305 Environmental Impact Assessment

Environmental Impact Assessment

Credits: 10 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Four sessions as chairperson. Submitted plagiarism declaration.
Type of course: Three to four hours seminar/colloquium per week for 10 weeks.
Contents: Principles and procedures, origin and development, early stages of assessment, impact prediction, evaluation and mitigation, monitoring and auditing, socio-economic impacts, practical experiences with assessments, methods for impact assessment on terrestrial and water ecology, methods for risk assessment and remote sensing.
Learning outcomes: Sufficient knowledge about principles and methods for environmental impact assessment to be able to participate in an EIA team.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Presentations (50 %) and written assignments (50 %).

EDS315 Management of Genetic Resources: Law and Policy

Management of Genetic Resources: Law and Policy

Credits: 5 **Language:** English
Staff/institute: Trygve Berg/ Noragric
Start term: January block
Terms: January block
Mandatory activities: Compulsory participation in seminars.
Prerequisites: General knowledge about biodiversity and the use of biodiversity in agriculture.
Type of course: Two days of combined lectures/seminars and one day of seminar (reviewing and discussing the week's exercise) per week
Contents: First week: Origin, diffusion, exchange and ownership of genetic resources through history. Second week: National and international structures and laws for managing and governing genetic resources. Third week: How the 'system' works: Access, exchange and sharing of benefits.
Learning outcomes: Knowledge about and ability to interpret conventions, laws and policies on agricultural genetic resources, including property rights, access, exchange and sharing of benefits arising from commercial use of such resources.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: The course is passed if weekly exercises are submitted and approved.

EDS325 Global Political Economy

Global Political Economy

Credits: 5 **Language:** English
Staff/institute: Simon Pahle/ Noragric
Teachers: Simon Pahle
Start term: January block
Terms: January block
Mandatory activities: Attending at least 2/3 of class sessions.
Prerequisites: Open only to students enrolled in Master programmes
Type of course: Taught in the short ‚block„ this is a full time course. The scheduled teaching time is 4 hours every Monday, Tuesday, Wednesday and Friday through January (16 hours/week), comprising 12 hours of lecturing; 4 hours of students, presentation/debate per week. Participants are expected to spend an additional 20 hours/week on reading, self-directed study and group work.
Contents: First, the course explores the main theoretical perspectives relevant to the study of the global political economy. Second, it examines the evolution of the global financial system, and its implication for development. Thirdly, it reviews the debt crisis and the debt relief and management offered by the World Bank and the IMF, including the critiques these have elicited, and recent responses (PRSPs) of the institutions. Fourthly, the course examines the politics of international trade, centering on the World Trade Organization (WTO): Its emergence; the substance of its agreements; procedures for agenda-setting, rule-making, and dispute-settlement. Fifth, it examines the increasing power exercised by private corporations-through resource scrambles and globalized production systems-and the attending debates on corporate misconduct and regulation. Finally, the course provides a critical review of the globalization/anti-globalization debate.
Learning outcomes: 1. A successful course graduate has a solid understanding of major theories about the exercise of power and distribution of wealth in the global system, and is familiar with its major processes, actors and institutions. Furthermore, she is capable of employing and assessing theory in relation to substantive case problems, and to discern connections across theoretical and substantive issue areas. 2: She has required additional skills in the following fields: Teamwork; searching-managing-sharing information; presentations and writing. 3: She has attained self-reflexivity, and is well aware of different normative approaches to challenges in the global political economy.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail

Assessment methods: Evaluation is based on i) an individual presentation given in class (over assigned title); ii) a short essay (1500 words) written over the same assigned title and submitted no later than the last day of the course; iii) a group work (term paper of 3000 words) written on self-designated title and submitted no later than 15 days after the last course day. Participants failing on any of the three requirements do not graduate. Further information is provided by the start of the course.

EDS330 Political Ecology

Political Ecology

Credits: 10 **Language:** English
Staff/institute: Tor Benjaminsen/ Noragric
Start term: Spring parallel
Terms: Spring parallel
Type of course: There will be lectures of two hours twice a week for about 10 weeks, thus totalling approximately 40 hours of lectures.
Contents: Political ecology originated in the 1970s, but its real expansion occurred in the 1980s and 90s. Today, political ecology is a leading source of innovative research on issues linked to poverty and the environment. The framework of the analysis in political ecology is centred on the idea of a ‚politicised environment‚. It explores the main actors involved in this management and their interests, aims, norms and narratives. This again leads into an investigation of power and power relations in environmental management. Lectures and discussions will deal with topics such as the the theoretical roots and history of political ecology, discourse and narrative analysis, winners and losers of global environmental change, land reform, and community-based conservation and its critique.
Learning outcomes: The chief aim of this course is to strengthen the students' interdisciplinary understanding by exposing the students to the different theoretical trends in the emerging field of political ecology and to empirical studies on resource and environmental management that are based on political ecological approaches. The course will investigate the links between local, national, and global levels of environmental management. It will further seek to develop among students a capacity of critical thinking.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Two individual take home essays based upon course lectures and readings and a final oral exam.

EDS345 Environmental Governance - From the Local to the Global

Environmental Governance - From the Local to the Global

Credits: 15 **Language:** English
Staff/institute: Arild Vatn/ Noragric
Teachers: Gunnvor Berge
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: EDS235 (Political economy - institutions and the environment) and EDS260 (Global environmental change) EDS234 (Environmental economics-the role of institutions) is an alternative to EDS235
Type of course: Lectures: 30 double hours Seminars: 8 double hours Supervision (term paper): Minimum 4 hours per group
Contents: 1) The concepts of governance and resource regimes; 2) Resource dynamics, complexity, uncertainty and governance options; 3) Management of environmental resources; 4) Environmental governance and policy instruments (economic, legal and informational)-theory and practice; 5) The governance system: The multilateral system, the role of states, the dynamics of markets and corporations; 6) The forming of international agreements and conventions, the logic of games, negotiations and deliberation; 7) Conflict and conflict resolution; 8) Study of specific international agreements and systems concerning a) the global governance system (UN, the World bank, the IMF), b) the system for regulating international trade (WTO with SPS and

TRIPS), and c) specific agreements and conventions: climate change (the Kyoto Protocol), biodiversity (the Convention of Biological Diversity), land degradation (the Convention on Desertification), the right to food (the Voluntary Guidelines for the Right to Food), fisheries (the Convention on the Law of the Sea), and water; 9) Term paper (groups) where the theory is applied to a concrete case study.

Learning outcomes: Students shall acquire deeper insights into the theories of environmental governance and resource regimes. Students shall develop the capacity to undertake interdisciplinary analyses. They shall obtain higher level understanding about the way resource and ecosystem dynamics and complexities influence the way different governance structures work. They shall moreover acquire the skills to study various management strategies for the use and maintenance of various environmental resources. Students shall also attain knowledge of core international agreements, conventions and protocols and how these function and interact. Students shall acquire the capacity to use the theory to study concrete cases concerning environmental governance at the global and local level within the context of international agreements. In relation to this, the role of the state will also be emphasized. Students shall, finally, be able to evaluate strengths and weaknesses of existing governance structures, and develop and evaluate ideas for alternative solutions.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Term paper: 50 %; oral exam 50 %

EDS350 Management of Dryland Resource Systems

Management of Dryland Resource Systems

Credits: 10 **Language:** English

Staff/institute: Peter Gufu Oba/ Noragric

Start term: Autumn parallel

Terms: Autumn parallel

Mandatory activities: 2/3 of all lectures are compulsory.

Type of course: Lectures: 3*2 hours per week

Contents: The course offers integrated and holistic approaches for understanding the dry land environments, integrates different scientific disciplines to improve the understanding of the ecosystems by applying scientific knowledge to management and policy. Because of the course's substantial interdisciplinary and practical nature, both natural and social science students will be interested. It includes: 1. Dryland resource systems 2) Evolution of drylands 3) Environmental history 4) Ecology and drylands 5) Economics and drylands 6) Management models 7) Case studies in central Asia, Africa and South America 8)Developmental models 9) Class exercise.

Learning outcomes: a)The students will participate in problem solving using exercises from cas studies based on field research; b) They will develop solid knowledge of ecological theories; c)They will develop in depth knowledge of development. This is an interdisciplinary course that requires students to synthesize holistic ideas related to the management of dry lands. The students will gain insights into the structure and functions of the dry lands and become familiar with theoretical and practical issues related to the management of the Global dry lands. The learning goals are critical thinking and synthesis related to how the dry lands respond to both natural and anthropogenic disturbances, as well as understanding how to use the resource responses for making management decisions and developing policies for sustainable management of these fragile ecosystems. This can be achieved by: 1. Developing skills for synthesizing information for critical thinking about the processes of dry lands that pose problems for management, 2. Understanding linkages between dry land ecosystem processes and management, 3. Critical thinking on the holistic use of the dry lands, Critical thinking on how the dry land ecosystems respond to the external and internal ecosystem drivers, 4. Critical thinking on the roles of integration of ecological and indigenous knowledge for the management of the dry lands, 5, Increased awareness of the fragility of dry land ecosystems and the risks posed by misuse, 6., Increased appreciation of the dry lands in international Global environmental conventions and 7, be familiar with the trajectories of change of the systems knowledge related to historical land use.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Two group presentations (counting 20% each) and final written examination accounting for 60% will be the only examination on this course.

EDS355 Climate Change and Development

Climate Change and Development

Credits: 10 **Language:** English
Staff/institute: Jens Bernt Aune/ Noragric
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
Type of course: 3 hr. lectures and 2 hr. groupwork per week.
Contents: The Kyoto mechanism and beyond Kyoto, the Clean Development Mechanism and the quota market, problems and prospects for developing countries to take part in the Clean Development Mechanism, options for sequestering and preserving greenhouse gases in land-use systems, energy problems in developing countries, how should developing countries preperare for climate change.
Learning outcomes: Understand the relationships between climate change and development with emphasis on tropical countries.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Term paper (25 %) and written exam (75 %).

EDS360 Conflict and Development

Conflict and Development

Credits: 10 **Language:** English
Staff/institute: Espen Olav Sjaastad/ Noragric
Teachers: N. Shanmugaratnam.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Participation in the workshop on conflict management and peace building is compulsory.
Type of course: A rough estimate of time allocation is as follows: Lectures: 40 hours Assignments: 30 hours Seminars/workshops: 16 hours Individual work: 26 hours
Contents: The course is divided into three modules: 1. Perspectives on development and conflict 2. Conflict and natural resources 3. Mechanisms and approaches to conflict management and resolution Modules 1 and 2 involve lectures. Module 3 is given as a compulsory workshop.
Learning outcomes: General objectives: Students should acquire an interdisciplinary understanding of international conflict and development problems and an understanding of the links between natural, technical, and social dynamics of conflicts and development. Specific knowledge and understanding: Students should, upon completion of the course, be able to: - identify and elaborate causal links within different types of conflicts over natural resources - identify critical aspects of a conflict and locate it within an historical context - identify methods previously used to manage and solve similar conflicts and to specify the strengths and weaknesses of such conflicts. Specific skills: graduates of the course should be capable of: - quickly gathering relevant information about, and building an outline of, different types of conflicts - using methods from different disciplines to generate useful and lucid information about a given conflict - demonstrating the usefulness of different types of communication tools for conflict management and resolution - knowing where additional information is available and how such information can be used Ethics and attitudes: a central objective is that students should learn to understand and appreciate the foundations and nature of individual, social, and ethnic differentiation, and their implications for conflict origins, paths and resolutions.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: One term paper (40%) and a final oral exam (60%) constitute the continuous evaluation.

EDS365 Coastal and Aquatic Resource Management

Coastal and Aquatic Resource Management

Credits: 5 **Language:** English
Staff/institute: Ian Bryceson/ Noragric
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Type of course: The class will meet for two hours per week (one double hour). Most weeks will be devoted to lectures and class discussions, but three weeks will be set aside for group-work and writing a mid-term paper.
Contents: Course contents - Integrated coastal zone management- Integrated aquatic resource and watershed management - Resilience and vulnerability in coastal ecological and social systems - Tropical coastal ecosystems: coral reefs, mangroves, seagrasses, etc. - Coastal fisheries: small-scale artisanal and large-scale industrial - Coastal aquaculture systems: integrated polycultures and monocultures - Coastal tourism developments: rights and distribution of benefits - Coastal pollution: impacts and control- Temperate and polar coastal and marine ecosystems - Temperate fisheries crisis and aquaculture issues - Tropical lakes, rivers and wetlands: resource use and management - Freshwater aquaculture systems- Freshwater fisheries management - Effects of globalisation on coastal and aquatic resources - Effects of climate change and vulnerability to disasters - Traditional ecological knowledge and coastal/aquatic resource management - Resilience of livelihoods, institutions and adaptive management approaches - Analytical approaches to studying ecological-social coastal and aquatic systems - A range of international case studies - Examples of MSc research projects addressing coastal and aquatic issues
Learning outcomes: ' Coastal and Aquatic Resource Management ' will provide a basis for understanding ecological and social systems in coastal, marine and freshwater environments as the context for international developments within fisheries, aquaculture, integrated coastal zone management and aquatic resource and watershed management. Key ecological and social processes will be explained, and the positive and negative impacts of human interventions will be discussed and analysed. Issues of sustainable and non-sustainable use of resources, livelihoods, conservation, rights, governance, and problems arising from conflicts of interest will be presented, with examples from different parts of the world, and with a focus on the effects of increasing globalisation. A holistic approach and interdisciplinary perspectives will be emphasised, incorporating the conceptual framework of linking social-ecological resilience and vulnerability. Students will be shown how to use these concepts within an analytical approach for research projects that may also be applicable to their own MSc projects.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: No calculator, no other examination aids

EDS370 Gender and Development

Gender and Development

Credits: 5 **Language:** English
Staff/institute: Ingrid Nyborg/ Noragric
Start term: January block
Terms: January block
Mandatory activities: Participation in group work and group assignment and class discussions.
Type of course: Ca. 60 hours, about 40 % lectures and 60 % individual work.
Contents: The course will include the following topics: Historical development of concepts of gender. Gender in agriculture. Gender in resource management. Gender in development discourse. Gender and economics. Gendered methodologies and analysis.
Learning outcomes: The course will introduce students to the concept of gender and development through examining the gendered dimensions of agriculture and resource management. Particular attention is given to exploring methodologies that allow for gendered analyses of social change.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The grade in the course is set on the basis of an individual term paper assignment

EDS385 Rural Development and Project Management

Rural Development and Project Management

Credits: 15 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Ingrid Nyborg
Start term: August block
Terms: August block Autumn parallel
Mandatory activities: a) Submit one written group report for approval b) Present one oral group presentation
Type of course: 50 hours of lectures and a minimum of 75 hours of practice/field work. In addition, various group work sessions and presentations.
Contents: Students attend lectures by a wide range of experienced staff from universities, government agencies and nongovernmental development organisations. Several field trips will give students the opportunity to interview farmers, government agents and staff members as well as gain experience in the use of research methods. Lectures and field work will cover the framework for livelihood analysis, livelihood diversification, poverty and income distribution, farm productivity, environment and sustainability, gender and rural livelihoods, macro policies and reform agendas, field methods for collecting information needed for development projects and research, ethics in field work, management techniques for development and research projects, monitoring and evaluation of development projects, contemporary issues in development, resource and environmental management.
Learning outcomes: The students will be able to 1) understand and work in rural environments in developing countries, 2) develop, manage, monitor, evaluate and sustain rural development projects concerning natural resource management and sustainable agriculture, and 3) use a variety of research methods, tools and techniques relevant for analysing rural development projects. Students will acquire an overview of concepts and approaches to understanding and analysing processes of social change in rural areas in developing countries and key factors in social and economic development of local communities, within a general framework of ecological sustainability. The programme offers students the opportunity to gain a deeper insight into the strategies used by rural men and women to secure their livelihoods. The sustainable livelihood approach is used as a framework for analysis. At the same time, the course provides practical insight into how development initiatives might become more effective in combating rural poverty and food insecurity and improving people,s quality of life. The course gives students a basis for understanding relations between management and local development. Sustainable agriculture and nature resource management are analysed as a driving force in rural development. The course emphasises the acquisition of knowledge and skills needed to manage rural development projects in developing countries. Through practical training, students will acquire skills in the use of research methods, tools and techniques relevant for analysing rural development projects and conducting thesis research work.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: The course grade is based on one written final examination.
Examination aids: No calculator, no other examination aids

EDS410 Doctoral Course in Development Studies

Doctoral Course in Development Studies

Credits: 15 **Language:** English
Staff/institute: Nadarajah Shanmugaratnam/ Noragric
Teachers: Staff at Noragric and invited lecturers.
Start term: Autumn parallel
Terms: Autumn parallel January block Spring parallel
Mandatory activities: Compulsory term paper and course participation in 2/3 of the lectures.
Prerequisites: Participants should hold a Master's degree or equivalent.
Type of course: The course will be based on full day seminars. It will be rather intensive for 5-6 weeks, then the rest of the semester will be available to write a term paper and for other seminars and discussions if required.
Contents: The course has two main components: 1. Environment-Development Relations (One module - 1/3) 2. Development Theory and Policy (Three modules - 2/3) a. Development theories in historical perspective b. Globalisation, Development and democracy: Current debates and the Global-Local Nexus c. Development policies and practices: Critical review and Case studies

The module on Environment-Development relations introduces the student to political ecological analyses and interpretations of society-nature interaction, resource appropriation and degradation, and marginalisation. Module 2.a. traces the origins of the more influential ideas of development and presents the main theories inspired by them from a critical and historical perspective. Module 2.b. deals with the current debates on globalisation with reference to development, democracy and global power relations. It focuses on a wide range of issues including the nature and role of multilateral organisations; globalisation-poverty relations; state building, liberalisation, democracy and governance; post-conflict development, and the global-local nexus. Module 2.c. critically addresses the question of development policies and what happens in practice with the aid of real world examples. Development performance, resource rights and distributional issues, resource conflicts and poverty are among the key issues covered.

Learning outcomes: International environment and development studies is an evolving multi- and inter-disciplinary field of study. Characterised by normative and policy concerns, this field of study examines processes of development and change in ways that illuminate the dynamics of power relations and states of human well-being and the environment in particular contexts from different perspectives. The PhD course is aimed at providing the students with a sound interdisciplinary understanding of environment-development relations and a critical knowledge of development theories, policies and practices with due regard to the diversity and complexity of the real world. Given its multi- and inter- disciplinary nature, the course draws on knowledge from social and natural sciences and present approaches that integrate the political economic, cultural and ecological aspects of change at macro, meso and micro levels.

Methods of examination: Final Oral exam **Grading:** Pass/Fail

Assessment methods: Oral exam

FMI310 Environmental Pollutants and Ecotoxicology

Environmental Pollutants and Ecotoxicology

Credits: 15 **Language:** English upon request

Staff/institute: Bjørn Olav Rosseland/ IPM

Teachers: Brit Salbu, Deborah Ougthon, Ole Martin Eklo and Inggard Blakar, guest lecturers.

Start term: January block

Terms: January block Spring parallel

Prerequisites: KJM100.

Type of course: Lectures: 36 hours. One day of field demonstration at Lake Årungen. Dissection course with fish in laboratory for sampling of organs for analyses of pollutants: 4 hours.

Contents: Lectures: Focus on natural and created sources that contribute to the contamination of trace metals, radionuclides and organic pollutants in air, water, earth sediments and vegitation and how the contaminants' form and mobility effect organisms up to and including man. Focus on standard (ISO) ecotests, terminology in toxicology and how early effects can be traced back to biological markers. Field demonstration: Demonstration of in situ fractioning techniques of contaminants in water, sequential extraction techniques of soil and sediments, and studies of the up-take in vegetation and aquatic organisms. Laboratory course: The students practice taking tissue samples from fish according to international standards. A certificate is issued for the sampling. Semester assignment: The students are to document broad knowledge on one central topic related to contaminants and ecotoxicological effects (completed individually).

Learning outcomes: The students will have knowledge of different sources of contamination and be able to evaluate the long-term effects of contamination of different ecosystems. The students will understand the links between concentration levels including the speciation of contaminants, and mobility and ecosystem transfer, biological uptake and bio-accumulation and bio-magnification of environmental contaminants in living organisms, and the ecotoxicological effects on cell, organ, organism and population. Students will be able to assess the short and long-term impact on man and the environment from contamination, and for some pollutants evaluate alternative countermeasures to reduce the impact in different ecosystems. Students will also be introduced to modern analytical techniques applied within the field. The students will understand that nature is fragile and that we need to consider the long term effects of pollutants to prevent negative ecotoxicological effects.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Both parts have to be passed.

FMI312 Environmental Exposures and Human Health

Environmental Exposures and Human Health

Credits: 10 **Language:** English upon request
Staff/institute: Yngvar Thomassen/ IPM
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: KJM100.
Type of course: 36 lectures: 3 hours per week for 12 weeks.
Contents: The course will deal with the connection between the most important biological, chemical and physical environmental factors and human health both in a local and global perspective. The consequences of pollution in air and water, exposure to unhealthy environmental factors at work, contaminants in nutrients and industrial discharges will be discussed.
Learning outcomes: The students shall understand how pollution in air and water, exposure to unhealthy environmental factors at work, contaminants in nutrients and industrial discharges affect human health.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Oral examination counts 3/4, semester assignment counts 1/4. Both parts must be passed.

FYS220 Statistical Thermodynamics

Statistical Thermodynamics

Credits: 10 **Language:** English upon request
Staff/institute: Unni Christine Oxaal/ IMT
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Three compulsory problem sets, that must be approved before the final examination.
Prerequisites: FYS112, MATH111, STAT100.
Credit reduction: TFY210, 9 Credits.
Type of course: Lectures: 52 hours. Exercises: 26 hours.
Contents: Lectures: Four hours per week where central topics in the course are discussed. Students must acquaint themselves with the topic of the day in advance, so that there will be a real discussion. Problem classes: Two hours per week, students work individually or in pairs with exercises. The subject teacher helps if needed. Basic ideas in statistical physics: The second law of thermophysics and multiplicity, entropy, efficiency, entropy in quantum physics, the canonical probability distribution, the partition function and its applications, chemical potential, free energy. Applications: Photons and phonons, the ideal quantum gas, fermions and bosons at low temperatures, chemical equilibrium, phase equilibrium, transport processes.
Learning outcomes: Be familiar with and understand the basic constitution of simple gases, liquids and solids when they are viewed as statistical many-particle systems. Understand and be able to explain the connection between the microscopic and macroscopic description of physical systems. Understand the microscopic basis for the second law of thermodynamics and the many and far reaching implications of this law. Be familiar with and understand the basic principles of statistical physics as applied to systems in equilibrium. Understand how simple statistical models predict the behaviour of material systems and their environment so that the models can be confirmed experimentally. Be familiar with a number of applications. Apply the second law of thermophysics, the canonical probability distribution, the partition function and the chemical potential to; temperature radiation, chemical equilibrium, phase equilibrium, diffusion of gases and other transport phenomena. The students should also be able to formulate mathematical models and to solve and interpret these. Make quantitative calculations based on these models and interpret the results. Understand how the atomistic nature of our surroundings forms the basis for our understanding of the world around us.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Three compulsory exercises must be completed and approved in order to participate in the final exam. The final written exam is of three hours duration. The exam paper will be graded according to the achieved percentage of the maximum score. The student will be tested for their understanding of the concept, and their ability to use a mathematical

formulation of the problem to answer the questions posed. They will also be required to give an interpretation of the formula or numbers presented in the answers.
Examination aids: Simple calculator, specified other examination aids

FYS381 Biological Physics

Biological Physics

Credits: 10 **Language:** English upon request
Staff/institute: Gaute Einevoll/ IMT
Teachers: Gaute Einevoll.
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Basic mathematics, computer science and physics.
Credit reduction: FYS380 - 10 credits.
Type of course: Lectures: 48 hours. Exercises: approximately 24 hours.
Contents: The curriculum will be presented in lectures, and problem calculation exercises will contribute to increased understanding of the topics.
Learning outcomes: Gain a comprehensive understanding of how the properties of biological systems are determined by basic physical laws, have an understanding of and be able to do mathematical calculations on some models for molecular and cellular processes, and be able to orient oneself further within the scientific literature on biological physics. The student should also be able to write a scientific report and put forward the results in an oral presentation. Know and understand i) how cells are built, ii) how a diffusive transport process is the result of random movements on the microscopic level and how the equation of diffusion may be deduced, iii) hydronamics at small spatial scales (cellular level), iv) what entropies forces are and how they work, v) chemical forces, vi) cooperative transitions in macromolecules, vii) enzymes and molecular machines, and viii) basic properties of electrically excitable cells. Be able to orient oneself and gain knowledge from scientific books on biological physics and ordinary scientific articles. Understand that the divisions between the natural sciences - physics, chemistry and biology - are made by man and that natural science is actually one continuous science.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Final oral exam based on the course curriculum.

FYS385 Project in Biological Physics

Project in Biological Physics

Credits: 5 **Language:** English upon request
Staff/institute: Gaute Einevoll/ IMT
Teachers: Cecilia Futsæther, Unni Oxaal.
Start term: Autumn parallel
Terms: Autumn parallel January block
Prerequisites: Basic mathematics, computer science and physics. FYS381 must be taken before or in parallel with the course.
Credit reduction: FYS380 - 5 credits.
Type of course: Weekly discussion with teachers and/or fellow students.
Contents: Work on the project. Writing of the scientific report. Oral presentation of the report.
Learning outcomes: The students should acquire in-depth knowledge of a specific topic in biological physics or be introduced to doing research within the field. Learn to write and orally present a scientific project report.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The project report is evaluated and counts for 3/4 of the final grade. If several students collaborate on a single report, it must be possible to identify their individual contributions. Every student gives a presentation, presenting either a part of a collaborative project or an individual project. The presentation is evaluated and counts 1/4 of the final grade. All students must attend the presentations. Both the report and the presentation must get a passing grade to pass the course.

FYS386 Mathematical Neuroscience

Mathematical Neuroscience

Credits: 5 **Language:** English upon request
Staff/institute: Gaute Einevoll/ IMT
Teachers: Gaute Einevoll.
Start term: Spring parallel
Terms: By demand
The course is offered: Other - Upon request, by appointment with course responsible.Gis etter behov etter avtale med emneansvarlig.
Prerequisites: Introductory courses in mathematics and information sciences.
Type of course: Discussion groups: ca. 24 hours.
Contents: Selected topics related to mathematical modelling of (i) signal processing in nerve cells, (ii) neural coding and decoding, (iii) receptive fields in the visual system, (iv) information transmission in the nervous system, (v) biophysics of nerve cells, (vi) biological neural networks, and (vii) learning and memory.
Learning outcomes: Gain a comprehensive understanding of how the properties of neurobiological systems can be modelled mathematically and be able to navigate in the academic literature on mathematical neuroscience. Be able to formulate and solve simple models from mathematical neuroscience. Be able to navigate in and acquire knowledge from scientific literature in the subject field in order to be able to develop more complicated models. Understand that mathematical models are necessary in order to understand complex neurobiological processes.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Final oral exam. The student will be asked questions from the curriculum by the examiner and the course teacher.

FYS387 Pattern Forming Processes

Pattern Forming Processes

Credits: 5 **Language:** English upon request
Staff/institute: Unni Christine Oxaal/ IMT
Teachers: Cecilia Futsæther.
Start term: Autumn parallel
Terms: By demand
The course is offered: Other -
Prerequisites: Basic courses in physics and mathematics.
Type of course: Discussion groups: ca. 24 hours.
Contents: Discussion classes on demand, of the following topics: (i) fractals,(ii) viscous fingering, (iii) pecolation, (iv) random walks, (v) time series,(vi) growth models, (vii) scaling, (viii) selected systems in nature (coastlines, rivers, aggregation), (ix) modelling of branching structures such as blood veins, bronchies, plants.
Learning outcomes: Gain a in-depth understanding of how pattern-forming processes such as crack formation in materials, flow paths in soil, streams and rivers in a catchment area or blood veins and bronchies form complicated networks and how such systems can be modelled mathematically. Be able to orient oneself further in the scientific literature on complex systems. Be aware of and understand selected topics related to the mathematical modelling of (i) fractals,(ii) viscous fingering, (iii) pecolation, (iv) random walks, (v) time series,(vi) growth models, (vii) scaling, (viii) selected systems in nature (coastlines, rivers, aggregation), (ix) modelling of branching structures such as blood veins, bronchies, plants. Be able to formulate and solve simple models from pattern forming processes. Be able to orientate oneself in and acquire knowledge from scientific literature on this subject in order to be able to describe pattern forming systems. Understand how complicated and beautiful patterns in nature can be described quantitatively through the use of physics and mathematics.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Final oral exam. The student will be asked questions from the curriculum by the examiner and the course teacher.

GEN220 Genetic Basis of Biodiversity

Genetic Basis of Biodiversity

Credits: 10 **Language:** English
Staff/institute: Manfred Joachim Heun/ INA
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: The laboratory exercises.
Prerequisites: BIO120.
Type of course: Lectures: 40 hours. Lab work: 5 hours.
Contents: General introduction, definition of biodiversity, genetic resources etc. Gradients of diversity and distribution patterns of selected species. Communities, ecosystems and biomes; Global timing and the past. DNA tools for detecting/ measuring of genetic diversity/relationship. Natural selection, mutations and novelty. Neutral theory of molecular evolution. Mammalian genome analysis/ sequencing and our past. RAPD lab experiment. Converting RAPD row data into a diversity matrix and later into an UPGMA.
Learning outcomes: The students should understand that all (today's and extinct) biodiversity is the outcome of Darwinian selection and other genetic mechanisms, which all have a common genetic basis. The enormous number of gene/allele combinations in the genomes of most living species is beyond imagination; yet, we have to learn genetic approaches to understand the above-mentioned adaptation processes.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam of 3 hours.
Examination aids: No calculator, no other examination aids

GEN320 Molecular Markers for Genomics

Molecular Markers for Genomics

Credits: 5 **Language:** English
Staff/institute: Manfred Joachim Heun/ INA
Teachers: Kari Vollan.
Start term: January block
Terms: January block
The course is offered: Even years
Mandatory activities: The entire laboratory course is compulsory. This forms the basis for a laboratory report and a presentation, for which a grade will be given. The laboratory course starts on the first day of lectures.
Prerequisites: BIO120 and GEN220.
Type of course: Lectures: 30 hours. Laboratory work: 60 hours. Presentations based on selected articles and laboratory results: 10 hours.
Contents: Understand the use of DNA marker for genome analysis. DNA marker and genome analysis, construction of genome maps (linkage maps), fine-mapping via BSA (bulked segregant analysis), map-based cloning and chromosome landing, synteny and genome evolution. Physical mapping, WWW searches of genome data.
Learning outcomes: The enormous number of gene/allele combinations in the genomes of most living species is beyond imagination and we will learn DNA marker-based approaches for understanding genome organisation and evolution. The lab part will provide the students with hands-on experience to do DNA-based work for their MSc/ PhD work.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam (3 hours) counts 3/5. Lab report and presentations of 1 lab result (1 hour) and presentation of one research article (1 hour) count 2/5.

GEN340 Molecular Evolution

Molecular Evolution

Credits: 5 **Language:** English
Staff/institute: Manfred Joachim Heun/ INA
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Even years
Mandatory activities: The student presentations.
Prerequisites: BIO120, GEN220 and GEN320.
Type of course: Lectures: 30 hours. Presentations: 5 hours.
Contents: GEN340 is as a continuation of GEN320. GEN340 will deepen the data analysis aspects and will show the power of different DNA marker systems in different species for explaining the observed sequence/ chromosome/ genome variation. The theoretical aspects of evolution and its study via phylogenetic analyses will be reviewed. Diversity-based methods like NJ will be compared with parsimony and maximum likelihood methods. Examples that such analyses can also be used in biogeography, molecular systematics/ taxonomy, nature management, conservation genetics or ecology will be lectured, and each student will have the challenge to present one current articles her/himself possibly related to interest/ MSc topic.
Learning outcomes: Mathematical approaches are needed to interpret the large amount of molecular data generated in a variety of research fields. The course takes the students to a level where they will be able to use these methods to progress with their own MSc or PhD thesis in related research areas.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam of 3 hours.
Examination aids: No calculator, no other examination aids

GEO222 Geology Project

Geology Project

Credits: 5 **Language:** English upon request
Staff/institute: Sylvi Haldorsen/ IPM
Teachers: Michael Heim, Jon Landvik, Rolf Sørensen.
Start term: Autumn parallel
Terms: By demand
Prerequisites: GEO100. Students who would like a special assignment in Quaternary Geology: GEO210. Students who would like a special assignment in groundwater: GEO220.
Type of course: Guidance: ca. 10 hours.
Contents: The student makes a plan for the work together with the teacher and the employer. The plan is to contain the purpose of the project, a detailed plan for the conduction of the project, product and report.
Learning outcomes: Use the knowledge acquired from the courses in geology to solve applied problems or problems related to geological research projects. Through the course, the students will acquire knowledge of the practical conduction of geological investigations. He/she have the opportunity to come into direct contact with employers and researchers in geology. The student will learn to write a report directed to the project leaders.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final report.

GEO300 Hydrogeology

Hydrogeology

Credits: 10 **Language:** English upon request
Staff/institute: Jan Mulder/ IPM

Teachers: Sylvi Haldorsen, Helen French (Bioforsk).
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Mandatory activities: Submission of exercises.
Prerequisites: GEO220.
Type of course: Lectures: 40 hours. Exercises: 15 hours. Modelling: 12 hours.
Contents: 1. Lectures - theory. 2. Calculation exercises. 3. Assignments (assessment included in the final grade). 4. Introduction of groundwater model MODFLOW. 5. MODFLOW exercises (to be submitted and approved).
Learning outcomes: The student will get insight into quantitative methods to describe properties of groundwater, including the flow of water and spreading of pollutants. Quantitative analysis of the transport of water and dissolved substances in porous media under saturated conditions. Use of quantitative methods, including large-scale groundwater models as predictive tools. The ability to evaluate the risk of irreversible changes in groundwater resources both in quantity and quality as a result of human encroachments is important in order to achieve good resource management. Clean groundwater is an important natural resource.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: 2 assignments: representing 40% of the final grade. Final written examination (3 hours): representing 60% of the final grade. The two assignments involve computation of transport problems in groundwater. This part will be done during the semester. Submission: One week after the students have received the assignment. Final written examination. Alle parts of the evaluation must be passed.

GEO310 Paleoenvironment and Climate Change

Paleoenvironment and Climate Change
Credits: 10 **Language:** English upon request
Staff/institute: Jon Landvik/ IPM
Teachers: Various.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Even years
Prerequisites: GEO100 and GEO210, or equivalent courses.
Contents: The course addresses the dramatic natural changes in the Earth,s physical and biological environments on geological time scales. There will be a focus on the development of both low and high latitude environments. The students will learn about the forcing mechanisms and feedbacks controlling long-term climatic change, the effect of climate change on the physical and biological environments, and gain an understanding for the environments, sensitivity to future changes. The course comprises lectures as well as seminars on up-to-date research papers addressing these topics.
Learning outcomes: The student will obtain an understanding of the natural changes in the Earth,s physical and biological environments in the recent geological past.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Submitted papers: 50%. Final exam: 50%. Both parts must be passed.

GMGD210 Geodetic Measurements

Geodetic Measurements
Credits: 5 **Language:** English
Staff/institute: Ola Øvstedal/ IMT
Start term: June block
Terms: Autumn parallel June block
Mandatory activities: Field course.

Prerequisites: GMUJ200. GMSG210.
Type of course: Field exercises: 40 hours. Lectures: 15 hours. Exercises: 50 hours.
Contents: Field course: Planning, reconnaissance and geodetic measurements. Selecting optimal observation methods (direction measurement, distance measurement, levelling as well as various GPS-based methods) for various types of geodetic measurements. Verification of observation material in the field. Lab: Groupwise calculations based on the results from the field exercises: searches for major errors, testing existing networks and reliability analysis. Relations with national standards.
Learning outcomes: Master the planning, field work and analysis of geodetic measurements. There will be great emphasis on quality assurance and connections to relevant standards.
Methods of examination: Final **Grading:** A-F
Assessment methods: Project report.

GMGD300 Geodesy Graduate Course

Geodesy Graduate Course

Credits: 15 **Language:** English upon request
Staff/institute: Bjørn Ragnvald Pettersen/ IMT
Teachers: Oddgeir Kristiansen, Kristian Breili, Christian Gerlach.
Start term: August block
Terms: August block Autumn parallel Spring parallel
Mandatory activities: Exercises. Compulsory, submitted work must be passed in order for the student to sit for the exam.
Prerequisites: GMSG200.
Type of course: Lectures and discussion groups: 80 hours. Exercises: 80 hours.
Contents: Selected topics in classical higher geodesy, geodetic reference systems, height systems, geoide calculations, astronomical and physical geodesy, space and satellite geodesy, inertial navigation, and parameter estimation.
Learning outcomes: Students are to understand the theoretical basis for calculation methods and techniques. They should be able to apply this in problem solving in several topics and themes in geodesy (e.g. topical list of the course).
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam: 1/1.

GMGI290 Geographical Information - Data Capture and Analysis

Geographical Information - Data Capture and Analysis

Credits: 5 **Language:** English
Staff/institute: Owe Löfman/ IMT
Teachers: Øystein B. Dick. Håvard Tveite.
Start term: June block
Terms: June block
Prerequisites: EDS220 or equivalent.
Credit reduction: GMGI100 - 3 credits, GMGI210 - 2 credits.
Type of course: Lectures: 35 hours. Laboratory exercises and project work: 60 hours.
Contents: A mix of lectures, laboratory exercises and course assignment. General: The GMGI290 course covers a general background to GIS technology and applications including different methods of data capture and manipulation of data for storage and geocoding. Specific: Inclusion of data into a GIS system and conversion between different data structures in the raster-vector perspective. Data capture by GPS and image analysis of satellite imagery and/or aerial photography. Basic spatial data analysis: buffering and overlays, query of geographical data. Basic spatial statistic data anaysis: descriptors of centrographic statistics, autocorrelation and spatial patterns of point-,line- and area data. Practical part: Excercises at computer lab and simple field use of GPS. Key words: GIS basics-Data capture-Spatial analysis-Basics of spatial statistics-Spatial interpolation-Image analysis-GIS practice-Cartography-Visualization.
Learning outcomes: After completing the course, the students should have a basic knowledge of the special character of geographical data and be able to plan for and perform geographical data capture. They should also be familiar with basic techiques for manipulating and analysing geographical data in a GIS environment and have a basic knowledge in geostatistics.
Methods of examination: Final **Grading:** Pass/Fail

Assessment methods: The evaluation will be based upon a written report and presentation of project work at a final seminar.

GMLM102 Geodetic Surveying Basics

Geodetic Surveying Basics

Credits: 10 **Language:** English upon request
Staff/institute: Inge Revhaug/ IMT
Teachers: Teaching assistants.
Start term: June block
Terms: Spring parallel June block
Mandatory activities: Laboratory works. Field course, 5 days.
Prerequisites: MATH100.
Type of course: Lectures: 26 hours. Exercises: 52 hours. Field course: 5 days.
Contents: Theory: Units and definitions in Surveying. A short introduction to coordinate systems, reference frames and map projections. Instruments: Total stations (theodolite and electronic distance measurer), levels and satellite receivers. Simple coordinate calculations. Exercises: Levelling. Tachymetry. Setting out. Traversing. GPS. Surveying software. Size in the block period: 6 days.
Learning outcomes: To give an introduction to modern geodetic surveying. The students should learn the basic principles and methods. In addition, the students should be able to use standard instruments and software.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam.
Examination aids: Any calculator, no other examination aids

GMLM211 Marine Geodesy

Marine Geodesy

Credits: 5 **Language:** English
Staff/institute: Christian Gerlach/ IMT
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Odd years
Prerequisites: GMLM102, GMLM213.
Type of course: Lectures: 28 hours. Exercises: 28 hours.
Contents: Role of the ocean in the Earth system. Elements of oceanography (ocean currents, tides). Measurement techniques to determine the ocean surface (tide gauges, satellite altimetry). Coordinate systems. Review of adjustment theory and quality control. Principles of positioning on sea. Radio frequency propagation in the atmosphere. Underwater acoustics. Selected measurement systems for positioning on sea, underwater navigation and sounding.
Learning outcomes: Students should understand the role of the ocean in the Earth system and understand the basic principles of geodetic measurement techniques related to oceanography as well as surveying on sea and under water.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam: 75%. Exercises: 25%.

GMSG410 Advanced Application of GPS

Advanced Application of GPS

Credits: 15 **Language:** English upon request
Staff/institute: Ola Øvstedal/ IMT
Start term: August block
Terms: By demand
The course is offered: Other -

Mandatory activities: Student presentations.
Prerequisites: GMSG200, GMSG210, GMUJ200.
Type of course: Lectures: 80 hours.
Contents: Modelling and estimation of error sources. Multi-base station RTK. OTF ambiguity resolution.
Learning outcomes: Students are to master the mathematical models for precise position determination using GPS.
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: Oral exam.

GMUJ200 Parameterbased estimation and control of quality

Parameterbased estimation and control of quality

Credits: 5 **Language:** English upon request
Staff/institute: Ola Øvstedal/ IMT
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Compulsory exercises.
Prerequisites: MATH130, STAT100, GMLM213.
Type of course: Lectures: 28 hours. Exercises: 28 hours.
Contents: Optimal estimation of parameters (e.g. coordinates). Methods to detect outliers in observations. Quantification of integrity in the form of computed numbers for reliability. Introduction to sequential methodes and Kalman filter.
Learning outcomes: Master parameter estimation and propagation of errors. Have knowledge of and ability to carry out outlier detection and reliability analyses, sequential adjustment and Kalman filter. Have knowledge of robust estimation, conditional adjustment and parameter adjustment with conditions.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam of 3.5 hours.
Examination aids: Any calculator, any other examination aids

HET401 Individual Ph.D. course in Ethology

Individual Ph.D. course in Ethology

Credits: 10 **Language:** English upon request
Staff/institute: Bjarne Olai Braastad/ IHA
Teachers: Morten Bakken, Knut E. Bøe and possibly others.
Start term: Autumn parallel
Terms: Autumn parallel January block Spring parallel June block
The course is offered: Other - Course given upon demandEmnet gis etter behov
Prerequisites: Competence at Master's degree level in ethology
Type of course: The structure is to be agreed upon by the PhD student and the supervisor.
Contents: Individually planned
Learning outcomes: The course shall give PhD students competence in ethology that goes beyond the master level courses in ethology. The topic is chosen in discussions between the student, the supervisors or other teachers. Individual learning goals are set up for the chosen topic.
Methods of examination: Final **Grading:** Pass/Fail
Assessment methods: The PhD student writes a semester assignment on a topic given by the teacher.

HFA300 Animal Breeding Plans

Animal Breeding Plans

Credits: 10 **Language:** English upon request
Staff/institute: Tormod Ådnøy/ IHA
Teachers: Employees of animal breeding organisations may be involved.
Start term: Spring parallel

Terms: Spring parallel
Mandatory activities: Participation in group work and presentations. Submission of group assignment.
Prerequisites: HFA200.
Type of course: Lectures: ca. 20 hours. Exercises: ca. 20 hours. Group work: ca. 20 hours. Presentations of group work and individual assignments.
Contents: - Biological basis and aids for breeding work - Definition of breeding goal and discussion of registration of needed information - Economic value of traits in the breeding goal and calculation of economic profits of the breeding work - Optimization of breeding plans - Optimization of specific breeding plans for pigs, cattle, goats, poultry and fish.
Learning outcomes: Students will learn about the importance of biological, technical and economic conditions within the different animal species, and evaluate this in alternative breeding plans.
Methods of examination: Final **Grading:** A-F
Assessment methods: Grading on the basis of individual semester assignment.

HFA301 Calculation of Breeding Values

Calculation of Breeding Values

Credits: 10 **Language:** English upon request
Staff/institute: Tormod Ådnøy/ IHA
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Hand-in exercises will be evaluated in order to assure good study progression throughout the semester.
Prerequisites: HFA200.
Type of course: Discussion groups/lectures: 2 hours per week. Datalab: 2 hours per week.
Contents: In this course, ways of calculating breeding values in domestic animal breeding programs will be explored. Focus will be put on understanding the methods, and limitations of the methods. Small practical calculation examples and matrix notation will be used. We will go through (chapter 26 in the textbook): The general mixed effect model. Estimation of fixed effects and prediction of random effects (blup). Estimation ability. Standard errors of estimators. Animal model. Reduced animal model. Calculation of relationship matrix and inverse relationship matrix. Breeding values in models with repeated measurements on individuals. Maternal effects models. There will not be focus on computer programmes that are specialised for breeding value calculations in practical domestic animal breeding situations, but the programme matlab will be used. Regarding variation component estimation (chapter 27 in the textbook), an introduction to the underlying theoretical foundation and the principles for calculation techniques will be covered.
Learning outcomes: Students will learn what breeding values calculated as blup-values are, and will be able to calculate these values for example data sets. They will also be acquainted with the estimation of variance components that are required to find blup-values.
Methods of examination: Final **Grading:** A-F
Assessment methods: Semester assignment

HFA304 Theory and application of inbreeding management

Theory and application of inbreeding management

Credits: 10 **Language:** English
Staff/institute: John Arthur Woolliams/ IHA
Teachers: Theo Meuwissen
First time the course is offered: SPRING 2008
Start term: January block
Terms: January block Spring parallel
Mandatory activities: Computer practicals to be presented as evidence of effort.
Prerequisites: HFA200
Type of course: 300 hrs

Contents: Introduction to inbreeding, Phenomenon associated with inbreeding, Relationships, Genetic contributions, Minimizing Inbreeding, Inbreeding and Selection, Contribution of Mating to managing inbreeding, Quantitative Genetics Guide to DNA Markers, Using DNA markers in diversity studies, Constructing IBD matrices and their use, Managing inbreeding within genomes.
Learning outcomes: To present a unified approach to the management of inbreeding, providing supporting concepts with practical tools.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: Any calculator, any other examination aids

HFA400 Quantitative Genetics

Quantitative Genetics

Credits: 10 **Language:** English upon request
Staff/institute: Hans Magnus Gjøen/ IHA
Teachers: The course is given when required. The supervisors of each PhD student are expected to contribute as teachers.
Start term: Autumn parallel
Terms: By demand
The course is offered: Other - On demandVed behov
Mandatory activities: Colloquia
Prerequisites: 300 level in livestock breeding, or the equivalent.
Type of course: Discussion groups: 22 hours. (Subject to change).
Contents: Quantitative genetics with focus on inbreeding, genetic variation and breeding plans and economics in breeding. Topics may be changed.
Learning outcomes: The students should acquire a solid understanding of quantitative genetics.
Methods of examination: Final Written exam **Grading:** Pass/Fail
Assessment methods: Written exam, 3 hours.
Examination aids: Any calculator, any other examination aids

HFA401 Biometrical Methods in Animal Breeding

Biometrical Methods in Animal Breeding

Credits: 10 **Language:** English upon request
Staff/institute: Tormod Ådnøy/ IHA
Start term: August block
Terms: By demand
The course is offered: Other - When enough students.Når det er nok studentar.
Mandatory activities: Participation in colloquia.
Prerequisites: Animal breeding up to PhD level. Linear algebra.
Type of course: Approximately 30 hours colloquium and 30 hours of exercises.
Contents: We will follow the textbook RA Mrode: Linear Models for the Prediction of Animal Breeding Values, CAB Int. Some original articles on variance component estimation will also be covered. At least the two last chapters of Lynch and Walsh: Genetics and Analysis of Quantitative Traits, are relevant as a supplementary text. Another requirement is to be capable of using the software vce/pest, asreml, dmu, or another variance component estimation program on a data set, and predict blup breeding values.
Learning outcomes: Successful candidates will be able to calculate breeding values for breeding companies, understand the underlying theory and be able to work with and publish papers using special mixed models (e.g. maternal effect, dominance)
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Semester assignment: 60 %. Written 3-hour exam: 40 %. The semester assignment shall present result of calculating breeding values on real data.

HFA404 Statistical Problems in Quantitative Genetics and Animal Breeding

Statistical Problems in Quantitative Genetics and Animal Breeding

Credits: 5 **Language:** English
Staff/institute: Daniel Gianola/ IHA
Start term: January block
Terms: By demand
The course is offered: Other - By demandEtter behov
Mandatory activities: Students will present selected topics and asked questions about their understanding.
Prerequisites: A solid background in regression analysis, quantitative genetics, and a course in introductory mathematical statistics or probability theory.
Contents: Discussion of advanced topics in statistical genetic analysis of continuous and discrete traits including linear models, variance components, Bayesian approaches and non-parametric procedures.
Learning outcomes:
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: Oral report/examination.

HFE300 Animal Nutrition, Selected Topics

Animal Nutrition, Selected Topics

Credits: 5 **Language:** English upon request
Staff/institute: Øystein Holand/ IHA
Teachers: Anders Skrede
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: To be approved, students are required to participate in a minimum of 3/4 of the student presentations.
Prerequisites: Knowledge of general nutrition equivalent to HFE200.
Type of course: The number of hours for structured activities is ca. 20, but this will depend on the number of students.
Contents: Presentation of main principles and important aspects in connection with the selection of a topic and the writing of the assignment. The selected topics will be presented and discussed. The main contents of the course are the writing and presentation/discussion (in class) of the assignments.
Learning outcomes: The course aims to increase students' understanding of nutrition, based on the selected topic for the semester assignment. After completion of the course, the students are also expected to have good insight into the basic use of scientific literature and the writing of a reference list. The student will also gain experience from an oral presentation and discussion of an assignment with focus on nutrition.
Methods of examination: Final **Grading:** A-F
Assessment methods: Deadline for submission and discussion of assignments is agreed upon with the students at start of the course. Evaluation of assignments.

HFE303 Nutrition and Optimisation of Diets for Monogastric Animals

Nutrition and Optimisation of Diets for Monogastric Animals

Credits: 10 **Language:** English upon request
Staff/institute: Nils Petter Kjos/ IHA
Teachers: Øystein Ahlstrøm, Harald Hetland and others.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises. The exercises will deal with calculation of digestibility/nutritive balance studies with monogastrics (roosters, mink or pigs), calculations on energy and protein value of compound feeds and feedstuffs for monogastrics, and optimising of diets for monogastrics.
Prerequisites: KJM100, HFX201, HFE200, HFE202, HFX253.

Type of course: The course includes 50 hours of lectures and 20 hours of group work.
Contents: Characteristics of the digestion and intermediary metabolism in monogastric animals. Background and construction of the energy and protein evaluation systems found in pigs, poultry and fur animals. Principles for an optimal feed composition and choice of feedstuffs based on considerations of product quality, resource utilisation and environmental concerns. Determination of standards for nutrition supply under various production conditions. Chemical analyses and in vitro analyses on which energy and protein evaluation systems are based will be discussed. When appropriate due to ongoing experiments, demonstration of digestion/nutritive balance studies in monogastric animals (roosters, minks or pigs) may be performed. Exercises on the calculation of energy and protein values in feedstuffs and compound feeds for monogastric animals.
Learning outcomes: Students should have a detailed understanding of the digestion and intermediary metabolism of energy and nutrients in monogastric animals, as well as the theoretical basis for energy and protein evaluation systems for monogastric animals (pigs, poultry, fur animals). Students should be able to use this knowledge for evaluating feedstuffs and complete feeds used for different domestic animal productions, based on physiological, nutritive, quality-related and resource-related conditions.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination.
Examination aids: Simple calculator, no other examination aids

HFE305 Feed Manufacturing Technology

Feed Manufacturing Technology

Credits: 10 **Language:** English
Staff/institute: Birger Svihus/ IHA
Start term: August block
Terms: August block Autumn parallel
Mandatory activities: Demonstrations and group work are compulsory.
Prerequisites: Basic knowledge in nutrition equivalent to HFE200, in physics equivalent to FYS100 and in chemistry equivalent to KJM110, is required.
Type of course: Approximately 40 hours of lecturing and 30 hours of demonstrations.
Contents: The following topics will be covered through lectures and demonstrations: The structure of the feed industry. Receiving, storing and transporting feed ingredients. Chemical changes during processing. Pelleting - principles and major effects. Pellet quality. Extrusion. Dosing, weighing and mixing of diets. Pelleting - technical part. Conditioning. Expander treatment. Grinding of feed ingredients. Use of liquid feed ingredients. Cooling and drying. Process quality assurance program (ISO 9001), lac. control etc. Feed milling administration, maintenance program and flow design.
Learning outcomes: After this course, the student should be familiar with most of the processes that are used in the feed industry, and they should have gained knowledge of the causes and the justification for the use of the processes by taking into consideration knowledge about nutritional requirements, ingredient characteristics and cost of the processes.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3 hours written examination.
Examination aids: Simple calculator, no other examination aids

HFE306 Advanced Feed Manufacturing Technology

Advanced Feed Manufacturing Technology

Credits: 5 **Language:** English
Staff/institute: Birger Svihus/ IHA
Start term: January block
Terms: January block
Prerequisites: The students must have taken HFE305.
Type of course: There will be 12 lecture hours in this course.
Contents: The course will mainly be based on group work carried out at the Center for Feed Technology. The group work will be carried out as complete experiments, and the group will present and hand in a report from the group work. The reports will be graded. Each student will also hand in an individual report. Topics that will be covered may include: - Grinding - Weighing and mixing - Conditioning and expanding - Pelleting - Extrusion - Cooling/drying

Learning outcomes: The purpose of this course will be to gain in-depth knowledge of how and why different key processes and equipments are installed and used in feed production plants. The objective is that the students after this course will be able to not only understand the principles used for key processes, but also to optimise these processes through discussions with factory personnel and equipment producers.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: 2-3 group assignments and one individual assignment per student. Graded group and individual reports, each counting 50% of the final grade.

HFE307 Feed Production Planning and Management

Feed Production Planning and Management

Credits: 15 **Language:** English
Staff/institute: Trond Storebakken/ IHA
Teachers: Ozren Zimonja, Dejan Miladinovic
Start term: Spring parallel
Terms: Autumn parallel Spring parallel
Mandatory activities: Lectures.
Prerequisites: The students must have taken HFE305.
Type of course: Ca. 4 hours per week.
Contents: The course is divided into 12 main areas or topics that are crucial for managing a feed production facility. They are: Design and construction of a feed production facility. Managing Nutrition concerns and Least cost formulation at the feed plant. Process quality issues of raw materials and their grinding. Process quality issues in dosing and mixing of raw materials. Conditioning and its nutritional consequences for the production process. Liquid ingredient application in the production process. Managing the steam system as a raw material. Managing a feed plant. Managing personnel. The Maintenance Management System of a feed plant. Quality Assurance Programs and ISO 9001 concept. Safety and health at the feed plant.
Learning outcomes: The goal is to gain insight into all the key processes of feed production management.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: First term report: 7/15 Oral exam: 8/15 The evaluation will partly be based on a written, individual report prepared home over a period of at least one month. The topic will be chosen from several alternatives, summarising the topics covered in the first term. Evaluation at the end of the second term will be an oral exam. The student must have passed both parts to pass the course.

HFE308 Feed Optimalisation for Different Species

Feed Optimalisation for Different Species

Credits: 10 **Language:** English
Staff/institute: Birger Svihus/ IHA
Teachers: Trond Storebakken.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Participation in group work will be compulsory.
Prerequisites: Equivalent to one year master studies in Feed Manufacturing Technology.
Type of course: Approximately 50 hours of lecturing.
Contents: The lectures will deal with the specific needs of the following species: Cattle, sheep, goats, pigs, poultry, horses, fur animals, salmon, trout, halibut, cod, tilapia, shellfish. In addition, lectures will cover specific interactions between feed ingredients and chemical components, and processing.

Learning outcomes: The purpose of this course is to gain knowledge about special needs of different species when it comes to feed composition and physical quality, and special needs when it comes to ingredients used. In addition, the interactions between feed components and processing will be studied.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral examination approximately 30 minutes per student.

HFE400 Lipid Metabolism

Lipid Metabolism

Credits: 10 **Language:** English upon request
Staff/institute: Bente Ruyter/ IHA
Teachers: Hilde Sundvold, Magny Thomassen
Start term: January block
Terms: By demand
The course is offered: Other - Upon demandVed behov
Prerequisites: Basic knowledge in biochemistry and physiology
Contents: The textbook; Biochemistry of Lipids, Lipoprotein and Membranes by D.E Vance and J.E. vance, will be followed. In addition a range of new review articles within the fields of lipid metabolism in liver, muscle and adipose tissue will be part of the course. These articles will be selected individually based on each student's main research focus.
Learning outcomes: Provide students with advanced up-to-date knowledge of major areas in the fields of lipid, lipoprotein and membrane biochemistry. With emphasis on lipid metabolism in the major metabolic tissues liver, adipose tissue and muscle.
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: One hour oral examination with an external examiner present

HFX207 Introduction to Animal Production and Fish Farming in Developing Countries

Introduction to Animal Production and Fish Farming in Developing Countries

Credits: 5 **Language:** English
Staff/institute: Lars Olav Eik/ IHA
Teachers: Experts in various fields.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Must attend a minimum of 80% of the lectures.
Prerequisites: HFX100 or similar knowledge.
Type of course: Approximately 70 lectures, as well as semester assignment presentations (30 - 45 minutes for each presentation).
Contents: A textbook describing the various production systems, including environmental factors, breeds and breeding, feeds and feeding and management aspects will constitute the basic framework and curriculum for the course. In addition, students will have access to lecture handouts and semester assignments from fellow students.
Learning outcomes: The objective of this course is to give students basic knowledge about important production systems for livestock and fish. Breeding, nutrition, veterinary and other management aspects are lectured in theatre presentations by specialists in various fields. In addition to the broader system approach, students will also obtain in-depth knowledge in a limited area by writing and presenting a semester paper. In this process the student will also acquire experience in writing and presenting a scientific paper. After completing the course, students will have a broader understanding of potentials and challenges of animal production and fish farming in the tropics. The students will be introduced to experts at UMB and partner institutions, and to projects in the South in which they can do research for their Master thesis. In their lectures, specialists from different fields and cultural backgrounds will focus on ethical aspects and increased awareness of other cultures.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The evaluation will be based on the contents of the semester assignment (2/3) and its presentation (1/3). The semester assignment may be written individually or jointly by two students.

HFX209 Evolutionary Biology

Evolutionary Biology

Credits: 10 **Language:** English upon request
Staff/institute: Øystein Holand/ IHA
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Students should have completed the 200 group in biology, but the course can also be taken by highly motivated students with a weaker background in biology.
Type of course: An even distribution between lectures and student presentations with discussion.
Contents: All information concerning lectures, exercises, presentations etc. will be available on the website in due time.
Learning outcomes: The students will gain insight in the following main topics: 1. A history of life on earth. 2. Conceptual structure of evolutionary theory with emphasis on genetic variation, natural selection and adaptation. 3. Speciation 4. Life history evolution 5. Sexual selection 6. Senescence in an evolutionary context. 7. Pattern and process in macro evolution. After completion, the students will be able to use the conceptual apparatus of evolutionary biology to interpret and understand biological processes.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination, 3 hours.
Examination aids: No calculator, no other examination aids

HFX300 Experimental Design and Analysis in Animal Science and Aquacualture

Experimental Design and Analysis in Animal Science and Aquacualture

Credits: 5 **Language:** English
Staff/institute: Theo Meuwissen/ IHA
Start term: August block
Terms: August block
Prerequisites: Knowledge of statistics in the areas of variance analysis and regression.
Type of course: 30 hours.
Contents: The course treats: the choice of statistical models, statistical designs, registration and analysis of research data, estimation of treatment effects, their interactions, how to deal with residual variation, hypothesis testing applied to animal science and aquaculture, types of hypostheses.
Learning outcomes: The course shall increase the practical understanding and application of statistical techniques, that were taught in earlier statistics courses, to the practical situations in animal science and aquaculture. The students shall be able to use, understand, and know the pros and cons of various statistical methods and designs that are used as part of their main master thesis. Also, the students should be able to critically judge the statistical methods used in research reports.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Duration of exam: 3 hours. The written exam has a weight of 100%. Use of course notes is allowed during exam. An examiner is used for the exam evaluation.
Examination aids: Simple calculator, specified other examination aids

HFX303 Main Course: Horses

Main Course: Horses

Credits: 15 **Language:** English upon request
Staff/institute: Dag Austbø/ IHA
Teachers: Odd Vangen, Bjarne Braastad, Knut Bøe.
Start term: Spring parallel
Terms: Spring parallel June block
Prerequisites: HFX150, HFE200, HFA200, HET100, HFA201.
Type of course: Spring parallel: Lectures (2 hours per week); discussion group work (2 hours per week) June block: Lectures (10 hours); practical exercises/discussion groups (10 hours)

Contents: The course runs in the spring parallel and the June block. The June block will be at the Norwegian Horse Centre in Starum where students lodge at the centre's boarding school. The oral exam takes place at the end of the June block. The course content is built up around the main themes of breeding, nutrition and ethology. The most common breeds and uses of horses will be discussed concerning these issues. The course includes a semester assignment.
Learning outcomes: Give students a basic introduction to horse breeding, nutrition and ethology. Within horse breeding it is important that students understand the special challenges of breeding work in small populations where the most important characteristics are longevity and performance within the types of competition specific to each breed. The teaching of nutrition focuses on horse nutritional requirements and the requirements set by choice of feed and ration composition for horses of different ages and training/competition. The teaching in ethology will give knowledge about horses' natural behaviour, which is the basis for understanding horses and the learning mechanisms that are utilised in taming and training of horses. The course aims to give a wide background within these subject areas, thus providing a foundation for independent study.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Group work 1/6, term papers 1/6 and oral examination 4/6.

HFX306 Feeding and production diseases in cattle

Feeding and production diseases in cattle

Credits: 5 **Language:** English upon request
Staff/institute: Harald Volden/ IHA
Teachers: Arvid Steen, Olav Reksten, Tore Sivertsen
First time the course is offered: SPRING 2008
Start term: June block
Terms: June block
Type of course: App. 50:50 distribution between lectures and assignments.
Contents: The course will be given as a combination of lectures and assignments. The following feeding-related diseases will be treated: indigestions, ketosis, hypocalcemia, hypomagnesemia and diseases related to micro minerals.
Learning outcomes: The aim of the course it to give students basic knowledge in feeding-related production diseases in cattle and how to diagnosticate these. The students are to gain skills in the evaluation of different strategies to prevent feed-related production diseases by using a new analytical and feed planning tool. The course is arranged in collaboration with The Norwegian Veterinary College, and the students at the two institutions will learn to utilize the comparative competence.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Semester assignment

HFX400 PhD Course in Nutritional Biochemistry and Physiology

PhD Course in Nutritional Biochemistry and Physiology

Credits: 15 **Language:** English upon request
Staff/institute: Anna Haug/ IHA
Teachers: Harald Volden, Magny Thomassen, Ragnar Salte, Øivind Andersen, Anders Kiessling, Knut Hove.
Start term: August block
Terms: By demand
The course is offered: By assignment
Mandatory activities: Submission of journals from the experiments. Presentation of a semester assignment and the submission of a short description of the topic (ca. 5 pages).
Prerequisites: Master degree in animal science, aquaculture or similar. Sound basic knowledge in chemistry, biochemistry and physiology.
Type of course: Lectures: 3-6 hours per week. Work on experiments (sampling, sample collection and laboratory work): 8-12 hours. Discussion groups: 3 hours per week.

Contents: Topics related to metabolism in general, the digestive system and methods for measuring digestability of feed materials, blood function, nerve functions, skeletal and bone metabolism, lactation, respiration, temperature regulation, and metabolism changes that occur following different forms of energy and nutrient intake.
Learning outcomes: Upon completion of the course, students will be able to explain, employ and analyse how organisms react to varying levels of energy supply, protein, fat and carbohydrate supply, liquid supply and supply of different vitamins and minerals. Further, students will be able to explain and evaluate the significance of different physiological regulatory mechanisms under various metabolic conditions. The student will be able to conduct experiments that include sample collection, laboratory analyses, and data evaluation. The students will be able to form their own opinion on main scientific issues under debate in the research field.
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: Grades (passed/failed) are based on the student's achievement in the oral examination at the end of the course. The examination lasts for about 1 hour.

INN310 Intellectual Property Rights

Intellectual Property Rights
Credits: 5 **Language:** English upon request
Staff/institute: Anders Lunnan/ IØR
Teachers: Ivar Wergeland and others
Start term: January block
Terms: January block
Mandatory activities: Case-study, presentation of case-study
Prerequisites: Students should have a B.Sc. degree or equivalent
Type of course: 30 hours lectures, 10 hours excercises
Contents: What is the purpose of IPR? Introduction to the fundamental understanding of innovations; novelty, inventiveness and industrial usefulness. Introduction to the fundamentals of the patent application process. Design, trade mark and copyright; when, where and how to apply. Business agreements: license- , confindentiality- and collaboration agreements. Commercialisation of IPR.
Learning outcomes: The course aims at giving the students the ability to read, analyse and practise the fundamental principles of intellectual property rights-IPR. The students should be able to handle the fundamental theory of trade marks, design, patents and business agreements (but also copyright and geographical rights). The skills should be demonstrated as essential elements in the development of new products and services.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam; case-study must be approved before written exam can be taken. No re-sit exam will be arranged.
Examination aids: No calculator, no other examination aids

INN320 Research Methods in Entrepreneurship and Innovation

Research Methods in Entrepreneurship and Innovation
Credits: 5 **Language:** English upon request
Staff/institute: Anders Lunnan/ IØR
Teachers: Frode Alfnes
First time the course is offered: AUTUMN 2008
Start term: Autumn parallel
Terms: Autumn parallel
Type of course: The course is based on active participation from the students. Students will learn from lectures, seminars and work with a plan for their master thesis.
Contents: Research strategies and research design. Quantitative research, qualitative research. Writing up research and implementation of research projects. Research in entrepreneurship and innovation. Plan for master thesis.

Learning outcomes: Research strategies and design. Quantitative research, sampling, surveys, statistical analysis. Qualitative research, interviews, focus groups, qualitative data analysis. Writing up research and implentation of research projects. Research and important journals in entrepreneurship and innovation.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Term paper (100 %).

JORD201 Process Modelling in Soil Water and Plant Systems

Process Modelling in Soil Water and Plant Systems

Credits: 10 **Language:** English upon request
Staff/institute: Jan Mulder/ IPM
Teachers: Lars Egil Haugen, Trine Sogn.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: MATH010, KJM100, JORD101.
Type of course: Lectures and exercises alternate and will take place in the lecture-room and computer room. Lectures: ca. 18 hours. Exercises (computer): ca. 54 hours. Independent work: 78 hours.
Contents: Lectures and practical exercises on the computer: Introduction of Model Maker; 0., 1. and 2. order reactions, use of Model Maker and analytical solutions; Model parameters; Sensitivity analysis; Effect of soil temperature and water content on reaction rate; Michaelis-Menten kinetics; Equilibrium reactions; Mineral weathering, Nutrient cycling; C and N turnover in soil; Transport of water and solutes in soil and water courses. Assignments: a) 1. order reaction b) mineral weathering and c) turnover of C and N in the soil. Assignment d) is an individually chosen topic.
Learning outcomes: The students shall be able to formulate, solve, apply and present simple models for major processes in the soil, water and plant system. Insight into quantitative causal connections in soil, water and plant systems is important for sustainable use and management of different ecosystems. Quantitative understanding of connections between processes in soil, water and plant systems. Evaluation of quantitative effects of different interventions. Construction of mathematical models to describe important processes in soil, water and plant systems. Evaluation of quantitative effects of different interventions in soil, water and plant systems through mathematical models. Implementation and interpretation of sensitivity and Monte Carlo analyses. Implementation and interpretation of scenario analyses. Presentation of the model and model results. The knowledge is important for sustainable use and management of different ecosystems.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: There will be four assignments for submission throughout the semester. All four must receive a passing grade. All four assignments deal with models that the students have to construct and that will be used for system analyses. Assignments 1 to 3, formulated by the teachers, are linked to reviewed data exercises, which have been discussed in the lectures. The final assignment for submission is on a topic chosen by each individual participant in the course. With support from teachers, the students must find information and necessary literature themselves.

JORD221 Soil Physics, Laboratory Course

Soil Physics, Laboratory Course

Credits: 5 **Language:** English upon request
Staff/institute: Trond Børresen/ IPM
Teachers: Lars Egil Haugen.
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: JORD101.
Type of course: Exercises: 52 hours.

Contents: Field exercises: Taking soil samples for physical analysis. Measurement of physical parameters of soil in the field. Laboratory exercises: Determination of volumetric conditions in soil, pore-size distribution, the conductivity of soil measured by water and air, the properties and root-lengths of soil aggregates.
Learning outcomes: Insight into: - measurement and calculation of various physical soil parameters, - relations between different physical soil parameters, - the use of physical soil measurements to describe the soil and what kind of environment it provides for the growing of plants.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written report (group work, 2-4 students) counts 50% and an oral examination at the end of the course counts 50%. Both parts of the examination must be passed.

JORD251 Soil Classification

Soil Classification

Credits: 5 **Language:** English upon request
Staff/institute: Line Tau Strand/ IPM
Start term: January block
Terms: January block
Mandatory activities: 1. Attendance at compulsory lectures. 2. Oral presentations or poster presentations of an assignment connected to regional soil resources. 3. 80 % of the exercises.
Prerequisites: JORD101.
Type of course: Lectures: 18-20 hours. Exercises: 20 hours. Student presentations: 4-10 hours.
Contents: Soil classifications, history nationally and internationally. Principles of soil classification, diagnostic layer/characteristics. Regional distribution. Use of information on a regional basis. Use of classification keys. Classification of soil in reference to different classification systems from standard soil profile descriptions.
Learning outcomes: After the course, students will be able to: - give an account of the regional distribution, formation, characteristics and use of the important soil types in the world, - describe principles for the formation and classification of soil in reference to the soil classification system Soil Taxonomy, FAO/Unesco system (1975/1990) and WRB (1998), - from the classification nomenclature be able to express the important characteristics of soil that is classified, - classify soil in reference to one of the mentioned international soil classification systems.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The students are assessed individually based on the report from the student-chosen assignment, which is to be submitted on the last day of the course.

JORD260 Tropical Soils, Their Properties and Management

Tropical Soils, Their Properties and Management

Credits: 5 **Language:** English
Staff/institute: Bal Ram Singh/ IPM
Teachers: Line Tau Strand.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Basic knowledge in Soil Science.
Type of course: The course is conducted 4 hours per week. In all, there will be 26 lectures and 6 exercise classes.
Contents: In part one we discuss climate and its effects on weathering, soil formation and eco-system development in the tropics. The importance of soil-organic matter is emphasised. A minimum of soil classification is introduced. In part two we describe the most important soil types in the tropics and sub-tropics, their distribution and their physical and chemical properties. Part three discusses soil management, and the use of different fertilisers. Emphasise is placed on special problems related to the tropical environment, such as erosion, nutrient deficiencies, salinity, crop rotation etc. The last part presents different maps

with information on soils, land suitability/capability at different levels of scale, how the maps are produced and how they can be utilised. Finally we present some future scenarios related to global warming, and their effect on soil and water resources.
Learning outcomes: Provide basic knowledge of tropical soils and their role in the ecosystems, both natural and man-made. Soil genesis in relation to the present and past environment and land use patterns. General understanding of the management of soil resources for sustainable production. Knowledge of the most important tropical soils (according to modern soil classification) and their relation to the present landscape, climate and vegetation. Physical and chemical degradation; soil erosion, soil mining, salinity, alkalinity, pollution, etc. The student should be able to evaluate the most important soil resources in the tropics and sub-tropics, and be able to read and understand soil maps, understand the most used land capability and land use classification systems. The students shall learn about the consequences of different land use for the individual farmer and for the national land resources.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final written examination (3 hours): 2/3. Semester assignment: 1/3. Both parts of the examination must be passed.

JORD310 Global and Local Pollution

Global and Local Pollution

Credits: 10 **Language:** English upon request
Staff/institute: Arne Stuanes/ IPM
Teachers: Lars Bakken, Tore Krogstad, Jan Mulder, Line Tau Strand.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: MINA200.
Type of course: Lectures: 20 hours. Group work with guidance: 20 hours. Discussion of group work: 10 hours.
Contents: Metals: sources, modelling of species in soil, distribution, bioavailability, effects on plants and micro-organisms, critical loads. Decomposition of organic pollutants: microbial functions, kinetic. Long-range transported pollutants: nitrogen and acidification - comparison between Norway, Europe and China. Phosphorus in soil and on a watershed scale. Land use change: effects on downstream water quality. Each topic: 10 hours (4h lecture, 4h group work with guidance, 2h discussion of own work).
Learning outcomes: To understand processes in different soils which control the cycling of metals, nitrogen, sulphur, phosphorus and organic pollutants. To have an in-depth understanding of how the terrestrial environment is affected by metals, nitrogen, acid rain, phosphorus, organic pollutants and land use change. This includes an understanding of soil as habitat, effects of the mentioned compounds on different soils and resilience of the soil system.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final oral examination: 50%. Semester assignment: 35%. Presentation of group work: 15%. All parts must be passed.

JORD315 Biogeochemistry, Global Change

Biogeochemistry, Global Change

Credits: 10 **Language:** English upon request
Staff/institute: Lars Bakken/ IPM
Teachers: Lars Egil Haugen, Jan Mulder, Trine Sogn, Arne Stuanes. External: Dag Hessen UiO, Per Aagaard UiO.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: A minimum attendance of 80% of the literature seminars.
Prerequisites: MINA200, JORD201.
Type of course: Lectures: 24 hours. Literature seminars: 20 hours. Semester assignment presentations: 6 hours.

Contents: The course starts with the big-bang-theory, creation of stars, heavy elements, planets, the atmosphere, and life's biogeochemical signatures on our planet. Further, we treat the climate system, the main biogeochemical element cycles, methods in biogeochemistry, isotope signatures and global changes. Important leitmotifs for the course are 'the biosphere as a reactor in the climate system' and the 'anthropogenic factor' now and in the future. A part of the course is dedicated to a presentation and discussion of ongoing climate research at IPM: - Fluxes of greenhouse gases between soil and atmosphere. - Turnover and losses of C and N from terrestrial ecosystems.
Learning outcomes: Knowledge of the processes and organisms which dominate and regulate the biogeochemical system. Understanding how and why the system is about to change, and the uncertainties involved. The students are trained in acquainting themselves with scientific debates/discussions of biogeochemistry and global change, and to be active in such debates by reading and using primary scientific literature in the seminars and semester assignments.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final oral examination: 50%. Seminars: 20%. Semester assignment: 30%. All parts must be passed.

JORD340 Soil Fertility and Soil Management

Soil Fertility and Soil Management
Credits: 10 **Language:** English upon request
Staff/institute: Bal Ram Singh/ IPM
Teachers: T. Børresen, , T. Sogn, Tor Arvid Breland, Å. Almås E. Govasmark and B. Sitaula
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Oral presentation of the semester assignment.
Prerequisites: JORD240 or JORD242, JORD241 or JORD243, JORD220.
Type of course: Lectures: 30 hours. Supervision: 10 hours. Presentation and discussion: 10 hours. Seminars: 8 hours.
Contents: Plant nutrition (sulphur, selenium and cobalt), pH's effect on the availability of nutrients, fertilization, liming and modelling of N-fertilising requirements. Soil tillage, irrigation, soil compaction, agriculture and the environment, erosion and leaching, other pollution sources.
Learning outcomes: To understand current issues regarding plant nutrition, fertilisation, soil tillage and management in the light of newer research results while at the same time to gain an insight into the significance of these production factors for the quality of our production area and the pollution of our water systems. Insight in selected topics of plant nutrition for their current significance for crop production. To understand the effects of fertilisation and soil tillage on plant growth, sustainable production and environmental conditions. Insight into other pollution sources such as heavy metals in soil and plant systems. Students should be in a position to evaluate the effects of different cultivation practices on plant growth and the environment. He/she should be able to put them in perspective of total management of our soil and water resources. To understand sustainable use of soil resources for maintaining crop production and minimising the pollution risks of terrestrial environment.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Oral examination (40-50 minutes) counts 60% and the semester assignment 40%. Both parts must be passed.

KJB310 Protein Chemistry

Protein Chemistry
Credits: 10 **Language:** English upon request
Staff/institute: Ragnar Flengsrud/ IKBM
Teachers: Vincent Eijsink, Lars Skjeldal, Gerd Vegarud.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Participation in the exercises, journal.

Prerequisites: Biochemistry equivalent to KJB210.
Type of course: Lectures: 35 hours. Exercises: 64 hours. Seminars: 2 hours.
Contents: The lectures start 4-6 weeks before the exercises, in order to give the necessary theoretical background. The exercise part is based on full days. The seminar is a presentation in plenary of selected topics which the students have prepared in groups. This will reflect the knowledge achieved from their exercises. One journal from the exercises is to be handed in before the examination. It should be emphasized that this course is intended for master's degree students, requiring the ability to work independently in the field by the use of computers and the Internet.
Learning outcomes: Give an understanding of the significance of a protein's structure for its stability and biological activity and of how the structure of a protein may be determined. Give an understanding of the most common bioinformatics relevant to protein structures.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination, 3.5 hours.
Examination aids: No calculator, no other examination aids

KJB320 Proteomics I

Proteomics I

Credits: 5 **Language:** English upon request
Staff/institute: Ragnar Flengsrud/ IKBM
Teachers: Einar Jensen, Morten Skaugen
First time the course is offered: SPRING 2007
Start term: January block
Terms: January block
Mandatory activities: Participation in all activities.
Prerequisites: Biochemistry equivalent to KJB210.
Type of course: Lectures: 16 hrs; laboratory work; 22hrs.
Contents: Sample preparation for two-dimensional electrophoresis, two-dimensional electrophoresis, preparation of protein spots for MS-TOF/TOF analysis, MS-analysis, evaluation of results, identification of proteins. It should be emphasized that this course requires the ability and will to work independently and meticulously with advanced biochemical methods. Students shall present one scientific article on a seminar. If necessary, this presentation should be given in English.
Learning outcomes: The students will acquire the training and understandig necessary to perform the methods independently in a research project.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Journal.

KJB420 Proteomics II

Proteomics II

Credits: 10 **Language:** English upon request
Staff/institute: Ragnar Flengsrud/ IKBM
Teachers: Einar Jensen, Morten Skaugen, stipendiat.
First time the course is offered: SPRING 2007
Start term: January block
Terms: January block
Mandatory activities: Participation in all activities.
Prerequisites: Biochemsitry equivalent to KJB210.
Credit reduction: KJB320 - 5 ECTS.
Type of course: Lectures: 16 hrs, laboratory work: 22 hrs, colloqium: 6 hrs, special exercise: 12 hrs.
Contents: Sample preparation for two-dimensional electrophoresis, two-dimensional electrophoresis, preparation of protein spots for MS-TOF/TOF analysis, MS-analysis, evaluation of results, identification of proteins.

Learning outcomes: The students will acquire the training and understanding necessary to perform the methods independently in a research project.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Journal + a literature thesis from selected topics

KJM310 Chromatography

Chromatography

Credits: 10 **Language:** English upon request
Staff/institute: Dag Ekeberg/ IKBM
Teachers: Elisabeth Olsen. Hanne Devle.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Laboratory work and course journal. Each student must do analyses, and the result must be of a certain quality in order to pass.
Prerequisites: General chemistry, KJM100 Organic chemistry, KJM110 + KJM211 eller KJM210 Analytic chemistry, KJM240
Type of course: Lectures: ca. 20 hours. Laboratory work: ca. 60 hours.
Contents: Lectures given by the teacher. Presentation of assigned topics from students. Laboratory work. Evaluation followed by the writing of reports from the laboratory work.
Learning outcomes: The student should be able to evaluate the use of various methods of separation (for instance HPLC, GC) and conduct separation of organic/biochemical molecules using GCA, LC, various columns/pillars and evaluate other alternative detectors and interpret the results. The student should have in-depth knowledge of and insight into chromatographic theory, and knowledge of chromatographical practices and the theory behind the various separation principles. Through independent study in the laboratory and a theoretical study of the subject, the students will achieve competence in comparing different analysis methods, and gain a basic understanding for quantitative results that, for instance, are related to the pollution of food and environment.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination: 3.5 hours.
Examination aids: Simple calculator, no other examination aids

KJM311 Organic Spectroscopy

Organic Spectroscopy

Credits: 10 **Language:** English upon request
Staff/institute: Yngve H. Stenstrøm/ IKBM
Teachers: Dag Ekeberg
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: KJM210 or KJM211 or an equivalent introductory course in organic chemistry that includes fundamental organic structural spectroscopy.
Type of course: Ca. 22 lecture hours, divided into 4 hours per week, thereafter ca. 26 hours of problem-solving divided into 4 hours per week. Semester assignments are to be submitted for assessment by the end of the semester.
Contents: Lectures are given by the teacher during the first part of the semester. In the second part of the semester, exercises will be reviewed by the teacher in cooperation with the students.
Learning outcomes: Gain comprehensive knowledge of organic spectroscopic methods, especially UV/visible, IR, NMR (especially 1H and 13C) and MS. Gain a good understanding of how and when the methods are used and be able to use the methods in an independent way for determining the structure of unknown organic compounds. Special emphasis will be placed on natural products.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Semester assignment: 40% of the total grade. Written examination with an external examiner: 60% of the total grade.

KJM312 Natural Product Chemistry

Natural Product Chemistry

Credits: 10 **Language:** English upon request
Staff/institute: Solveig Flock/ IKBM
Teachers: Yngve Stenstrøm.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Odd years
Prerequisites: Basic Organic Chemistry equivalent to KJM210.
Type of course: Lectures: ca. 30 hours. Assignment review: ca. 10 hours.
Contents: Lectures are given by the teacher throughout the semester. Exercises will be gone through in plenary.
Learning outcomes: Gain advanced knowledge of the most important classes of substances within the natural products. Especially hydrocarbons, fatty acids, terpenes, phenols and alkaloids. Students should be familiar with structures, characteristic properties of the product classes, the most important sources, simple biosynthetic principles and basic syntheses.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3.5 hours written exam.
Examination aids: No calculator, no other examination aids

KJM350 Radiation and Radiochemistry

Radiation and Radiochemistry

Credits: 10 **Language:** English upon request
Staff/institute: Brit Salbu/ IPM
Teachers: Lindis Skipperud, Ole Chr. Lind, Marit Nandrup Pettersen, Tove Loftaas, Signe Dahl.
Start term: August block
Terms: August block Autumn parallel
Prerequisites: KJM100.
Type of course: Lectures: 21 hours. Laboratory exercises: 6 exercises: 28 hours. Journal writing.
Contents: Lectures: The properties of radionuclides including half life, radiation types and radiotoxicity. The biological effects of radiation and radiation protection. The use of simple measurement methods (alpa, beta, gamma radiation). Laboratory exercises: Simple tracer methods and the use of simple measurement methods for alpha radiation, beta radiation and gamma radiation in qualitative and quantitative analyses. The more challenging parts of the syllabus may be reviewed.
Learning outcomes: Students will have an understanding of the properties of radionuclides and emitted ionising radiation, the use of radioactive tracers and simple measurement methods as well as radiation protection. The course will provide the students with working permission related to the use of open, ionising radiation sources in their future work. The students will after the course: Understand the properties of radiouclides including half life, radiation types and radiotoxicity. Have insight into the biological effects of radiation and effective radiation protection. Be able to use simple tracer methods and simple measurement methods for alpha radiation, beta radiation and gamma radiation for qualitative and quantitative analysis applied to research projects. Have sufficient knowledge of radioactive substances and radiation protection for students to be approved as users of ionising sources that they can use in their research projects. Understand that radioactivity is a phenomenon that humans have always been exposed to, and that radioactivity can be used for good purposes (cancer therapy) and that measures can be implemented for reducing the unwanted effects of radioactive radiation. Knowledge is important in reducing unnecessary fears and anxiety related to radioactivity among the population.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Laboratory journals (6 journals have to be approved before the final examination) and a final written 3-hour examination. Laboratory journals count for 1/4 of the grade. Written examination (3 hours) counts for 3/4 of the grade.

KJM351 Radioecology/Behaviour of radionuclides in the Environment

Radioecology/Behaviour of radionuclides in the Environment

Credits: 10 **Language:** English upon request

Staff/institute: Brit Salbu/ IPM

Teachers: Deborah H. Oughton, Lindis Skipperud, Ole Chr. Lind, Tove Loftaas, Marit Nandrup Pettersen, Lene S. Heier.

Start term: Autumn parallel

Terms: Autumn parallel

Prerequisites: KJM100.

Type of course: Lectures: 18 hours. Laboratory exercises (4 exercises): 20 hours. Laboratory journal report to be approved before the final examination. Guided project report: time used depends on the individual.

Contents: Lectures: Radioecology and the transport and mobility of radioactive substances in various ecosystems. Radioactive sources and species (speciation) and the use of advanced methods in radioecology. Laboratory exercises: Sources and radioactive particles (electron microscopy). Radiochemical separation methods, various tracer techniques and advanced measurement methods including particle characterisation and ICP-MS. Speciation, mobility and biological uptake. Project report: An independently chosen topic.

Learning outcomes: The students are expected to have an overview over radioecology and be able to conduct experimental radio-ecological studies. The course gives a thorough introduction to radiochemistry including tracer techniques, radiochemical separation techniques as well as advanced measurement methods that are used in radioecology. In addition to radioactive sources, the course also focuses on species (speciation), transport, mobility, biological uptake and the effect of radiation as well as assessment of environmental impact and risks related to radioactive contamination. The students will have knowledge of radioactive sources and understand the transport of radioactive substances in various ecosystems, understand the basis for environmental impact and risk assessments and be become able to conduct radioecological studies using tracer techniques, radiochemical separation techniques and advanced measurement methods. The students will have insight in environmental impact and risk assements and the use of effective countermeasures, i.e. competence that is needed within national preparedness associated with radioactive contamination.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: The laboratory journal counts 1/5. The project report counts 1/5. Final written examination (3.5 hours) counts 3/5. All parts of the exam must be passed

KJM360 Accessing Risk to Man and Environment, Ethics

Accessing Risk to Man and Environment, Ethics

Credits: 10 **Language:** English

Staff/institute: Deborah H Oughton/ IPM

Teachers: Per Strand, Brit Salbu, Ole Christian Lind, Lindis Skipperud.

First time the course is offered: SPRING 2008

Start term: January block

Terms: January block Spring parallel

Mandatory activities: Field work.

Prerequisites: KJM350.

Type of course: Field work: 8 hours. Seminars: 16 days. Lectures: 30 hours. Presentation of thesis: 10 hours. Independent study: 234 hours.

Contents: Effects of radionuclides on man and the environment: Biological effects, hazard characterisation, dose-effect relationship, dose-models, RBE, biological endpoints, cancer, dose to biota, ecotoxicology, micro-dosimetry. Impact and Risk Assessment: Environmental risk, risk characterization, principles of Radio toxicology/ Epidemiology. Countermeasures and remediation. Environmental ethics: philosophy and principles. Alara priciples, international politics and conventions Field courses Studies: Studies of radionuclides in terrestrial, freshwater and marine ecosystems, sampling and environmental radiation monitoring.
Learning outcomes: Understand the basis for evaluations of environmental impact and become able to conduct radioecological studies using tracer techniques, radiochemical separation techniques and advanced measurement methods.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The semester assignment counts 1/2 and the written exam counts 1/2 of total. Both parts must be passed.

KJM410 Organic Mass Spectrometry (MS)

Organic Mass Spectrometry (MS)
Credits: 10 **Language:** English upon request
Staff/institute: Dag Ekeberg/ IKBM
Teachers: Elisabeth Olsen.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Assignments.
Prerequisites: General chemistry, KJM100 Organic chemistry, KJM110 + KJM211 eller KJM210 Analytic chemistry, KJM240 Organic Spectroscopy, KJM311
Type of course: Ca. 60 hours of lecturing, including ca. 22 hours of discussion groups.
Contents: The course covers the following types of mass spectrometry: sector instruments, quadrupole instruments, time of flight instruments, and ion cyclotron resonance instruments. The course also covers the interpretation of mass spectra and the types of interface used for different types of analyses.
Learning outcomes: Give knowledge of both the practical and theoretical background for using mass spectrometry, such as for instance GC-MS, MALDI-MS and LC-MS. The candidates should be able to use mass spectrometry for identifying organic and biological compounds. Candidates are to have knowledge of and be familiar with the various techniques used to separate the ions in a mass spectrometer, such as for instance quadrupole, sector instruments (magnets and ESA), Time of Flight (TOF), ion traps and Fourier transfer ion cyclotron resonance (FT-ICR). Spectrum interpretation is a central topic in the course and candidates will spend time interpreting structures. Students will become familiar with the theory behind the different fragmentations of various compounds in different mass spectrometers.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Final oral examination.

LAD202 3D Computer Modelling for Landscape Architecture

3D Computer Modelling for Landscape Architecture
Credits: 5 **Language:** English
Staff/institute: Ramzi Hassan/ ILP
Teachers: Knut Hallgeir Wik Marius Fiskevold
First time the course is offered: SPRING 2008
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Other - On demand.På forespørsel
Mandatory activities: 80% of lectures. 80% of lab work with supervision.
Prerequisites: LAD101, LAD201, LAA113, LAA214

Type of course: The course is based on lectures and practical exercises with supervision at the computer lab through the semester. As a finale assignment, students are asked to model a design concept in 3D or a case study. The final project should be approved by the supervisor first.
Contents: The course is ideal for Landscape architectural (LA) or Planning students (ARE) who needs to create 3D models or rendered stills of a 3D model for landscape analysis and project presentations.
Learning outcomes: In order to be able to create and visualize three dimensional (3D) illustrations that support a design concept, one should be able to model in 3D using the right techniques. This course will provide a hands-on experience of basic 3D modelling, using standard modelling packages such as AutoCAD and SketchUp for landscape designers. Students will gain knowledge of basic modelling techniques with materials and textures, virtual lights/sunlight and cameras, and rendering stills. The techniques learned in the course will be then applied to a landscape design project. The final output from each student will be a 3D model illustration of a design project.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Students will present there finale project work and course assignments in a seminar at the end of the course with presence of external examiner.

LAD301 Advanced Computer Visualisation /NOVA

Advanced Computer Visualisation /NOVA
Credits: 5 **Language:** English
Staff/institute: Ramzi Hassan/ ILP
Start term: June block
Terms: Autumn parallel June block
Mandatory activities: 80% of lectures. 80% of lab work with supervision.
Prerequisites: LAD101, LAD201, LAA113, LAA114, LAA234.
Type of course: 25% lectures. 35% lab work with supervision. 40% individual project work with supervision.
Contents: Students are introduced to a number of visualisation techniques and Virtual Reality technology. Students will practise using 3D modelling and Virtual Reality as a tool for presenting data and analysing landscape projects. Lectures/seminars, exercises using state-of-the-art computer systems and a variety of software, equipment and approaches, including Virtual Reality, animation. Students will investigate case studies using the techniques learned from part one. Each student will produce project exploring a landscape topic and its representation. In this part, students are working on individual basis with individual supervision. Course exercises and projects will be presented in a gallery on the Internet via NOVA's website: http://www.novaland.kvl.dk.
Learning outcomes: This course is an opportunity for students who master the basics of 3D modelling and digital presentation techniques to explore more thoroughly the possibilities of Virtual Reality technology and visualising landscape architectural qualities digitally.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Project work.

LAFT201 Form, colour and drawing IV

Form, colour and drawing IV
Credits: 5 **Language:** English upon request
Staff/institute: Irene Rasmussen/ ILP
Teachers: Roddy Bell, Lise Farmen, Jan Bernigeroth
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Compulsory excursion. 80% participation in lectures and scheduled work on exercises.
Prerequisites: LAFT101, LAFT102, LAFT103.

Type of course: Lectures: 12 hours. Exercises/assignments with individual guidance: 84 hours. Exercises/assignments without guidance: 54 hours.
Contents: Introduction/lectures followed by practical assignments in topics decided upon by the course teachers. Students will work with analytical drawing, also 1 and 2 point perspective and perspektiv construction drawing relating to both drawing in general and drawing specifically for project presentation. Students will also practice free hand drawing with pen techniques, large format drawing, vegetation and landscape drawing, croquis and life drawing. Within the subject of form, students will work with basic design strategies, abstraction and transformation, and with problems relating to the interaction of form and colour.
Learning outcomes: From a point of departure achieved through their participation in LAFT courses 101, 102, 103, students shall now further develope their abilities within form, drawing, colour and digital techniques in order to strengthen their basic capabilities with regard to their future activities within landscape architecture.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Project assignments.

LAFT202 Form, colour and drawing. Advanced

Form, colour and drawing. Advanced
Credits: 5 **Language:** English upon request
Staff/institute: Roddy Bell/ ILP
Teachers: Roddy Bell and guest lecturers.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: 80% participation in lectures and sheduled work on exercises.
Prerequisites: LAFT101, LAFT102, LAFT103, LAFT201.
Type of course: Lectures: 12 hours. Exercises/assignments with individual supervision: 84 hours. Exercises/assignments without supervision: 54 hours.
Contents: Introduction/lectures followed by exercises and assignments in topics decided upon by the course teachers. Students will be given tasks which relate to space and site specificness, inner architectural space, landscape and conceptualised space. Students will work with both found/ready made and pliable materials and practice a liberal attitude to drawing as an extended field of activity.
Learning outcomes: It will be expected that students develope their previously gained knowledge from LAFT courses in more depth where they will be using a combination of form, colour, drawing and digital techniques to solve the given tasks. It is expected that students will achieve an independant stand towards task solving, be capable of developing clear powers of conceptualisation, and articulate, both verbally and visually, about their working processes to both teachers and students alike.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Project assignments.

LAØ370 Landscape Ecology

Landscape Ecology
Credits: 10 **Language:** English
Staff/institute: Gareth Lindsay Fry/ ILP
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: 80 % attendance/participation.
Prerequisites: Courses at 200-level in ecology, landscape analysis, or nature management.
Type of course: 30 % lectures and seminars, 30 % practical work, 40 % project work.
Contents: Students will be introduced to landscape-ecological concepts through work with field and map data of real landscapes. They will first learn how to measure and quantify landscapes, how to define patches and quantify their characteristics such as

size, shape, edge characteristics, pattern, connectedness etc. Students will then examine the physics of processes such as habitat fragmentation by using simulations of logging processes in forest ecosystems. Furthermore, the students will learn about the ecological and human consequences of landscape processes including fragmentation, connectivity, complementation, supplementation, heterogeneity, grain size, etc. The role of landscape ecology in wildlife management will be taught in seminars on barriers, wildlife corridors, fauna passages and the theory of metapopulations. Early in the process, the students will start working on mini projects that exemplify landscape-ecological concepts using specific examples related to the background theories and course literature.
Learning outcomes: - be able to undertake computer-based landscape-ecological analysis of mapped data or aerial photographs, - be able to identify the types of habitat and species that are vulnerable to habitat fragmentation, - be able to evaluate landscapes, to identify potential corridors and barriers to the movement of people and wildlife, - be able to create solutions for landscape planning problems based on landscape ecological principles, - be able to demonstrate an awareness of the limitations of generalising management solutions from one landscape to another.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: 1. Completion and presentation of mini projects: 30 %. 2. Oral defence of project: 30 %. 3. Project report (various media): 40 %.

LAA308 Landscape Design

Landscape Design

Credits: 20 **Language:** English upon request
Staff/institute: Ola Bettum/ ILP
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: The semester assignments must be approved. Attendance at 80 % of the review sessions and seminars is required.
Prerequisites: LAA113, LAA214, LAFT202 or the equivalent.
Type of course: Lectures: 30 hours. Discussion groups and seminars: 60 hours. Supervision: 15 hours. Review sessions in class: 40 hours. Field work and surveys: 30 hours. Study trip: 40 hours.
Contents: The course contains a large, individual project assignment which has a high degree of difficulty, connected to a realistic situation. Students choose their assignments themselves within a defined framework. The course evaluation will mainly be based on this assignment. An analysis and a theoretical assignment done in groups are also handed in. Lectures and discussions are arranged in cooperation between the teachers and students. Individual supervision regarding the projects and theory assignments is given. In addition, a 5-10-day study trip is arranged, dependent of the budget situation. Work on the project assignment is based on advanced use of IT-based graphical drawing programs and presentation techniques.
Learning outcomes: Students should acquire thorough knowledge of current architecture and landscape architecture. They will be able to solve complex problems connected to projects related to parks or green areas at a high level, from analysis and concept development to detailed design. Students will be able to handle planning and decision-making processes related to complex projects, including construction methods used in landscape areas and visualisation of architecture projects, from concept to detailed building instructions. Through the students individual work, they will develop independent problem-solving skills, plus the skill of independent work, scientific thinking and reflection.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Independent work, individually. Handed-in project assignment counts 4/5, and an oral presentation of the assignment counts 1/5.

LAA315 Urban space design

Urban space design

Credits: 10 **Language:** English upon request

Staff/institute: Arne Sælen/ ILP
Teachers: Ola Bettum.
Start term: Spring parallel
Terms: Spring parallel June block
Mandatory activities: Excursions, seminars and reviews.
Prerequisites: LAA113, LAA114, LAFT202, LAA215 or equivalent.
Type of course: Lectures: 25 hours. Seminars and reviews: 30 hours. Surveys and practice: 25 hours. Supervision: 10 hours.
Contents: The course consists of a theoretical part and a project part. The theoretical part will encompass methods for analysis and project development for modern, urban traffic systems. An overview over relevant examples of this kind of systems will be given. The main part of the course is a bigger, individual project assignment for a typical urban situation, for example a complex urban area, a depot area, or a traffic junction point. Inspection of relevant projects shall be arranged.
Learning outcomes: The students should be familiar with the most important functional requirements for projecting urban traffic areas, including construction methods for such sites. They should be able to analyse requirements related to traffic and space for such sites, and be able to develop solutions for typical situations based on analyses through concept discussion into thoroughly prepared solutions. The project should be prepared and presented in a professional manner.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Project assignment counting 4/5 on written work and 1/5 on presentation.

MATH250 Partial Differential Equations and Models

Partial Differential Equations and Models

Credits: 10 **Language:** English upon request
Staff/institute: John Andreas Wyller/ IMT
Teachers: John Wyller.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Other - The course is offered upon demand and if resources allow it.Emnet gis ved behov og under forutsetning av at ressurssituasjonen tillater det.
Mandatory activities: Compulsory assignments that must be approved within the given deadlines.
Prerequisites: MATH111, MATH112, MATH130, MATH140.
Type of course: Lectures: 4 hours per week. Calculation exercises: 2 hours.
Contents: Lectures cover the most important parts of each topic. After this, they are given exercises on the same topics. The exercises are intended to help students practise calculation technique, understand methods and ideas as well as be able to apply the subject to technical-physical problems. Projects based on MATLAB will be an important part of the course.
Learning outcomes: Students are to learn the basic theory of partial differential equations. They are to become capable of using this theory for solving problems in biology, geomatics, physics and technology. After completing the course, the students should master the following topics: - conservation laws - the wave equation - diffusion equations - the Laplace equation - separation of variable techniques - Sturm-Liouville theory - difference methods. Students are to be able to use: - relevant methods and techniques with emphasis on practical applications - the computer programme MATLAB for solving and visualising problems that are part of the course. They should also be able to make and analyse simple mathematical models.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written exam, 3.5 hours.
Examination aids: Simple calculator, specified other examination aids

MATH310 Continuous Dynamical Systems

Continuous Dynamical Systems

Credits: 10 **Language:** English upon request
Staff/institute: John Andreas Wyller/ IMT
Teachers: John Wyller.

Start term: Spring parallel
Terms: Spring parallel
The course is offered: Other - The course is offered on demand and if the resource situation allows it.Emnet gis ved behov og under forutsetning av at ressurssituasjonen tlllater det.
Mandatory activities: Compulsory semester assignment.
Prerequisites: MATH111, MATH112, MATH130, MATH140, MATH250 and MATH290.
Type of course: 4 hours lectures per week. 2 hours seminar per. week
Contents: The most important parts of each topic are covered in lectures. The students are then given exercises on the same topics. The aims of the exercises are for students to understand methods and ideas as well as be able to apply them to problems in physics, biology or environmental subjects. The students are given individual guidance on the application of these topics to the problem issue that is studied in the semester assignment.
Learning outcomes: Students are to learn the theory concerning continuous dynamical systems (ordinary and partial differential equations) and the application of such systems to selected problems in environmental subjects, biology and physics. The course contents may vary from year to year, but will normally consist of the following parts: - dimension analysis, scaling and perturbation methods, - geometrical theory for systems of ordinary differential equations (phase space, Picard's theorem, equilibrium, limit cycles, stability analysis, bifurcation theory and normal forms) and delay- equations. The theory is applied to for instance reaction kinetics, biological oscillations and the propagation of electrical signals in nerve fibres. - selected topics in diffusion equation theory, reaction diffusion equation theory and nonlocal models. The theory is applied to excitable media, the Turing-mechanism and pattern-forming processes.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam.

MINA301 Term Paper in Environment and Natural Ressourses

Term Paper in Environment and Natural Ressourses

Credits: 5 **Language:** English upon request
Staff/institute: Jan Mulder/ IPM
Teachers: Lars Bakken, Arne Stuanes and others.
Start term: Autumn parallel
Terms: By demand
Prerequisites: The course must be combined with one of the following Master's level courses: GEO300, JORD310, JORD315.
Type of course: Guidance, individually or in groups: max. 5 hours. Presentation in plenary: hours depend on the number of students and the chosen arrangement.
Contents: This will vary somewhat, but the approach to a scientific report follows certain standard routines and should contain as many as possible of the following points (in the approximate order): choice of topic, definition and limitation of the task, background/history, methodology, collecting data, data processing, results, interpretation, summing up/recommendations, reference list.
Learning outcomes: Acquire detailed knowledge of a certain subject field through literature studies (theory) possibly combined with laboratory/field studies (practical experience). Learn to formulate, conduct and present (in written and/or oral form) a scientific paper according to a well-established outline/routine. If working in groups; learn the advantages and disadvantages of teamwork at a level and in a form that is normal in research environments, in trade and industry etc.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final assessment of written work (report and possibly poster), possibly combined with an oral presentation of the main contents. In addition, an oral examination may be used. This is recommended when individual grades shall be given based on group work. The assessment is connected to the related Master's course.

MINA310 Project Management and Research Methods

Project Management and Research Methods

Credits: 10 **Language:** English

Staff/institute: Lindis Skipperud/ IPM
Teachers: Lindis Skipperud, Ole Christian Lind, Brit Salbu and the students advisors
First time the course is offered: AUTUMN 2007
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Coursework 100%. Two pieces of coursework to assess students ability to enterpret data and apply statistical techniques. One project proposal with presentation to demonstrate students ability to design and plan a MSc project. Analysis of given cases, workshops/tutorials.
Prerequisites: KJM100.
Type of course: Lectures and supporting computer laboratories to impart knowledge and applied workshops to familiarise with various statistical techniques: 40t. Other study hours: 140 hours. Total study hours per semester: 180 hours. Other study hours: interpret data, literature search, design and plan a MSc project, make a presentation.
Contents: Research methods: Statistics and data handling, database and literature resources, critical analysis of publications, efficient scientific writing Project management: Design, implementation and management of projects. Introduction to generic management tools.
Learning outcomes: The students will be competent in designing research projects (Master projects), analysing and evaluating data using appropriate statistical techniques, extract literature, and critical evaluated available data for their own use. They will be trained in making oral and written presentations.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail

MVI261 Heat Engineering I

Heat Engineering I
Credits: 5 **Language:** English
Staff/institute: Tomas Isaksson/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Mathematics equivalent to MATH100. Physics equivalent to FYS100.
Type of course: Lectures: 52 hours.
Contents: Mass balances, energy balances, pumps, fans and compressors, circular processes, heat transfer, evaporation and evaporators, humid air and drying, and cooling processes.
Learning outcomes: Students will acquire knowledge of unit operations and machine equipment that are part of processing lines.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3.5 hour written exam.
Examination aids: Simple calculator, specified other examination aids

MVI310 Proteins, Polysaccharides and Fat/oils; Structure and Functionality

Proteins, Polysaccharides and Fat/oils; Structure and Functionality
Credits: 10 **Language:** English
Staff/institute: Gerd Elisabe Vegarud/ IKBM
Teachers: Thor Langsrud, Tove Devold, Bjørg Egelandsdal, Elling-Olav Rukke.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: The first lecture and all colloquia groups are compulsory in addition to student presentations and group activities (oral/written) throughout the semester.
Prerequisites: Knowledge in food chemistry equivalent to KJB210.
Type of course: 6 hours per week. These hours are made up of lectures, group work, colloquia and student presentations (written and oral).

Contents: The course is made up of three units; 1. Polysaccharides; structure and function. 2. Proteins; structure and functional properties 3. Fats and lipids; types, modification and uses. Each unit contains lectures, group work and colloquia. The students will write projects/essays and hold presentations (written/oral). Time has also been set aside for independent study and Internet searches. We recommend students to take the database search course given at the Library. The course has guest lecturers and demonstrations from relevant industry.
Learning outcomes: The students are to acquire an elementary theoretical and analytical understanding of the significance that lipids and polymers of proteins and polysaccharides have for the structure and rheological properties of food, as well as their use in food and fodder products. The students should get basic knowledge of how components from vegetabilians, meat and milk can be used as ingredients in the food and feed industry.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Group activities, submitted written assignments and oral presentations during the semester count 50 %. Assessed by the course teachers and have to be passed. Written essay (14 days) handed in at the end of semester counts 50 %. Assessed by an external examiner.

MVI321 Fermentation Microbiology

Fermentation Microbiology

Credits: 5 **Language:** English upon request
Staff/institute: Hilde Marit Østlie/ IKBM
Teachers: Thor Langsrud
Start term: August block
Terms: August block
Mandatory activities: Laboratory exercises and excursion.
Prerequisites: Knowledge of food microbiology corresponding to MVI220, biochemistry corresponding to KJB200 and general microbiology corresponding to BIO130.
Type of course: Lectures, reviews, excursion. Lectures: 40 hours. Laboratory exercises: 30 hours. Excursion: 8 hours.
Contents: The following topics are covered both theoretically and practically by lectures and laboratory exercises/individual projects: - Systematics for bacteria, yeast and mould that are used in the food industry. - Metabolism, stability/instability, bacteriophage problems. - Production, control and maintenance of cultures for fermentation purposes.
Learning outcomes: The student is to have knowledge and laboratory skills on identification, characterisation and maintenance of microbiological cultures for fermentation purposes.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam (3.5 hours) counts 50% of the final grade. Reports of laboratory experiments count 50% of the final grade.

MVI322 Pathogenic Microorganisms

Pathogenic Microorganisms

Credits: 10 **Language:** English upon request
Staff/institute: Helge Holo/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Microbiology corresponding to BIO130. Biochemistry corresponding to KJB200.
Type of course: Lectures and discussion groups: 3 hours per week.
Contents: The course will give an overview on food and waterborne pathogenic organisms. Biology and pathogenesis. Preventive measures. Routes of infection. Toxins. Epidemiology. Detection and tracing of pathogens by modern molecular tools.
Learning outcomes: Knowledge about food and waterborne pathogenic microorganisms; their biology, pathogenesis and spreading routes. Know modern methods for detection and identification of these microbes, and preventive safety measures.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Portfolio assessment and written exam. The literature paper counts 25 % and must be handed in by week 44. The written exam counts 75 %.

MVI330 Experimental Design and Data Analyses

Experimental Design and Data Analyses

Credits: 10 **Language:** English upon request
Staff/institute: Tomas Isaksson/ IKBM
Teachers: Torfinn Torp og Andriy Kupyna.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Other - The course is given fall 2007, not fall 2008, and then every years.Emnet gis høst 2007, ikke høst 2008, og deretter hvert år.
Mandatory activities: Exercises: 2 hours per week with a short written report.
Prerequisites: BSc, unspecified.
Type of course: 6-8 hours per week for 14 weeks (incl. exercises).
Contents: The course deals with how to plan experiments, both in the laboratory and in pilot and production processes. Methods such as full factorial and fractional factorial experimental design, CCD (central composite design) and mixture design will be part of the course. The main part of the course covers various methods for analysing multivariable data. Central methods are: pre-processing and centring of data, cross correlation, data compressions (PCA, principal component analysis), multivariable regression (MLR, multiple linear regression, PCR, principal component regression, PLS, partial least squares regression) and classification (cluster analysis and discriminating analysis, LDA, linear discriminating analysis, Fisher's linear discriminating function, KNN, K-nearest neighbour, SIMCA, soft independent modelling of class analogies). The methods will be covered theoretically, through students carrying out practical calculations (exercises) and through demonstrations. The vast majority of the examples are taken from Food Science.
Learning outcomes: After the course, the student will be able to conduct and analyse statistical experimental designs and data-analytical multivariable calculations related to food science and food production processes.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3.5 hour written examination, counts 100%.
Examination aids: Simple calculator, no other examination aids

MVI361 Unit Operations and Measurement Methods

Unit Operations and Measurement Methods

Credits: 10 **Language:** English upon request
Staff/institute: Reidar B. Schuller/ IKBM
Teachers: Tomas Isaksson.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Even years
Prerequisites: One of the following courses: MVI260/MVI261/MVI281 or equivalent.
Credit reduction: MVI361 replaces MVI360 and MVI370. Credit reduction will be implemented for students that have previously taken these courses.
Type of course: 6 hours per week for 13 weeks.
Contents: Transport phenomena, air/water mixtures, rheology, pipe transport, porous beds, fluidisation, filtration, separation processes, heat transfer, dehydration and measurement methods. The course will give an overview of important methods for measuring the quality of raw materials, intermediate and final products. The course will cover both off-, at-, on- and in-line measurement methods.

Learning outcomes: Students will aquire deeper knowledge and more skills in relation to unit operations in food engineering. They will also acquire a greater insight into the conditions regarding machinery, instruments and other equipment in the food industry, and further knowledge of measurement methods. The students should be able to use or implement measurement methods into food production.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: 3.5 hour written examination counts 80%. Semester assignment counts 20%.

MVI381 Muscle Food Processing Technology

Muscle Food Processing Technology

Credits: 10 **Language:** English upon request
Staff/institute: Bjørg Egelandsdal/ IKBM
Teachers: Tot Bruun (Dep. of Chemistry, Biotechnology and Food Science), Tom Chr. Johannessen (The Norwegian Food Research Institute (MATFORSK)), various engineers.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Mandatory activities: Practical exercises and excursion.
Prerequisites: Knowledge of unprocessed food corresponding to the part about meat/fish in MVI271.
Credit reduction: NMF271 (as offered until 2002/2003), 5 credits.
Type of course: Lectures: 60-80 hours. Work in pilot installations and laboratories: 6-8 days. Student presentations of project assignments in plenary - duration depends on the number of participants. Excursion: 1 complete day.
Contents: Animal welfare in connection with stunning of animals. Slaughter technology, grading and by-products of slaughter. Technology used to ensure tenderness. Process technology: Heat treatment and cold storage. Minced meat technology. The use and function of selected ingredients/additives. Salting and smoking technology. Lipid oxidation and warmed flavour: Technology for avoiding lipid oxidation. Products with improved fatty acid composition. Marinating: The process and its ingredients. Production of fermented dry-cured sausages: The process and the development of flavour. Fundamentals on flavour development of meat, boar taint and the problems related to entire male pig production. Microbiology/hygiene/parasites and similar, specific for meat will be included in the course, depending on the background knowledge of the participants. A project may be given on this topic. Recipe optimisation methodology and (mathematical) modelling relevant for shelf life managing of animal products is introduced.
Learning outcomes: The student will gain an understanding of several of the industrial processes (minced meat technology, salting/smoking, fermentation and similar) that are used for keeping and processing meat products. The student will gain detailed insight into the production process, the choice of raw materials as well as the quality of selected final products. The course covers to some degree the well-being of animals/the slaugtherprocess and its impact on final product quality. In addition, environmental problems related to handling waste materials from slaugtherhouses and the insufficient consumption of by-products are touched upon. Oxidative stability of meat through storage and processing as well as the major mechanisms that influence degradation of food components through processsing will be lectured. The course is built around 4 larger projects where the students are producing and evaluating different meat products using their own analysis. As a rule, dry fermented sausages, bacon and two heated, comminuted meat products are produced. However, minor changes are made every year. The student should acquire sufficient knowledge to be able to apply their qualifications to the development of meat products and be able to judge the consequences of their choices with regards to final product quality. The student should be able to select raw materials, ingredients and control processes towards the desired final product quality (for selected products). The student must know methods for suggesting an improved process when faults occur.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Project work and report: 40%. Literature evaluation: 20%. Written examination: 40%. The student must pass every part of the course.

MVI382A Alcoholic Beverages

Alcoholic Beverages

Credits: 5 **Language:** English upon request
Staff/institute: Trude Wicklund/ IKBM
Teachers: External lecturers.
First time the course is offered: SPRING 2007
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Excursions and presentations
Type of course: Ca 20 hours of lectures
Contents: Qualities of different raw materials for production of cider, beer, wine and alcohol. Emphasis will be placed on the raw material and processing methods for the quality of the finished product.
Learning outcomes: Students will gain advanced knowledge of production of cider, beer, wine and spirits.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Project assignment.

MVI382B Cereal Technology

Cereal Technology

Credits: 5 **Language:** English upon request
Staff/institute: Trude Wicklund/ IKBM
Teachers: Anne Kjersti Uhlen and Anette Moldestad, IPM.
First time the course is offered: SPRING 2007
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Lab exercises and excursions
Prerequisites: Knowledge of cereal as raw material, corresponding to the part about vegetables in MVI270. Knowledge of technology corresponding to MVI281.
Type of course: Lectures and exercises - ca. 40 hours.
Contents: Students will gain advanced knowledge of different aspects concerning the quality and use of cereals.
Learning outcomes: Cereals-importance in the diet, chemical composition. Starch - energy, synthesizing and degradation of starch. Protein-amino acid composition in cereals, functional properties, quality aspects. Fibre-different qualities, properties and importance in the diet. Minerals and vitamins, antioxidants in cereals. Wheat, rye, oats and barley, tropical cereals-rice, maize, sorghum and millet. Baking technology, niche products from cereals - Spelt - Einkorn-Buck wheat. Extrusion/breakfast cereals, pasta, biscuits and cakes, crisp bread.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Project assignment.

MVI383A Dairy Technology

Dairy Technology

Credits: 15 **Language:** English upon request
Staff/institute: Roger K. Abrahamsen/ IKBM
Teachers: Siv Skeie, Judith Narvhus.
Start term: Autumn parallel
Terms: Autumn parallel

Mandatory activities: Exercises in the pilot plant and analysis work in the laboratories. Excursions. Journals shall be handed in for evaluation 2 weeks after the exercise is completed.
Prerequisites: Knowledge of unprocessed food equivalent to the part about milk in MVI270. Knowledge of food production processes equivalent to MVI281.
Type of course: Ca. 32 double lectures hours are planned given by the teacher at the department. The lectures will be distributed throughout the semester. 2 excursions of 3 days in total. Excursion dates are given when the course starts up. The exercises in the pilot plant and in the laboratories are done over ca. 10 days.
Contents: Milk as a raw material for dairy products. The treatment of milk in the dairy. Unfermented and fermented consumption milk products. Manufacturing of butter and butter-like products. Powdered milk. Cheese technology. Types of cheeses. Uses of whey. Brown whey cheese technology. Ice cream technology.
Learning outcomes: Knowledge of the composition of milk in relation to the manufacturing of various products is a central goal of the course. In addition, the students shall gain good theoretical knowledge of the various processing steps when manufacturing dairy products. Knowledge of the key manufacturing of important dairy products and knowledge of key factors for the final quality of the products are the ultimate goals of the course. On the basis of theoretical and practical experience, partly gained through exercises and experiments in the pilot plant for food manufacturing, the students are to understand the manufacturing processes for the most important dairy products and the quality properties of the products. Knowledge and understanding of the composition of milk, unit operations when processing milk, as well as the manufacturing of unfermented and fermented milk products, milk powder, butter, cheese, whey products and ice cream. Through practical exercises in the pilot plant for food manufacturing, the students are to have achieved skills in the production of fermented milk products, butter, cheese, whey products and ice cream. The course emphasises the conveyance of attitudes related to the importance of and possible uses for a food raw material such as milk, in that as much as possible of its components are used as food. Emphasis is placed on an understanding that has significance both for food security and food safety in a world where undernourishment and malnutrition are global problems, and we have an international responsibility. The course emphasises conveyance of knowledge of the processing of milk which might be useful in a global food supply situation.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination, 3.5 hours, counts 100%.
Examination aids: No calculator, no other examination aids

MVI383B Fresh Fermented Dairy Products

Fresh Fermented Dairy Products

Credits: 10 **Language:** English upon request
Staff/institute: Judith Narvhus/ IKBM
Teachers: Roger K. Abrahamsen.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Discussion groups and practicals.
Prerequisites: Knowledge of milk as a raw material, equivalent to the milk section of MVI270. Knowledge of dairy technology equivalent to MVI383A.
Type of course: Each week, a topic is studied both through group work and in discussion groups where specific areas within the topic are covered. There will be practicals in the 3rd and 5th week of the course, each of one and a half days.
Contents: The course contains 5 major parts that are conducted as lectures and colloquia: - Technological aspects of the manufacturing of fermented milk products. - The formation of acid gel. - Yoghurt. - Mesophilic fermented milk products. - Fresh cheeses. In addition, the course contains two large practicals. Emphasis is placed on journal writing.
Learning outcomes: Students will gain an understanding of the characteristic properties of various fermented dairy products and understand the technology used in making these products. The connection between the metabolism of the starter and the product properties is significant in this context.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam, 3.5 hours - counts 2/3. Two journals - count 1/3. The deadline for handing in journals is two weeks after having completed the exercise.

MVI383C Cheese Technology

Cheese Technology

Credits: 10 **Language:** English upon request
Staff/institute: Siv Borghild Skeie/ IKBM
Teachers: Roger Abrahamsen.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Lectures, discussion groups, exercises and excursion.
Prerequisites: Knowledge of milk as a raw material for food processing equivalent to milk section of MVI270. Knowledge of dairy technology equivalent to MVI383A.
Type of course: Lectures: 8 hours. 3 weeks discussion groups: 10 hours per week. Exercises: 24 hours. Excursion: 6 hours.
Contents: The course contains 10 major parts conducted as lectures, colloquia and experiments (2): Milk requirements, cheese classification, cheese manufactuing based on ultra-filtered milk, cheese yield, equipment for cheese manufacturing, cheese ripening, low fat cheese technology, special types of cheese, sensory properties of cheese, nutritional aspects of cheese. Emphasis is placed on journal writing.
Learning outcomes: Students will gain insight into and a deeper understanding of the cheese manufacturing and the cheese ripening process. The students should be able to develop process lines for the manufacture of various cheese types by applying recent technology and equipment. In addition, students should be able to evaluate the connection between factors significant for the cheese ripening and the development of its characteristic properties. The students should learn to write a journal according to internationally accepted forms for scientific publishing. Students are to be able to put cheese production into a historical and cultural context. The students are to be able to evaluate what effect various production technologies have on the quality and safety of the products, when regarded as foods.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written examination, 3.5 hours - counts 2/3. Two journals count 1/3. The deadline for handing in journals is two weeks after having completed the exercise.

MVI384 Functional Foods

Functional Foods

Credits: 10 **Language:** English upon request
Staff/institute: Judith Narvhus/ IKBM
Teachers: Wicklund, Trude; Haffner, Karin; Vegarud, Gerd: Hansen, Magnor; Uhlen, Anne Kjersti.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Discussion groups.
Prerequisites: Basic knowledge of nutrition, food chemistry and microbiology at the 200 level.
Type of course: Lectures: 2 hours. Discussion groups: 4 hours per week. Computer room: 2 hours.
Contents: 1. Definitions, laws and regulations. Trends, ethics and consumer demands. Advertising regulations and methods, Clinical trials. 2. Functional products and ingredients from cereals and other seeds, vegetables and fruits. 3. Functional products and ingredients from milk and fish. 4. Probiotics and prebiotics.
Learning outcomes: The students will develop a broad knowledge and understanding of how diverse foods and ingredients can affect our health, in areas outside of traditional nutrition. A knowledge-based critical attitude will be encouraged and an understanding of how the national and international regulations affect the development within this area.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Presentations count 50 % and oral examination counts 50 %.

MVI385 Product Development

Product Development

Credits: 10 **Language:** English upon request
Staff/institute: Elling-Olav Rukke/ IKBM
Teachers: Tomas Isaksson, Bjørg Egelandsdal, Ola Eide and others.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Mandatory activities: Seminars/case studies and role plays.
Prerequisites: Bachelor's degree.
Type of course: 1. Lectures: ca. 45 hours. 2. Seminars (discussion groups): ca. 30 hours. 3. Various activities (excursion to the FoU section in a food industry): ca. 10 hours.
Contents: The course is constructed around the following subjects; 1. Identifying new products (keys to success and failure, processing technology, food-/healthy products etc.). 2. Key requirements for successful product development (developing an innovation strategy, the PD-process, the knowledge base for PD, the consumer). 3. Research design. 4. Managing and improving PD, including case studies.
Learning outcomes: Students are to acquire knowledge about cost-effective and market-oriented innovation processes from idea to launching, regarding; 1. Identifying new products. 2. Key requirements for successful product development. 3. Research design and prescription optimalisation. 4. Managing and improving product development processes.
Methods of examination: Final Written exam **Grading:** Pass/Fail
Assessment methods: Final written examination: 3.5 hours, counts 100%.
Examination aids: No calculator, no other examination aids

MVI390 Immunology, Food Allergy and Intolerance.

Immunology, Food Allergy and Intolerance.

Credits: 5 **Language:** English upon request
Staff/institute: Tor Erling Lea/ IKBM
Start term: August block
Terms: August block
Prerequisites: Knowledge of biochemistry equivalent to KJB200. Knowledge of microbiology equivalent to BIO130.
Type of course: Lectures: 24 hours. Supervised discussion groups: 24 hours. Presentation of group assignments.
Contents: A thorough introduction to the immune system structure and function. This will be the starting point for an in-depth study of special conditions linked to the immunology of mucous membranes and mechanisms for the development of allergies, plus give the necessary background for understanding the difference between immune-mediated hypersensitivity reactions and other forms of intolerances brought on by food products. Through lectures, supervised discussions and group projects, the students will have the opportunity to work through key issues, which are particularly relevant for their future careers.
Learning outcomes: After completing the course, students will have a thorough, general understanding of the development and function of the immune system. It is an asset to be able to understand why the body,s defence system against infections also reacts against non-infectious agents and in this way contributes to the development of hypersensitivity reactions such as allergies and auto-immune diseases. The course approach to food allergies and intolerance entails that students will gain special knowledge of mucosal immunology and, mechanisms behind the development of allergic reactions, plus understanding of the aetiology of other selected immune-mediated diseases in the digestive system. Students will also have a clear understanding of the differences between immune-mediated hypersensitivity reactions and other forms of intolerances. These learning goals assume that the students develop skills that prepare them to access relevant scientific literature, make grounded evaluations and give advice in food production with the goal to avoid allergies and other hypersensitivity reactions.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Group assignment with presentation and discussion: 40%. Written exam, 2 hours: 60%. Group assignment with presentation in plenary. Each presentation shall last maximum 30 minutes with time for questions afterwards. In addition to the presentation of own assignment, each group will be responsible for the evaluation of another group's assignment, prepare questions and discuss the content and presentation. Written exam-multiple-choice.

MVI391 Diet and Health

Diet and Health

Credits: 5 **Language:** English upon request
Staff/institute: Helle Margrete Meltzer/ IKBM
Start term: January block
Terms: January block
Prerequisites: Knowledge of chemistry equivalent to MVI210 or KJB210. Knowledge of biochemistry equivalent to KJB200. Knowledge of nutrition equivalent to HFE100.
Type of course: Lectures: 24 hours. Supervised group work: 24 hours.
Contents: The course will focus on what we know about food components and their relation to health. Furthermore, the impact of diet composition, eating habits etc. in relation to health. The course will give an overview over the impact of diet in different phases of life and in relation to the most serious public health challenges. Current issues such as diet supplements and popular diets will be included if the time allows it.
Learning outcomes: Students should be updated on present-day knowledge about the relationship between diet and reduced or increased risk for health problems or disease.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Group assignment with presentation in plenary. Each presentation shall last for maximum 30 minutes with time for questions afterwards, counts 40 %. Written examination, counts 60 %. The written examination has to be graded E or better.

MVI410 Proteins, Polysaccharides and Fat/oils, Structure and Functionality

Proteins, Polysaccharides and Fat/oils, Structure and Functionality

Credits: 10 **Language:** English upon request
Staff/institute: Gerd Elisabe Vegarud/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: By assignment
Prerequisites: Knowledge of Food Chemistry equivalent to BSc and MSc in Food Science.
Type of course: Together with MVI310: structured teaching: 78 hours (6 hours per week) distributed on the different teaching methods. In addition, discussion groups, self-study and literature corresponding to PhD-study.
Contents: The course consists of 3 parts: 1. polysaccharides; structure and function. 2. proteins; structure and function. 3. fats/oils; structure. Modification and application in productions. The course builds on MVI310 with additional literature.
Learning outcomes: Students will have knowledge of proteins, polysaccharides, fats and oils; their chemical structure and function in food engineering on a high international PhD level.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Written assignment (14 days) counts 60 %. Presentation (oral/written) counts 40 %.

MVI411 Milk Components: Quality, Health and Nutrition (NOVA Course 41B/02)

Milk Components: Quality, Health and Nutrition (NOVA Course 41B/02)

Credits: 8 **Language:** English
Staff/institute: Gerd Elisabe Vegarud/ IKBM
Teachers: NOVA and NorFa teachers from Norway, Sweden, Finland, Denmark and Iceland, plus invited guest lecturers.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Other - The course will be given every third year.Emnet går hvert tredje år.
Mandatory activities: Active participation in the course. Preparation of a small thesis.
Prerequisites: MSc in Dairy Science or equivalent.
Type of course: The schedule for the course is the following: 1 week preparation of literature. 1 week active participation in the course. 4 weeks preparation of the assignment at home university.
Contents: The course has the following topics: Part 1. Milk components in relation to health (NLH, 2002). Part 2. Milk proteins; Functional genomics (SLU, 2004). Part 3. Milk components; technology and processing (KVL).
Learning outcomes: Students are to learn about different types of milk proteins; caseins and casein micelles, whey proteins, lactoferrin, minor components, structure and functional properties. Genetic protein variants. Bioactive proteins and peptides. Types of identification and formation (in vitro/in vivo).
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: The semester assignment must be submitted within 28 days after completion of the course.

MVI470 Monitoring of Quality Parameters in Food by Non-destructive On-line Measurement methods

Monitoring of Quality Parameters in Food by Non-destructive On-line Measurement methods
Credits: 10 **Language:** English
Staff/institute: Elling-Olav Rukke/ IKBM
Teachers: Prof. Tomas Isaksson, Prof. Harald Martens, Prof. Paul Geladi-SLU, Prof. Frans van den Berg-KVL, Ass. prof. Knut Kvaal.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Other - The course is planned as a NOVA PhD-course. But the course will be given at UMB depending on number of interested PhD-students. The next NOVA course will be given at KVL, Denmark by Frans van den Berg.Emnet er planlagt som et NOVA PhD-kurs, men lar seg gjennomføre ved påmelding av tilstrekkelig antall PhD-studenter. Emnet går som NOVA PhD-kurs på KVL, Danmark i 2006 med Frans van den Berg som emneansvarlig.
Mandatory activities: Active participation in the structured instruction period.
Prerequisites: Approved Master's degree or equivalent documented qualifications.
Type of course: Consult the final course programme.
Contents: Detailed course programme is produced hour-by-hour during the period the course is offered. In addition, the basis is: -45 hours of individual study from provided syllabus before course start. -45 hours at UMB (lectures, demonstrations, exercises, discussions). -Minimum 230 hours for a Graduate project in the form of a peer-reviewed paper, which must be submitted within 10 weeks from the completion of the course.
Learning outcomes: Teaching students, instructors and industrial participants how to use chemometry and remote on-line methods to analyse multivariable data connected to characterising the quality of food products, without necessarily having extensive knowledge of mathematics and statistics.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Each student shall indvidually produce a written report of minimum 20 pages on a required subject after the course. The report shall be graded ‚pass/fail, by an external examiner in collaboration with the course responsible. The report should be produced as a scientific publication in accordance with the rules and guidelines for peer-reviewed papers.

MVI480 Food Process Technology

Food Process Technology

Credits: 10 **Language:** English upon request
Staff/institute: Tomas Isaksson/ IKBM
Teachers: Several members of the IKBM academic staff.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: By assignment
Prerequisites: MVI280 or equivalent.
Type of course: Discussion groups 2 hours per week for 14 weeks.
Contents: The course contains basic theory at a PhD level regarding food engineering technology, such as mass and energy balance, material characteristics, heat transportation etc. and some information on process control. In addition, important unit operations such as blanching, pasteurising, sterilising, baking, frying, infrared, ohmic and dielectric heating, cooling and freezing are covered. The course is a PhD course and is done in discussion groups/independent study.
Learning outcomes: After the course, students will be able to complete evaluations, quality assurance and calculations connected to unit operations such as cooling, freezing, thawing, warming, heat conservation and sorting.
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: Oral examination, counts 100 %.

MVI481 Fresh meat science and technology

Fresh meat science and technology

Credits: 5 **Language:** English upon request
Staff/institute: Bjørg Egelandsdal/ IKBM
Teachers: Will vary from year to year.
Start term: June block
Terms: June block
The course is offered: Odd years
Mandatory activities: Exercises.
Prerequisites: Master of Science Degree in either Food Science and Technology, Animal Science or Veterinary Sciences or Biochemistry.
Type of course: Block teaching, 1 week.
Contents: Introductory material on the conversion of muscle to meat and muscle pigment. The focus of the course is on new theories for the death of cells and these theories, implications for muscle development and early post-mortem processes. Materials on our present understanding of mitochondrion composition and structure, partly during the death process, and the suborganelle,s possible impact on colour stability post mortem are included. Recent literature on colour stability of meat. Post-translational modification of collagen and ageing of muscle and its impact on meat tenderness are included. Newer theories on early post mortem proteolysis and oxidation and their relation to water holding ability are presented. Finally, a few ideas about the opportunity to improve meat quality through enhancement technology encompassing antioxidants and packing are given.
Learning outcomes: The students should have acquired in-depth knowledge of the conversion of muscle into meat and changes related to cold storage of fresh meat - all based on chosen quality parameters and recent literature. The students should be able to synthesise new knowledge within the narrow area of meat science/technology chosen here. The students should be able to organise new knowledge within the framework of the course topic.
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: Oral examination with presentation of project work counts 100 %.

MVI482 Processed Meat Technology: Dry-Cured Products

Processed Meat Technology: Dry-Cured Products

Credits: 5 **Language:** English upon request

Staff/institute: Bjørg Egelandsdal/ IKBM
Teachers: Terje Sørhaug, Ingolf Nes.
Start term: June block
Terms: June block
The course is offered: Even years
Mandatory activities: Excursion.
Prerequisites: Master of Science Degree in either Food Science and Technology, Animal Science or Veterinary Sciences or Biochemistry.
Type of course: Block course, 1 week.
Contents: Manufacturing of dry-cured (intact) meat. Types of dry-cured products. Characterisation of proteolysis and lipolysis. Flavour development. Nutritional properties. Effect of raw materials and processing on quality. Main defects and preventive measurements. Quality monitoring techniques. Safety aspects.
Learning outcomes: The students should have enquired an in-depth knowledge in the different biochemical and technological aspects of producing dry-cured intact meat products. The students should be able to synthesize new knowledge within the narrow area of meat science/technology chosen here. The students should be able to organise new knowledge within the framework of the course topic.
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: Oral examination with presentation of project work (counts 100 %).

MVI483 Dairy Technology

Dairy Technology

Credits: 10 **Language:** English upon request
Staff/institute: Roger K. Abrahamsen/ IKBM
Teachers: Siv Skeie, Judith Narvhus
Start term: Autumn parallel
Terms: Autumn parallel Spring parallel
The course is offered: By assignment
Prerequisites: Relevant Master's degree, preferably with focus on dairy technology. In cases of doubt, an individual evaluation of the candidate's previous knowledge must be made. In any case, candidates qulifications in dairy technology must be on the same level as the knowledge acquired by taking courses in dairy technology at the 300 level at UMB.
Type of course: Discussion groups are arranged when required.
Contents: This PhD course is suited for students whose research is within the area of dairy technology or related areas. A substantial part of the course will be production oriented, but builds on the comprehensive knowledge of the components of milk and on the units operations in dairy technology. Utilising the components of milk in product manufacturing, product quality and characteristics, and relevant control of products and of production processes will be central topics in the course.
Learning outcomes: Students will gain an in-depth understanding of the selected topics for the course. The knowledge level will be updated with the most recent research documentation. Within the chosen dairy technology topics, students will approach the edge of the discipline's knowledge platform.
Methods of examination: Final Written exam **Grading:** Pass/Fail
Assessment methods: A final written examination would be the normal procedure. If the course is taken completely on an individual basis, the examination form can be discussed. Oral examination or written assignment can be used.
Examination aids: No calculator, no other examination aids

NATF210 Environmental Monitoring

Environmental Monitoring

Credits: 5 **Language:** English upon request
Staff/institute: Tron Haakon Eid/ INA
Teachers: Svein Solberg, Skogforsk.
Start term: January block
Terms: January block

Mandatory activities: 1 compulsory excursion. 70 % of the home assignments must be passed.
Prerequisites: STAT100.
Contents: Presentations: Local and global environmental problems; objectives for monitoring; national and international environmental agreements; the role of monitoring in environmental management; ongoing monitoring programmes; design of monitoring programs; bio-indicators; thresholds and critical loads; historical reference data; field methods; sensors and measurement techniques in the field; sampling and analyses; remote sensing; telemetry; automatic stations; monitoring of forests, vegetation, soil, soil water, water, air, animals; traps for pollen, spores and insects; integrated monitoring; data handling and quality assurance; statistical properties of monitoring data; presentation techniques; data analyses. Training: Gather and present data for a given monitoring topic.
Learning outcomes: After the course the students shall: * have an overview of the wide range of available methods for monitoring; * know the major international monitoring activities and the conventions to which they belong; * know the background for monitoring: the environmental problems; * be able to handle monitoring data and presenting the results in a suitable way; * be able to make a sketch for a monitoring design for a given problem issue.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam, 3 hours.
Examination aids: No calculator, no other examination aids

NATF250 Current Challenges in the Management of Norwegian Natural Resources

Current Challenges in the Management of Norwegian Natural Resources
Credits: 10 **Language:** English
Staff/institute: Reidar Borgstrøm/ INA
Teachers: PhD. Candidate Stian Stensland, Post. Doc. Kari Klanderud, Associate Professor Jonathan Colman and Olav Hjeljord, Professor Sigmund Hågvar, Bjørn Olav Rosseland, Jon Swenson and John E. Brittain
First time the course is offered: SPRING 2007
Start term: June block
Terms: June block
Mandatory activities: All activities are compulsory.
Prerequisites: Students must have an interest in the management of natural resources and should have completed basic and intermediate courses in biology and/or ecology.
Type of course: - Before arrival in Norway, students will have familiarized themselves with background material and literature accessed via the virtual learning environment Classfronter. - The course will formally start with one week of lectures and seminars at The Norwegian University of Life Sciences (UMB). - Then there is a 7-day field excursion to the mountain areas of Heimdalen/Jotunheimen. - Upon returning from the field course to the University at Ås, students will have a final week of study and guidance before taking the final exam.
Contents: The course will cover: Important wildlife species, their ecology and management. Management of large predators. The most common freshwater fish species, their ecology and management. Vegetation ecology and vegetation types, with management challenges. Alpine and arctic plant communities. Nature protection and national park policy in Norway.
Learning outcomes: Upon completion of the course, students should be able to: Account for plant communities, freshwater fish and wildlife in Norway. Identify main ecological effects of the exploitation of wildlife, freshwater fish and plant communities. Explain different approaches to the (sustainable) management of natural resources. Identify main ecological threats and changes influencing Norwegian ecosystems, and ecosystems in the northern hemisphere, in general. Carry out methods for data collection and registration in the field.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: No calculator, no other examination aids

NATF251 Current Challenges in the Management of Norwegian Natural Resources, With Essay

Current Challenges in the Management of Norwegian Natural Resources, With Essay

Credits: 12 **Language:** English
Staff/institute: Reidar Borgstrøm/ INA
Teachers: PhD. Candidate Stian Stensland, Post. Doc. Kari Klanderud, Associate Professor Jonathan Colman and Olav Hjeljord, Professor Sigmund Hågvar, Bjørn Olav Rosseland, Jon Swenson and John E. Brittain.
First time the course is offered: SPRING 2007
Start term: June block
Terms: Autumn parallel June block
Mandatory activities: All activities are compulsory.
Prerequisites: Students must have an interest in the management of natural resources and should have completed basic and intermediate courses in biology and/or ecology.
Type of course: - Before arrival in Norway, students will have familiarized themselves with background material and literature accessed via the virtual learning environment Classfronter. - The course will formally start with one week of lectures and seminars at The Norwegian University of Life Sciences (UMB). - Then there is a 7-day field excursion to the mountain areas of Heimdalen/Jotunheimen. - Upon returning from the field course to the University at Ås, students will have a final week of study and guidance before taking the final exam. - A semester assignment should be written before October.
Contents: The course will cover: Important wildlife species, their ecology and management Management of large predators The most common freshwater fish species, their ecology and management Vegetation ecology and vegetation types, with management challenges Alpine and arctic plant communities Nature protection and national park policy in Norway
Learning outcomes: Upon completion of the course, students should be able to: Account for plant communities, freshwater fish and wildlife in Norway Identify main ecological effects of the exploitation of wildlife, freshwater fish and plant communities Explain different approaches to the (sustainable) management of natural resources Identify main ecological threats and changes influencing Norwegian ecosystems, and ecosystems in the northern hemisphere, in general Carry out methods for data collection and registration in the field
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The written exam counts 5/6 of the grade and the semester assignment counts 1/6 of the grade.

NATF300 Conservation Biology

Conservation Biology

Credits: 5 **Language:** English
Staff/institute: Jon Swenson/ INA
Start term: August block
Terms: August block
Prerequisites: ECOL200, NATF200.
Type of course: Lectures and discussions: 30 hours.
Contents: Guest lecturers have high competency in the relevant topics. Discussions of relevant scientific papers. Progression from theory to practical examples.
Learning outcomes: Students will gain sufficient knowledge of genetics, demography, ecology, landscape management and social sciences to work for the conservation of biological diversity as an interdisciplinary task.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: The written examination lasts 3 hours.
Examination aids: No calculator, no other examination aids

NATF320 Ecology and Management of Natural Resources in the Tropics

Ecology and Management of Natural Resources in the Tropics

Credits: 10 **Language:** English
Staff/institute: Stein Ragnar Moe/ INA
Teachers: Jonathan E. Colman.
Start term: Autumn parallel

Terms: Autumn parallel
Mandatory activities: Seminars and short reports.
Prerequisites: ECOL200.
Type of course: Lectures, 4 hours per week.
Contents: The course is a combination of basic ecological elements (e.g. species diversity and ecosystem functioning) and more applied dimensions, focusing on management and conservation issues. Human dimensions necessary for understanding and effectively managing tropical ecosystem are also included. Students will be exposed to international conventions, the importance of local knowledge and bio-prospecting issues. The course also draws from a wide range of expert contributions and examples from all over the world. The students, acting as a participatory component via presentations and discussions, form an integral part of the course and our learning progress. Guest lectures will also provide exciting state-of-the art knowledge and expertise.
Learning outcomes: The course aims at providing the students with an in-depth understanding of ecological processes that form the basis for advanced conservation and management of natural resources in the tropics.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written exam, 3.5 hours, counts 3/5 of the grade. Semester assignment counts 2/5 of the grade. All of the evaluated elements in the course must be passed to pass the course.

NATF350 Community Based Natural Resuorce Management

Community Based Natural Resuorce Management

Credits: 5 **Language:** English
Staff/institute: Stein Ragnar Moe/ INA
Teachers: Thor Larsen, Fred Midtgård, Pål Vedeld.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Class presentations.
Prerequisites: ECOL250 and NATF320.
Type of course: Seminars 20 hours, lectures 10 hours.
Contents: During the past decade, there has been an increasing realisation that conservation and preservation of natural resources cannot be effectively achieved without incorporating local people and their needs. The first part of the course will cover the important theoretical framework for successful CBNRM. The course will explore how to integrate important ecological (e.g. island biogeography theory), social (e.g. institution building, stakeholder analysis) and economic (e.g. income generating activities, benefit sharing) tools in an integrated ecosystem management approach. The latter part of the course will focus on case studies from different parts of the world. We will study different approaches to CBNRM and look at previous elements of success and failures. The entire course will depend on student participation. One or several students in the class will present each topic. After each presentation, we will have plenary discussions. Thus, it is essential that all students are prepared before classes. Students are also expected to write a 6-7 pages semester assignment that will be published electronically on the INA web site.
Learning outcomes: The course is designed to provide an in-depth understanding of Community-Based Natural Resource Management (CBNRM). The main goal is to explore all levels of community involvement in natural resource management, from national park outreach to complete transfer of tenure and user rights to local people.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The course is evaluated based on a short semester assignment.

PAE301 Ecology of Farming and Food Systems

Ecology of Farming and Food Systems

Credits: 5 **Language:** English
Staff/institute: Geir Lieblein/ IPM
Teachers: KU: V. Langer; SLU: L. Salomonsson, N. Sriskandarajah; Helsinki Univ.: J. Helenius.

Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Bachelor's degree or its equivalent in agriculture, economics, natural resources, human nutrition or other relevant social or natural sciences.
Contents: With a concrete case as starting point, the course deals with structure and functioning of agroecosystems as whole entities seen from different perspectives. Examples of such are ecological, economic, social, time and spatial scale, and organisational level perspectives. The students will also learn about and practice methods for describing and analysing the case and its goals, and they are expected to suggest improvements.
Learning outcomes: After completing the course the student should: 1. Understand key concepts and principles regarding structure and functioning of farming and food systems (agroecosystems). 2. Know how to deal with goals and value bases of such systems. 3. Have become familiar with methodology, methods and tools for describing, analysing and improving farming and food systems. 4. Know how to connect theory to a practical case.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Details for the portfolio assessment will be given at course start. Students will be assessed on written assignments, on understanding of the materials, on ability to conceptualise the course content and on making application to the case and to their current local situations. Their papers, short assignments, and contributions to discussions will be the basis for a grade.

PAE302 Agroecology and Farming Systems

Agroecology and Farming Systems

Credits: 15 **Language:** English
Staff/institute: Tor Arvid Breland/ IPM
Teachers: Geir Lieblein, Nadarajah Sriskandarajah (KVL) and others.
Start term: August block
Terms: August block Autumn parallel
Mandatory activities: Field excursion.
Prerequisites: Bachelor's degree or equivalent in agriculture, economics, natural resources, human nutrition or other relevant social or natural sciences.
Type of course: Details will be given at course start.
Contents: The course consists of two interlinked parts. The real-life project work includes description, analysis and redesign of farming systems. Lectures and seminars deal with agroecology, ecological (organic) agriculture, systems thinking, learning, group dynamics, agroecosystems, sustainability, ecological principles of farm design, social dimensions, agronomic and economic issues, and from farm to global scales. Students write a group report for their clients in the farming system. They also write an individual report where they reflect on agroecological issues of the project work as well as their own learning while preparing the group report.
Learning outcomes: After completing the course, the students should know how to: - Describe and analyse farming systems, - link theoretical knowledge and concrete action regarding farming systems, - acquire knowledge about their own learning. Further, the students should acquire: - Knowledge of structure and functioning of conventional and ecological (organic) farming systems, - knowledge of links between disciplinary (sub-system) knowledge and systemic (holistic) approaches, - experience with methods for systems analysis, including assessment of overall system sustainability, - the ability to handle complexity and change, - the ability to link theory to real-life situations, - the ability to communicate and facilitate, - the ability to learn autonomously and life long, - experience in dealing with attitudes as part of the agroecosystem and learning community. Through real-life case studies with focus on change processes, attitudes of both students and actors in the farming system will be made explicit. The students will learn how to deal critically and constructively with attitudes and value-based choices as important system elements. Desirable attitudes of the students: open-minded, critical, spirited, determined, approachable, exploring and communicative.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: Group report: 30%, individual report: 30%, oral examination: 30%, course contribution: 10%. All parts have to be passed. Basis for the evaluation is a written group report ('client document'), a written individual paper ('learner document'), an oral presentation and discussion of their individual paper (oral examination), and the students' overall contribution to the course process.

PAE303 Agroecology and Food Systems

Agroecology and Food Systems

Credits: 15 **Language:** English
Staff/institute: Geir Lieblein/ IPM
Teachers: Tor Arvid Breland, Charles Francis, Nadarajah Sriskandarajah (SLU) and others.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Field excursion.
Prerequisites: Bachelor's degree or its equivalent in agriculture, economics, natural resources, human nutrition or other relevant social or natural sciences. Builds on PAE302 or similar.
Type of course: Details will be given at course start.
Contents: The course consists of two interlinked parts. In the real-life project work, redesign of food systems are dealt with. Students write a group report for their clients in the food system and an individual report where they reflect on their own learning while preparing the group report. In lectures and seminars the following topics are dealt with: Extension and rural development, global and local food systems, food distribution, consumer issues on food, systems ecology, food security, nutrient flows and recycling, intercultural learning, interview techniques, visionary thinking, dialogue, force field analysis, creative problem solving, facilitation.
Learning outcomes: After completing the course, the students should know how to: - Describe and analyse food systems, - link theoretical knowledge and concrete action regarding food systems, - acquire knowledge about their own learning. Further, the students should acquire: - knowledge of structure and functioning of conventional and ecological or local food systems, - knowledge of links between disciplinary (sub-system) knowledge and systemic (holistic) approaches, - experience with methods for systems analysis, including assessment of overall system sustainability, - the ability to handle complexity and change, - the ability to link theory to real-life situations, - the ability to communicate and facilitate, - the ability to learn autonomously and life long, - experience in dealing with attitudes as part of the agroecosystem and learning community. Through real-life case studies with focus on change processes, attitudes of both students and actors in the food system will be made explicit. The students will learn how to deal critically and constructively with attitudes and value-based choices as important system elements. Desirable attitudes of the students: open-minded, critical, spirited, determined, approachable, exploring and communicative.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Group report: 30%, Individual report: 30%, oral examination: 30%, course contribution: 10%. All parts have to be passed. Basis for the assessment is a written group report (‚client document‚), a written individual paper (‚learner document‚), an oral presentation and discussion of their individual paper (oral examination), and the students' overall contribution to the course process.

PHA223 Greenhouse and Nursery Crops I

Greenhouse and Nursery Crops I

Credits: 15 **Language:** English upon request
Staff/institute: Hans Ragnar Gislerød/ IPM
Teachers: Sissel Torre, Ingjerd Solfjeld, Ørjan Omdal, Liv Knudzon.
Start term: January block
Terms: January block Spring parallel
The course is offered: Odd years
Mandatory activities: Excursions.
Prerequisites: BOT130, PJH200 or equivalent.

Type of course: Lectures: 50 hours. Assignments/exercises: 20 hours. 4 excursions.
Contents: Climate, growth media, nutrient supply and applied plant physiology. Framework conditions and development tendencies. Propagation and production of young plants. Plant quality and production systems. Production of herbs, tomatoes, cucumbers, cut flowers, pot plants, plants for planting outside, deciduous and evergreen bushes, fruit trees, berry plants, deciduous trees, climbers, roses and herbaceous perennial plants.
Learning outcomes: Gain knowledge of greenhouse production, the running of nurseries and the most commonly used production methods for plants for indoor environments, landscapes and urban greeneries.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Oral exam, duration: ca. 45 minutes. Assignments count 2/5 and oral exam counts 3/5. Both parts have to be passed.

PHA224 Greenhouse and Nursery Crops II

Greenhouse and Nursery Crops II
Credits: 20 **Language:** English upon request
Staff/institute: Hans Ragnar Gislerød/ IPM
Teachers: Sissel Torre, Liv Knudzon, Ingjerd Solfjeld, Ørjan Omdal, Idun Bratberg.
Start term: January block
Terms: January block Spring parallel June block
The course is offered: Odd years
Mandatory activities: Excursions.
Prerequisites: BOT130, PJH200 or equivalent.
Credit reduction: PHA223, 15 credits.
Type of course: Lectures: 50 hours. Assignments/exercises: 50 hours. 4 excursions.
Contents: Climate, growth media, nutrient supply and applied plant physiology. Framework conditions and development tendencies. Propagation and the production of young plants. Plant quality and production systems. Production of herbs, tomatoes, cucumbers, cut flowers, pot plants, plants for setting outside, deciduous and evergreen bushes, fruit trees, berry plants, deciduous trees, climbers, roses and herbaceous perennial plants.
Learning outcomes: The students are to acquire knowledge of greenhouse production, the running of nurseries and the most commonly used production methods for plants used for indoor environments, landscapes and urban greeneries.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Oral exam, duration: ca. 45 minutes. Assignments count 11/20 and oral exam counts 9/20. Both parts have to be passed.

PHA225 Greenhouse and Nursery Crops III

Greenhouse and Nursery Crops III
Credits: 5 **Language:** English upon request
Staff/institute: Hans Ragnar Gislerød/ IPM
Teachers: Sissel Torre and others.
First time the course is offered: SPRING 2007
Start term: January block
Terms: January block
The course is offered: Odd years
Mandatory activities: Excursion.
Credit reduction: 5 credit reduction versus PHA223 and PHA224.
Type of course: Lectures: 40 hours.
Contents: Cultivating systems, the climate used to optimalise growth and quality in some major cultures.

Learning outcomes: To gain an understanding of the production conditions in a greenhouse valued at NOK 1500 million. Gain an overview of which cultivating systems are used and a few major cultures.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: 40 minute oral exam, 3/4. Exercises 1/4. Both parts have to be passed.

PHA320 Applied Plant Physiology in Controlled Environment

Applied Plant Physiology in Controlled Environment

Credits: 10 **Language:** English upon request
Staff/institute: Hans Ragnar Gislerød/ IPM
Teachers: Sissel Torre.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Prerequisites: BOT200, PHA223 or Bachelor's degree in Plant Science or equivalent.
Type of course: Lectures: 52 hours, 4 hours per week for 13 weeks. Exercises: 26 hours, 2 hours per week for 13 weeks. Computer room. Excursion: 1 day, 8 hours.
Contents: The following central topics are covered thoroughly: 1. Fertilisation planning. 2. Growth, developmental physiology and growth regulation. 3. Post-harvest physiology. The course is a part of the Master's programme in Plant Sciences, and it is one of the courses offered for other relevant MSc programs at UMB. There is a distinct environmental profile in this course.
Learning outcomes: After completing the course, the students should be able to use their knowledge of plant physiology and fertilisation planning as a foundation for effective and environmentally friendly production of flower plants of high quality for the local environment. A thorough covering of the following, central topics: 1. Fertilisation planning for greenhouse crops. 2. Growth and development physiology, and growth regulation. 3. Post-harvest physiology. Solving of both theoretical and practical problems in connection with the use of fertilisation planning and climate control in greenhouse cultures for optimal growth and plant quality. Also analyses and interpretations of reasons for irregular growth, damage symptoms, bad plant quality and durability. Several of the topics in the course focus on an environmentally friendly greenhouse production. This contributes to students gaining attitudes that may lead to more attention being paid to this topic when they turn up as teachers, advisors and researchers in the horticulture field.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Continuous assessment in topic 1, 2 and 3 with part tests/ handing in of exercise, counts 3/10. Final oral examination, counts 7/10. 30-45 minutes per candidate. Both parts have to be passed.

PHA321 Applied Plant and Production Physiology in Controlled Environment, theme paper

Applied Plant and Production Physiology in Controlled Environment, theme paper

Credits: 15 **Language:** English upon request
Staff/institute: Hans Ragnar Gislerød/ IPM
Teachers: Sissel Torre and others.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Prerequisites: BOT200, PHA223 or Bachelor's degree in Plant Science or simular background.
Credit reduction: PHA320, 10 credits.
Type of course: Lectures: 52 hours, 4 hours per week for 13 weeks. Exercises: 26 hours, 2 hours per week for 13 weeks. Computer room. Excursion: 8 hours. Guidance in connection with semester papers. The papers are gone through. In total: ca. 25 hours.

Contents: The following central topics are covered: 1. Fertilisation planning. 2. Growth, development physiology and growth regulation. 3. Post harvest physiology. 4. Semester assignment. The course has a distinct environmental profile.
Learning outcomes: After completing the course, the student is going to have a deep understanding of applied plant physiology and fertilisation planning as a base for an effective and environmentally friendly production in greenhouse of high quality and beneficial for the local environment. For further information see PHA320. In addition, the student will gain experience in writing a semester assignment of 5 credits in a selected topic.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The assessment consists of three main parts and is done by: Part 1: Continuous assessment of topic 1, 2 and 3 with part tests/ handing in of exercises, counts 3/15. Part 2: Topic 4: continuous assessment of semester paper, counts 5/15. Part 3: Final oral examination, counts 7/15. 30-45 minutes per candidate.

PHA322 Applied Plant Physiology related to Plant Growth in Regulated Climate, Term Paper

Applied Plant Physiology related to Plant Growth in Regulated Climate, Term Paper
Credits: 10 **Language:** English upon request
Staff/institute: Hans Ragnar Gislerød/ IPM
Teachers: Sissel Torre and others.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: By assignment
Prerequisites: BOT200, PHA223 or Bachelor's degree in Plant Science.
Type of course: Ca. 2 hours per week. Individual guidance corresponding to ca. 20 hours.
Contents: Independent study on a topic that has been agreed upon, and literature with guidance. The choice of topic will primarily be linked to already running projects.
Learning outcomes: The student is to have theoretical depth on certain topics in applied plant physiology related to greenhouse crops.
Methods of examination: Final **Grading:** A-F
Assessment methods: Semester assignment.

PHI400 Philosophy of Science and Research Ethics

Philosophy of Science and Research Ethics
Credits: 10 **Language:** English
Staff/institute: Frode Kjosavik/ IØR
Teachers: Frode Kjosavik is course responsible in 2007, whereas Terje Kvilhaug gives about half of the lectures.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: The students must attend at least 70% of lectures and seminars.
Type of course: 4 hours weekly: ca. 2/3 lectures, 1/3 seminar.
Contents: Two parts: Part I: Philosophy of science. This part deals with both natural and social sciences. Different views will be discussed - theories, methodology, modelling and theory formation, scientific progress, realism and relativism, what is characteristic of various sciences and what is the relation between them (including reductionism and interdisciplinary potential). Part II: Research Ethics and the Social Responsibility of Science. This part treats general ethical theories and more specifically norms and values that govern and legitimate scientific research. The relation between society, science and technology on the one hand, and between science, politics and expertise on the other, will be discussed. The course will also focus on issues concerning bioethics and legislation as well as environmental ethics and politics.
Learning outcomes: The course takes science in practice as its point of departure, i.e. science as it is carried out and its diverse ways within the social and cultural sphere. The course looks at what is specific about scientific practice - its rationality and methods in different fields, how it is influenced by the surrounding society and how it in turn has consequences for society.

The objective of the course is to stimulate students to reflect critically on their own field of research and their own research projects, in particular on methodological, social, political and ethical aspects of their own scientific activity. The objective is to increase critical awareness and sense of responsibility in the student, and to make her or him more informed on questions pertaining to philosophical and ethical questions concerning science and research.
Methods of examination: Final **Grading:** Pass/Fail
Assessment methods: Semester assignment.

PJH210 Field Crops for Food and Feed I

Field Crops for Food and Feed I

Credits: 10 **Language:** English upon request
Staff/institute: Anne Kjersti Uhlen/ IPM
Teachers: Several.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises and group work. Journal writing.
Type of course: Lectures: 50 hours. Exercises/field work: 20 hours. Group work/project work: 6 hours.
Contents: General part: Cultivation methods of annual/ perennial crops, mixed cultures etc.; crop rotation and cultivation systems, plant development, winter survival, fertilisation, harvesting and storage; influence of cultivation methods upon yield and quality. Specialisation within the following crops: 1) Grain crops (cereals, oilseed crops, leguminous crops); 2) Feed crops (meadow and pasture crops, other feed crops); 3) Vegetables on open land (including potato).
Learning outcomes: Upon completion, the students should be able to: -explain cultivation techniques for agricultural and horticultural crops as well as storing techniques for the plant products - explain impacts of cultivation and storing techniques on yield and product quality; - describe how cultivation can be done in a sustainable way; - estimate influences of cultivation technique and environment upon plant development, crop development and quality characteristics; - adapt cultivation systems and methods in order to meet various requirements for yield and quality.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Multiple-choice test (15%) and written assignments (15%) in the autumn parallel. Written exam (70%). All parts must be passed.

PJH211 Field Crops for Food and Feed II

Field Crops for Food and Feed II

Credits: 5 **Language:** English upon request
Staff/institute: Anne Kjersti Uhlen/ IPM
Teachers: Several.
Start term: January block
Terms: By demand
Prerequisites: PJH210.
Type of course: Semester paper: 2 hours introduction + individual guidance.
Contents: Specialisation within the following crops from PJH210 through a semester assignment: 1) Grain crops (cereals, oilseed crops, leguminous crops); 2) Feed crops (meadow and pasture crops, other feed crops); 3) Vegetables on open land (including potato). The semester assignment will give students an in-depth understanding within one of the 3 specialisations.
Learning outcomes: Upon completion, the students should be able to: - acquire deeper knowledge within one of the three outlined specialisations in PJH210. - acquire experience in finding, selecting and presenting relevant literature on a topic, and in drawing sound conclusions. - acquire experience from writing such presentations and referring to literature.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Semester assignment.

PLV420 NOVA PhD-course in Plant Pathology

NOVA PhD-course in Plant Pathology

Credits: 5 **Language:** English
Staff/institute: Anne Marte Tronsmo/ IPM
Teachers: Professor Jonathan Yuen, SLU. Professor David Collinge, KVL. Professor Minna Pirhones, HU International guest teachers
Start term: Spring parallel
Terms: Spring parallel June block
Mandatory activities: Active participation in the intensive course. Participation in dicussion groups. Abstract and presentation of lecture or poster.
Prerequisites: Basic courses in Plant Pathology and Microbiology.
Type of course: 7 full days of intensive course. 70 hours: Lectures, discussions, lab. practicals demonstrations. Literature study and discussions before the course: 50 hours (discussion groups arranged in each country). Preparation of the students own presentation and evaluation of the presentation: 30 hours.
Contents: The approaches and tools to study plants and pathogens have changed during the last few years. This offers a way to get an overall picture of the changes in gene expression in different phases or different types of interactions. These methods have been utilised to study several plants and their pathogens and the results have provided new insight into plant-pathogen interactions. During the lectures, a range of techniques and their application to study plant-pathogen interactions, mechanisms of pathogenicity and plant defence mechanisms will be described. Results obtained by these methods and the way these results have affected our understanding of plant-pathogen interactions will be discussed
Learning outcomes: The students will learn methods that can be used to study the gene expression and regulation in organisms where the genomic sequence is available. They should understand the theoretical aspects of the methods and know the basic ways for data analysis and normalisation. They should know the kind of that questions can be studied with the available methods and understand which methods they can apply in their own project. The students should also obtain an overview of gene expression and regulation in host and pathogen during plant-pathogen interactions, including fungal, bacterial and viral pathogens and their hosts. Furthermore, the students should have knowledge about the recent development in this field be able to explain how this have affected the understanding of the mechanisms of pathogicity, plant defence and the signalling involved in these phenomena.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail

PØL300 Agroecosystems

Agroecosystems

Credits: 10 **Language:** English
Staff/institute: Marina Azzaroli Bleken/ IPM
Teachers: Several UMB teachers.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: First lesson. Student seminars. A presentation by the student on a chosen topic. Discussion of the exercises assigned by the teacher.
Prerequisites: Bachelor's degree in Agronomy, Agriculture, Plant Science or corresponding. AlsoPAE302 + PAE303 in combination with a an agronomic/natural science study profile.
Type of course: 5 hours/week.
Contents: Agroecology in a historical perspective, biodiversity, elements of epidemiology, food cycle, local and global food supply, analysis of agroecosystems on regional and farm level. The students will have to reflect upon advantages and limitations of both conventional and organic agriculture.
Learning outcomes: The students will acquire basic understanding of the diversity and complexity of the factors that control an agroecosystem,s sustainability.

Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Active participation in class: 30%, oral exam: 70%. Both parts have to be passed.

REIS300 Nature-based Tourism

Nature-based Tourism

Credits: 10 **Language:** English upon request
Staff/institute: Øystein Aas/ INA
Teachers: Birger Vennesland, Stian Stensland.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Excursion: 10-14 September, 2007. (Remember registration).
Prerequisites: REIS200.
Type of course: Lectures, excursion and project paper: 40 hours.
Contents: Nature-based tourism as a business in Norway. Experiences with nature as a product, supply, demand, organisation, logistics. Project development and project evaluation. Excursion and undertaking of a practical project exercise in cooperation with players in the market.
Learning outcomes: The course should: - Give an overview of nature-based tourism as a business in Norway. - Give a theoretical basis for analysis of nature based tourism projects. - Undertake a concrete analysis of a nature based tourist project.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Project paper (counts 40%) and oral exam (counts 60%).

RØP301 Capital Management in Forestry and Agriculture

Capital Management in Forestry and Agriculture

Credits: 5 **Language:** English upon request
Staff/institute: Birger Solberg/ INA
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Project assignment.
Prerequisites: BUS110, SMI230/SKOG230.
Type of course: Lectures: 26 hours (2 hours per week). Exercises: 26 hours (2 hours per week).
Contents: I Profitability- and income terms: - internal interest/profit, - nominal, - real, - income, - depreciation, - net payment. II Value calculations: - the current value method, - earning requirement (capital cost) for individual projects, - utility value/profit value. III Taxes: - profitability effects of taxation, - effective taxation, - earning requirements after tax for individual projects. IV Uncertainty in investment analyses: - attitudes towards risk and uncertainty, - portfolio theory and relevant risks, - the capital value model, - risk compensation, - alternatives to uncertainty analysis. V General information on value calculations for economic enterprises: - balance based methods, - earning-based methods. VI Value calculations: - forest, - soil.
Learning outcomes: Students should be familiar with theory and methods for analysing different uses of capital on a forest estate, and the potential effects of taxation. Students should know the general theory for economic valuation as well as the relevant principles for valuating forest area in different contexts.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination.
Examination aids: Any calculator, no other examination aids

SKS303 Silviculture

Silviculture

Credits: 15 **Language:** English upon request
Staff/institute: Andreas Brunner/ INA
Teachers: Scientists from INA, Norwegian forest and landscape institute (Skog og Landskap), Norwegian institute for agricultural and environmental research (Bioforsk).
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Excursions.
Prerequisites: SMI220/SKOG220.
Type of course: Seminars, 3 exercises, 8 days excursion.
Contents: Silviculture is often based on production ecology of trees. Knowledge on competition and growth is an important prerequisite of most silvicultural treatments. Genetics and natural forest dynamics are two other important basics for silviculture that are chosen as topics. To increase the knowledge of possible silvicultural options we will base the learning on a number of examples within the topics of regeneration, pre-commercial thinning, thinning and final cut. The effect of silviculture on wood quality is another example. See http://athene.umb.no/emner/SKS303
Learning outcomes: Applied silviculture selects treatments to manage forest ecosystems according to given objectives. This activity requires fundamental knowledge of forest ecosystems and their reactions to management (production ecology), local variation of general patterns in forest ecosystems, objectives of forest management and an extensive overview over silvicultural methods. This course on the master level will enable the students to extract knowledge from the international research literature in silviculture. The students will learn technical terms in Norwegian and English, learn to understand and critically interpret research results, learn to see their relevance in the context of other research results, and learn to see the practical use of new knowledge.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written and oral presentations of course. Literature counts 30%. Written exam (4 hours) counts 30%. Oral exam (4 hours) counts 20%. Semester assignment counts 20%.

STAT300 Statistical Data Analysis

Statistical Data Analysis

Credits: 10 **Language:** English upon request
Staff/institute: Elling-Olav Rukke/ IKBM
Teachers: Assistant teachers.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Compulsory assignments.
Prerequisites: STAT100, or equivalent.
Credit reduction: ECN201 (5 credits), STAT200 (5 credits).
Type of course: 6 hours of organised teaching per week, for most weeks it will be 4 hours of lectures and 2 hours of exercises.
Contents: Basic aspects within multivariate statistical analysis of data. Simple matrix algebra. Linear regression, selection of explanatory variables, checking assumptions, and validation of models. Multicollinearity. Multivariate normal distribution. Principal component analysis, and factor analysis. Discriminant analyis, classification, and cluster analysis. If time: Multivariate analysis of variance, and canonical correlation analysis.
Learning outcomes: The students learn about the assumptions, applications, and theoretical background for the most common methods within multivariate statistical analysis. It will be emphasised that the students, to a given problem in their study or later in their work, will be able to formulate the problem in such a way that it can be analysed by means of suitable multivariate statistical method(s). Furthermore, the students learn to decide which method(s) that can be used to model and analyse the problem, and to do the analysis, (if necessary) by means of suitable software. The students also learn the practical interpretation and to assess the validity of models, methods, and results.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3.5 hour written examination.
Examination aids: Any calculator, any other examination aids

STAT310 Design of Experiments and Analysis of Variance II

Design of Experiments and Analysis of Variance II

Credits: 10 **Language:** English upon request
Staff/institute: Trygve Almøy/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Compulsory project assignment.
Prerequisites: STAT100 or equivalent.
Credit reduction: STAT210, 5 ECTS.
Type of course: Lectures and exercises: 6 hours per week in the autumn parallel.
Contents: Fundamental theory for design of experiments and analyses of data from such experiments, replication, randomisation and blocking. Analysis of variance models with fixed, random and mixed effects. Hierarchical models. Orthogonal contrasts. Splitting of sum of squares. Multiple comparisons. Testing equality of variances. Consequences of departure from the assumptions. Transforming data. Analyses of unbalanced data. Some usual experimental plans, such as: Completely randomised design, block design, Latin square design, split-plot design and incomplete block design. Factorial designs; interaction. Two- and three-level designs. Fractional factorial designs. Confounding of effects.
Learning outcomes: The students should learn the statistical principles for design of experiments used to compare different groups or treatments and to analyse data from such experiments, first of all by means of analysis of variance. They also learn the mathematical basis so that they will be able to use their knowledge in new situations that they encounter in their studies and later in their working life. By means of exercises and projects with real problems and data, the students should show that they have reached the learning goals.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination, 3.5 hours.
Examination aids: Any calculator, any other examination aids

STAT330 Analysis of Categorical Data

Analysis of Categorical Data

Credits: 10 **Language:** English upon request
Staff/institute: Ellen Sandberg/ IKBM
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Even years
Mandatory activities: Assignments.
Prerequisites: Regression analysis equivalent to STAT200.
Type of course: Lectures: 2 hours per week. Calculation/computer exercises: 2 hours per week.
Contents: Poisson, binomial and multinomial distributions. Analysis of 2x2 tables and two-way and three-way contingency tables. Generalised linear models. Logistic and loglinear regression.
Learning outcomes: Be able to analyse contingency tables and binary data by chi-square tests, loglinear regression and logistic regression.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination: 3hours.
Examination aids: Any calculator, any other examination aids

STIN340 Computer-intensive Statistical Methods

Computer-intensive Statistical Methods

Credits: 10 **Language:** English upon request
Staff/institute: Ulf Geir Indahl/ IKBM
Teachers: Henrik René Cederkvist.

Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Even years
Prerequisites: Linear algebra equivalent to MATH130, Statistics equivalent to STAT100, Mathematical statistics equivalent to STAT250, Programming equivalent to INF110.
Type of course: Lectures: 2 hours per week. Exercises: 2 hours per week.
Contents: Core curriculum: Introduction to MATLAB (simulation tool), Introduction to Computer-intensive Statistical methods, Basic probability theory, Sampling, Generation of numbers from random variables. Specialisation curriculum selected from: Monte Carlo methods (including Bootstrapping, Markov Chain Monte Carlo), Density estimation, Statistical pattern recognition, Modern multivariate regression methods.
Learning outcomes: 1. To give an introduction to modern data-intensive methods within statistics, together with computational tools to handle these. 2. To demonstrate the effectiveness of data-intensive methods in situations where traditional statistical software does not apply.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Oral examination (1 hour - weight 60%). 2 compulsory assignments (weight 40%).

TAT101 Aquaculture Laboratory Course

Aquaculture Laboratory Course

Credits: 10 **Language:** English upon request
Staff/institute: Tor Kristian Stevik/ IMT
Teachers: Asper Jon, Støkken Harald.
Start term: Autumn parallel
Terms: Autumn parallel Spring parallel
Prerequisites: Some background knowledge about salmon farming is an advantage.
Type of course: A combination of lectures and exercises: 78 hours in total, divided between autumn and spring.
Contents: The course is a laboratory course with main focus on methods for producing salmon. The students will be guided through a complete production cycle. In laboratory exercises, methods for producing eggs, hatching, start- and growth-feeding are demonstrated and investigated. Furthermore important production factors such as water quality and water treatment, the layout and management of farms, feeding and feeding systems are examined. Special equipment for measuring and monitoring water quality is also demonstrated.
Learning outcomes: On completion of the course, students should have gained basic knowledge about technology for the production of salmon. Also, they will have good insight into the periods in which the main activities at a fish farm are planned, key elements of these activities, and how they are organised and carried out. The students will also have a good overview and knowledge of important technologies used at fish farms, including equipment for measuring and controlling water quality etc.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: The students are required to carry out and deliver reports for at least 7 sets of exercises in each of the two semesters (14 reports in total). The laboratory exercises and compulsory reports are evaluated and then returned to the students with comments and advice for any required corrections that should be made before the final evaluation.

TAT230 Design of Equipment for Norwegian Aquaculture Facilities

Design of Equipment for Norwegian Aquaculture Facilities

Credits: 10 **Language:** English upon request
Staff/institute: Odd Ivar Lekang/ IMT
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: AKX100 (production technology part) or TAT 254 or AKX 250.

Type of course: Lectures: 40 hours. Exercises with teacher present: 30 hours. Exercises are handed out and gone through, if necessary on the blackboard.
Contents: The course is based on problem-solving. Initially, the students are offered lectures in relevant topics. After that, the students are given a project task directly linked to the specific topic. These are practical and realistic tasks, where the students are doing measurements, evaluating solutions, calculating and are doing simple design jobs for various installations. The course is based on the courses TAT101 and TAT 211, and utilises knowledge that the students have acquired from them. A selection of technical components and installations which are used in designing a complete farm is discussed and evaluated. The following topics will be lectured, discussed and used in exercises: 1. Vessels, 2. Systems for aeration and oxygenising water, 3. Systems for heating water, 4. Wastewater from fish farming, 5. Filtration of waste-water, 6. Desinfection of water, 7. Equipment for removal of ammonia, 8. Water recycling, 9. Nets.
Learning outcomes: The students should be able to clarify key issues with regard to design, function and dimensioning of fish farms. Furthermore, the students will have knowledge about and be able to calculate and plan the most important systems and components in this kind of facility, e.g. vessels, equipment for oxygenising, heating and purification of water (with special emphasis on wastewater), purification, equipment for removal of ammonia, recycling as well as breeding facilities and systems for anchoring. The students will be able to evaluate technical solutions in the mentioned areas.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: The students are required to complete 5 sets of compulsory project tasks during the course. The reports are commented on by the teacher and returned for corrections/upgrading before final evaluation (Passed/Failed). All five tasks have to be approved in order to pass the course.

TAT250 Laboratory Course in International Aquaculture

Laboratory Course in International Aquaculture

Credits: 10 **Language:** English
Staff/institute: Bjørn Frode Eriksen/ IMT
Teachers: Støkken Harald, Asper Jon, Lekang Odd Ivar, Stevik Tor Kristian.
Start term: Autumn parallel
Terms: Autumn parallel Spring parallel
Prerequisites: Bachelor or corresponding - Entrance requirement for the Master's programme in aquaculture at UMB.
Credit reduction: TAT101- Aquaculture laboratory course. Students that have completed TAT101 will only be credited 5 credits for a subsequent TAT250 (reduction from 10 to 5 credits).
Type of course: Lectures: 6 hours. Laboratory exercises: 70 hours. Student presentation of exercise results: 6 hours.
Contents: The course will focus on production methods, mainly for Atlantic salmon and rainbow trout. In the laboratory exercises, the students will follow and control the production cycle and make comments about the production results. There will be exercises in measuring of the water quality and using of equipment to improve the water quality. There will also be exercises in controlling other types of equipment used on a fish farm.
Learning outcomes: The students shall get practical training and insight in operations used in international fish farming. The focus is on land-based fish farms and production methods.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Continuous assessment, laboratory reports and presentation counts 1/1.

TAT254 Aquaculture Production

Aquaculture Production

Credits: 5 **Language:** English
Staff/institute: Odd Ivar Lekang/ IMT
Teachers: Stevik Tor Kristian, Eriksen Bjørn Frode.
First time the course is offered: SPRING 2007

Start term: January block
Terms: January block
Mandatory activities: Literature studies.
Prerequisites: Bachelor in life science or ongoing Bachelor studies at UMB.
Credit reduction: TAT254 is an integrated part of AKX250 and overlaps 100%. Students that have already passed AKX250 will not be credited extra credits for TAT254. The course also overlaps with parts of AKX100 - Aquaculture (10 credits), but with higher demands to scientific content. Students that have passed AKX100 and wish to attend TAT254 will only be credited 10 credits in total for both courses (i.e. a reduction of 5 credits for AKX100).
Type of course: Activities consist of lectures and literature studies for a three week period ending with a written exam. In addition, each student will perform an individual written project. The estimated activity includes 8 hours with lectures and theoretical exercises per week + individual literature studies. The individual project is estimated to require one week of work.
Contents: In the course there will be lectures in production cycles, manipulating of natural production cycles, farming methods, function and design of major used equipment, water requirement, quality and treatment, farm design for land based and offshore farms. The course is arranged in collaboration with The NOVA Aquaculture and Freshwater Fisheries Education Network (http://www.nova-university.org/novadb/courses/) and is one out of four theoretical blocks of AKX250. Lectures, exercises and literature is parallel with the students participating in AKX250, but the student of TAT254 (this course) will in addition perform an individual project.
Learning outcomes: The aim of the course is to give the student a knowledge basis in production of fish and the use of technology to achieve an optimal production.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The written exam and the individual project will count 80 % and 20 % respectively of the final grade.

TAT310 Aquaculture Engineering, Main Topic

Aquaculture Engineering, Main Topic

Credits: 15 **Language:** English upon request
Staff/institute: Odd Ivar Lekang/ IMT
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: TAT211 - Production technology in aquaculture. TAT230 - Design of Equipment for Aquaculture Facilities, or equivalent prior knowledge.
Type of course: Lectures: 4 hours per week, totalling 52 hours. Exercises and project work with the teacher present: 4 hours per week, totalling 52 hours.
Contents: As part of the course, the students are required to carry out a larger project task within the field of aquaculture engineering. The task will be linked to ongoing projects and research. The students will utilise knowledge from previous courses as well as new knowledge to solve complex problems. New knowledge will be added in fields as planning of fish farms, theory and analysis, choosing locations, describing locations, design and technical descriptions. Furthermore, the students will gain more knowledge about equipment and plants for processing fish. This comprises filleting, skinning, cooling, freezing, smoking and packing of fish. Design and layout for rooms and facilities is also discussed. The students are required to plan a smaller facility for slaughtering/processing of fish.
Learning outcomes: The students will be able to utilise acquired and new knowledge to solve complex problems related to aquaculture engineering and planning of land-based fish farms. They will also be able to evaluate and determine suitable equipment and process lines for slaughtering and processing of fish.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final oral exam, approx. 3/4 hours per student. At the oral exam, the candidate is evaluated through a combination of examination in basic theory and defence of the compulsory project work and report. Grading of both parts is combined into one grade, where the oral examination counts 2/5 and the defence and quality of the project work count 3/5.

TAT350 Planning and Design of Intensive Fish Farms

Planning and Design of Intensive Fish Farms

Credits: 10 **Language:** English
Staff/institute: Odd Ivar Lekang/ IMT
Teachers: Eriksen Bjørn Frode.
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: TAT254 - Aquaculture production, or similar knowledge in the area.
Type of course: Lectures: 3 hours per week, totalling 39 hours. Exercises and project work with supervision: 3 hours per week, totalling 39 hours.
Contents: Through the course, the students will gain new knowledge as well as utilise previously acquired knowledge in a process where they will plan and design an intensive land-based fish farm. The plan will be adapted for an actual site and an actual production. The course has an international scope, and the planning of a farm for international and non-traditional species can be done. Topics for lectures are design and dimensioning of inlet, transfer pipelines, pump stations, fish handling, feed handling, farm design, site selection, superstructure principals, room program, planning and technical design.
Learning outcomes: The students should be able to plan and design a land-based facility for intensive fish farming and carry out projects in this area.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Final oral exam, approx. 3/4 hours per student. At the oral exam, the candidate is evaluated by a combination of examination in basic theory and defence of the compulsory project work and report. The grades of both parts is combined into one grade, where the oral examination counts 1/3 and the defence and quality of the project work count 2/3.

TBM150 Introduction to FEM

Introduction to FEM

Credits: 5 **Language:** English upon request
Staff/institute: Tor Anders Nygaard/ IMT
Teachers: Stemsrud Egil.
Start term: August block
Terms: August block
Mandatory activities: 4 assignments.
Prerequisites: FYS110 - Statics, MATH111 - Calculus 1.
Type of course: Lectures: 26 hours of lectures focused on basic FEM-theory. Exercises: Several smaller problems/exercises, which are solved in groups and interaction between students and teacher. Compulsory assignments.
Contents: Central topics are: Terminology, direct method for generating element matrices, compatibility, equilibrium, system matrices and boundary conditions. Galerkin method and interpolation functions. Generation of matrices for solution of structural and heat transfer problems. Solution algorithms. Solution of simple problems by hand and programming. The course has compulsory exercises which must be passed in order to sit for the examination.
Learning outcomes: Having passed the course, students will have gained basic understanding of how to use the Finite-Element-Procedure (FEM) in solving practical problems. This course provides basis for TMP250 - FEM-design, which goes further in solving practical problems with commercial FEM- software used in research and development.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam, 3 hours.
Examination aids: Simple calculator, no other examination aids

THT280 Ecologically Engineered Systems for Waste Water and Waste Treatment.

Ecologically Engineered Systems for Waste Water and Waste Treatment.

Credits: 10 **Language:** English upon request
Staff/institute: Lasse Vråle/ IMT
Teachers: Arve Heistad and Petter Jenssen.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Exercises.
Prerequisites: GEO100.
Type of course: Lectures: 44 hours (11 weeks of 4 hours/week). Exercises (in class): 4 hours. Presentation and discussion of semester assignment: 8 hours. One-day excursion.
Contents: Introduction to natural and recycling (ecosan) systems, for treatment of wastewater, stormwater, landfill leachate and agricultural runnoff. Purification processes in natural systems including pathogen removal. Wastewater treatment by soil infiltration, bio-filters, wetlands, and pond systems. Source separating systems based on alternative toilet technology (vacuum-, composting and urine diverting) and corresponding treatment (hygienizing) of excreta. Agricultural use of organic based fertilizer products. Greywater treatment and reuse. Introduction to system evaluation and risk assessment.
Learning outcomes: The students shall have an overview of natural and recycling systems for waste water treatment, and have basic knowledge about the design of treatment systems based on local conditions.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Written examination: 3 hours, counts for 3/4. Project assignment counts for 1/4.

THT281 Appropriate Sanitation for the Developing World

Appropriate Sanitation for the Developing World

Credits: 5 **Language:** English
Staff/institute: Petter D. Jenssen/ IMT
Start term: June block
Terms: June block
The course is offered: Other - The course in August 2007 is cancelled. A course is being planned for June 2008.Emnet tilbys ikke høsten 2007. Emnet planlegges gitt i juniblokka 2008.
Mandatory activities: Exercises.
Prerequisites: THT280.
Type of course: Lectures: 35 class hours. 5 days of 7 hours per day. Demonstrations: 4 class hours. 2 days of 2 hours per day.
Contents: Worldwide, two of the major causes of mortality and morbidity are unsafe water supplies and inadequate disposal of human excreta. Sanitation inadequacies also hinder economic and social development, constitute a major impediment to reducing poverty, and inevitably lead to degrading the environment. Unfortunately, the people in poverty stricken areas-especially infants and young children-suffer the most. This calls for appropriate solutions that are affordable considering local constraints. This course explores ecological sanitation solutions (ecosan) for the poor through case studies presented by international experts. Both the technical and the socioeconomic sides of successfully improving sanitation as well as sanitaion in crisis situations are covered.
Learning outcomes: The students shall have an overview of the challenges of inadequate sanitation in developing countries. Further, knowledge of appropriate technologies for problem remediation and the socioeconomic factors of relevance for successful implementation.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Semester assignment.

THT282 Ecotechnology Basics

Ecotechnology Basics

Credits: 10 **Language:** English
Staff/institute: Petter D. Jenssen/ IMT
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Other - The course will not be offered in 2007.Emnet tilbys ikke høsten 2007.
Prerequisites: Basic knowledge of geology, microbiology and chemistry equivalent to GEO100, BIO130, KJM100.
Type of course: Lectures: 48 class hours. 4 hours per week. Discussions and exercises: 18 class hours. Short, local excursions.
Contents: The course will cover the basic concepts for understanding ecologically engineered systems. Key concepts: biogeochemical cycling, analysing life cycles, watershed management, groundwater hydrogeology, examples of state-of-the art ecotechnology. It will also deal with the interrelationships to the institutional and social setting, the constraints and potentials due to design of nature-based systems and the effects on sustainability. It is possible to write a semester assignement related to the topics given in this course in order to obtain an additional 5 points, see information given under THT299.
Learning outcomes: The students shall upon completion of the course have knowledge about the principles of ecological engineering and be able to elucidate the connection to nature and society in the design of decentralised systems for water supply, bioenergy and recycling of organic waste and wastewater. The students shall have the basic knowledge needed to understand the design of systems for groundwater supply, bioenergy and recycling organic waste and wastewater.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** Pass/Fail
Assessment methods: Exercises and evaluation of participation in group discussions, each student gives a short introduction and writes a summary from one of the discussions.

THT299 Environmental Engineering, Project Work

Environmental Engineering, Project Work

Credits: 5 **Language:** English upon request
Staff/institute: Jarle Tommy Bjerkholt/ IMT
Teachers: Oddvar Lindholm, Petter Jenssen, others.
Start term: August block
Terms: By demand
The course is offered: By assignment
Prerequisites: The course can normally not be attended before the 3rd year of study. This implies that the student has undertaken the basic courses in science and mathematics and also has some basic courses in technology. The latter is not a prerequisite.
Type of course: 15 hours of supervision.
Contents: The starting period and completion are decided by the supervisor and the student. All periods are relevant. The course will normally consist of work where the aim is to combine assignments of theoretical or experimental nature with practical ones. The work can for example include a study of a relevant problem that can be solved by way of literature study or theoretical analysis. Other types of assignments can be more consultancy or task-oriented, where one can solve a problem in collaboration with a municipal or industrial partner or in collaboration with an ongoing research project.
Learning outcomes: The goal of the project work is to provide the students with experience in solving concrete problems of a scientific, analytical or practical, technical nature. The students also get practice in project planning and in reporting the achieved results.
Methods of examination: Final **Grading:** A-F
Assessment methods: Project.

THT310 Ecological and Conventional Systems for Treatment of Water

Ecological and Conventional Systems for Treatment of Water

Credits: 15 **Language:** English upon request
Staff/institute: Lasse Vråle/ IMT
Teachers: P.D. Jenssen, H. Ratnaweera, A. Heistad.
Start term: August block
Terms: August block Autumn parallel
Mandatory activities: Exercises.
Prerequisites: THT280 or THT282 and THT271.
Type of course: Lectures: 66 hours. (6 hours per week for 11 weeks). Review of exercises: 4 hours. Presentation and discussion of a semester project: 12 hours. A one or 2-day excursion.
Contents: The course provides in-depth knowledge of processes in nature based and alternative (ecosan) treatment systems as well as conventional systems for water and wastewater treatment. In addition the course contains design procedures and dimensioning of treatment systems. The course will also focus on systems evaluation and selection of appropriate systems for rural and urban settings. Through applied exercises and the semester assignment, students will gain experience which prepares them for professional work. The course also contains field work and one excursion.
Learning outcomes: The students shall upon completion of the course be able to select and design appropriate treatment systems for water and wastewater. Furthermore, the students shall be able to analyse different treatment systems and synthesise knowledge of geology, biology, ecology and technology to design treatment systems that are adapted to local conditions.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Oral examination, 45 minutes, 3/4. Project assignment 1/4.

TMP301 Machinery and Product Development

Machinery and Product Development

Credits: 15 **Language:** English upon request
Staff/institute: Tor Anders Nygaard/ IMT
Teachers: Bøe Jan Kåre, Stemsrud Egil.
Start term: August block
Terms: August block Autumn parallel
Mandatory activities: All compulsory exercises which are part of the august block (not part of the main project) shall be handed in and approved by the end of September. Approval is only valid for one calendar year.
Prerequisites: Students must have gained the necessary knowledge in materals technology and engineering, calculation and sizing of machinery parts, technical design and FEM-analysis, either by the relevant TMP200 courses or by similar education and/or experience.
Type of course: August block: Lectures: 24 hours, 6 hours per week, Exercises: 20 hours, calculation exercises and laboratory work (guided) 4 hours per week. Autumn parallel: Lectures: 36 hours. Week 36-41: 3+3 hours per week. Exercises; 24 hours, Week 40-46: 4 hours per week. Project paper: 30 hours, Week 38-49: 2-4 hours per week (plus homework), with academic supervision.
Contents: The course has four phases: Part 1. Basic design (August): Central topics are technical standards, stress and safety calculation for complex parts, the choice of materials and design based on functional, environmental and aesthetical requirements, production and joining methods, finish and surface protection, traditional and CNC-controlled production technologies, Part 2. Advanced design and optimization: Central topics are safety calculation and testing methods for complex constructions and assemblies, non-linear deformation processes, dynamic loading, fatigue, energy absorption and lifetime calculations, industrial ecology, This part also includes more advanced training in FEM-analysis/calculation programs. Part 3: Project planning: Planning, organising, carrying through and reporting a development process, rules, systems and guidelines. Part 4. Compulsory project work: A limited design and product development project is carried through with the submission of a report/disc containing all necessary backgrounds, calculations and descriptions for the manufacturing of a prototype. The projects are to a large extent carried out in cooperation with enterprises, or as an early phase in technology development at the department.
Learning outcomes: Students are to gain competence in projecteering, calculation, design and visualization of complex machinery- and process-technical constructions, and in the use of computer based design and production technologies. The students are to practice development cooperation, enterprise cooperation and important elements of small-scale industrial

production of new products. After having completed the course, the student is to have knowledge on methods for calculating the properties of materials, strength and lifetime of various types of constructions and evaluate results from complex calculations and analysis tools. They are to be able to make choices concerning design and materials from considerations of strength, economy and environment and give advice on the technical aspects of production. Also, they are to have good knowledge of modern computer assisted production methods for different product categories. Through the course, the students are to gain abilities that make them suited for conducting every engineer-technical phase in a product development project, individually or in teams with others. They are to be able to plan, conduct, calculate, visualize and report a new technological product with production instructions. Throughout the course, there is a focus on the effects of technology on the environment and on human beings, among other things through the use of energy, material ecology and pollution aspects.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam: Project presentation with examination, counts 50%. Project work: Project report with appendixes, counts 50%. Continuous assessment: All smaller tests during the august block has to be approved (by the end of September) before the final examination. The project work must be completed one week before entering the final oral examination. The oral examination consists of an assessment of theoretical knowledge as well as a presentation and discussion of the project work. The project work is assessed on basis of a set of criteria which are available to the student.

TMPP212 Materials Science and Engineering II, Organic Materials

Materials Science and Engineering II, Organic Materials

Credits: 10 **Language:** English
Staff/institute: Johan Andersen/ IMT
Teachers: Wicklund Trude.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: One of the laboratory exercises and one of the written project papers are compulsory.
Prerequisites: Bachelor's degree or; General chemistry at the level of KJM100, Physics at the level of FYS100 and Mathematics at the level of MATH010.
Type of course: Lectures: 52 hours, 4 hours per week. Self-study and group work: 52 hours, 2 hours per week. Laboratory exercises: 20 hours.
Contents: Part 1: Synthetic polymers (Plastics and rubbers). Structures of polymers, the effect of molecular bindings on mechanical properties. Resistance to denaturising related to water and chemicals. Structure, properties and application of composite materials. Part 2: Biopolymers (Proteins and polysaccharides). Structures of proteins, the effect of molecular bindings on mechanical properties. Resistance to denaturising related to water and chemicals. Part 3: Viscoelasticity in biomaterials (Dynamic- and mechanical properties). Part 4: Cereals as raw material in feed products. Characterisation of basic components and there transformations in processes like extrusion, pelleting, expanding, and how these processes change the properties of the raw materials.
Learning outcomes: The aim is to build up basic knowledge about why materials with a biological origin have some specific mechanical properties. These properties are measured as a response of some known external force, and the topic is called Rheology. One example is cereals as raw material in feed products. How these properties will be affected by water content, temperature and pressure is important. The student shall gain material technology knowledge which links the properties of single material components to the properties of a mixed multi-component material focused on the bindings between molecular structures. The mechanical properties should be expressed in notions with reference to physics, chemistry and mathematics. It is important to gain knowledge about how to describe and classify biomaterials and to be aware of the similarities in properties between synthetics and biologic polymers.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The continuous assessment is based on a personal written report and common tests.

TMPP250 Process Technology I

Process Technology I

Credits: 10 **Language:** English upon request
Staff/institute: Tor Kristian Stevik/ IMT
Teachers: Salas Carlos, Lekang Odd-Ivar.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Two exercises.
Prerequisites: FYS112 - Mechanics and Thermophysics, MATH111 - Calculus I, MATH112 - Calculus II. Alternative: Bachelor's degree in Engineering (special criteria for the Master's degree in Feed Manufacturing Technology).
Type of course: Lectures: 44 hours, 4 hours per week. Seminar, laboratory exercises and calculation exercises with guidance: 26 hours, 2 hours per week. Semester assignment.
Contents: The first part of the course contains an introduction to basic principles of energy-balances, fluid-theory, heat-exchange and contact equilibrium. The second part deals with various examples of important processes, as well as the layout and function of relevant technology. Emphasis is given to calculations and dimensioning. The last part deals with optimising a given process.
Learning outcomes: After the course, students will have acquired basic knowledge about material- and energy balances, flow in fluids, heat-transfer and contact equilibrium. They will be able to use terms and calculation methods for the following processes; Separation, concentrating, vaporization, extruding, dehydration, cooling and freezing. Emphasis is put upon linking basic subjects as mathematics, chemistry and physics to real life examples. Furthermore, the students will be trained in improving and documenting certain processes. It is also important to give the students training in teamwork with experts in order to solve mutual tasks.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam.
Examination aids: Simple calculator, no other examination aids

TMPP350 Process Technology II

Process Technology II

Credits: 15 **Language:** English upon request
Staff/institute: Johan Andersen/ IMT
Teachers: Stevik Tor Kristian, Lekang Odd Ivar, Nygaard Tor Anders et.al.
Last time the course is offered: HØST
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Reports form excursions and industry-seminars are compulsory. Also, journals/other assignments from the group exercises must be approved before the students can enter the exam.
Prerequisites: MATH112 - Calculus II, FYS112 - Mechanics and Thermophysics, TEL230 - Control Engineering, TMPP250 - Process Technology I, or equivalent.
Type of course: Lectures/seminars: 24 hours, 6 hours per week during the first 4 weeks. Group work, exercises and project assignment: 72 hours, 6 hours per week for 12 weeks, with guidance.
Contents: Calculations and numerical methods in certain fields of thermodynamics and fluid dynamics. Internal transportation and logistics for raw materials. Topics in advanced control theory and leadership of development projects. Quality control. production planning (for instance within agroproduction, food-processing, aquaculture, waste-treatment, energy systems etc.) Production and process optimization, project planning, project work and reporting. Feasibility studies. A larger individual projekt task, preferreably in collaboration with reaserchers/industry.
Learning outcomes: On completion of this course, the students should be able to lead a development activity related to: analysing, simulation and optimisation of single unit processes or complete production systems. It is important for the students to gain experience in an analytic way of solving problems, based on science in physics, chemistry and mathematics in relationship to control and process engineering.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam, approx. 45 minutes, with presentation and discussion of the project work. Project report must be submitted at least one week before the oral exam.

TPS220 Bulk Solids Handling

Bulk Solids Handling

Credits: 5 **Language:** English
Staff/institute: Johan Andersen/ IMT
Teachers: Salas Carlos.
Last time the course is offered: HØST
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Laboratory exercises are compulsory.
Prerequisites: General chemistry equivalent to KJM100 - General Chemistry. Physics equivalent to FYS 100 - Physics and Nature.
Type of course: Lectures: 26 hours, 2 hours per week. Laboratory exercises: 12 hours, 2 hours per week.
Contents: Mechanical properties of granular materials. Fractioning and Weibull analysis. Transport of solid bulk materials. Design of different types of transport systems with emphasis on pneumatic conveying and fractioning of products during transport. Segregation and mechanisms related to this phenomenon. Methods for design of silos. Flow patterns inside silos.
Learning outcomes: On completion of the course, the students should be able to carry out measurements of parameters related to technical quality of bulk solids, based on production process knowledge of granulated biological raw materials. Be able to describe the physical mechanisms related to fraction of particles and segregation of particles of different sizes. Complete design of systems for transport and storage of bulk solid materials.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: Continuous assessment, ending with written exam, 3 hours.

ZOOL300 Ecological Entomology

Ecological Entomology

Credits: 10 **Language:** English upon request
Staff/institute: Eline Benestad Hågvar/ INA
Teachers: Midtgaard, Fred (shared course responsibility).
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Seminars.
Prerequisites: ZOOL240, ECOL200.
Type of course: Presentations and discussion of scientific articles: 2x2 hours per week for ca. 12 weeks.
Contents: The first hour is devoted to the student's presentation of a scientific article, and the second hour is devoted to a common discussion of the paper. Here we put a critical view on the results and put the conclusions in a broader ecological frame. The entomological articles are grouped in different topics, e.g. tritrophic interactions, plant defence, competition, population dynamics/fluctuations, ecological effects of gene modified plants on insects, habitat fragmentation/metapopulations/scale, biodiversity/indicators/conservation, ecological effects of biological control. The teachers give an introductory review (1-2 hours) on each main topic.
Learning outcomes: The students should acquire a critical attitude towards published results in ecological entomology and be able to apply the theory in practical situations. They should be familiar with reading, understanding and presenting scientific papers within ecological entomology and be able to discuss the results within a broader ecological frame. Based on the discussions, the student should be able to judge different point of views in environmental questions, included ethical problems. The papers will also give new scientific knowledge within certain topics.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F

Assessment methods: The exam has two parts: A final oral exam which counts 3/5, where scientific articles are presented and discussed. This takes about 30 minutes. The last 2/5 represents the student's oral and written presentations during the seminar, together with his/her activity during the discussions. It is not necessary that the student passes every evaluated element in the course to pass the entire course. A passing grade is based on the overall quality of the entire evaluated material.

ZOOL310 Behavioural and Population Ecology

Behavioural and Population Ecology

Credits: 10 **Language:** English upon request
Staff/institute: Geir Andreas Sonerud/ INA
Teachers: Svein Dale.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Seminars with teacher present: approx. 40 hours.
Prerequisites: ZOOL250 and ECOL200, and ZOOL210 or ZOOL220.
Type of course: Seminars with teacher present: approx. 40 hours.
Contents: The content of the course is given by the content of the research articles that are selected for presentation. The articles are selected by the teachers. To secure that the collection of articles selected for the course is up to date, less than 20% of the articles used in one year are being used the next year. Each seminar lasts two hours, and includes the presentation and discussion of two articles. These two articles are on the same topic, and are selected to supplement each other, for instance by representing conflicting results and interpretations.
Learning outcomes: On completion of the course, the students should be able to understand the content of research articles in international peer-reviewed journals on topics in behavioural ecology and population ecology. The students are also to be able to evaluate the scientific value of such articles, and to present such articles critically to a group of professional colleagues.
Methods of examination: Continous assessment. The teacher should be able to document how the various course activities are to be assessed, if they need to be passed, and how they are weighted when determining the course's final grade. **Grading:** A-F
Assessment methods: The exam has two parts: 1) A final oral exam of about 40 minutes, which counts 4/5 of the grade. In this exam, the student will be examined in three scientific articles selected by the teachers. One of these articles has been presented by the student himself/herself in a seminar, while the two others have been presented by other students. 2) The last 1/5 represents the student's oral and written presentations during the seminar, together with his/her activity during the discussions.

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