Course Catalog 2009/2010

Norwegian University of Life Sciences

- Deadline for registration from August block: Friday 14 August

- Deadline for registration for Autumn parallel: 15 September

- Deadline for registration for January block: 8 January

- Deadline for registration for Spring parallel and June block: 15 February

COURSE CATALOG 2009/2010

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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 aspiring to be one of the 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. More than 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 of your own study programme.

I encourage you to study what we have on offer in this pamphlet of the courses offered in English in 2009/2010. 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 3 100 students at UMB, of which more than 15% are international students. UMB has exchange agreements with approximately 90 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 2009/20010

Autumn Semester 2009
3 – 7. August: Introduction for new international students
10 August: Semester starts
10 - 29 August: August block period
12 August: "Graskurs" (Information day for new students) - 12:00 - 16:00 no classes
14 August: Matriculation in Aud Max (for degree students) 13:00 - no classes after 12:00
14 August: Deadline for registration/withdrawal for August block
31 August: Examinations for August block

1 September - 4 December: Autumn parallel period
15 September: Registration deadline for Autumn parallel

15 October: Registration deadline for re-examination in December
28 October: Career Day - 12:00 - 16:00 no classes

15 November: Deadline for withdrawal from master's thesis
15 November: Deadline for withdrawal from Autumn parallel
15 November: Deadline for withdrawal from re-examination in December
25 November: General Meeting for students - no classes 12:00 - 16:00

7 - 18 December: Examination period for the Autumn parallel
15 December: Deadline for the submission of master's thesis
21 and 22 December: **Re-examination in December**
23 December - 3 January: Christmas holiday – no classes

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

Spring Semester 2010
4 January: Semester starts
4 – 22. January: January block period
8 January: Registration/withdrawal deadline for January block
25 January: Examinations for January block
26 January - 7 May: Spring parallel period

15 February: Registration deadline for Spring parallel
15 February: Registration deadline for June block

15 March: Registration deadline for re-examination in May

27 - 5 April: Easter Holiday – no classes
15 April: Deadline for withdrawal from master's thesis
15 April: Deadline for withdrawal from Spring parallel
15 April: Deadline for withdrawal from June block
15 April: Deadline for withdrawal from re-examination in May

5 May: General Meeting for students - 12:00 - 16:00 no classes
1 May: May Day. Public holiday – no classes
8 May: "Ringfest" (celebration for graduating students)
13 May: Ascension Day. Public holiday – no classes
15 May: Deadline for submission of master's thesis
17 May: National Day. Public holiday – no classes
10 - 26 May: Examination period Spring parallel

24 May Whit Monday. Public holiday – no classes
27 - 28 May: Re-examination period
31 May - 24 June: June block period

11, 18 and 25 June: Examination days for June block
25 June: End of semester

Note: Democracy hour Wednesdays: 12:00 - 14:00 no classes

If the above dates fall on a Saturday, Sunday or a public holiday, dates and deadlines are postponed to the next working day. There is no teaching from the Monday after Palm Sunday until after Easter Monday; teaching starts again on the first Tuesday after Easter. There are no classes 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
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 done 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 3100 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 15% of all students. Of the 940 University staff, more than half hold scientific positions.

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Bachelor English

Master 2-year English

Studyprogrammes Bachelor

Bachelor in Development Studies

Language of instruction: English.

Credits: 180

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

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 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 programmes Development and Natural Resource Economics, and Ecology, and the Norwegian master 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 attracts a significant number of 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. Student exchange to other parts of the world is also possible. It will also be possible to extend the stay to undertake field work for the bachelor 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 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 85-90 credits of compulsory courses, 25-30 credits of exchange courses, a 15 credit bachelor thesis plus 45-55 credits of elective courses. Non-Norwegian speaking students are limited to two sample plans. Norwegian speaking students can choose between seven sample plans or design their own.
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 80 credits at the 200 level. The Study Coordinator will provide guidance regarding the choice of electives.

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.

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 to both Norwegian and international students.

Cooperation with other institutions:

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

Possibilities for study abroad:

Sections of the programme may be completed abroad. 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 oral or written examinations or continuous assessment.

Contents:

For Norwegian students the Master's programme in Aquaculture consists of: 30 compulsory 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 200-level, included AKA260 (10 stp, compulsory course). 30 stp. are optional and the Master's thesis is 30 credits. For international students the Master's programme in Aquaculture consists of: 30 credits compulsory aquaculture courses at 300-level within fish breeding, fish nutrition, special course in aquaculture and planning and design of aquaculture plants, 40 credits compulsory courses at 200-level, 20 credits are compulsory and Master's thesis (30 credits).

Student guidance:

The programme has a student adviser.

Quality assurance:

Approval of all alterations and rules are done in the Study Committe. Final course evaluations are also considered 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's degree or equivalent degree with a major or specialisation 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 programme 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 programme 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 programme qualifies for Ph.D. studies.

Internationalisation:

This is an international Master s programme 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 2008/2009, parts of this programme will be conducted in close cooperation with The Collaborative MSc program in Development and Natural Resource Economics . This programme 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). The cooperation with the collaborative master's programme relies on funding from the NOMA scholarship program.

Possibilities for study abroad:

The students on this Master s programme will have the opportunity to go to Mekelle University in Ethiopia the second semester in this master s programme (spring 2010). A compulsory part of this programme is doing field work for the thesis research in a developing country preferably in the summer between the second and third semester. This field work is a core aspect of this Master s programme. It enables the students to get first hand experience with working and doing research in a developing country.

Learning outcomes:

The programme 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 programme 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 assessment methods are used, including final examinations, semester papers and assignments.

Contents:

The programme consists of compulsory courses 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 to compulsory field work, the master s thesis and elective courses.

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 larger assignments.

Quality assurance:

This programme 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 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 or the Tribhuvan University in Nepal. 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:

A basic aim of the programme is to enhance the students' understanding and appreciation of social and cultural differences that are important for development. 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 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.

Student Assessment:

Most courses use different evaluation methods. In some, student work is evaluated continuously on a pass/fail basis, while the final grade is determined by a final examination or a semester assignment. Other courses will only have a final examination or a single semester assignment.

Contents:

The programme is normally of two-year duration. The programme consists of relatively few core corses; Introduction to Development Studies, Development Theory and Policy, two methods courses and one field course in Uganda/Nepal. In addition, the students will combine elective courses according to interests. All courses given by Noragric are preapproved. It is also possible to take courses at other departments and universities, although such courses must be approved in each case. A master thesis based on individual data collection, is mandatory. Most students write a 30-credit thesis, but a 60-credit thesis is optional.
A minimum of 30 course credits must be at 300 level, and maximum 10 credits can be at 100 level. At least 30 credits must be taken at Noragric.

Student guidance:

During the introduction course in August, students will be given introduction to the programme and guidance concerning their academic progression. In their final year, the students will be assigned a supervisor who will assist in the development and completion of the master thesis.

Quality assurance:

The main basis for programme evaluation is the 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 its equivalent, in Natural Sciences (biology, ecology, agricultural or environmental sciences) with basic knowledge in statistics/research methods.

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:

Engelsk:This is an English taught Master s programme with students from many countries. All courses in this programme are taught in English, and focus on general questions in ecology and natural resource management. Ecological effects of environmental change, e.g. deforestation and climate change, are global. The program provides a fine opportunity to study ecological processes in an international perspective.

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 for instance in Asia and Africa.

Possibilities for study abroad:

The course allows for the possibility of studying abroad, provided the student takes the compulsory 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 plant 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 compulsory 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 compulsory for all students: Conservation Biology and Scientific Methodology in Ecology and Management of Natural Resources. For students with weak statistical background a course in statistics is recommended. In addition for students that follow the study direction General Ecology: Global Change Ecology, Genetic Basis of Biodiversity and at least one of the following 300-level courses: Photobiology, Pollination and Reproductive Ecology of Plants, Molecular Evolution, Ecological Entomology, Behavioural and Population Ecology, Landscape Ecology, Ecology and Management of Rivers and Lakes, Environmental pollutants and Ecotoxicology or Restoration Ecology. In addition for students that follow the study direction Tropical Ecology and Management of Natural Resources: Tropical Ecosystems and Biodiversity, Ecology and Management of Natural Resources in the Tropics, Restoration Ecology and Community Based Natural Resource Management.

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, field work, 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's degree also gives possibilities for Ph.D. studies within feed manufacturing technology.

Internationalisation:

The programme of study is open to 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 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, excursions, independent studies, exercises, seminars and teaching by students.

Student Assessment:

Examinations, individual reports 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 compulsory core subjects (55 credits). Students may complete the remaining 35 credits by choosing other subjects offered at the Norwegian University of Life Sciences (UMB). Total: min. 120 credits.

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 assessed 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

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 to 30 September), the students take a 15-credit course at Noragric's regional partner institutions, for example Makerere University in Uganda and at Tribhuvan 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 field 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 governance 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 development organisations, policy arenas and processes, international conventions and agreements. Understanding the linkages between challenges at global, national and down to local levels of governance 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 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 30 course credits must be at 300 level, and a minimum of 30 course credits must be taken at Noragric. Maximum 10 credits can be at 100 level. Apart from the above requirements, the study programme is open concerning coice of corses at Noragric. Courses taken at other departments and universities require 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:

The students have access to advisers 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.

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:

Engelsk:Bachelor's degree (BSc) or 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 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, if necessary limit of students..

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 (2 x 10 ECTS credits), three specialist modules (2 x 10 ECTS credits) and a research project (1 x 60 ECTS credits). 15 ECTS are eligable. 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: 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, Øyvind Andersen and Anna Sonesson.
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: AKX100, 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.
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 must be approved. Grades are set based on the final examination.

AKA260 Aquaculture - Breeding and Genetics

Aquaculture - Breeding and Genetics

Credits: 10 **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: 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 must be approved. Grades are set based on the final examination.

AKA350 Optimisation of Fish Breeding Programs

Optimisation of Fish Breeding Programs

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

Terms: Autumn parallel
The course is offered: Other - The course will not be given the autumn of 2009, since the teacher is on sabbatical-leave.Kurset går ikke høsten 2009 fordi eneste lærer i kurset har permisjon.
Mandatory activities: Submission of case work.
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: Final **Grading:** Pass/Fail
Assessment methods: In addition to the compulsory semester assignment, there will be emphasis on contributions during the group work.

AKE251 General Aquaculture - Nutrition

General Aquaculture - Nutrition

Credits: 10 **Language:** English
Staff/institute: Anders Kiessling/ IHA
Teachers: Researchers from NOFIMA and from Aquaculture Protein Centre, School of Veterinary Science.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Demonstrations, exercises and quizzes.
Prerequisites: BSc in life science or third year BSc studies at UMB.
Credit reduction: Overlapping with HFE200.
Type of course: Structured teaching time will be roughly divided as follows: Lectures: 4 hours per week (total 44 hours). Group tutorials: 2 hours per week (total 30 hours). Demonstrations: Total 10 hours.
Contents: This course is an introduction to animal nutrition with special emphasis on fish, constituting a platform enabling the student to specialize in monogastric nutrition of both aquatic and terrestrial animals. It also formulates the platform for further studies of specific feed types and feed technology. The course is broad in this sense, and may be divided into 3 sub-topics: 1. Nutrients: (Macro and Micro nutrients). 2. Feed evaluation and digestibility: (Feed composition, Digestion and Feed utilization). 3. Intermediate metabolism: (Energy partitioning, Catabolism and Anabolism of macro nutrients). Particular emphasis is placed on understanding relationships between the different sub-topics.
Learning outcomes: The aim of the course is to provide students with a basic understanding of nutrition with emphasis on monogastric animals and in particular fish. The student should gain an understanding of the main components of the diet and their interrelationships and importance for the animal. The student will be brought up to date in the area of aquafeeds and in addition be given an introduction to feed composition, feed evaluation and calculation of feed rations 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: During the course there will be three sub-exams (1 hour each) based on the questions of the exercises of the three sub-sections, nutrients, digestion and intermediate metabolism. Each sub-exam will receive grades and each account for 15% of the total grade. The course will end with a final written examination, focusing on the interrelationship between the three sub-sections. This final examination will contribute 55% to the final grade. Passed in all examination-parts and registered participation at the demonstration are compulsory in order to be allowed to sit the final examination (3 hours).

AKE310 Aquaculture Nutrition

Aquaculture Nutrition

Credits: 10 **Language:** English
Staff/institute: Anders Kiessling/ IHA

Teachers: Researchers from NOFIMA, from Aquaculture Protein Centre and from Norwegian School of Veterinary Science.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Participation in all parts of the practical feed project including written and oral group presentation. Personal project including written and oral presentation.
Prerequisites: General nutrition at 200 level (HF200) or Introduction to Aquaculture Nutrition (AKE251) or equivalent.
Type of course: 2-4 hours of lectures and theoretical exercises per week. 4-10 hours of practical projects per week. The remaining time is 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: 35 %, Oral examination: 40 %, activity in whole and carrying out of subsection of group project 25%.

AKX251 General Aquaculature - Anatomy and Health in Farmed Fish

General Aquaculature - Anatomy and Health in Farmed Fish

Credits: 10 **Language:** English
Staff/institute: Anders Kiessling/ IHA
Teachers: Relevant teachers from UMB, Norwegian School of Veterinary Science, Faculty of Life Sciences at Copenhagen University.
Start term: August block
Terms: August block Autumn parallel Spring parallel June block
Mandatory activities: Exercises, demonstrations, field weeks and project.
Prerequisites: BSc in life science.
Credit reduction:
Type of course: The course starts in the August block with a four week full-time lecture session combined with short exercises. This introduction block is followed by a one-week field course early in 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 examination. During the second lecture 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. A field week in late May/early June, again synchronized with the other partners of the NOVA network, will end the course. The project will be finalized during the last 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 that 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 requirement to pass the written examination 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, Ingrid Olesen, Bente Ruyter.
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 excursions and visits to applied research institutions. The student is expected to present her/his impressions in the excursion report which has to be approved before the examination.
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 factors regulating 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: Written multiple choice examination.
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: All student projects are compulsory.
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%.

AOS233 Strategiske prosessar og avgjerdetaking

Strategiske prosessar og avgjerdetaking

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 semester assignment, case analyses and presentations. Semester assignment: 60 %. Cases and presentations: 40 %.

APL100 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: Elin Børrud/ 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
Staff/institute: Lars-Gustav Snipen/ IKBM
Teachers: Tahir Mehmood
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Prerequisites: Introduction to bioinformatics equivalent to BIN210. Programming knowledge equivalent to INF110. Statistics equivalent to STAT250.
Type of course: Lectures: 2 hours per week. Computer lab exercises: 4 hours per week.
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. The student should also be able to present subject-relevant material both orally and in writing.
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
Mandatory activities: Yes.
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. 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: Two approved hand in assignments and one home exam

BIO220 Eucaryot Molecular Biology

Eucaryot Molecular Biology

Credits: 5 **Language:** English upon request
Staff/institute: Hilde-Gunn Opsahl Sorteberg/ IPM
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Study groups and semester assignment presentations (at least 80% attendance).
Prerequisites: BIO120.
Type of course: Lectures: 22 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. The students will also gain an increased understanding of how genes determine the resulting organism, including food quality.
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 provides a basis for further studies in biotechnology, livestock breeding, food, plant breeding, bioinformatics and medicine. Students should also learn how to use literature for solving problems, with elements of problem-based learning in colloquia. This is to repeat the basis of molecular biology as well as opening up for increased current learning. Optionally, a term paper can be written for 5 extra credits individual work in addition to BIO220. This requires a thoroughly written paper using primary litterature according to scientific standards for publications.
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 organic farming require its own species? Is gene modification different from the old methods of acquiring new breeds? What is your advice to 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 increasing farmland acreage. Since the discovery of Mendel's laws, increased production has taken place on the same land 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 controls 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 organic farming require different 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 BIO222. 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 absence).
Prerequisites: BIO120 or equivalent.
Type of course: Exercises: 4 hours per day 4 days a week for 3 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
Mandatory activities: Attendance in 80% of the practical classes
Prerequisites: Fundamental knowledge about plant physiology is an advantage.
Credit reduction: A student is only awarded credits for BIO240 and BIO242 (15 credits total). You will not be credited for BIO241 if BIO240 and 242 are conducted.
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 give 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
The course is offered: Even years
Mandatory activities: Attendance in 80% of the practical classes

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
The course is offered: Even years
Mandatory activities: Group work, laboratory exercises. Compulsory attendance in 80% of the practical classes.
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 Act on 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 og Hilde Kolstad
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). 4) Transmission electron Microscopy - TEM. 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. 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.

BIO301 Advanced cell biology

Advanced cell biology

Credits: 10 **Language:** English upon request
Staff/institute: Tor Erling Lea/ IKBM
Teachers: Charlotte Kleiveland, Trine Nilsen
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Cell biology corresponding to BIO100. Biochemistry corresponding to KJB200.
Type of course: Lectures or Colloquia 4 hours/week.
Contents: The main focus of the course will be on the understanding of mechanisms for cell communication, different receptor groups, principles for intracellular signal transduction including adapter proteins, scaffolding proteins and activation of central transcription factors. The course will also give the students an introduction to central concepts of stem cell biology.
Learning outcomes: After completing course, students should have good insight into molecular mechanisms of eukaryotic cell biology and important concepts of stem cell biology. Understanding the principles of cell communication, cell interaction and intracellular signal transduction will be prioritized. The students should acquire knowledge about central signaling pathways controlling growth and differentiation processes, how these signaling pathways are regulated and which

transcription factors that are affected. These learning aims should contribute to the students' development of skills, enabling them to acquire relevant literature on the subject and to formulate scientific problems within cell biology.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: No calculator, no other examination aids

BIO320 Development Biology

Development Biology

Credits: 5 **Language:** English upon request
Staff/institute: Hilde-Gunn Opsahl Sorteberg/ IPM
Teachers: Olsen, Odd-Arne
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
Staff/institute: Odd Arne Rognli/ IPM
Teachers: Siri Fjellheim, Simen Rød Sandve
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Each student have to take part in a presentation of a selected seminal paper in the class as a basis for a discussion involving the teacher and the students.
Prerequisites: BIO120 - Introduction to Genetics, MATH100 - Introductory Mathematics, STAT100 - Statistics.
Type of course: Lectures: 2 hours per week for 12 weeks. Student presentations: 2 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: Final Oral exam **Grading:** A-F
Assessment methods: Oral examination is based on the complete syllabus, i.e. textbook and selected papers.

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
Mandatory activities: Yes.
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.The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research 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: Approved semester assignment and written examination.

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 (introductory Plant Breeding, PLV220 (Introductory Plant Pathology) or courses at similar level.
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 these 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: Final Written exam **Grading:** A-F
Assessment methods: Written examination counts 2/3 and assessment of the report 1/3.
Examination aids: No calculator, no other examination aids

BIO330 Environmental Microbiology

Environmental Microbiology

Credits: 10 **Language:** English upon request
Staff/institute: Åsa Helena Frostegård/ IKBM
Teachers: 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. Written report from one seminar.
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
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: January block: three weeks (120 hrs) laboratory course, with some lectures. Spring parallel: 2 seminars / lectures in the first half of the parallel, will be announced by the course responsible. Submission of written report: week 9; Oral exam: week 11 or 12.
Contents: The course is an intensive laboratory course during weeks 2-4. 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. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research 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: 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 hands in an independent assignment. In addition, there will be an oral exam where the student is asked questions concerning the written report and related topics. An external examiner will participate at the oral exam. Grades A-F will be given for both the written report and the oral exam (contributing 50% each to the final grade), and both parts have to be approved.

BIO333 Mycology

Mycology

Credits: 10 **Language:** English upon request
Staff/institute: Arne Tronsmo/ IKBM
Teachers: Rolf Arnt Olsen, Linda Hjeljord
Last time the course is offered: HØST
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. Molecular biology equivalent to BIO210
Type of course: Lectures: 4 hours per week. Seminars or experimental work: 4 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. The students should be able to consider possible positive and negative effects of fungi, suggest actions to limit any possible risks, and be able to classify fungi using morphological techniques.

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: Participation in lectures is compulsory.
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 assessment and consequence analyses. 3: Ethics and ethical evaluations. During the rest of the course, the students will write a semester assignment on a subject of their own choice.
Learning outcomes: Students should get acquanted with the legislation in the field and know the central participants that researchers work with. 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: Olsen, Odd-Arne
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
Staff/institute: Odd Arne Rognli/ IPM
Teachers: Siri Fjellheim, Simen Rød Sandve
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Each student have to take part in a presentation of a selected seminal paper in the class as a basis for a discussion involving the teacher and the students.
Prerequisites: BIO120 - Introduction to Genetics, MATH010/MATH100 - Introductory Mathematics, STAT100 - Statistics.
Credit reduction: Credit reduction in relation to BIO321: 10 credits.
Type of course: Lectures: 2 hours per week for 12 weeks. Student presentations: 2 hours per week for 12 weeks.Presentation and discussion of semester assignment: 3 hours.
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: Oral examination is based the complete syllabus, i.e. textbook, selected papers and term paper. Oral examination from the textbook and selected papers counts 2/3, and the term paper, including examination, counts 1/3

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: Autumn parallel
Terms: Autumn parallel
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-page 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%.

BOT200 Plant Physiology

Plant Physiology

Credits: 10 **Language:** English upon request
Staff/institute: Jorunn Elisa Olsen/ IPM
Teachers: Engineer Linda Ripel, PhD-student Micael Wendell
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Approved laboratory course with approved participation and approved reports.
Prerequisites: BOT130, KJM100.
Type of course: Lectures: 26 hours. Laboratory course: 30 hours.
Contents: The topics of the course are the metabolism and regulation of growth and development in plants as well as the effects of environmental and climatic factors in these respects. The experimental nature of the field is emphasised by experimental work related to the topics of the course as well as by reporting experimental results.
Learning outcomes: The course gives knowledge and understanding of the structure and functions of plants. The course also gives the students knowledge of the responses of plants to environmental and climatic conditions and how these interact with the metabolism and mechanisms of plant growth regulation. The course provides experience in the conduction of practical experiments and the presentation and discussion of experimental results. The course also provides practice in the application of methods and terminology of the field as well as cooperation in groups.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination
Examination aids: No calculator, no other examination aids

BOT230 Plant Ecology

Plant Ecology

Credits: 5 **Language:** English upon request
Staff/institute: Ørjan Totland/ INA
Teachers:
Start term: August block
Terms: August block
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: 20 hours.
Contents: Field demonstrations, field teaching, independent field work exercises, lectures
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 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:** Pass/Fail
Assessment methods: The exam consist of approval of field reports

BOT250 Plants and Health

Plants and Health

Credits: 5 **Language:** English
Staff/institute: Kåre Lye/ INA
Teachers: Knut Asbjørn Solhaug and Torunn Stangeland.
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 give an introduction to the history of medication, the use of plants in various alternative methods of healing, 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 should achieve a good understanding of how plants in different parts of the world are being 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 Developmental Physiology

Advanced Course in Plant Developmental Physiology

Credits: 15 **Language:** English
Staff/institute: Christiaan van der Schoot/ IPM
Teachers: Rinne, Päivi L.H
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: A 30 minute ppt seminar on 1-2 recent scientific publications.
Prerequisites: BOT200.
Type of course: Lectures: 30 hours. (or: lectures 20 hours. Colloqia 12 hours. Labclasses 50 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. From 2009 onwards lab classes will be dependent on the replacement of teaching equipment.
Learning outcomes: The course provides opportunities to develop 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 presenting and discussing scientific material.
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 put 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 put 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 students' interests and requirements.
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 (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. 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: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam

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
Mandatory activities: A case must be handed in and approved in order to take the final examination.
Prerequisites: Introductory courses in mathematics, statistics and micro economics.
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.
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 formulating and solving 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 examination 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
Mandatory activities: A case must be handed in and approved in order to get the course approved.
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.
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 examination 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
Mandatory activities: A case must be handed in and approved in order to get the course approved.
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.
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 examination, counts 100%.
Examination aids: Simple calculator, no other examination aids

BUS233 Management Information Systems

Management Information Systems

Credits: 5 **Language:** English
Staff/institute: Kjell Gunnar Hoff/ 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 best-selling textbooks and is a leader in designing national curricula and accreditation standards for the information systems discipline.
Start term: June block
Terms: June block
The course is offered: Even years
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 be available on the ClassFronter.

BUS314 Corporate Governance

Corporate Governance

Credits: 5 **Language:** English upon request
Staff/institute: Ole Gjølberg/ IØR
Teachers:
First time the course is offered: SPRING 2010
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Brief written assignments
Prerequisites: Basic business, primarily financial accounting, cost accounting; finance
Type of course: Approx. 30 hours
Contents: The course will consist of traditional lecturing as well as classes, guest lectures and written assignments.
Learning outcomes: There are numerous laws and regulations related to corporate governance/risk mangagement/internal control in Norwegian companies. The course will deal with important concepts, rules and regulations, and also highlight the roles of different agents such as the borad, auditing board, administrative leadership, auditor, risk management and complience functions.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: Any calculator, any other examination aids

BUS321 Empirical Analyses of Financial and Commodity Markets - Theory

Empirical Analyses of Financial and Commodity Markets - Theory

Credits: 5 **Language:** English upon request
Staff/institute: Ole Gjølberg/ IØR
Teachers: Prof. Frank Asche, Assoc. Prof. Olvar Bergland, Prof. Alan Love.
Start term: June block
Terms: June block
Prerequisites: BUS220 and ECN202 or equivalent.
Credit reduction: 5 credit 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 students 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 examination, 3.5 hours.
Examination aids: Any calculator, no other examination aids

BUS322 Investment Analysis and Financial Risk Management

Investment Analysis and Financial Risk Management

Credits: 10 **Language:** English upon request
Staff/institute: Ole Gjølberg/ IØR
First time the course is offered: SPRING 2009
Start term: Spring parallel

Terms: Spring parallel
Mandatory activities: 2-3 assigments accepted in order to present oneself for final exam.
Prerequisites: Basic finance, statistics/econometrics, microeconomics.
Type of course: Lectures: 30 hours. Supervised exercises in the computer lab: 30 hours.
Contents: The course covers key topics and problem issues within financial market analysis and financial risk management: - stock pricing, - dividends analysis and risk, portfolio optimization, interest and currency markets - risks and risk management, - bonds pricing and management, - bond management evaluation, - forward markets - futures pricing and tools for risk management, - stock option pricing - investment and risk management through stock options, calculating capital costs.
Learning outcomes: By completing the course, the students will acquire key qualifications within contemporary financial market analysis and finance management. Key concepts include: portfolio optimization, finance management evaluation, risk analysis of financial markets, stock option pricing and calculation of capital costs.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 2-day examination. Individual analysis of a case.
Examination aids:

BUS331 Business Management Science: Methods and Techniques

Business Management Science: Methods and Techniques

Credits: 10 **Language:** English upon request
Staff/institute: Marie Steen/ IØR
Teachers: Ole Gjølberg and Carl Brønn (and possibly guest lecturers).
First time the course is offered: SPRING 2009
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Other - The course may not be given in some years, depending on the resource and personnel situation.Det tas forbehold om at kurset kan utgå enkelte år avhengig av personell- og ressurssituasjonen.
Mandatory activities: Compulsory homework/cases must be approved in order to take the final examination.
Prerequisites: Introductory Management Science.
Credit reduction: BUS330: 5 ECTS reduction.
Type of course: Approx. 30 hours of lecture and approx. 30 hours of organized computer lab sessions.
Contents: The course will be given as a "smörgåsbord" of a number of methods and techniques within Management Science and Management of the firm. The content may vary from year to year, but most of the following subjects will normally be covered: * Project Management, PERT/CPM-models. * Decision analysis. * Waiting lines and queueing theory. * Logistics. * Advanced lineær programming. * Non-linear programming. * Transportation and assignment problems. * Markov analysis. * Peak-load pricing.
Learning outcomes: Through this course the students acquire knowledge of important Management Science methods and techniques and skills to apply these in practical management of firms.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 36 hour individual take-home examination.
Examination aids: No calculator, no other examination aids

ECN150 Introduction to Development Economics

Introduction to Development Economics

Credits: 5 **Language:** English
Staff/institute: Mette Wik/ IØR
Teachers: Arild Angelsen, Stein Holden.
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Odd years
Mandatory activities: Writing of one semester assignment. The paper must be approved but is not part of the final course grade.

Prerequisites: ECN110, ECN111, or EDS140.
Type of course: Lectures: 2-4 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: 3.5 hour written examination.
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:
Prerequisites: Mathematics (MATH100), statistics (STAT100), and microeconomics (ECN210).
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 term paper.
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 the 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: 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: 60% of the final grade will be based upon a 3.5 hour written examination. 40% of the final grade will be based on a term paper.

ECN230 International Economics

International Economics

Credits: 5 **Language:** English
Staff/institute: Roberto J. Garcia/ IØR
Teachers: External lectures
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 examination.
Examination aids: No calculator, specified other examination aids

ECN270 Resource and Environmental Economics

Resource and Environmental Economics

Credits: 5 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Teachers: Ragnar Øygard.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Four out of five exercises approved.
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 and exercise review per week (some weeks only 2 hours).
Contents: Lectures and exercises will address the following issues: 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 examination, 3 hours: 100 %.
Examination aids: Any 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
Teachers: David Barton
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: ECN170 (or ECN270)or similar introductory course in environmental and resource economics; and ECN210 or similar introductory course in microeconomics.
Type of course: 28-30 hours plus supervision of the group assignments.
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 (100 %), which is prepared by groups of 2-4 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
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 economic data - both cross-sectional and time-series 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, and time-series models for stationary or non-stationary processes, cointegration and error correction models.
Learning outcomes: The successful student should be able to conduct independent econometric analysis of 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 hour final examination.
Examination aids: Simple calculator, specified other examination aids

ECN302 Mathematics for Economists

Mathematics for Economists

Credits: 5 **Language:** English
Staff/institute: Kyrre Rickertsen/ IØR
Teachers: Dadi Kristofersson.
Start term: August block
Terms: August block
Prerequisites: Mathematics on the level of MATH100.
Credit reduction:

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. Topics 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 envelope 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 course.

ECN303 Impact Assessment Methods

Impact Assessment Methods

Credits: 5 **Language:** English
Staff/institute: Stein Terje Holden/ IØR
First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Compulsory participation in exercises
Prerequisites: Econometrics (ECN201), Statistics (STAT100), basic knowledge of STATA
Type of course: 2 hours per week, combining lecture and exercise.
Contents: Basic introduction to Impact Assessment and Overview of Methods: Establishment of causality vs. correlations. Impacts of what on what? How far can the results be generalized? Introduction and exercise in use of Matching methods, Instrumental variable methods, Control function methods, Difference-in-Difference methods, Panel data methods, Pipeline and experimental methods.
Learning outcomes: An introduction to modern impact assessment methods for quantitative assessment of impacts of changes in policies, projects, shocks and other changes. An overview of the most relevant methods, their strengths, weaknesses and areas of application. An exercise is given for each of the main methods to give students as experience with their application.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3.5 hours written exam
Examination aids: No calculator, no other examination aids

ECN311 Microeconomics

Microeconomics

Credits: 10 **Language:** English
Staff/institute: Kyrre Rickertsen/ IØR
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Five problem sets must be graded as passed before taking the examination.
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, welfare measures, 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 hour written examination.
Examination aids: Simple calculator, no other examination aids

ECN312 Industrial Organisation

Industrial Organisation

Credits: 5 **Language:** English
Staff/institute: Olvar Bergland/ IØR
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Intermediate microeconomics (ECN211). Mathematics at the level of ECN302.
Credit reduction: This course replaces ECN213, a student cannot receive credits for both ECN213 or ECN312.
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 examination, counts 100%, 3 hours.
Examination aids: No calculator, no other examination aids

ECN320 Macroeconomics III

Macroeconomics III

Credits: 10 **Language:** English
Staff/institute: Ragnar A. Øygard/ IØR
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Students will be assigned three individual written assignments, two of which must obtain a pass grade. Each student must also give a presentation in class of a scientific paper, a book, a debate, or similar. Passed compulsory activities will be valid for 1.5 years.
Prerequisites: Bachelor's degree in economics or an intermediate course in macroeconomics at the level of ECN220. A repetition of core theories and models from short and medium term stabilization policy from ECN220 will be offered in the first weeks of the course.
Credit reduction: ECN352: 10 ECTS.
Type of course: 4 lecture hours per week. 2 hours per week of repetition lectures, student presentations, andexercises
Contents: Topics in the course include: 1. Growth theory. 2. The relationship between economic growth and development. 3. Poverty and inequality. 4. Stabilization policy. 5. Current issues
Learning outcomes: Students should be able to use economic models to analyze current concerns related to macroeconomic stabilization, economic growth and development. The course should also stimulate interest in current social issues and an analytical attitude.

Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: A written examination (3.5 hours)
Examination aids: Any 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 examination, 3.5 hours, 60%. Oral examination, 40%. The students have to pass both parts of the examination.

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 macroeconomy 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 examination, 3.5 hours.
Examination aids: No calculator, no other examination aids

ECN350 Development and Environment Economics

Development and Environment Economics

Credits: 10 **Language:** English
Staff/institute: Stein Terje Holden/ IØR
Teachers:
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Compulsory exercises. Group work/presentations.
Prerequisites: Basic knowledge in economic theory (microeconomics, macroeconomics, development economics, resource economics, econometrics, operations research. ECN200/201, ECN230, ECN353, ECN270.
Credit reduction: ECN450, 10 credits.
Type of course: Lectures: 2-4 hours per week. Exercises: 0-2 hours per week. Total: 4 hours per week (lectures and exercises).
Contents: Quantitative Development Policy Analysis. Economics of rural organisation. Natural resource economics, poverty 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: Final Written exam **Grading:** A-F
Assessment methods: Written examination (3.5 hours).
Examination aids: Simple calculator, no other examination aids

ECN351 Research in Development Economics

Research in Development Economics

Credits: 5 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Teachers: Stein Holden, Mette Wik, Ragnar Øygard.
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 ECN210/211 Microeconomics II and ECN220 Economics II, 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, questionnaire design 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.

ECN353 Development Economics, Micro

Development Economics, Micro

Credits: 5 **Language:** English
Staff/institute: Mette Wik/ IØR
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.
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 from 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 examination 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: Ragnar A. Øygard/ IØR
Teachers: Arild Angelsen, Stein Holden, Mette Wik.
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's 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 semester assignment a research proposal for the Master's 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.

ECN356 Issues in Development Economics: Institutions

Issues in Development Economics: Institutions

Credits: 5 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Teachers:
Start term: Spring parallel
Terms: Spring parallel
The course is offered: Other - The course offers every 3th year, (next time 2012)Kurset gis igjen i 2012. Roterer med ECN 354 og ECN 358.
Mandatory activities: Class presentation.
Prerequisites: Intermediate knowledge of micro- and development economics.
Type of course: Lectures: 12 x 2 hours per week.
Contents: The course will review 10 key articles within on development and institutions. The class will meet once a week (2h) and review one article. The course ends with a written take-home examination.
Learning outcomes: Give insights into key contributions within the field of institutions and development, e.g., related to agriculture and common property 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: Home examination (2 days).

ECN358 Issues in Development Economics

Issues in Development Economics

Credits: 5 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Start term: Spring parallel
Terms:
The course is offered: Other - The course will be given in 2010 and after that every 3th yearKurset gis i 2010 og alternerer med ECN354 og ECN356 (dvs. hvert 3. år)
Mandatory activities: Presentation in class.
Prerequisites: Intermediate knowledge of micro- and development economics.
Type of course: Lectures: 12 x 2 hours per week.

Contents: The course will review 10 key articles on a specific topic in development. The class will meet once a week (2h) and review one article. The course ends with a written take-home examination. The topic for 2009 is not yet decided, but might be development aid or climate.
Learning outcomes: Provide knowledge of the key contributions within a specific area of development economics.
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: Home examination (2 days).

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: Microeconomic analysis at the intermediate/MSc level equivalent to ECN 311. Environmental and resource economics courses at the introductory level (ECN 170 or equivalent). 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 the case studies. 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 examination, 3 hours (100%). To qualify for taking the examination, students must have participated in the case studies.
Examination aids: No calculator, no other examination aids

ECN372 Climate and Environmental Economics

Climate and Environmental Economics

Credits: 10 **Language:** English upon request
Staff/institute: Eirik Romstad/ IØR
Teachers: E. Romstad, A. Angelsen, S. Navrud, O. Bergland
First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Hand-ins. Seminars with presentations.

Prerequisites: ECN 210 or an equivalent course in microeconomics
Credit reduction: ECN370: 10 credits.
Type of course: 28-30 hours
Contents: The course consists of two main parts: i) GLOBAL CLIMATE REGIME AND NEGOTIATIONS Here we will provide the background to understand the global climate negotiations, and also to assess the different options currently being discussed in the UNFCCC process , leading up to the main climate meeting (COP15) in Copenhagen in December 2009. Topics include: - the science of climate change, how to value the future and deal with risk? - main principles for a global climate regime: tradable emission quotas or a global carbon tax? - what is a fair distribution of quotas (distribution of costs and benefits) between countries? - how much should rich countries pay for emissions reduction in developing countries, and how much should developing countries bring to an agreement? - What is the climate game? What happening at the negotiation table and in the corridors? - what is Norway's role? - how to assess the economic costs of climate change ii) NATIONAL POLICIES AND IMPLEMENTATION - what policies are available for implementing climate targets in Norway? - can technological development solve the problem? - what co-benefits can greenhouse gas emission reductions produce? - policies for implementing Reduced Emissions from Deforestation and forest Degradation (REDD) in developing countries
Learning outcomes: The course will give the students a theoretical overview, using environmental economics and game theory, and learn them to apply this to current international negotiations and national policy discussions. The aim is to show how economic tools yield insights into the current debate, and can also be used to assess different options being discussed. While the combination of theoretical overview and application is focussed on the climate issues, the integrative part of the course will also be useful to many other environmental issues.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral exam counts 100% of the grade. The students must have passed on all hand-ins.

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: Final **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, 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 deterministic and stochastic 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. Computer models will be used extensively.
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 examination, 3 hours.
Examination aids: No calculator, specified other examination aids

ECN379 Decision making and the environment

Decision making and the environment

Credits: 5 **Language:** English
Staff/institute: Eirik Romstad/ IØR
Teachers: Jason Shogren (jramses(at)uwyo.edu
Start term: August block
Terms: August block
The course is offered: Other - This course explores the behavioral economic underpinnings of environmental and resource policy in theory and practice. The goal of the course is to provide students a deeper understanding on how understanding the success and failures of economic theory and empirical applications can help make good environmental policy better, and prevent bad environmental policy from getting worse. We focus on decision making under environmental risk, conflict, cooperation, control, valuation, and prosperity. The material we will explore includes alternative theories of decision-making under risk and uncertainty, game theory, incentive design, valuation methods, and development ideas and empirical tools with special emphasis on experimental applications. Course readings will rely primarily on research papers from the literatures on behavioral economics, environmental economics, and experimental methods.Gis i august som erstatningen for ECN331. Kursbeskrivelse, se engelsk tekst
Mandatory activities: In class presentations. Term paper (preferably written with another student taking the course)
Prerequisites: This is an upper level MSc / PhD level course. Good knowledge of microeconomic theory (ECN 311 [http://www.umb.no/search/courses/ecn311]or equivalent), desirable with knowledge of game theory/industrial organization (ECN 312 [http://www.umb.no/search/courses/ecn312] or equivalent) and environmental economics (ECN 371 [http://www.umb.no/search/courses/ecn371] or similar). The course will consist of lectures, in class excercises and presentations, and a term paper (preferably written jointly with one more student).
Credit reduction: None
Type of course: 32-36 lecture hours

Contents: Daily lectres (4 lecture hours), starting Aug. 18/19 and ending Sept. 1/2. Students who want credits for this course needs to write a term paper (deadline October 10). Preferable that the term paper is written with other students (max 3 per group) taking the course.
Learning outcomes: Understand the implications of the performance and design of environmental policy instruments under different assumptions on how economic agents behave.
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

ECN380 Energy Markets and Regulation

Energy Markets and Regulation

Credits: 10 **Language:** English
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: BUS220, ECN201/ECN202, ECN211, ECN280.
Type of course: About 30 hours of lectures, and 10 hours of organized project work.
Contents: The course covers central issues concerning energy markets and economic regulation in the energy sector. Specific topics include: 1) regulation of network providers through dynamic yardstick competition, 2) measuring efficiency with DEA (data envelopment analysis) and SFA (stochastic frontier analysis), 3) organization of energy markets, 4) modeling of energy markets, 5) stochastic production planning in hydropower systems, 6) investments under uncertainty.
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 examination. (Note: Students have no right to complain against the marking of oral tests/ examinations, in accordance with the University and College Act § 5-3).

ECN450 Development Economics: Methods and Policy Analysis

Development Economics: Methods and Policy Analysis

Credits: 20 **Language:** English
Staff/institute: Stein Terje Holden/ IØR
Teachers:
Start term: Autumn parallel
Terms: Autumn parallel January block
The course is offered: Other -
Mandatory activities: Exercises, group work, presentations, writing of scientific paper.
Prerequisites: Master's degree in Economics or Agricultural Economics.
Credit reduction: ECN350 - 10 credit units.
Type of course: Lectures: 2-4 hours per week. Exercises: 0-2 hours per week. Writing of paper.
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. - Land reforms and impact assessment. Environment and development. - Market imperfections and the environment. - Poverty and land degradation. Choice of own topic for paper
Learning outcomes: Application of economic theory and methodology on development policy issues in developing countries. Combination of theory and methodology. 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 examination: 1/2, Paper: 1/2. Written examination, joint with ECN350.

ECN452 Topics in Development Economics I

Topics in Development Economics I

Credits: 5 **Language:** English
Staff/institute: Arild Angelsen/ IØR
Teachers: Gerald Shively
Start term:
Terms: By demand
The course is offered: Even years
Learning outcomes: Topics vary from year to year, but will generally be within applied microeconomics for development analysis.
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

ECN454 Topics in Development Economics II

Topics in Development Economics II

Credits: 5 **Language:** English upon request
Staff/institute: Ragnar A. Øygard/ IØR
Teachers: Arild Angelsen, Gerald Shively, Ian Coxhead.
First time the course is offered: SPRING 2009
Start term: Spring parallel
Terms: By demand
The course is offered: Odd years
Mandatory activities:
Prerequisites: Graduate level economics.
Type of course: Varies from year to year.
Contents: Course contents vary from year to year.
Learning outcomes: Course content will vary from year to year, depending on demand and supply.
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 home-examination/semester assignment. All assignments/semester assignment/ examinations must receive a 'pass' grade.

ECOL110 Tropical Ecology and Biology

Tropical Ecology and Biology

Credits: 10 **Language:** English
Staff/institute: Fred Midtgaard/ INA
Teachers:
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Field work, lab work and student presentations.
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. 50 hours. Lab work: ca. 20 hours. Field course: ca. 10 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 significant plants and animals 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: 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 three tests given throughout the semester and one student presentation. Each part counts 25% of the grade. All parts must be passed to pass the course.

ECOL200 General Ecology

General Ecology

Credits: 10 **Language:** English upon request
Staff/institute: Knut Asbjørn Solhaug/ INA
Teachers: Jon Swenson and Mikael Ohlson.
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 will 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's evaluation is based on one independent work (semester assignment).

ECOL250 Tropical Ecosystems and Biodiversity

Tropical Ecosystems and Biodiversity

Credits: 5 **Language:** English
Staff/institute: Torbjørn Haugaasen/ INA
Teachers:
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Seminars/student presentations.
Prerequisites: ECOL200.
Type of course: Lectures/seminars/student presentations: 2 hours per week.
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.
Learning outcomes: The course provides the students with an understanding of key biological characteristics of tropical ecosystems, and establishes 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: Final Written exam **Grading:** A-F
Assessment methods: Written exam, 3 hours.
Examination aids: No calculator, no other examination aids

ECOL300 Scientific Methodology in Ecology and Management of Natural Resources

Scientific Methodology in Ecology and Management of Natural Resources

Credits: 5 **Language:** English
Staff/institute: Svein Dale/ INA
Teachers: Geir Sonerud, Jon Swenson, Ørjan Totland, Andreas Brunner, Tron Eid, Ole Hofstad.
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, Biology, Management of Natural Resources, Nature-based Tourism, or Forest Sciences.
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. Weekly exercises by the computer with teachers present will assure that the students get to know the use of statistics programmes etc. 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 will give students a basic understanding on 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 will be documented by working out a plan and a description of the student's own future Master's degree work. Ecology and natural resource management use a wide range of different scientific methods. The students will focus on methods used either in ecological science or social science, depending on study programme and topic for the Master's thesis. 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 to investigate, deduce predictions that are to be tested, plan how the data should 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:** A-F
Assessment methods: Project assignment counts 50% and final written exam counts 50%.

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 will be able to synthesise and acquire information 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.
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 4 weeks field course in Tanzania. The first few days will consist of orientations and introductions followed by 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 both limits and gives 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 ongoing 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 must hand in their project reports for evaluation by May 15th.

ECOL350 Restoration Ecology

Restoration Ecology

Credits: 5 **Language:** English
Staff/institute: Torbjørn Haugaasen/ INA
Teachers: Stein R. Moe.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Short reports and presentations.
Prerequisites: Ecology courses at intermediate level.
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 economical 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 developed 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), Tharan Fergus and 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 with 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.

EDS101 Introduction to Environment, Development and Globalization

Introduction to Environment, Development and Globalization

Credits: 5 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Contact teacher: Esben Leifsen (esben.leifsen@umb.no)
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', globalization, population growth and the environment, gender and development, global climate change, genetic resources, trade and the environment, water in a global perspective, and conservation areas.
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: Exam in ENGLISH ONLY. Three hours written exam.
Examination aids: No calculator, no other examination aids

EDS106 Development Seminar

Development Seminar

Credits: 10 **Language:** English
Staff/institute: Ingrid Nyborg/ Noragric
Teachers: The course will be run by a seminar leader
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Attending at least 2/3 of the seminars and participating in group presentations
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. 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: Exam in ENGLISH ONLY. Term paper of 8-10 pages

EDS111 Sosialantropologi

Sosialantropologi

Credits: 5 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Contact teacher and lecturer: Rune Flikke (rune.flikke@sai.uio.no)
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 12 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.
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: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY.
Examination aids: No calculator, no other examination aids

EDS115 Social Science Statistics and Methods

Social Science Statistics and Methods

Credits: 10 **Language:** English
Staff/institute: Darley Jose Kjosavik/ Noragric
Teachers: Darley Jose Kjosavik
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Term paper submission.
Type of course: 44 hours of lectures including student presentations and discussions - two double lectures spread over 12 weeks.
Contents: The topics discussed will include introduction to social science research methods; the use of qualitative and quantitative approaches, interdisciplinarity, ethics, using secondary sources, reference management; 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. The course will also include practical excercises on data collection, analyses and interpretation using quantitative data and 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 much 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: Exam in ENGLISH ONLY. Portfolio of compulsory assignments (40%). Final written exam (60%).

EDS120 Sociology

Sociology

Credits: 10 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Contact teacher and lecturer: Ronald Nolet (ronald.nolet@hiof.no)
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities:
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: Exam in ENGLISH ONLY. The course grade will be based on the final written exam.
Examination aids: No calculator, no other examination aids

EDS140 Economics for Environment and Development

Economics for Environment and Development

Credits: 10 **Language:** English
Staff/institute: Fred Håkon Johnsen/ Noragric
First time the course is offered: SPRING 2010
Start term: Spring parallel
Terms: Spring parallel
Type of course: Fifty hours of lectures
Contents: The topic comprises four main sections: 1. Microeconomics with emphasis on food and agricultural production. 2. Environmental and resource economics. 3. Social appraisal of development projects with emphasis on environmental aspects. 4. Macroeconomics with focus on development.

Learning outcomes: The students will be able to apply basic concepts and theories from microeconomics, resource economics, socio-economic project appraisal and macroeconomics in interdisciplinary analysis of problems relating to environment, agriculture, development and natural resources.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY.
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: Engelsk: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: Exam in ENGLISH ONLY. 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
Mandatory activities: One oral presentation
Credit reduction:
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 be introduced to current development issues. They will become motivated for further studies through exposure to a range of literature. They will acquire skills in group work, presentation, computer work and the learning platform ClassFronter. Students will get an understanding of what is expected of them as a master student at UMB. They will learn 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: Exam in ENGLISH ONLY. Term paper

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
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: Engelsk: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. Fundamentals 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:** Pass/Fail
Assessment methods: Exam in ENGLISH ONLY. one group assignment (40 %) plus final exam (60 %).

EDS205 Development Theory and Policy

Development Theory and Policy

Credits: 15 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Contact teacher and main lecturer: Stig Jarle Hansen (stig.hansen@umb.no). Contributing: Lyla Mehta.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Engelsk:Participation in group work and submission of individual assignments. An approved group project assignment is compulory (pass/fail).
Prerequisites: BSc/BA or equivalent.
Type of course: The scheduled teaching time is ten hours 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: 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: Engelsk:The course gives an introduction to Development Studies as an interdisciplinary and problem oriented study of social, political, economic and environmental dimensions 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: Exam in ENGLISH ONLY. The examination is based on a portfolio of 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. The two papers combined count 30%. The participants select which two shall count. An individual term paper counts 60%. Participation and overall assessment counts 10%. Grades on the smaller individual assignments (1-3) will be set during the semester (a maximum of three weeks after submission). Grades on the group project, term paper and participation/ overall assessment 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.

EDS212 Research Methods

Research Methods

Credits: 5 **Language:** English
Staff/institute: Darley Jose Kjosavik/ Noragric
First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel
Type of course: 24 hours of lectures and discussions - two double lectures per week spread over 6 weeks
Contents: The course will include discussions on the following topics: Theoretical underpinnings of research methods, research strategy and design, qualitative and quantitative methods of data collection, analysis and interpretation, use of secondary data, interdisciplinary research, research ethics, introduction to a statistical package and so on
Learning outcomes: The students are expected to gain an understanding of the theory and application of qualitative and quantitative research methods in interdisciplinary contexts
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY. Final writte exam counts 100%
Examination aids: No calculator, no other examination aids

EDS215 Sustainable Agriculture and the Environment

Sustainable Agriculture and the Environment

Credits: 5 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Main teacher: M. Bukenya
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Completed online plagiarism quiz.

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:** A-F
Assessment methods: Exam in ENGLISH ONLY. Students will be evaluated on the basis of weekly short assignments (20 %), participation in discussions (10%) and a final term paper (70 %). 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, 10 credits (ECTS).
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: 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: Exam in ENGLISH ONLY. A midsemester multiple choice test counts 25% of the total mark. A final written 3.5 hours examination counts 75% of the total mark.

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: Engelsk:'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 put on: - 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: Exam in ENGLISH ONLY. 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: Pål Vedeld
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: The students are asked to write two short papers. For the student to pass the course, these papers must be graded 'pass'
Prerequisites: Some basic competence in micro economics and/or social sciences
Credit reduction: Credits are not given for both EDS234 and EDS235
Type of course: Lectures and seminars: 18 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.10) Environmental policy measures.
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 environmental 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
Assessment methods: Exam in ENGLISH ONLY.
Examination aids: No calculator, no other examination aids

EDS235 Political economy - institutions and the environment

Political economy - institutions and the environment

Credits: 5 **Language:** English
Staff/institute: Arild Vatn/ Noragric
Teachers: Pål Vedeld
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Presentation of paper in seminar.
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: 20 double hour lectures. Seminars: 8 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. 10) Environmental policy measures. 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: Exam in ENGLISH ONLY. Term paper counts 40 %. Written exam counts 60 %. Students must pass both.

EDS245 Human Rights and Development

Human Rights and Development

Credits: 10 **Language:** English
Staff/institute: William Derman/ Noragric
Teachers: 1. To give an overview and academic understanding of major theories in international human rights and to enable course participants to critically discuss and use these theories and concepts in development policy in their social, economic and environmental context. 2. To develop skills in: working interdisciplinary teams; searching, managing and sharing information; presenting and debating themes in human rights policy; writing as a means of learning, reflection and communication. 3. To develop awareness of values and normative approaches in development including the tensions and contradictions in human rights-based approaches to development theory, policy and practice.

First time the course is offered: SPRING 2009
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: The assessment will be: 1. An article or film review on a human rights issue. Pass/fail 2. Group Project: examine one human rights and how it is has been included as part of national development. Pass/fail)
Type of course: There will be an approximate total of 22 hours of lectures. In addition, there will be 12 hours group seminars. 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: Engelsk:Human rights has become increasingly important and an important ethical and practical approach to development theory, policy and practice. In adding economic and social rights to civil and political rights, human rights law makes development central to the realization of virtually all human rights. This course considers the range of economic, social and cultural rights in light of how, if implemented, it can augment or alter paths to social and economic development and equality. The class will consider among others the right to food, to water, to health, to property, to work, to a clean environment, to gender equality, et al. States' (and other international institutions) practices will be examined in light of how they fulfil their obligations under the range of human rights principles and laws. With the tremendous growth of international business, investment agreements and trade, the class will consider the possibilities and effects existing human rights law might have upon international business practices. Throughout the course critiques of human rights approaches will be covered, especially those which focus on their western biases, their ineffectiveness, or their costs. The aim is to support students in their understanding of human rights law, its uses, its limits and how it can be used to support development.
Learning outcomes: 1. To give an overview and academic understanding of major theories in international human rights and to enable course participants to critically discuss and use these theories and concepts in development policy in their social, economic and environmental context. 2. To develop skills in: working in interdisciplinary teams; searching, managing and sharing information; presenting and debating themes in human rights policy; writing as a means of learning, reflection and communication. 3. To develop awareness of values and normative approaches in development including the tensions and contradictions in human rights-based approaches to development theory, policy and practice.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY. Written examination based upon course lectures and readings.
Examination aids: No calculator, no 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: Exam in ENGLISH ONLY. Written exam.

Examination aids: No calculator, no other examination aids

EDS255 Health, Environment and Development

Health, Environment and Development

Credits: 10 **Language:** English
Staff/institute: Cassandra Bergstrøm/ Noragric
Teachers: Ingrid Nyborg
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. Each of the groups will determine whether its own members have particpated activlely in the group work. Students must receive a pass from their groups to complete this compulsory activity. All students must also sign an non-plagiarism contract.
Type of course: The scheduled teaching time is five hours (5 X 45 minutes) per week. This is tentatively distributed between 3 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 three blocks: 1. Introduction to Health and sustainable development; 2. Environment and health; and 3. Global health. 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. Chosen problem areas will be analyzed by student groups 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. The three group work projects will be documented in some way. Students will choose one of these projects for grading. This will represent 40% of the student's grade. In addition, each student will write a final essay for the course demonstating his/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 (such as 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: Exam in ENGLISH ONLY. Each of the group work projects will be documented in some way. Groups choose one of these projects for grading. This will represent 40% of the students grade. In addition, each student writes a final essay for the course demonstating his/her understanding of the course material and methods. This essay/take-home exam comprises 60% of the final grade.

EDS260 Global Environmental Changes

Global Environmental Changes

Credits: 5 **Language:** English
Staff/institute: Jens Bernt Aune/ Noragric
Teachers: Kjell B. Esser, Arild Vatn
Start term: Autumn parallel
Terms: Autumn parallel
Type of course: 22 hr lectures

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: William Derman/ Noragric
Teachers: To be decided
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Attendance at a minimum of 2/3 of the seminars
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: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY.
Examination aids: No calculator, no other examination aids

EDS270 Development Aid and Politics

Development Aid and Politics

Credits: 10 **Language:** English
Staff/institute: Darley Jose Kjosavik/ Noragric
Teachers: Lecturer and contact teacher: Stein Terje Vikan (stein.vikan@ssb.no)
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities:
Type of course: Engelsk:14 two-hour lectures and 14 two-hours seminars given once a week during the autumn parallel (in all 56 contact 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: Exam in ENGLISH ONLY.

EDS275 Writing Seminar

Writing Seminar

Credits: 5 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: The course will be given by a seminar teacher
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities:
Prerequisites: Eligibility for university admission
Type of course: 24 hours of lectures, presentations and discussions over 12 weeks.
Contents: This course gives the students an opportunity to learn writing skills, especially in writing scientific papers, present written work 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 seminar aims at helping students write quality scientific papers, includign term papers. The students will receive comments on their written 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: Exam in ENGLISH ONLY. Term papers

EDS278 World Issues Journalism (World Development Journalism)

World Issues Journalism (World Development Journalism)

Credits: 15 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Teacher: Larry Hansen, Madison Area Technical College
First time the course is offered: SPRING 2009
Start term: January block
Terms: January block Spring parallel
Mandatory activities: Submission of magazine-length news and feature stories; blogs and vlogs (video); multimedia presentations
Prerequisites: Fluency in English
Type of course: 96 hours group work, 290 hours writing, 64 hours reading
Contents: Students will engage in news reporting assignments that relate to world issues, such as water, energy, and war. Students will write investigative and interpretive news stories; and they will produce blogs, video logs (vlogs), and multimedia presentations. The students final products will be showcased in an online magazine. In addition to the reporting assignments, students will also study free press issues worldwide, and the journalism practices and traditions that emerge from different parts of the world.

Learning outcomes: Students will: - know how to find relevant expert primary sources for news stories that uncover the causes and ramifications of specific world issues. These sources will be worldwide. - know the difference between the inverted pyramid structure of American journalism and the more personal style of European journalism in the study of news reporting style around the world. - become adept at spotting the newsworthy themes regarding world issues that emerge from investigative reporting data. - know how to write news and feature stories for publication. - know how to write blogs and produce vlogs for online sites. - know how to work together in investigative teams that seek to uncover the causes and ramifications of specific world issues. - fully understand the new trend of solution-oriented journalism to embark on solution-oriented stories about specific world issues. - know how to edit stories collaboratively for the purpose of publishing an online magazine. - have acquired basic multimedia journalism skills. - understand the ethics of reporting world issues. - know how different regions of the world have such different views of freedom of the press and how these views impact specific world issues.
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: Exam in ENGLISH ONLY. News and feature stories 60 %, blogs and video logs 20 %, multimedia presentation 20 %

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: Darley Jose Kjosavik/ Noragric
Teachers: Hans Sevatdal, Stein Holden, Tor Arve Benjaminsen
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 three main components: 1. Basic concepts and theories 2. Property transactions 3. 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: Exam in ENGLISH ONLY. Student evaluation will consist of three assignments: two group assignments and one individual assignment. Each assignment counting 1/3 of the course grade. The students must receive a passing grade on each activity to pass the course.

EDS290 Development Classics

Development Classics

Credits: 10 **Language:** English
Staff/institute: Darley Jose Kjosavik/ Noragric
Teachers: Darley Jose Kjosavik
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: 4 hours of lectures, group discussions, presentations, class discussions and guidance per week for 12 weeks.

Contents: The course 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: Exam in ENGLISH ONLY. Take home exam at the end of the term (carries 100%).

EDS295 International Relations, Politics and Development

International Relations, Politics and Development

Credits: 10 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Contact teacher and lecturer: Stig Jarle Hansen (stig.hansen@umb.no)
First time the course is offered: SPRING 2009
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Participation in 2/3 of the lectures and seminars are mandatory.
Type of course: Two hours of lectures and two hours of seminars per week, for 12 weeks.
Contents: Engelsk:The course will include 12 lectures, and 12 seminars. The course will focus upon international relations theory in order to put development in a wider context. The classics within international relations theory will be introduced and discussed. Each seminar will discuss certain pre-set questions. It is expected that the students do the compulsory readings before the seminars.
Learning outcomes: 1) The student should gain a good understanding of the main theories used to explain world affairs in international relations theory. 2) Students should gain knowledge on how theories about international relations have changed over time, and be able to contextualise such theories. 3) Student will be able to understand development issues and strategies in the light of international politics. The course is excellent for students who want to focus on international relations theory in their future studies. It also gives students of development studies a much needed understanding of the international context of development policy making and practice.
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: Midterm paper 40 % and final written exam 60 %

EDS312 Methods in Environment and Development Research

Methods in Environment and Development Research

Credits: 10 **Language:** English
Staff/institute: Darley Jose Kjosavik/ Noragric
Teachers: Darley Jose Kjosavik, Stig Jarle Hansen, and other Noragric teachers will be drawn upon to give lectures and discussions in their own specialised fields of research related to Environment and Development
First time the course is offered: SPRING 2010
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Participation in group assignment

Type of course: Lectures - 30 hours, practice of data analysis-20 hours. In addition the students do independent study and a group assignment, totaling about 250 hours. The total work load for the students will be 300 hours.
Contents: The course will include discussions on the following topics: Ontological and epistemological underpinnings in research methods, with special reference to linkages between ontology, epistemology, theory and methods, the research process- experiences from specialised fields of research in environment and development studies - such as political economy of development, globalisation studies, conflict and development, climate change and development, health and development, livelihood research, research on property rights, agro-ecological research, pastoral research, coastal ecosystems and fishery research, gender and development research, migration studies, environmental impact assessment and project evaluation studies, conservation research, corruption research, discourse analysis and so on. It will also include introduction to a statistical package.
Learning outcomes: The students are expected to gain an advanced understanding of the theory and practice of research methods in specific fields of environment and development studies in interdisciplinary contexts. The course also aims at developing practical skills of the students regardign sample survey, data entry, analysis and 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: Exam in ENGLISH ONLY. Individual Term paper counts 100%

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: Participation in seminars
Prerequisites: General knowledge about biodiversity and the use of biodiversity in agriculture.
Type of course: Every week two days of combined lectures/seminars, one compulsory exercise, and one day of seminar (reviewing and discussing the week's exercise).
Contents: Origin, diffusion, exchange and ownership of genetic resources through history. National and international structures and laws for managing and governing genetic resources. 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: Exam in ENGLISH ONLY. Approved weekly exercises

EDS330 Political Ecology

Political Ecology

Credits: 10 **Language:** English
Staff/institute: Tor Benjaminsen/ Noragric
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: All students must participate in a presentation at the group seminars. Students must participate in a minimum of 80% of the lectures
Type of course: There will totally be approximately 22 hours of lectures. In addition, there will be 12 hours group seminars.
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: Exam in ENGLISH ONLY. Two individual term papers of five pages each (counting 50%) based upon course lectures and readings and a final oral exam. The oral counts ca 50 % of the total grade. Results from the term papers will be available in classfronter two to three weeks after submission. Students must pass all three exam activities to pass the course.

EDS335 Advanced Readings in Development Studies

Advanced Readings in Development Studies

Credits: 5 **Language:** English
Staff/institute: Tor Benjaminsen/ Noragric
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Presentation of one book chosen from the reading list.
Type of course: Seminars: 5 times 2 hours.
Learning outcomes: The main aims of the course are to introduce students to some key texts in development studies and to train students in analyzing, discussion and contrasting these readings.
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: Exam in ENGLISH ONLY. Each student writes 1000 words about 4-5 of the books chosen

EDS346 National Environmental Governance

National Environmental Governance

Credits: 10 **Language:** English
Staff/institute: Pål Vedeld/ Noragric
Teachers: Pål Vedeld and Arild Vatn
First time the course is offered: SPRING 2010
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Term-paper group Excursion 4 days
Prerequisites: EDS235 (Political economy - institutions and the environment) EDS260 (Global environmental change) EDS234 (Environmental economics (the role of institutions) is an alternative to EDS235
Type of course: Lectures: ca 48h. Supervision: 4 h. Mandatory Excursion 4 days
Contents: The course encompasses national and local environmental politics with cases from both developing and developed countries. The following themes are relevant: 1) The concepts of institutions, governance and resource regimes; 2) Resource dynamics, complexity, uncertainty and governance options; 3) Some key issues within policy studies; power, knowledge, politicals structures and processes, policy networks ; 4) The governance system: The role of the state, the civil society and private sector 5) Environmental management, governance and policy instruments (economic, legal, pedagogic and organisational (theory and practice) 6)Conflict and conflict resolution; Term paper (groups) where the theory is applied to

a concrete case study. 4 days mandatory excursion to study Norwegian environment and development policies at national, regional and local levels.

Learning outcomes: Theoretical goals: 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 acquire the capacity to use theory to study concrete cases concerning environmental governance at the national and local level within the context of international agreements, national policies and local politics. 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. Skills goals:The students should acquire the skills to use theoretical perspectives on to practical political issues and through political analyses suggest political solutions where efficiency, legitimacy and political viabilty are important criteria. Attitude goals: The students should develop their skills in critical thinking, in understanding both own and other people's attitudes, values and norms and develop a self-reflection around both scientific and interpersonal relationships.

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: Exam in ENGLISH ONLY. Term paper: 40 %; Written exam 60 %.

EDS347 International Environmental Governance

International Environmental Governance

Credits: 5 **Language:** English

Staff/institute: Pål Vedeld/ Noragric

Teachers: Siri Eriksen and Arild Vatn

First time the course is offered: SPRING 2010

Start term: Spring parallel

Terms: Spring parallel

Mandatory activities: Group presentation Excursions

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: 20double hours Seminars: 4-6 double hours Excursions Supervision (group presentation): 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 role of the state, the multilateral system (UN, WB/IMF, WTO), 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 environmental 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) Smeinar presentation (groups) where the theory is applied to a concrete case study.

Learning outcomes: Theoretical goals: Students shall acquire deeper insights into theories of environmental governance and resource regimes at international governance levels. 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 further learn about the historical evolution of the international governance regimes and core international agreements, conventions and protocols and how these function and interact. Key fields or themes include climate, biodiversity, pollution desertification, ocean/global fisheries, global forest politics and trade/environment linkages. They should also be conversant with important globalization trends. Students shall acquire the capacity to use the theory to study concrete cases concerning environmental governance at the global 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.

Skills goals: The students should acquire the skills to use theoretical perspectives on to practical political issues and through political analyses suggest political solutions where efficiency, legitimacy and political viability are important criteria. Attitude goals: The students should develop their skills in critical thinking, in understanding both own and other peoples attitudes, values and norms and develop a self-reflection around both scientific and interpersonal relationships.
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: Exam in ENGLISH ONLY. Term paper: pass/fail Written exam. The student must passs in both parts

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: One group presentation is compulsory.
Type of course: Lectures: 2*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: Engelsk:a)The students will participate in problem solving using exercises from case 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: Exam in ENGLISH ONLY. One group presentation (counting 40%) 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
Start term: Spring parallel
Terms: Spring parallel

Mandatory activities: One term paper
Type of course: 4 hours lectures per week. Term paper.
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. Biofuels and GHG emissions. Biofuels and food security.
Learning outcomes: Engelsk:Understand the relationship between climate change and development with emphasis on tropical countries.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY. Written exam (100 %).
Examination aids: No calculator, no other examination aids

EDS360 Conflict and Development

Conflict and Development

Credits: 10 **Language:** English
Staff/institute: Nadarajah Shanmugaratnam/ 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: 44 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 post-conflict development 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 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 - 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: Exam in ENGLISH ONLY. One term paper (40%) and a final oral exam (60%) constitute the continuous evaluation.

EDS365 Coastal, Marine and Aquatic Resource Management

Coastal, Marine and Aquatic Resource Management

Credits: 10 **Language:** English
Staff/institute: Ian Bryceson/ Noragric
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: One term paper (group work)
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
Assessment methods: Exam in ENGLISH ONLY.
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: Engelsk: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 analyses.
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: Exam in ENGLISH ONLY. The grade in the course is set on the basis of an individual term paper assignment

EDS374 International Relations Theory

International Relations Theory

Credits: 10 **Language:** English
Staff/institute: Knut G. Nustad/ Noragric
Teachers: Contact teacher and main lecturer: Benjamin de Carvalho (NUPI) (bdc@nupi.no). Supporting lecturer: Halvard Leira (NUPI)
First time the course is offered: AUTUMN 2009

Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: General knowledge of international issues, preferably undergraduate courses in relevant social sciences
Type of course: The course will go over 12 weeks and include 2 hours lecture and 2 hours seminar per week
Contents: These perspectives will include realism and neo-realism(s), liberalism and neo-liberalism(s), the so-called English School of International Relations, constructivism, reflectivism, post-structuralism and historical sociology. The course will also address the history of International Relations Theory, as well as normative theory.
Learning outcomes: The aim of the course is to give students an understanding of different perspectives in International Relations theory, and how different perspectives conceive of the nature of international 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:** A-F
Assessment methods: Exam in ENGLISH ONLY. Written examination (2 hours) will count 30 % and essay (15 pages) on chosen topic (to be approved by the course responsible) will count 70 %

EDS375 State Formation: Historical Issues and Contemporary Debates

State Formation: Historical Issues and Contemporary Debates

Credits: 10 **Language:** English
Staff/institute: Knut G. Nustad/ Noragric
Teachers: Contact teacher: Benjamin de Carvalho (NUPI) (bdc@nupi.no). Supporting staff: Iver B. Neumann, Ole Jacob Sending
First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Undergraduate background in the social sciences
Type of course: The course will go over 12 weeks and include 2 hours lecture per week.
Contents: What is the state? How did the most central political institution of our time emerge? Is a state ever complete? And how do we study the state? These are all questions which the course seeks to answer. The course will begin with addressing the state in historical perspective, before looking at state-formation today. Finally, it will discuss the state and its formation in contemporary debates and through different disciplines.
Learning outcomes: The aim of the course is to give students the necessary conceptual tools and perspectives to understand the state from different perspectives and 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: Exam in ENGLISH ONLY. Written examination (2 hours) will count 30 % and essay (15 pages) on chosen topic (to be approved by the course responsible) will count 70 %

EDS385 Rural Development and Project Management

Rural Development and Project Management

Credits: 15 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Gorettie Nabanoga, Keshab Awasthi
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
Credit reduction: Study point reduction for EDS386: 10 sp.
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.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY. The course grade is based on a written final examination.
Examination aids: No calculator, no other examination aids

EDS386 Environmental Governance at the Local Level

Environmental Governance at the Local Level

Credits: 15 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Gorettie Nabanoga (Uganda) and Keshab Awasthi (Nepal)
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
Credit reduction: Study point reduction for EDS385: 10 sp.
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 government agents, staff members and local people/farmers as well as gain experience in the use of research methods. Lectures and field work will cover global and local environmental challenges, international and national environmental legislation, sustainability, macro policies and reform agendas. Field methods will be studied for collecting information needed for projects and research, ethics in field work, management techniques, monitoring and evaluation of projects, contemporary issues, resource and environmental management.
Learning outcomes: The students will be able to 1) understand the links between global environmental issues and local governance, 2) develop, manage, monitor and evaluate environmental projects in developing countries and 3) use different research methods, tools and techniques that are relevant for analysing environmental projects and for conducting thesis research. The students will get an overview of concepts and approaces to understand and analyse environmental and social change processes in developing countries. The course gives practical knowledge of how laws and governance can become more effective to combat environmental degradation. The course gives the students an understanding of relationships between governance and the local environment. Sustainable agriculture and management of natural resources will be analysed as driving forces in the environmental policy. The course stresses knowledge and skills that are necessary to manage the environment in developing countries.

Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Exam in ENGLISH ONLY. Final written exam
Examination aids: No calculator, no other examination aids

EDS410 Doctoral Course in Environment and Development Studies

Doctoral Course in Environment and 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: Exam in ENGLISH ONLY. Oral exam

EDS415 Research Methodology in Development Studies

Research Methodology in Development Studies

Credits: 5 **Language:** English
Staff/institute: Randi Kaarhus/ Noragric
Teachers: Arild Vatn
Start term: January block
Terms: January block
Mandatory activities: The students must submit a preliminary paper before the first lecture.
Prerequisites: Participants should hold a Master's degree or equivalent.
Credit reduction: No
Type of course: 16 hours of lectures and 10 hours group work

Contents: Engelsk:The main objective of the course is to provide course participants with a basic understanding of some of the key challenges of research design in development studies, with an emphasis on the use of qualitative research methods, and how these relate to quantitative methods. This also involves addressing the challenges of research design in development studies as an interdisciplinary field. The course aims to provide a link between general methodological principles and challenges, and the selection and use of a set of research methods and tools for data collection in a PhD research project. In mono-disciplinary research within a traditional academic discipline, the methods of data collection are often given in some way. In development studies, as an interdisciplinary field, many of the methodological choices in a research project do not have a standard answer, and need to be made explicit, discussed and reflected upon. The course will offer an opportunity for such discussions, and will also address the relationship between epistemology, theoretical perspectives, research questions, and tools of data collection and analysis. In concretising the use of research methods, the course will also focus more specifically on fieldwork research.
Learning outcomes: Course participants should get a better understanding of the relationship between theoretical perspectives and research methodology in development studies, and a clearer idea of how to develop their own research design for a PhD project. Course participants will be challenged to think more systematically on how they choose and define units of data collection and analysis. Participants will also have the opportunity to discuss basic elements in their own research design in smaller groups.
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: Exam in ENGLISH ONLY. A final term paper (8-10 pages).

FMI310 Environmental Pollutants and Ecotoxicology

Environmental Pollutants and Ecotoxicology

Credits: 15 **Language:** English
Staff/institute: Bjørn Olav Rosseland/ IPM
Teachers: Brit Salbu, Deborah Ougthon, Ole Martin Eklo,Knut-Erik Tollefsen, John Einseth, Inggard Blakar, Per Strand and guest lecturers.
Start term: January block
Terms: January block Spring parallel
Prerequisites: KJM100.
Type of course: Lectures: 42 hours. One day of field demonstration at Lake Årungen. Excursion over two days to visit the Norwegian Institute for Water Research (NIVA) in Oslo, the Norwegian Institute for Air Research (NILU) in Lillestrøm, NIVA Marine Research Station Solbergstrand and UMB's Gamma Radiation Source (Campus). Dissection course with fish in laboratory for sampling of organs for analyses of pollutants: 4 hours. Term paper 150 hours.
Contents: Lectures: Focus on natural and man made sources that contribute to the contamination of trace metals, radionuclides and organic pollutants in air, water, sediments, soil and vegetation and how the contaminants forms and mobility effect organisms up to and including man. Focus on standard (ISO) ecotoxtesting, terminology in toxicology and how early effects can be traced back to biomarker responses. Field demonstration at Lake Årungen: Demonstration of important limnological and chemical methods, including in situ fractioning techniques for metals in water, and sampling of plants, soil, sediments, and aquatic organisms. Laboratory course: The students practice taking tissue samples for determination of contaminants in fish organs according to an international ptotocol. A certificate is issued for the sampling (voluntarily). Term Paper: The students are through a Term Paper 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 exam and term paper must be passed to pass the course. Term paper counts 1/3 and exam counts 2/3 of total grade.

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
Mandatory activities: An individual semester assignment of minimum 10 pages to be submitted medio November. This assigment must be accepted before the oral examination.
Prerequisites: KJM100.
Type of course: 30 lectures: 3 hours per week for 10 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: Final Oral exam **Grading:** A-F
Assessment methods: Oral examination counts 100 %.

FORN310 Bioenergy -Resources, Profitability and Solutions

Bioenergy -Resources, Profitability and Solutions

Credits: 5 **Language:** English
Staff/institute: Erik Trømborg/ INA
Teachers: INA + guest lecturers
First time the course is offered: AUTUMN 2010
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Excursions and seminars
Prerequisites: FORN210
Type of course: Ca. 35 hours lectures, excursions and seminars
Contents: Emphasis will be placed on practical processes related to the establishment of bioenergy facilities. Technological solutions for small-scale (local heating plants) and large-scale solutions (district heating facilities) will be presented. Thorough and consistent profitability assessments are important for project realisation, and will thus be extensively covered in the course. Resource analysis is extremely important, and students will learn about various methods for this (from theoretical modelling to local solutions). Concession processes will also be discussed (case-presentations), with regard to formal requirements, schedules, cost developments and technological aspects.
Learning outcomes: The course shall provide an in-depth understanding of technological, environmental, legal and resource consequences related to bioenergy. Students shall be able to work with cross-cutting problems and planning processes linked to the establishment of bioenergy facilities (generation of both heat and electricity). This implies being able to analyse, synthesise and present knowledge from such fields as technology, environment, economics and law. Students are to be trained in written and oral communication of interdisciplinary issues and research 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: 3-hour written exam (counts 80 %) and term paper (counts 20 %)

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 examination 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
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 assessed 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 assessed 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 examination. 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 detection/ measurement 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. The students 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: GEN220 and GEN320.
Type of course: Lectures: 30 hours. Presentations: 5 hours.
Contents: GEN340 is 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

GEN401 Research School Genetics A

Research School Genetics A

Credits: 5 **Language:** English upon request
Staff/institute: Tormod Ådnøy/ IHA
Teachers: Teachers from UMB and invited seminar speakers.
Start term: Autumn parallel

Terms: Autumn parallel
Mandatory activities: One presentation per student - of own research or related topic. Approximately 20 minutes + questions. Participation in at least 75% of the gatherings.
Prerequisites: 300-level in genetics, breeding or molecular genetics.
Credit reduction: No.
Type of course: Usually structured teaching time 12-16 two wednesdays per month. Last wednesday of month: lectures, exercises, group work etc lead by UMB teacher, and student presentations. First wednesday of month: lectures, exercises, group work etc lead by UMB teacher 12-14, followed by seminar by (UMB-)external invited researcher and social gathering at 14-16. For every gathering there is written material and maybe exercises that should be studied.
Contents: A choice of 4-5 of the topics will be given: molecular genetics, molecular biology, mathematical-statistic methods in genetics and breeding, bioinformatics, genomics, genome analysis, selection, prediction of breeding values, genetic resources, inbreeding and relationship, breeding plans, philosophy of science, and ethics. Teachers at UMB will give an overview of a topic - often based on a course they already teach.
Learning outcomes: - To give an overview of genetics and methods used in genetics. The overview shall be up to date concerning topics and techniques in molecular genetics and breeding. - To strengthen the cooperation of genetics and breeding workers. - After having completed the course students should be able to point out relevant methods to solve specific research tasks in the genetic fields 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:** Pass/Fail

GEN402 Research School Genetics S

Research School Genetics S

Credits: 5 **Language:** English upon request
Staff/institute: Tormod Ådnøy/ IHA
Teachers: Teachers from UMB and invited seminar speakers.
First time the course is offered: SPRING 2009
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: One presentation per student - of own research or related topic. Approximately 20 minutes + questions. Participation in at least 75% of the gatherings.
Prerequisites: 300-level in genetics, breeding or molecular genetics.
Type of course: Usually structured teaching time 12-16 two wednesdays per month. Last wednesday of month: lectures, exercises, group work etc lead by UMB teacher, and student presentations. First wednesday of month: lectures, exercises, group work etc lead by UMB teacher 12-14, followed by seminar by (UMB-)external invited researcher and social gathering at 14-16. For every gathering there is written material and maybe exercises that should be studied.
Contents: A choice of 4-5 of the topics will be given: molecular genetics, molecular biology, mathematical-statistic methods in genetics and breeding, bioinformatics, genomics, genome analysis, selection, prediction of breeding values, genetic resources, inbreeding and relationship, breeding plans, philosophy of science, and ethics. Teachers at UMB will give an overview of a topic - often based on a course they already teach.
Learning outcomes: - To give an overview of genetics and methods used in genetics. The overview shall be up to date concerning topics and techniques in molecular genetics and breeding. - To strengthen the cooperation of genetics and breeding workers. - After having completed the course students should be able to point out relevant methods to solve specific research tasks in the genetic fields 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:** Pass/Fail

GEO222 Geology Project

Geology Project

Credits: 5 **Language:** English upon request
Staff/institute: Mona Henriksen/ IPM
Teachers: Michael Heim, Jon Landvik, Stein-Erik Lauritzen.
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 will have the opportunity to come into direct contact with employers and researchers in geology. The student will learn to write a report addressing the needs of the client.
Methods of examination: Final **Grading:** A-F
Assessment methods: Final report.

GEO300 Hydrogeology

Hydrogeology

Credits: 10 **Language:** English upon request
Staff/institute: Jan Mulder/ IPM
Teachers: 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. 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: Mona Henriksen, Stein-Erik Lauritzen.
Start term: Autumn parallel

Terms: Autumn parallel
The course is offered: Even years
Prerequisites: GEO100 and GEO210, or equivalent courses.
Type of course: Seminars and lectures: 24 hours
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, Christian Gerlach, Ola Øvstedal, Jon Glenn O. Gjevestad.
Start term: Spring parallel
Terms: 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 and modern higher geodesy: global geodetic reference systems, astronomical and physical geodesy, space and satellite geodesy, height systems, geoide calculations, 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 in geodesy (e.g. topical list of the course).
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral examination: 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 assessment will be based upon a written report and presentation of project work at a final seminar.

GMGI300 Geographical Database Systems

Geographical Database Systems

Credits: 10 **Language:** English upon request
Staff/institute: Håvard Tveite/ IMT
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Prerequisites: Geographical Information Systems, introductory course (GMGI100), or the equivalent. Programming course (INF110, INF210). Database Systems (INF130).
Type of course: Lectures: 42 hours (3 hours per week). Work on exercises/projects (predominately undertaken by the student): 70 hours (5 hours per week).
Contents: Modelling of geographical information. Spatial data structures. Geographical database systems. Standards for modelling, storing and transferring geographical information. Database solutions for GIS. Distributes systems. Implementation of geographical information services.
Learning outcomes: After completing the course, the student should be capable of building models for geographical information, evaluating different solutions for geographical database handling and implementing storage and services for geographical information in centralised and distributed 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: Final written examination (3.5 hours): 60%. Project assignment: 30%. Article presentation: 10%.

GMLM102 Geodetic Surveying Basics

Geodetic Surveying Basics

Credits: 10 **Language:** English upon request
Staff/institute: Inge Revhaug/ IMT
Teachers: Teaching assistants (students).
Start term: Spring parallel
Terms: Spring parallel June block
Mandatory activities: Laboratory exercises. 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 examination.
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. Coordinate systems. Review of adjustment theory and quality control. Principles of navigation and positioning on sea. 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 examination: 75%. Exercises: 25%.

GMSG200 Satellite Geodesy

Satellite Geodesy

Credits: 5 **Language:** English upon request
Staff/institute: Bjørn Ragnvald Pettersen/ IMT
Teachers: Oddgeir Kristiansen.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises.
Prerequisites: Basic courses in mathematics and physics.

Type of course: Lectures: 28 hours. Exercises: 28 hours.
Contents: Celestial and terrestrial reference systems. Time systems. Precession, nutation and polar motion. Theory of Kepler orbits. Perturbations. Space geodetic observation techniques. International organisations and available information in electronic networks.
Learning outcomes: The students must know reference systems used in space geodesy and understand the theoretical foundation for satellite motion in space. They must be updated on the individual space geodetic observing techniques and satellite systems and be familiar with international organisations and their services (IERS, IGS etc.).
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination.
Examination aids: Any calculator, no other examination aids

GMSG310 Satellite Geodesy - Analysis

Satellite Geodesy - Analysis
Credits: 10 **Language:** English upon request
Staff/institute: Bjørn Ragnvald Pettersen/ IMT
Teachers: Oddgeir Kristiansen, Ola Øvstedal, Jon Glenn O. Gjevestad
Start term: Autumn parallel
Terms: Autumn parallel Spring parallel
The course is offered: By assignment
Mandatory activities: Exercises.
Prerequisites: GMSG200, GMSG210, first part of GMGD300.
Type of course: Supervision: 28 hours.
Contents: Through colloquium work, guided self-study and practice exercises the students are to acquire knowledge in satellite geodetic calculations. Bernese GPS Software and GIPSY are offered as analysis tools. This is a very flexible arrangement which is offered when need and the possibility arises.
Learning outcomes: The students are to master selected program tools for processing global and regional satellite geodetic calculations.
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.

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 examination.

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: By demand
The course is offered: Other - Course given upon demand.Emnet 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: 10 hours.
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 assessed 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.
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: 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: Examination: Continous assessment. Written examination at the end of January block. Semester report must be approved before the examination result is given.

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 demand.Ved 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 examination, 3 hours.
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 examination: 40 %. The semester assignment shall present the 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 demand.Etter behov.
Mandatory activities: Students will present selected topics and be 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: Trond Storebakken
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: Approx. 20 hours of structured activites, 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 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 the start of the course. Assessment 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, Birger Svihus 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 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). 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 hour written examination.
Examination aids: No calculator, no other examination aids

HFE306 Advanced Feed Manufacturing Technology

Advanced Feed Manufacturing Technology

Credits: 5 **Language:** English
Staff/institute: Ozren Zimonja/ IHA
Start term: January block
Terms: January block
Prerequisites: The students must have taken HFE305.
Type of course: Lectures will be given if required.
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: 1-2 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, Jovo Kosanovic.
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: Final Oral exam **Grading:** A-F
Assessment methods: Oral examination.

HFE308 Optimalization of Feed Processing for Different Animal Species

Optimalization of Feed Processing for Different Animal Species

Credits: 10 **Language:** English
Staff/institute: Birger Svihus/ IHA
Teachers: Trond Storebakken.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Individual asignment and presentation of this asignment is compulsory.
Prerequisites: Equivalent to one year of master's studies in Feed Manufacturing Technology.
Type of course: Approximately 50 hours of lecturing.
Contents: The lectures will deal with the specific needs with relevance for feed processing for common species such as ruminants, pigs, poultry and fish. 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: 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 hour written examination.

HFE309

Credits: 5 **Language:** English upon request
Staff/institute: Birger Svihus/ IHA
First time the course is offered: SPRING 2009
Start term: June block
Terms: June block
Mandatory activities:
Prerequisites: HFE100, KJB200 or equivalent.
Type of course:
Contents:
Learning outcomes:
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:

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 demand.Ved 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.

HFX206 Product Quality, Meat and Fish

Product Quality, Meat and Fish

Credits: 5 **Language:** English upon request
Staff/institute: Magny S. Thomassen/ IHA
Teachers: Jan Berg, Nils Petter Kjos, Anna Haug, Birger Svihus, Mia Bencze Rørå,Rune Rødbotten
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Group work must be approved before the examination.
Prerequisites: Basic knowledge in chemistry and biochemistry.
Credit reduction: MVI271.
Type of course: Lectures: 25 - 30 hours. Group work/submission of group assignments: 20 - 25 hours.
Contents: The students are expected to first acquire a general overview of Norwegian production of animal commodities, including fish, their place in the Norwegian diet and trends in consumption. Afterwards a basic understanding of quality characteristics is developed, incl. definitions and need for measurement and control. Students are expected to acquire detailed knowledge about muscle structure, chemical composition and post mortem processes of relevance for quality and shelf life. In the last part of the course, students will aquire an overview of the important principles for control of quality through production, related to different product types (cattle, pigs, sheep, goats, poultry, fish, eggs and milk).
Learning outcomes: Through the course, students will have acquired a basic theoretical understanding of quality characteristics and the factors that control the quality of meat and fish raw products, plus a basic overview of the significance of these commodities in the Norwegian diet. Students will also be able to explain how quality can be influenced by different ante- and early post-mortem factors, and can explain the main principles for some frequently used measuring methods.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination.
Examination aids: No calculator, no other examination aids

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: HFX110 or equivalent.
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 assignment. 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 assessment 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
Mandatory activities: Participation on seminars. Students will be divided into groups. All groups have to prepare a seminar where a central topic within the field will be presented based on selected scientific papers, followed by a discussion. To secure a fruitful discussion all students have to study one selected key paper beforehand.
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: Type of course: About 2/3 lectures and the rest seminars based on student*s presentations.
Contents: All information about the course; lectures and seminars will be available on Classfronter
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 hypotheses.

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 examination: 3 hours. The written examination has a weight of 100%. Use of course notes is allowed during the examination. An examiner is used for the examination assessment.
Examination aids: Simple calculator, specified other examination aids

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.
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: 10 **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 assignments and the submission of short description of the topics.
Prerequisites: Master's 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.

INF200 Advanced Programming

Advanced Programming

Credits: 10 **Language:** English upon request
Staff/institute: Hans Ekkehard Plesser/ IMT
First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel January block
Mandatory activities: You must have gotten several programming exercises approved during the autumn parallel to be allowed to commence work on the programming project in the January block.
Prerequisites: INF110 or INF120 or equivalent programming competence.
Credit reduction: INF210: 10stp INF201: 5stp
Type of course: Autumn parallel - 26h lectures - 78h computer lab January block - 10h assembly - 10h colloquia - 10h project tutoring - 120h programming project
Contents: Classes and objects; - inheritance; - self-defined datatypes; - overloading; - polymorphy; - generic programming; - standard libraries; - dynamical memory handling; - error handling; - use of debugger and profilers; - use of documentation tools. The course is presently based on the programming language C++.
Learning outcomes: After completing the course, students will know how to: - develop comprehensive programs based on object-oriented and generic programming; - read and understand programs at an equivalent level of complexity; - analyse complex tasks and use algorithms to solve them; - use the functionality delivered by standard libraries; - localise errors in programs; - use advanced programming tools such as debuggers, profilers and compilation tools. The student will have acquired more knowledge about the higher-level programming language that is used in the course. The student is able to evaluate the applicability of more complex programs and be able to assert their quality. The student will have developed an insight into the programmer's responsibility for the correct and reliable functioning of his or her own programs, their quality and documentation. Students are to be motivated to play with computer solutions that exist, to use the 'freedom to thinker' that open source computerware gives. Students are to discover the advantages that access to the source code of other programs may give to their own learning and are thereby encouraged to publish their own programs as well.
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: valuation of the programming project in three parts: 1. Presentation of project (0-20 points) 2. Individual discussion of project (0-20 points) 3. Handed-in source code and documentation (0-60 points) Part 1 and 2 are examined during the exam day for the January block, and results are communicated to the students at the end of the day. Part 3 is evaluated within the evaluation period and the result is posted on ClassFronter. If two students collaborate on a project, then a joint evaluation is given for parts 1 and 3, while individual evaluations is given for part 2. The overall grade is determined based on the total point score obtained.

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 exercises. The course is given in the January block. The teaching is given in two blocks, the students are expected to work on exercises between the teaching periods.
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 trademarks, 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 examination; the case study must be approved before the written examination can be taken. No re-sit examinations will be arranged.
Examination aids: No calculator, no other examination aids

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: MATH100, 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 based on an introductory lecture, background literature and data; the student have to construct a model, calibrate it and apply it given different scenarios.
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 (each counts 20%). The final assignment for submission is based on a model, which has to be developed by the students themselves. With support from teachers, the students must find information and necessary literature (counts 40%).

JORD220 Soil Physics and Soil Cultivation

Soil Physics and Soil Cultivation

Credits: 5 **Language:** English upon request
Staff/institute: Trond Børresen/ IPM
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: MATH100, JORD101.
Type of course: Lectures: 48 hours.
Contents: The solid material of the soil. The water in soil. The dynamic properties of soil. Soil structure. The air in soil. The energy conditions in soil. Physical properties of soil profiles. Energy transfer machine-soil. Compaction of soil. Soil cultivation. Erosion. Soil improvement, farming systems and soil structure.
Learning outcomes: Insight into the physical properties and processes of soil. Understand the connection between soil structure and plant growth. Be able to evaluate the effects of various ways of cultivating the soil on soil quality and environment. Understand how the physical properties of soil are affected by the composition and use of the soil. Knowledge of how the different physical properties of soil (soil structure) form the basis for different growth conditions for plants. Select the appropriate cultivation method based on the properties of the soil, terrain conditions, environmental consequences and plant selection. Calculate important physical parameters in soil. Understand that our cultivated areas are limited and that we therefore must protect them carefully for generations to come, by avoiding erosion, soil compaction and loss of organic material.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written examination, 3 hours.
Examination aids: Simple calculator, no other examination aids

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
Mandatory activities: Participating on the exercises is mandatory
Prerequisites: MATH100, 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
The course is offered: Even years
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: The national and international history of soil classification. 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 (1999), FAO/Unesco system (1975/1990) and WRB (2006), - 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: a selection of classification assignments (following the exercises) 50% and the report from the student-chosen assignment, which is to be submitted on the last day of the course 50%.

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
The course is offered: Other - JORD260 is not given in 2010JORD260 gies ikke i 2010
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: Åsgeir Almås, Lars Bakken, Tore Krogstad, Vegard Martinsen, 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. Presentation and discussion of scientific papers: 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. Climate change with focus on terrestrial carbon and nitrogen. Phosphorus in soil and on a watershed scale. Land use change: effects on vegetation, soil and downstream water quality. Each topic: 10 hours (4h lecture, 4h group work with guidance, 2h presentation and discussion of scientific papers).
Learning outcomes: To understand processes in different soils which control the cycling of metals, nitrogen, carbon, sulphur, phosphorus and organic pollutants. To have an in-depth understanding of how the terrestrial environment is affected by metals, nitrogen, phosphorus, organic pollutants, climate change 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%. Three selected essays: 35%. Presentation and summaries of scientific papers: 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
The course is offered: Even years
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: Trond Børresen/ IPM
Teachers: T. Børresen, , T. Sogn, T. Krogstad, Å. Almås, E. Govasmark and P. Dörsch
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Oral presentation of the semester assignment and presentation of one scintific paper.
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, approved journal.
Prerequisites: Biochemistry equivalent to KJB210.
Type of course: Total:Lectures: 35 hours. Exercises: 64 hours. Seminars: 2 hours. Per normal week: 4 hours lectures (Mon and Thu), 8 hours exercise
Contents: The lectures start 4-6 weeks before the exercises, in order to give the necessary theoretical background. The exercise part is based on a full day per week with a teacher present. It is strongly advised to participate in an active way in the computer exercise since this is of paramount importance for understanding the topics. A journal from the exercises has to be approved before the exam. It should be emphasized that this course is intended for master degree students, requiring the ability to work independently in the field using 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. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research literature.
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: Vincent Eijsink, Einar Jensen, Morten Skaugen.
Start term: January block
Terms: January block
Mandatory activities: Participation in all activities.
Prerequisites: Biochemistry equivalent to KJB210.
Credit reduction: 5 credits (ECTS) reduction with KJB420, 2 credits (ECTS) reduction with KJM313 and 2 credits (ECTS) reduction with KJM410.
Type of course: Intensive course, three weeks in January: Lectures 16 hrs; laboratory work 22 hrs; presentation 3 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. 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. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research 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:** Pass/Fail
Assessment methods: Journal.

KJB420 Proteomics II

Proteomics II

Credits: 10 **Language:** English upon request
Staff/institute: Ragnar Flengsrud/ IKBM
Teachers: Vincent Eijsink, Einar Jensen, Morten Skaugen, PhD student.
Start term: January block
Terms: January block Spring parallel
Mandatory activities: Participation in all activities.
Prerequisites: Biochemistry equivalent to KJB210.
Credit reduction: 5 credits (ECTS) reduction with KJB320, 2 credits (ECTS) reduction with KJM313 and 2 credits (ECTS) reduction with KJM410.
Type of course: January block: Intensive course for two weeks, including lectures 16 hrs, laboratory work 22 hrs. Spring parallel: colloqium: 6 hrs, special exercise: 40 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. LC/MS.

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 and a thesis

KJM310 Chromatography

Chromatography

Credits: 10 **Language:** English upon request
Staff/institute: Dag Ekeberg/ IKBM
Teachers: 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. Poster presentation.
Prerequisites: General chemistry, KJM100 (or equivalent) Organic chemistry, KJM210 (or equivalent) Analytic chemistry, KJM240 (or equivalent).
Type of course: Lectures:2 hours/week. Laboratory work: ca. 60 hours.
Contents: Lectures given by the teacher. Presentation of assigned topics from students. Laboratory work. 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. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research literature.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods:
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
Mandatory activities: The semester assignment is mandatory. A passing grade (E or better) has to be achieved for the student to be able to take the final exam.
Prerequisites: KJM210 or KJM211 or an equivalent introductory course in organic chemistry that includes fundamental organic structural spectroscopy.
Type of course: 22 lecture hours, divided into 4 hours per week, thereafter 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: 30% of the total grade. Written examination with an external examiner: 70% of the total grade.

KJM312 Natural Product Chemistry

Natural Product Chemistry

Credits: 10 **Language:** English upon request
Staff/institute: Yngve H. Stenstrøm/ IKBM
Teachers: New asociate professor.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Basic Organic Chemistry equivalent to KJM210.
Type of course: Three hrs per week. All together 30 hrs lectures and 10 hrs assignment review.
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, biosynthetic principles. Basic principles of isolation, characterisation and some examples of syntheses will be given.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: 3.5 hours written exam. If the number of candidates is 7 or less, the examination will be oral.
Examination aids: No calculator, no other examination aids

KJM313 Mass Spectrometry

Mass Spectrometry

Credits: 10 **Language:** English upon request
Staff/institute: Dag Ekeberg/ IKBM
Teachers: New associate professor
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Asignment pressented in plenum
Prerequisites: General chemistry, KJM100 (or equivalent) Organic chemistry, KJM210 (or equivalent) Analytic chemistry, KJM240 (or equivalent) Physical chemistry, KJM230 (or equivalent)
Credit reduction: 10 credits (ECTS) reduction for students with KJM410. 2 credits (ECTS) reduction against KJB320 and KJB420.
Type of course: 6 hours of lecturing/discussion groups/week
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 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), TOF, ion traps and 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. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research literature.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids: Simple 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, Deborah H. Oughton, Marit Nandrup Pettersen, Tove Loftaas.
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. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research 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: Laboratory journals (6 journals have to be approved before the final examination) and a final written 3-hour examination. Laboratory journals count for 50% of the grade. Written examination (3 hours) counts for 50% of the grade. Both of the exam elements must have a passed 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.
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. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research 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: The laboratory journal counts 1/4. The project report counts 1/4. Final written examination (3.5 hours) counts 2/4. 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.
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 environmental stressors on man and the environment. The course will use ionising radiation as a case study, but will cover protection and assessment approaches for any environmental pollutant, and students can choose their own stressor for their case study. Thus the course will be relevant for students within radioecology as it will enable them to put the models and approaches for assessing radiation in to contect with other environmental stressors as well as the protection of man from ionising radiation. Themes: Biological effects, hazard characterisation, dose effect relationship, dose-models, RBE, biological endpoints, cancer, dose to biota, ecotoxicology, micro-dosimetry. Ecological Impact and Risk Assessment: Environmental risk, risk characterization, species sensitivity distribution, population dynamics. Countermeasures and remediation. Environmental ethics: philosophy and principles. ALARA and BAT principles, international politics and conventions Field Course: 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. Effects of environmental stressors on man and the environment. The course will use ionising radiation as a case study, but will cover protection and assessment approaches for any environmental pollutant, and students can choose their own stressor for their case study. Thus the course will be relevant for students within radioecology as it will enable them to put the models

and approaches for assessing radiation in to contect with other environmental stressors as well as the protection of man from ionising radiation.
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 50% and the written exam counts 50% 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:
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Assignments and lab. rapport to be presented in plenum.
Prerequisites: General chemistry, KJM100 or equivalent. Organic chemistry, KJM210 or equivalent. Analytic chemistry, KJM240 or equivalent.
Credit reduction: For students who have completed KJM313: 8 credits reduction, for those who have completed KJB320 or KJB420: 2 credits reduction.
Type of course: 6 hours of lecturing/discussion/week.
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 quadrupole, sector instruments (magnets and ESA), TOF, ion traps and 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
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,LAA116,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 or Planning students 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 then be 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 final project work and course assignments in a seminar at the end of the course in the presence of an external examiner.

LAFT201 Form, colour and drawing IV

Form, colour and drawing IV

Credits: 5 **Language:** English upon request
Staff/institute: Roddy Bell/ ILP
Teachers: Roddy Bell, Lise Farmen, NN.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Compulsory excursion. 80% participation in lectures and scheduled work on exercises.
Prerequisites: LAA115, LAA116, LAA250
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, as well as 1 and 2 point perspective and perspective 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 LAA115, LAA116, LAA251, 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, Irene Rasmussen and guest lecturers.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: 80% participation in lectures and sheduled work on exercises.
Prerequisites: LAA115, LAA116, LAA250,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 develop their previously gained knowledge from LAFT courses to achieve a deeper understanding of form, colour, drawing and digital techniques to solve the given tasks. It is expected that students will achieve an independent 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: Mari Sundli Tveit/ 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. Mini projects: Pass/ fail. 2. Oral exam: 50 %. 3. Term paper: 50 %.

LNG130 Norwegian as a Foreign Language

Norwegian as a Foreign Language

Credits: 5 **Language:** English upon request
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Høgskolelektor Camilla Bjørke (camilla.bjorke@hiof.no) and Wenche Høidal (Tlf. 99730189)
Start term: Autumn parallel
Terms: Autumn parallel Spring parallel
The course is offered: Other - Given twice a year - spring and autumn.Gis 2 ganger i året, både i vårparallell og i høstparallell.
Mandatory activities: A short essay must be submitted during the semester and 80 % attendance at lectures is compulsory.

Contents: Engelsk:Getting acquainted; Family and home; Eating; Daily routines; Shopping; Weather; Travelling and transport; Arriving in Norway; Work
Learning outcomes: The course will give the students basic knowledge of spoken Norwegian, with the aim of understanding and using the language in everyday situations. Pronunciation and oral exercises are given priority. It is expected that students will work on their own with the CD and grammar exercises on the Internet (http://pavei.cappelen.no) In addition to the language course some lectures on Norwegian culture and society will be given in English.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Individual oral exam

LNG135 Norwegian as a foreign language II

Norwegian as a foreign language II

Credits: 5 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Høgskolelektor Camilla Bj
Start term: Autumn parallel
Terms: Autumn parallel Spring parallel
Mandatory activities: Engelsk:A short essay must be submitted during the semester and 80 % attendance at lectures is compulsory.
Prerequisites: English and Norwegian I or equivalent
Credit reduction:
Type of course: Language instruction: 40 hours
Contents: Facts about Norway
Learning outcomes: The course builds on Norwegian for foreigners I, giving more extensive knowledge of Norwegian with more sophisticated texts. Pronunciation and oral exercises are given priority. It is expected that the students will work on their own with the CD and grammar exercises on the Internet (http://pavei.cappelen.no).
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written exam
Examination aids: No calculator, specified other examination aids

LNG150 Swahili Intensive Course

Swahili Intensive Course

Credits: 5 **Language:** English
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Responsible teacher is to be announced later.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Short written essay.
Contents: Pronunciation and oral exercises will be prioritised.
Learning outcomes: Engelsk:The aim is for the students to be able to understand and use everyday language in a simple communication setting. The course will give them basic knowledge in Swahili and elementary insight in intercultural communication as preparation for fieldwork in the autumn semester.
Methods of examination: Final Oral exam **Grading:** Pass/Fail
Assessment methods: 100% oral examination.

LNG240 Academic Writing

Academic Writing

Credits: 5 **Language:** English upon request
Staff/institute: Kjell Bjørgen Esser/ Noragric
Teachers: Teacher from Østfold University College, Jon D. Orten,e-mail jon.d.orten@hiof.no

Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: There are three obligatory exercises in the course; one evaluation of a research paper, and the writing of two individual research papers.
Contents: The course gives an introduction to writing of academic texts in English. Students will be given the opportunity to write papers relevant to their field of study and to receive individual advice on their texts.
Learning outcomes: Academic writing is a clearly defined type of writing. It is linear, and has a clear purpose - with introduction, discussion and conclusion. The course aims at training students in working independently with academic writing in English. After having completed this course the students shall be able to write well structured research papers 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:** A-F
Assessment methods: One-week home examination, during which the student is to write a paper relevant to his or her field of research of approximately 10 pages.

LAA116 Introduction to Landscape Architecture II

Introduction to Landscape Architecture II

Credits: 15 **Language:** English upon request
Staff/institute: Alf Haukeland/ ILP
Teachers:
First time the course is offered: SPRING 2010
Start term: January block
Terms: January block Spring parallel
Mandatory activities:
Prerequisites: LAA115
Credit reduction:
Type of course:
Contents:
Learning outcomes:
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

LAA308 Landscape Design

Landscape Design

Credits: 20 **Language:** English upon request
Staff/institute: Ola Bettum/ ILP
Teachers: Karsten Jørgensen and others
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: LAA116, LAA215, 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.

LAA321 Restoration and conservation of historical gardens and landscapes; 3D-visualisation

Restoration and conservation of historical gardens and landscapes; 3D-visualisation

Credits: 10 **Language:** English
Staff/institute: Karsten Jørgensen/ ILP
Teachers: Hassan, Ramzi
First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: LAA111, LAD101
Type of course: Lectures: 20 hours, Fieldwork 40 hours, Seminar: 10 hours, Exercises 30 hours
Contents: The course is based on a combination of lectures, excursions and group work, and consists of a theoretical part, a studio part and a part with introduction into 3D modelling techniques. The emphasis is put on investigation of gardens and garden elements and interpretation of the historical traces and remains. The participants will get an overview of the tools used to analyse the traces in the landscape, which plants belong to the different historical eras of Norwegian history of the art of gardening. Conventions and regulations, ICOMOS/IFLAs Florence-charter. The relation between cultural and natural heritage management. In addition, the course explains the procedures for treatment of an historical garden in the planning process. Conservation and restoration plans, methodology, development of main concept, analysis of the existing situation, discussion of historical relations, and management plans. Data and information will be fed into a digital model. The digital model will then be visualized at the Virtual Reality Lab. Through real-time interaction with the 3D model, the different historical phases and development of the site can be visualized. This will enhance the understanding of the configuration of the site and can form a basis for sound decisions concerning the conservation and management of the garden.
Learning outcomes: The aim is to give the students knowledge of central topics in relation to investigation, conservation, restoration and management of historical gardens and landscapes, including the challenges in today's cultural heritage management for both private and public sector. When the course is finished, the students should be able to recognize and investigate an historical garden or garden element, and present an analysis of this according to historical sources. Students will use 3D modelling and visualization techniques as a supportive tool for the analysis. Basic 3D modelling techniques will be introduced for students.
Methods of examination: Final **Grading:** A-F

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 must be approved within the given deadlines.
Prerequisites: MATH111, MATH112, MATH113.
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 examination, 3.5 hours.
Examination aids: No calculator, no other examination aids

MATH270 Complex Analysis and Transformation Methods

Complex Analysis and Transformation Methods

Credits: 10 **Language:** English upon request
Staff/institute: John Andreas Wyller/ IMT
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Compulsory assignments must be approved within the given deadlines.
Prerequisites: MATH111, MATH112, MATH113
Type of course: Lectures: 4 hours per week. Calculation exercises: 4 hours per week.
Contents: The most important information on each topic of the course is given in lectures. After this, the students are given problems to solve on the same topics. The aims of the problem-solving are for students to practice calculation technique, understand methods and ideas, as well as be able to apply the subject to technical-physical problems.
Learning outcomes: The students shall learn elementary theory for analytical functions and transformation methods. They shall be able to apply this theory to problems in geomatics, physics and technology. After completing the course, the students shall master: - complex numbers, - complex functions, - Cauchy's integral theorem and Cauchy's integral formula, - Taylor series and Laurent series, - residue calculations, - Fourier transformations.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination, 3.5 hours.
Examination aids: No calculator, specified other examination aids

MATH280 Numerical linear algebra with applications

Numerical linear algebra with applications

Credits: 10 **Language:** English upon request
Staff/institute: Ulf Geir Indahl/ IMT
Teachers:
First time the course is offered: SPRING 2010
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities:
Prerequisites: MATH113 or MATH131

Type of course: Lectures: 4 hours per week. Calculation exercises 2 hours 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 to be able to apply the subject to relevant problems.
Learning outcomes: Theoretical understanding of the basic methods in numerical linear algebra, selected optimization problems and insight in selected practical applications, i.e: - Numerical aspects associated with solving Linear Equations - Vector Spaces and Linear Transformations - Diagonalization and change of Change of Coordinate Basis - Inner Products, Length, Orthogonality and Inner Product Spaces - Orthogonal Projections and Least-Squares Problems - The Singular Value Decomposition Some possible applications: - Constrained Optimization - Linear Regression (Principal Component Regression, Ridge Regression, Weighted Least Squares, Partial Least Squares) - Dynamical Systems - Linear Programming - Image Analysis - Economical analysis
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:

MATH290 Real Analysis

Real Analysis

Credits: 10 **Language:** English upon request
Staff/institute: Arkadi Ponossov/ IMT
Teachers: Arkadi Ponossov.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Other - The course is offered on demand and if resources allow it.Emnet gis ved behov og dersom det er lærerkapasitet.
Mandatory activities: Compulsory assignments
Prerequisites: MATH111, MATH112, MATH113.
Type of course: Lectures: 4 hours per week, calculation exercises: 2 hours 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 to be able to apply the subject to relevant problems.
Learning outcomes: The students are to learn how to use mathematical ideas precisely. This is a necessary background for understanding mathematical analysis. After completing the course, students are to master: - axiomatic description of the different number systems, - basic topological ideas such as metrical space, completeness, compactness, - convergence and uniform convergence, - the Riemann integral, - selected topics in functional analysis.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: Oral examination.

MATH310 Continuous Dynamical Systems

Continuous Dynamical Systems

Credits: 10 **Language:** English
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. The teaching language of the course is English.Emnet gis ved behov og under forutsetning av at ressurssituasjonen tlllater det. Undervisningsspråket er engelsk.
Mandatory activities: Compulsory semester assignment.
Prerequisites: MATH111, MATH112, MATH130, MATH140, MATH270 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 examination.

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, Huw Jones from Middlesex University UK, Brit Salbu and the students' advisors
Start term: Autumn parallel
Terms: Autumn parallel

Mandatory activities: Coursework 100%. Eight 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 (intensive week). 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 (stats), implementation and management of projects. Introduction to generic management/statistical 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
Assessment methods:

MVI261 Heat Engineering I

Heat Engineering I

Credits: 5 **Language:** English
Staff/institute: Reidar B. Schuller/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Mathematics equivalent to MATH100. Physics equivalent to FYS100.
Type of course: Lectures; 2 x 2 hours per week, calculation exercises and laborattory work 2 hours per week.
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: Any calculator, any other examination aids

MVI271 Fish and meat as raw materials

Fish and meat as raw materials

Credits: 5 **Language:** English upon request
Staff/institute: Bjørg Egelandsdal/ IKBM
Teachers: Magny Thomassen (main lecturer), Jan Berg, Nils Petter Kjos, Birger Svihus, Turid Mørkøre, Mia Rørå
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Group work with presentations that must be approved before the final, written exam.
Prerequisites: Basic knowledge of chemistry and biochemistry.
Credit reduction: HFX 206, 5 ECT
Type of course: Lectures (25-30 hrs). Group work (20-25 hrs) plus presentations.
Contents: The students will first acquire an overview of the Norwegian production of animal raw material, inclusive fish and their importance for the Norwegian households. Trends in the consumption of these raw materials. The quality of raw materials: definition, measurements and monitoring. A substantial part of the course is devoted to explaining the structure of muscles, chemical composition, post-mortem processes and the latter processes' impact on quality and shelflife. The final

part of the course is devoted to managing and monitoring the production of slaughter animals of the desired quality. The differences among species (cattle, pork, lamb/sheep, poultry with eggs) are emphasized.
Learning outcomes: The students should acquire a basic understanding of the quality of raw materials originating from fish, meat and eggs. The nutritional importance of these raw materials is emphasized. The effect of ante-mortem and early post-mortem treatment of the animals for the quality of the raw material is lectured. Raw material quality is defined, and typical, important methods of measuring raw material quality will be elaborated.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Semester assignment 40%; written exam 60%, that has to be approved
Examination aids: No calculator, no 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: Tove Devold, Elling-Olav Rukke, Hilde Skaar, PhD students
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.
Credit reduction: MVI410, 10 ECT
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 are obliged to 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 a basic 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 plants, meat and milk can be used as ingredients in the food and feed industry. The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research 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: 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: Linda Hjeljord, Margreet Brovold
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: 20 hours. Laboratory exercises: 35 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. If the student does not pass the laboratory part and/or the theroretical part the student will not pass the course.

MVI322 Pathogenic Microorganisms

Pathogenic Microorganisms

Credits: 10 **Language:** English upon request
Staff/institute: Helge Holo/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Loboratory excercise
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:
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises: 2 hours per week with a short written report.
Prerequisites: Bachelor of Food Science or corresponding
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

MVI340 Sensory Analysis and Consumers Research

Sensory Analysis and Consumers Research

Credits: 10 **Language:** English upon request
Staff/institute: Marit Rødbotten/ IKBM
Teachers: Margrethe Hersleth
Start term: Spring parallel
Terms: Spring parallel June block
Mandatory activities: Laboratory exercisis and seminars.
Prerequisites: Knowledge of statistics corresponding to STAT100. Knowledge of biochemistry corresponding to KJB200 and KJB210.
Type of course: Spring parallell lectures and excersises: 3 hours per week 2 hours laboratory exercises in june block project work 20 hours.
Contents: Brief introduction to anatomy and physiologi related to sensory science. Introduction to the use of sensory analysis in research and industry (selection and training of sensory panels), sensory methods and reporting of sensory results. Instrumental measurements of sensory quality, qualitative and quantitative methods for consumer testing, statistics and multivariate analysis of sensory data, segmentation of consumers, factors that influence perception and preferences for food and general consumer understanding.
Learning outcomes: The students will be able to conduct sensory tests and consumer tests and analyse and interpret the results from these tests. The students should also be able to gather, analyse and interpret relevant literature to be able to discuss and answer essential problems/questions on sensory analysis and consumer 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: Written exame 30%, laboratory journal 30% project work 40%

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
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: Various engineers (Dept. of Chemistry, Biotechnology and Food Science), Tom Chr. Johannessen (NOFIMA-FOOD).
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 MVI271, KJB 200 Biochemistry or corresponding, KJB210 Food chemistry or corresponding
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.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Excursions, lab work and presentations
Prerequisites: Knowledge of fruit and cereal raw materials equivalent to MVI272, food technology equivalent to MVI281 and fermentation porcesses equivalent to MVI321.
Type of course: 3x 2 hours lectures per week including laboratory and group work.
Contents: Qualities of different raw materials for production of cider, beer, wine and spirit. Emphasis will be placed on the raw material and processing methods for the quality of the finished product.
Learning outcomes: Students will learn about the 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 (50%) and 2 hours written test(50%).

MVI382B Cereal Technology

Cereal Technology

Credits: 5 **Language:** English upon request
Staff/institute: Trude Wicklund/ IKBM
Teachers: Anne Kjersti Uhlen, IPM and Anette Moldestad, Nofima.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Lab exercises and excursions
Prerequisites: Knowledge of cereal as raw material, corresponding to MVI272. Knowledge of technology corresponding to MVI281.
Type of course: 3x2 hours lecture per week including laboraty and group work.
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 50%, and 2 hours written exam 50%.Both parts has to be approved.

MVI383A Dairy Technology

Dairy Technology

Credits: 15 **Language:** English upon request
Staff/institute: Roger K. Abrahamsen/ IKBM
Teachers: Siv Skeie
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 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: Practicals and excursion.
Prerequisites: Knowledge of milk as a raw material, equivalent to MVI270. Knowledge of dairy technology equivalent to MVI383A. Fermentation microbiology equivalent to MVI321.
Type of course: Each week, one topic is covered. There will be practicals in two of the weeks, each of one and a half days and some additional time used for treatment of the results from the practicals.
Contents: The course contains 6 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. - Probiotic bacteria and -products. 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 appr. 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, Kim Marius Moe
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Presantations, discussion groups, exercises and excursion.
Prerequisites: Knowledge of milk as a raw material for food processing equivalent to MVI270. Knowledge of dairy technology equivalent to MVI383A.
Type of course: Lectures: 20 hours. Colloquia: 8 hours. Exercises: 48 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 50 %. Two journals count 30%. The deadline for handing in journals is two weeks after having completed the exercise. One presantation counts 10% and a presantation of a topic on cheese on Wikipedia counts 10 %.

MVI384 Functional Foods

Functional Foods

Credits: 10 **Language:** English
Staff/institute: Judith Narvhus/ IKBM
Teachers: Wicklund, Trude; Remberg, Siv F; Vegarud, Gerd: Hansen, Magnor; Uhlen, Anne Kjersti; Haug, Anna.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Other - NB! This course will not be given in autumn 2009. The course will be given in autumn 2010.NB! Kurset gis ikke høst 2009. Kurset vil bli gitt høsten 2010
Mandatory activities: Discussion groups.
Prerequisites: Basic knowledge of nutrition, food chemistry and microbiology at the 200 level.
Type of course: Lectures: 4 hours. Discussion groups: 2 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, Eirik Selmer Olsen, Ola Eide and others.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Seminars/case studies and role plays.
Prerequisites: Bachelor's degree.
Type of course: 1. Lectures: 2 hours x 3 per week including seminars (discussion groups and excursion to the FoU section in a food industry.
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.

The students will learn and obtain experience with how to prepare and deliver effective oral and written presentations of technical information and scientific results. They will learn to think critically and solve complex and multidisciplinary problems, as well as learn to accurately interpret current research 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: Group assignment with presentation and discussion: 1/3. Written exam, 2 hours: 2/3. 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.

MVI390B Immunological techniques

Immunological techniques

Credits: 5 **Language:** English upon request
Staff/institute: Tor Erling Lea/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Basic immunology corresponding to MVI 390
Type of course: Laboratory exercises, demonstrations and lectures 60 hrs. Colloquia and self study 60 hrs.
Contents: The course will give the students thorough practical experience with isolation of antibodies, the use of antibody reagents for analyses based on precipitation and agglutination, and analytical formats employing enzyme-, fluorescence- and isotope conjugated antibodies (ELISA and RIA). Important methods for isolation and characterization of immune cells, fractionation of immune cells into different subgroups, and techniques for studying functional properties of immune cells will also be reviewed.
Learning outcomes: After having completed the course, students should have acquired practical and theoretical experience with the most important analytical methods of immunochemistry and cellular immunology. They should be able to select suitable analytical formats for their own problems, evaluate sources of errors, and resolve problems connected to the use of immunological techniques.
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: Exam 14 days after the last lecture

MVI391 Diet and Health

Diet and Health

Credits: 5 **Language:** English upon request
Staff/institute: Kari Almendingen/ IKBM
Teachers: Guest lecturers
Start term: January block
Terms: January block
Mandatory activities: The first day lecture is obligatory. Active participation in seminars.
Prerequisites: Knowledge of chemistry equivalent to MVI210 or KJB210. Knowledge of biochemistry equivalent to KJB200. Knowledge of nutrition equivalent to HFE100.
Type of course: January block (3 weeks) 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 current 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 1/3. Written examination, counts 2/3. The written examination has to be graded E or better.

MVI392 Gastrointestinal anatomy and physiology

Gastrointestinal anatomy and physiology

Credits: 5 **Language:** English upon request
Staff/institute: Morten Jacobsen/ IKBM
Teachers: Morten B. Jacobsen
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: Biochemistry corresponding to KJB200. Nutrition science corresponding to HFE100. Basic knowledge of microbiology and cell biology.
Type of course: Lectures including colloquia: 6 hrs. one day per week.
Contents: Particular emphasis is placed on intestinal cellular anatomy, neural, humoral and feedback regulatory mechanisms, satiety and hunger, motility, and immune competence of the intestinal tract. The main functions of the stomach, small and large intestine, liver and pancreas are presented in detail. Also the role of the intestinal mucosa in immune defence is discussed. Furthermore students should achieve some knowledge of relevant medical terminology.
Learning outcomes: The lectures aim to provide a basic understanding of the biology and the different elements and processes in the alimentary tract, how they function, interact and how their functions are modified to achieve optimal nutrition and 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: Group presentation and individual written exam. Marking is partly bsed on group presentation (40%) and partly on individual written exam (60%).

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: MVI281 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: Various teachers according to need
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 acquired 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, prefereably 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

MVI484 From Milk to Cheese

From Milk to Cheese

Credits: 5 **Language:** English
Staff/institute: Siv Borghild Skeie/ IKBM
Teachers: Associate Professor Inga Ciprivica, LLU, Latvia, Professor Roger Abrahamsen, UMB, Norway, Professor Anders Andrén, SLU, Sweden, Research scientist Tiiu Maie Laht, TUT, Estonia, Associate Professor Finn Vogensen, KU Life, Denmark, Professor Ylva Ardö, KU Life, Denmark, Professor Tapani Alatossava, UH, Finland,
Start term: August block
Terms: August block
The course is offered: Other -
Mandatory activities: The week in Ås is mandatory for all participating students
Prerequisites: The students participating in this course should have a Masters degree in Food Science or a comparable bacground and the scientific content of the course will be based on this assumption
Type of course: Each day will have two sessions, one morning session between 8.15 and 12.00 and one evening session between 12.30 and 16.15. Each session will start with a lecture followed by further discussions of the topic in colloquia. I.e. 1 hour lecture and 3 hours colloquia. It is mandatory that the students have been reading the literature before the week in Ås. During the colloquia the students will work on problems given by the lecturer. On day 4, the colloquia will be replaced by practical exercises in a cheese pilot plant. All documents can also be found on the web on Classfronter which will be opened to you around 1st of August. You will find the problems/questions that should be focused within each topic on this site.
Contents: The course focus on the aspects related to cheesemaking, as milk quality and milk treatment; coagulation kinetics during renneting; structure development of the cheese curd; antimicrobial interactions; starter cultures; influence on cheese making and the foundation for flavour development and cheese making technology.
Learning outcomes: The students will have a scientific basis to understand the principles of cheesemaking and factors that influences the cheesemaking process. The students should gain an in-depth understanding of the complexity of cheesemaking and various factors influencing the quality of the cheese. The knowledge level will be updated with the most recent research documentation. Within the chosen topics, students will approach the edge of the discipline knowledge platform.

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 will be evaluated by 10 pages report.

NATF210 Environmental Monitoring

Environmental Monitoring

Credits: 5 **Language:** English upon request
Staff/institute: Svein Øivind Solberg/ INA
Teachers: Five guest lectures from Norwegian institutions carrying out environmental monitoring.
Start term: January block
Terms: January block
Mandatory activities: 1 compulsory excursion. 75 % of the home assignments must be submitted and passed.
Prerequisites: STAT100.
Contents: Lectures: various methods (field work, bioindicators, automatic monitoring, telemetry, remote sensing). Data handling and interpretation (databases, GIS, environmental standards, critical loads and levels, proxy and paleo data, politics versus science). Examples of methods and conventions for monitoring of soil, soil water, water, air, climate, radioactivity, animals, vegetation, forest and biodiversity. Norwegian and international examples. Data lab training: We practice on databases, GIS and remote sensing Excursion: Look on methods and installations for monitoring. Tree climbing. Social trip. Group work: Make a poster on a self chosen example of environmental monitoring and present it. Home work: Calculations and work on data from environmental monitoring.
Learning outcomes: After the course the students shall: - have an overview of the methods for environmental monitoring; - know major international monitoring activities and treaties; - have some knowledge about the background of environmental monitoring: i.e. the environmental problems; - be able to handle and interpret monitoring data and present them in a good 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: Any calculator, no other examination aids

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 competence 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:
Start term: Spring parallel
Terms: Spring 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 Resource Management

Community Based Natural Resource Management

Credits: 5 **Language:** English
Staff/institute: Stein Ragnar Moe/ INA
Teachers: Thor Larsen
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Class presentations.
Prerequisites: Completed Bachelor's degree and knowledge in ecology at ECOL250 level.
Type of course: Seminars: 20 hours, lectures: 10 hours.
Contents: Throught the world we find examples of conflicts between conservation and human development. During the past decade, however, there has been an increasing realisation that conservation and preservation of natural resources cannot be effectively achieved without incorporating local people and their needs. With a focus on developing countries the course explore how to integrate important ecological, social and economic tools in an integrated ecosystem management approach. Part of the course will focus on case studies from different parts of the world. We will study different approaches to community based natural resource management 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 how people and ecosystems interact.The main goal is to explore different conflicts between development and conservation and how these conflicts can be reduced by community involvement in 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: 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, K. Svanäng; Helsinki Univ.: J. Helenius.
Start term: Spring parallel
Terms: Spring parallel
Prerequisites: Bachelor's degree or its equivalent in agriculture, plant science, 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 excursions.
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: a group-based real-life project work and an individual reflection on the project work. 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 are spanning from farm to global scales. Students write a group report for their farmer clients. 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: 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. The weighting is: group report 30%, individual report 30%, oral examination 30%, course contribution 10%. All parts have to be passed.

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 excursions.
Prerequisites: Bachelor's degree or its equivalent in agriculture, plant science, 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. 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: 10 **Language:** English upon request
Staff/institute: Sissel Torre/ IPM
Teachers: Hans Ragnar Gislerød, Eva Vike, Per Anker Pedersen
Start term: Spring parallel

Terms: Spring parallel
The course is offered: Odd years
Mandatory activities: Exercises and excursions.
Prerequisites: BOT130, PJH103 or equivalent.
Type of course: Lectures: 40 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, and different nursery crops
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: 15 **Language:** English upon request
Staff/institute: Sissel Torre/ IPM
Teachers: Hans Ragnar Gislerød, Eva Vike, Per Anker Pedersen
Start term: Spring parallel
Terms: Spring parallel June block
The course is offered: Odd years
Mandatory activities: Exercises and excursions.
Prerequisites: BOT130, PJH103 or equivalent.
Credit reduction: PHA223, 10 credits.
Type of course: Lectures: 40 hours. Assignments/exercises: 40 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, and different nursery crops.
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.

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 equivalent.
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: January block
Terms: January block Spring parallel June block
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 ongoing 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 counts 100%.

PHI401 Research Ethics and Philosophy of Science I

Research Ethics and Philosophy of Science I

Credits: 5 **Language:** English
Staff/institute: Frode Kjosavik/ IØR
Teachers: Frode Kjosavik, Deborah Oughton.
First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: The studentens must attend at least 70 % of lectures and seminars.
Credit reduction: The course overlaps the first part of the course PHI 402. Students who take the course PHI 402 in addition to PHI 401 will only receive 5 study points. Students who have taken the course PHI 400 (given last time autumn 2008) will receive no study points by taking the courses PHI 401 or PHI 402.
Type of course: Around 28 hours lectures + seminars and group discussions.
Contents: An elementary and introductory course in philosophy of science will give the student a good basis for a better understanding of issues in the main part (research ethics/social responsibility of science), both through illuminating science as a practice form and through its own ethical aim ('good' science). Among the issues to be discussed can be mentioned: The value- and norm systems of science; facts and values; political-economical interests and scientific integrity; research ethical guidelines; duties towards other scientists and research objects; science, technology and society; ethical challenges in developmental research; scientific rationality and scientific methods; scientific realism and social constructivism; metaphors and theory formation; theoretical experience/experimental experience.
Learning outcomes: The course aims at an increased understanding of science in practice, i. e. science as it is carried out in diverse ways within the natural, social and cultural sphere. The course considers what is specific about scientific practice, rationality and method in diverse fields, what its aims are, how it is influenced by society and what kinds of social and cultural consequences it may be said to have. The objective is to stimulate students to reflect on their own and others research projects and research fields, in particular with a view to increase their ability to see and diagnose philosophical and ethical problems in the sciences as well as their consciousness of their ethical responsibility.
Methods of examination: Final Written exam **Grading:** Pass/Fail
Assessment methods: Term paper.
Examination aids:

PHI402 Research Ethics and Philosophy of Science II

Research Ethics and Philosophy of Science II

Credits: 10 **Language:** English
Staff/institute: Frode Kjosavik/ IØR
Teachers: Frode Kjosavik, Deborah Oughton.

First time the course is offered: AUTUMN 2009
Start term: Autumn parallel
Terms: Autumn parallel January block
Mandatory activities: The students must attend at least 70 % of lectures and seminars.
Credit reduction: See PHI 401.
Type of course: Around 40-44 hours lectures + seminars/group discussions.
Contents: The contents and structure of this course is by far the same as in the course PHI 401 (see 'Contents' under PHI 401). But the course PHI 402 offers an extended study in philosophy of science especially. It should be noted that the following examples of issues to be discussed here are also ethically relevant: The relation between natural and human sciences; science in society (science as social practice); what nature must be like for science to be possible; open and closed systems; epistemological problems in open (natural and social) systems; naturalism and its limits; the transformative model of society; laws, powers, models and idealization; reductionism and anti-reductionism in biology; problems related to the understanding of the selection entities; anti-reductionism and the developmental system-theories about onto-genesis and evolution.
Learning outcomes: Teaching goals as well as lectures, seminars and syllabus are by far the same as in the course PHI 401 (see 'Teaching goals' under PHI 401). But the course PHI 402 will, with an extended course in philosophy of science as its point of departure, give the students an opportunity to go deeper into philosophical and/or ethical issues related to their own research projects. Through the work with a term paper related to their own projects, the students will receive a possibility to think through pressing problems of the kind.
Methods of examination: Final Written exam **Grading:** Pass/Fail
Assessment methods: Term paper.
Examination aids: No calculator, no other examination aids

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.
Last time the course is offered: HØST
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises and group work. Journal writing and presentation.
Type of course: Lectures: 40 hours. Exercises/field work: 20 hours. Group work/project work: 30 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) Field vegetables (including potatoes).
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: Oral presentation (30%) in the autumn parallel. Written exam (70%). Both 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.
Last time the course is offered: VÅR
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) Field vegetables (including potatoes). 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.

PLV220 General Plant Pathology

General Plant Pathology

Credits: 10 **Language:** English upon request
Staff/institute: Anne Marte Tronsmo/ IPM
Teachers: Professor Anne Marte Tronsmo, Arne Stensvand, Mat Bente Brurberg + Researchers from the Norwegian Institute for Agricultural and Environmental Research, Division Plant Pathology.
Last time the course is offered: HØST
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Field walks. Approved herbarium. Lab. practicals. Approved lab. report.
Prerequisites: Genetics (BIO120), Microbiology (BIO130), Botany (BOT100), Introductory Plant Physiology (BOT130).
Credit reduction: Overlap with PLV210. Credit reduction: 2.
Type of course: Lectures: 28 hours. Field trips/walks and work on collected material: 18 hours. Lab. practicals: 24 hours. Lectures, practicals and demonstrations of diseases in different crops: 32 hours.
Contents: Causes of plant diseases: plant pathogens: Fungi, viruses, phytoplasma and bacteria. Symptoms and diagnosis of plant pathogens. Isolation, culturing and pathogenicity testing. Disease cycle of important groups of pathogens: Survival and dispersal, infection, disease physiology and plant defence. Genetic aspects of plant diseases. Epidemiology and yield reduction. Control measures: Preventive (Legislation, choice of plant material, use of resistance, hygiene, growth conditions); Chemical, biological and integrated control. Identification of diseases. Make a collection of diseased plants (herbarium).
Learning outcomes: To be able to identify the most important plant diseases, and the organisms that causes the diseases. To describe the biology of the viruses, bacteria and fungi that are causing the diseases. To demonstrate simple methods for identification of plant pathogens. To explain parasitism and disease development, how pathogens attack plants and how plants defend themselves. To explain the interaction between host and pathogen on enetic, physiological, organism and population level. To explain how epidemics develops and how they can be controlled. To know the disease control methods that are relevant for plant production in Norway. Understand the ecological background of plant disease development and control methods. Utilise acquired knowledge to develop control strategies in different plant crops. Understand the relationship between beneficial and harmful organisms in different settings.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written questions including a diagnosis test.
Examination aids: No calculator, no other examination aids

PLV300 Plant Health and Plant Protection

Plant Health and Plant Protection

Credits: 10 **Language:** English
Staff/institute: Trond Hofsvang/ IPM
Teachers: Arild Andersen, Anne Marte Tronsmo, Ole-Martin Eklo, researchers from Bioforsk, Plant Health and Plant Protection Division.
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: Odd years
Mandatory activities: Approved journals from laboratory exercises must be handed in at least one week after finishing the exercise. Three small assignments must be approved.
Prerequisites: PLV220, PLV230 and PLV240.
Type of course: Lectures/exercises: ca. 50 hours.
Contents: Integrated plant protection: definitions, historical development and conditions nationally and internationally. Make diagnoses of pests, biology of pests, interaction between pests and the environment, damage thresholds, fight against pests, risks and environmental effects of pesticides, international trade agreements and risk assessment. Key processes. Pesticides' destiny in the environment is examined in laboratory exercises to explain the meaning and use of different models for risk assessments. The experiences are summed up and discussed in exercises and the independent assignment.
Learning outcomes: The students shall have the necessary basis to become advisers and to specialize in complex plant protection issues seen in a future-oriented ecological general perspective. The students shall know about integrated plant protection in theory and practice and acquire an understanding of the ecological processes that integrated plant protection is based on. They shall have knowledge about new and current challenges in plant protection today. Understanding of ecological processes and risks of environmental effects as a basis for integrated measures against pests in crop production. Consider dates for different integrated measures in different cultures based on damage thresholds, prognoses, warnings and indicator models. Make plans for integrated fight strategies with the fewest risks for environmental strain. Consider integrated plant protection measures in a general perspective for crop production and environmental quality. Product quality considered as production quality - an expanded quality concept.
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 2/3 (ca. 30 minutes per student). Independent assignment counts 1/3. Both parts have to be passed

PLV320 PLANT PATHOLOGY IN A CHANGING WORLD

PLANT PATHOLOGY IN A CHANGING WORLD

Credits: 5 **Language:** English
Staff/institute: Anne Marte Tronsmo/ IPM
Teachers: Jonathan Yuen, Department of Forest Mycology and Pathology, SLU. Lisa Munk, Department of Plan Biology, Faculty of Life Sciences (LIFE), Copenhagen University, Denmark. Minna Pirhonen, Department of Applied Biology, University of Helsinki, Faculty of Agriculture and Forestry, HU-AF, Finland. Agricultural University of Iceland, LBHI, Iceland. The course is part of the Nordic MSc programme in Plant Pathology.
Start term: August block
Terms: August block
Mandatory activities: Excursions and exercises approx 40 hours (compulsory). Seminars and group discussions approx 15 hours (compulsory). Submitting reports that are approved.
Prerequisites: A first degree (bachelors or candidate degree) in biology or closely related field: Equivalent to 180 ECTS including 90 ECTS in Biology or as an alternative: Equivalent to 120 ECTS including 60 ECTS in Biology of which at least 5 ECTS each of plant physiology, microbiology,genetics and floristic and faunistic are part of the 60 ECTS.
Credit reduction: Perhaps some overlap with PLV220. No credit reduction.
Type of course: Lectures ca 25 h. Seminars ca 10 h. Exercises ca 20 h. Project/group work ca 15h. Excursions ca 30 h.

Contents: The content is tailored to the interests and needs of the individual student. In lectures and seminars the scientific basis of plant pathology is explained, particularly the impact of plant disease on mankind from a historical perspective. Seminars and group discussions cover basic terminology and philosophy of the science of plant pathology, and give perspectives on plant disease management. Career opportunities are discussed with local guest lecturers. In field and laboratory exercises the students will study plant diseases from a field perspective. The students observe disease symptoms and signs, collect material for subsequent laboratory exercises, and are introduced to basic laboratory methods used in plant pathology. Exercises are production-oriented. Link to Norpath's homepages:http://www.nova-university.org/NorPATH/index.htm
Learning outcomes: The main objective of the course is to both deepen and broaden knowledge in plant pathology from a societal perspective. On completion of the course, students will be able to - give an account of the key concepts of plant pathology, - describe the social impact of plant disease and its relevance for society - be familiar with methods to address plant pathological questions in a scientific manner - discuss plant disease management from different perspectives with respect to international trade, climate change, and sustainable production. This course is an introductory course to the NorPATH programme and additional goals include development of individual study plans, both possibilities for thesis subjects and locations, as well as conveying knowledge about the possible career opportunities in plant pathology
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 detailed planning is not yet completed. Check the web site for an updated version, or contact: anne-marte.tronsmo@umb.no

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 David Collinge, LIFE, København - Organiser in 2010 Professor Jonathan Yuen, SLU - Organiser in 2009. Professor Anne Marte Tronsmo, UMB - Organiser in 2011 Professor Minna Pirhonen, HU- Organiser in 2112 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: Master degree that qualifies for enrollment as a PhD student in Plant Pathology. 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: See description on the NOVA home page
Learning outcomes: See description on the NOVA home page
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: Contribution and performance in discussions are assessed by nordic teachers. Content and presentastion of poster or oral presentation are assessed by a group of international and nordic teachers.

PPK300 Crop Science

Crop Science

Credits: 10 **Language:** English upon request
Staff/institute: Arne Oddvar Skjelvåg/ IPM
Teachers: A. K. Uhlen, M. A. Bleken, T. Bjor, external teachers.

Start term: August block
Terms: August block Autumn parallel
The course is offered: Other - The course will only be given if at least five students register. Registration: to the course organiser before 31 March of the same calendar year because of preparation of materials for field practicals. The course will be revised and will not be given ordinary in 2009. All interested students are welcome to contact anne.uhlen@umb.noEmnet vert gitt berre dersom minst fem studentar melder seg på. Påmelding til den kursansvarlege må skje innan utgangen av mars same året pga. tillaging av øvingsmateriale i felt. Emnet er under revisjon og vil ikkje bli gitt ordinært i 2009. Interesserte kan kontakte anne.uhlen@umb.no for meir informasjon
Mandatory activities: Exercises, the written assignments and excursions in the autumn block.
Prerequisites: JORD242, PJH103, PJH210, PLV220, PLV230, PLV240.
Type of course: The course consists of 60 hours of exercises in the autumn block and 56 hours of lectures etc. in the parallel period. The rest of the time is set aside for the written assignment. The parallel period is made up of: Question hours or self-tuition: 10 hours. Excursions: 10 hours. Exercises: 56 hours. Written assignments: 80 hours.
Contents: There is a two-week period with practicals in field and laboratory on: crop physiology, experimental design, field-experimental work, seed and variety testing. Journals will be required. A few topics will be further discussed in lectures later in the autumn. The students are supposed to do self-studies on selected topics and take part in discussion afterwards. They shall analyse the crop production potential under various soil and clilmatic conditions. There will be extra consultancy and assistance to run model simulation in the work on the assignment.
Learning outcomes: The students are supposed to understand the physiology and ecology of crops, and the quantification of this in crop growth models. On this basis and on graduate courses they should be able to discuss and give advice on practical solution on present issues in crop production. In separate assignments they shall analyse the basis for crop production under various soil and climatic conditions.
Methods of examination: Final Oral exam **Grading:** A-F
Assessment methods: At the oral examination three problems are presented to the student, two from the theoretical topics and one from the topic papers, which are to be handed in before examination and read by the teacher and the external examiner. The duration of the examination is at least 45 minutes for each student.

PPUT301 Science and Technology in School and Society - LUN

Science and Technology in School and Society - LUN

Credits: 20 **Language:** English upon request
Staff/institute: Erik Knain/ IMT
Teachers: Astrid Sinnes and others.
Start term: August block
Terms: By demand
Mandatory activities: The students must give a presentation linked to their master's thesis and open for discussion with the other students at the seminar. The presentation is assessed as 'passed/failed'. All three compulsory assignments must be passed.
Prerequisites: LUN students. PPXP, PPRA301, PPPE301, PPFD301, natural science courses. Science teacher education.
Credit reduction: Equivalent to 15 credits if taken in parallel with the master's thesis.
Type of course: Handed out at course start. There are two compulsory assignments and presentations in the autumn semester. In the spring semester, the students will give presentations linked to their master's theses.
Contents: The students are to develop their own opinions about educational theory by studying literature on educational theory and written texts where the theories are applied to real-life problems. The topics covered by the common literature include: 'Characteristics of natural science and technology', 'Nature, natural science, culture and identity in a globalised world', 'Natural science and technology in socio-political controversy'. Work methods and basic skills in natural science. This constitutes the main part of the course, is given in the autumn semester and contains two compulsory assignments. In the spring semester, the course is intended to support the students in writing their master's theses through compulsory seminars.
Learning outcomes: The students will gain insight into literature on educational theory and principles, and apply this literature to their own problems within educational theory. One part of the literature is common and one part is chosen by the students. The students are to develop the correct use of quotes and be able to discuss and review literature. Literature shall be used actively in the students' written work and empirical research. Through presentations and discussions, the

students should develop their own opinions about educational theories and principles in the natural sciences. The course aims to give the students a basis before embarking on their master's theses.
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 written assignments. 1) An essay on relevant literature. The aim of the first assignment is to develop skills which are important when writing a master's thesis: - discuss relevant problems in teaching theory, - find and choose literature to discuss a problem, - using quotes from the chosen literature correctly, critical literature review, - use the literature in a coherent manner, - give an independent review of the literature and solve the problem. 2) The second assignment is an empirical survey in light of the first assignment and may serve as a pilot project for a master's thesis. The aim of this assignment is to discuss and use literature in connection with empirical research. Emphasis is placed on discussing teaching theory and using literature, and not on methodology. The two assignments each accounts for 50 % of the final grade.

PØL300 Agroecosystems

Agroecosystems

Credits: 10 **Language:** English
Staff/institute: Marina Azzaroli Bleken/ IPM
Teachers: Arild Andersen; Petter Jensen; Helge Skinnes; Leif Sundheim and other teachers at IPM
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. PAE302 + PAE303 in combination with a an agronomic/natural science study profile.
Type of course: 5 hours/week.
Contents: This course combines bird-view and deep-diving into a number of topics and case studies concerning food production for the sustainment of the increasing human community and its effects on the environment at a global and local scale. Essentially we shall concentrate on the consequences of different production choices on the long term sustainability of the agroecosystem. There is no single way of doing such a study and no simple answer. Nevertheless, a core of evidences shows that the consequences of a cultivation choice can be quite different when examined on a large spatial and temporal scale, compared to the immediate effect on the yield of a single crop. Some keywords for the topics considered are: Agroecology in a historical perspective, secure and safe food supply at local and global scale, the C- and N cycles (and their relevance for global warming), biodiversity, water supply and ecological sanitation, elements of plant epidemiology, analysis of agroecosystems on a regional and farm level. The students will reflect upon advantages and limitations of both conventional and organic agriculture. 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 and others.

Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Excursion
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%).

SKOG310 Nordic Forestry and Forest Research

Nordic Forestry and Forest Research

Credits: 10 **Language:** English
Staff/institute: Andreas Brunner/ INA
Teachers: Sjur Baardsen, Tron Eid, Terje Gobakken, Ole Hofstad and Birger Solberg
First time the course is offered: SPRING 2009
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Excursion
Prerequisites: Bachelor in Forestry or similar.
Credit reduction: Overlap of 2 credits against SKOG300, 1 credit against SKS303, 2 credits against RØP320
Type of course: Lectures, seminars, excursion, semester assignment.
Contents: A few short lectures will introduce the students to natural and socio-economic conditions for forest management in Norway and the other Nordic countries. Research papers within seven general topics, where INA contributes actively to forest research, will be discussed in seminars with the teachers: Forest inventories in Norway are based on field measurements as well as advanced remote sensing technology. Issues related to inventory methods and the value of the information collected will be discussed. (Gobakken) Planning in Norway is conducted for small private forest holdings as well as for larger forest areas. Procedures, decision-support systems and decision-making related to Norwegian planning will be addressed. (Eid) Silviculture in the boreal region is dominated by Norway spruce and Scots pine. Regeneration and thinning practices for those two species in the Nordic countries will be discussed. (Brunner) Bioenergy: Competition for forest fiber between forest industries and bioenergy production. Impacts of policy means. (Solberg) International markets: Economic impacts on the European forest sector of a. accellerating forest growth, b. Russian timber export fees, and c. increased forest protection in Europe. (Solberg) Timber market: Roundwood market functioning and research in the Nordic countries (Baardsen) Economy: The concept of forest as capital will be explained. The diminishing role of forestry in national and regional economies as well as in the economy of individual forest owners will be discussed. (Hofstad) Forest policy is determined by private ownership and public incentives. The combination of efficient resource utilization and sustainable ecosystem management is a political aim. Contemporary issues like biodiversity conservation and carbon sequestration will be discussed. (Hofstad)
Learning outcomes: This course is designed for exchange students from outside Norway wishing to learn about forestry and forest research in Norway and the other Nordic countries. Students will learn about the natural and socio-economic conditions for forestry in the Nordic countries and the forestry practices that are special to that region. current research results related to forest management from UMB and other Nordic forest research institutes.
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 count 60%. Semester assignment counts 40%.

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: SKOG220.
Credit reduction: 1 credit against SKOG310
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: Trygve Almøy/ 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:

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:

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: Odd 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: 3.5 hours.
Examination aids:

STAT360 Theoretical Statistics

Theoretical Statistics

Credits: 10 **Language:** English upon request
Staff/institute: Trygve Almøy/ IKBM
Start term: Autumn parallel
Terms: Autumn parallel
The course is offered: By assignment
Mandatory activities: Project assignment
Prerequisites: STAT100, STAT250, MATH130
Type of course: 4 hours per week. Mainly lectures, but also some calculation exercises.
Contents: Follow-up on estimation theory from STAT250. Fisher information. Cramer-Raos difference. The most important asymptotic results in estimation theory. Sufficience. Some Bayesian statistics. Linear models treated generally with matrix formulation. Specialisation to regression analysis, variance analysis and covariance analysis. Estimation and hypothetis testing in linear models. Estimability. Optimality in connection with linear models. Multi-variable distributions from a matrix formulation. Theory on model reduction, prediction and classification.
Learning outcomes: The students should acquire a basic theoretical understanding of the most important classes of mathematical-statistical models used among other things when analysing biological data and for the statistical methods developed in connection with such models. They should be able to see connections for exponential distribution classes in general and for linear models especially. The should also understand why and when a model reduction produces better result. The student should also be able to present subject-relevant material both orally and in writing.
Methods of examination: Final Written exam **Grading:** A-F
Examination aids:

TAT101 Aquaculture Laboratory Course

Aquaculture Laboratory Course

Credits: 10 **Language:** English upon request
Staff/institute: Bjørn Frode Eriksen/ 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 assessed and then returned to the students with comments and advice for any required corrections that should be made before the final assessment.

TAT211 Production Technique in Aquaculture

Production Technique in Aquaculture

Credits: 10 **Language:** English
Staff/institute: Odd Ivar Lekang/ IMT
Teachers: Eriksen Bjørn Frode.
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Students are required to hand in two compulsory written assignment.
Prerequisites: KJM100 - General Chemistry, MATH100 - Introductory Mathematics, or corresponding knowledge. In addition is TAT254 or knowledge that correspond required.
Type of course: Lectures: approx. 78 hours.
Contents: The course gives a general survey of production technology for aquatic organisms, with focus on intensive farming where Norwegian salmon farming is used as an example. Knowledge is given in production of broodstock, juvenile and ongrowing. The students will be given an overview of central working operations, site selection, maintenance, production hygiene and regulation for juvenile and ongrowing production. There will be lectures in production planning and making of production plans, which also include evaluation and optimizing of plans. In this topic will also a survey of investments and running cost for major technical equipment be included. The students shall through two exercises make their own production plans for respectively juvenile and ongrowing farms. The exercises shall also include working plans for major working operations. Lectures will also be included in production management and important factors that can be controlled. Production control, design of production control and routines for deviation will also be included in lectures. A main aim with the course will be overall and practical understanding of the production.
Learning outcomes: - Have general knowledge in production of aquatic organisms, with focus of salmonids. - Know how to produce broodstock, juvenile and adult fish - Know how to evaluate and optimize the most important working operations on a juvenile and ongrowing farm. - Knowledge to make a production plan for a juvenile and ongrowing farm. - Know which factors that is important to optimize the production on a juvenile and ongrowing farm. - Know which factors that affect the production velocity, how can they be changed, and what is the effect of this. - Know procedures for season independent smolt production. - Know how to performe site evaluations and know site selection criteria. - Know how to prepare documents for production control and propose efforts with deviation. - Be able to prepare working plans for smolt production and ongrowing production farms. - Know maintenance routines/plans for smolt production and ongrowing production. - Be able to estimate investment and running cost for main components in smolt and ongrowing farms. -Know laws and regulations that have affect on the production planning.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Final written examination, 3 hours.
Examination aids: Simple calculator, no other examination aids

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 (The 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 on 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 assessment (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.
Start term: Autumn parallel
Terms: Autumn parallel Spring parallel
Prerequisites: Bachelor degree 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 Basic Aquaculture Engineering

Basic Aquaculture Engineering

Credits: 5 **Language:** English
Staff/institute: Odd Ivar Lekang/ IMT
Teachers: Eriksen Bjørn Frode.
Start term: January block
Terms: January block
Mandatory activities:
Prerequisites: Bachelor degree in life science or ongoing bachelor degree studies at UMB.
Credit reduction:

Type of course: Activities consist of lectures and literature studies for a three week period ending with a written examination. The estimated activity includes 8 hours with lectures and theoretical exercises per week + individual literature studies.
Contents: The course gives an overview over technical equipment used in aquaculture production, how it function and is constructed. The course is divided in three modules, 1. Water transport and water treatment, 2. Production units, 3. Additional necessary equipment.
Learning outcomes: The aim of the course is to give the student basic knowledge on technical equipment, methods and systems that are nessessary for aquaculture production.
Methods of examination: Final Written exam **Grading:** A-F
Assessment methods: Written examination, 3 hours, counts 100%.
Examination aids: Simple calculator, no other examination aids

TAT310 Aquaculture Engineering, Main Topic

Aquaculture Engineering, Main Topic

Credits: 15 **Language:** English upon request
Staff/institute: Bjørn Frode Eriksen/ IMT
Teachers: Lekang Odd Ivar.
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 examination, approx. 3/4 hours per student. At the oral examination, the candidate is assessed 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: Bjørn Frode Eriksen/ IMT
Teachers: Lekang Odd Ivar.
Start term: Autumn parallel
Terms: Autumn parallel
Prerequisites: TAT254 - Aquaculture Production, or similar knowledge in the area. TAT211 - Production Technology in Aquaculture, or similar knowledge.

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 examination, approx. 3/4 hours per student. At the oral examination, the candidate is assessed 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.

TBM250 The Finite Element Method

The Finite Element Method

Credits: 10 **Language:** English upon request
Staff/institute: Tor Anders Nygaard/ IMT
Teachers: Basic FEM/August block: Tor Anders Nygaard (5 ECTS). FEM-design/Autumn semester: Egil Stemsrud (5 ECTS).
Start term: August block
Terms: August block Autumn parallel
Mandatory activities: Compulsory exercises/problems.
Prerequisites: MATH111, MATH112, MATH113, FYS101, FYS102, FYS103, FYS110, TBM120, INF120.
Type of course: August block: 2 hours lectures per day, 2 hours exercises per day. Autumn semester: 2 hours lectures per week, 2 hours exercises per week.
Contents: Central topics are: Terminology, direct method for element matrices, compatibility, equilibrium, system matrices and boundary conditions. Galerkin method and interpolation functions. Derivation of structural dynamics matrices for beam elements. Solution algorithms. Solution of simple problems by hand and programming. Use of commercial software packages. Beam elements, plate/shell elements and volume elements. Boundary conditions and symmetry. Convergence criteria. Sources of errors and singularities. A number of compulsory problems must be solved in order to pass the course.
Learning outcomes: Having passed the course, the students will have gained basic understanding of how to use the Finite-Element-Method (FEM) in solving practical problems. This class also provides training in problem solving using commercial FEM- software packages.
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: Failed/Pass, based on exercises/compulsory problems.

THT280 On-site wastewater treatment - Planning, design and impact assesment

On-site wastewater treatment - Planning, design and impact assesment

Credits: 10 **Language:** English upon request
Staff/institute: Arve Heistad/ IMT
Teachers: Razak Seidu. Guestlecturers.
Start term: Spring parallel
Terms: Spring parallel

Mandatory activities: Exercises.
Prerequisites: THT100 or eqivalent.
Type of course: Lectures: 44 hours (11 weeks of 4 hours/week). Presentation and discussion of excercises: 8 hours. One-day excursion.
Contents: Introduction to natural on-site systems, for treatment of wastewater, stormwater and landfill leachate. Purification processes in natural systems including pathogen removal. Wastewater treatment by soil infiltration, bio-filters, wetlands, and package treatment plants. 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 on-site systems for wastewater treatment and reuse, and have basic knowledge about the design of treatment systems and their impact on health and 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: Written examination: 3 hours, counts for 3/4. Excercises 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/ IPM
Teachers: Internationally known experts will contribute to the course.
Start term: June block
Terms: June block
Mandatory activities: Lectures, excursions.
Credit reduction: Students cannot obtain credits for both THT281 and THT283. THT283 will be reduced by 5 credits.
Type of course: Lectures: 56 class hours. 8 days of 7 hours per day. Demonstrations/excursions minimum 4 hours.
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: Final Written exam **Grading:** Pass/Fail
Assessment methods: Written exam counts 100%.(Multiple choice)
Examination aids: Any calculator, no other examination aids

THT282 Ecotechnology Basics

Ecotechnology Basics

Credits: 10 **Language:** English
Staff/institute: Petter D. Jenssen/ IPM
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Excursions and exersises.
Type of course: 4 lectures and 2 hours exercise per week and one day excursion and shorter excursions close to UMB.
Contents: The course will introduce the principles of ecological engineering and elucidate the connection to nature and society in the design of systems for water supply, bioenergy and recycling of organic waste and wastewater. The course

will cover the basic knowledge needed to understand design of systems for groundwater supply, bioenergy and recycling organic waste and wastewater. Keywords: technical (conventional) and natural systems, centralized and decentralized systems, ecological sanitation, source separating systems, blackwater, urine and greywater handling, dry sanitation, reclamation, hygienization and reuse of waste resources in agriculture, bioenergy production from waste resources, biogeochemical cycling. Potable water from rainwater harvesting, ground- and surface water sources. Health considerations, financial end economic issues and socio-cultural and institutional aspects, introduction to system analysis and risk assessment.
Learning outcomes: The students shall upon completion of the course have an insight into the major water and sanitation challenges of the world and an overview of sustainable water and sanitation options; conventional and alternative (ecological sanitation). The student shall be able to elucidate the connection to nature, society and health in the design of systems for water supply and wastewater handling.
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 (multiple choice) counts 50%, term paper counts 50%

THT283 Sustainable sanitation - decentralized, natural and ecological wastewater treatment

Sustainable sanitation - decentralized, natural and ecological wastewater treatment

Credits: 10 **Language:** English
Staff/institute: Petter D. Jenssen/ IPM
Teachers: Internationally known experts will contribute to the teaching
Start term: June block
Terms: June block
Mandatory activities: Teaching (80% presens), selected excursions and exersizes are compulsory.
Prerequisites: Basic knowledge of geology, microbiology and chemistry equivalent to GEO100, BIO130, KJM100, GEO220 or THT280 or THT282
Credit reduction: Students can not obtain credits for both THT281 and THT283. THT283 will be reduced by 5 credits.
Type of course: 3 and a half week of lectures and exercises. Excursions.
Contents: The course will elucidate how unsafe water supplies and inadequate disposal of human excreta hinder economic and social development and 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 sustainable sanitation solutions for the poor, but also for rich countries. The different systems are introduced through case studies presented by international experts. Through inductive learning based on real cases from different parts of the world, including sanitation in crisis situations, dry and wet and cold climates, the students are challenged to suggest and design systems. Lectures are given on key topics related to system function and design. The course emphasizes on decentralized solutions, natural systems (wetlands ponds, soil infiltration and sandfilters) treating combined wastewater and greywater, small diameter pressure vacuum and gravity collection systems, source separating systems (dry sanitation, urine diverting and blackwater systems) and anaerobic treatment of waste resources for production of biogas and fertilizer from excreta and organic household waste. Both the technical and the socioeconomic sides of successfully improving sanitation are covered. Prior to the lecture period some course material will be sent to the students. Through self-studies and e-learning the students are given the necessary background knowledge to fully benefit from attending the following lecture and exercise part at the Norwegian University of Life Sciences (UMB). The course work at UMB is divided into three parts: 1) lectures and excercises 2) an excursion showing examples of relevant systems and a taste of Norwegian nature and 3) course summary and exam. Those that complete the course are given 12 ETCS credits. UMB students that take the course THT280 do not need preparatory part (prior to arriving at UMB) and will be accredited 10ECTS credit points instead of 12 ECTS points for the course.
Learning outcomes: The students shall have an overview of the challenges related to inadequate sanitation in developing countries and an overview of potential technical solutions. The students should know limitations and advantages of different treatment systems and the socioeconomic factors of relevance for successful implementation in different parts of the world. The participants should be able to design and implement smaller decentralized, natural and source separating systems.
Methods of examination: Final Written exam **Grading:** Pass/Fail

Assessment methods: Written exam (multiple choice) counts 50%. Exercises have to be approved before exam (counts 50%).
Examination aids: Any calculator, no other examination aids

THT299 Environmental Engineering, Project Work

Environmental Engineering, Project Work

Credits: 5 **Language:** English upon request
Staff/institute: Jarle Tommy Bjerkholt/ IMT
Teachers: Oddvar Lindholm, Lasse Vråle, 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 Applied Water and Wastewater Treatment

Applied Water and Wastewater Treatment

Credits: 15 **Language:** English upon request
Staff/institute: Lasse Vråle/ IMT
Teachers: H. Ratnaweera, A. Heistad, John Morken and guest lectues.
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Exercises.
Prerequisites: THT280 and/or 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. 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.
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 for smaller scale systems. The course will give a deeper understanding of some treatment processes and more emphasis on treatment and practical experiance.

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.

TMP261 Heat and flow simulation

Heat and flow simulation

Credits: 5 **Language:** English
Staff/institute: Odd Ivar Lekang/ IMT
Teachers: Carlos Salas
First time the course is offered: SPRING 2010
Start term: Spring parallel
Terms: Spring parallel
Mandatory activities: Compulsory exercises and an individual project report involving simulating a unit operation. Examples of projects are: Simulation of a dryer, a cooler, a cyclone, a heat exchanger, a mixer, a freezing room, flows in pipes or valves, pneumatic transport of particles, porous media like membranes, etc.
Prerequisites: MATH 111 - Calculus 1, MATH 112 - Calculus 2, FYS 101 - Mechanics, FYS 102 - Termophysics og electromagnetism.
Type of course: Three hour with lectures and tuition per week through the semester
Contents: The course gives an introduction to heat and flow simulation. The main program used in the course will be flow simulation from CosmosFlow software. Other used simulation programs like CFX will also be briefly described. The course include lessons and exercises with tutorials on model preparation and creation of a flow simulation project. Key elements are: Meshing and thin wall optimization, electric cooling, transient heat transfer, two dimensional flow, conjugate heat transfer, parametric analysis, porous media, particle trajectory, rotating reference frames, cavitation, relative humidity and load transfer from fluid analysis into stress analysis (Finite element analysis).
Learning outcomes: Having finished the course, the student shall be able to utilize modern computersimulation tools to simulate and predict heat and flow transfer in process installations.
Methods of examination: Final **Grading:** Pass/Fail
Assessment methods: The students are evaluated on basis of having passed mandatory exercises and the quality of their final project report.

TMPP350 Process Technology II

Process Technology II

Credits: 15 **Language:** English upon request
Staff/institute: Tor Kristian Stevik/ IMT
Teachers: John Mosbye, Odd Ivar lekang, Carlos Salas
Start term: Autumn parallel
Terms: Autumn parallel
Mandatory activities: Reports from excursions and industry-seminars are compulsory. Also, journals/other assignments from the group exercises must be approved before the students can sit the examination.
Prerequisites: MATH112 - Calculus II, FYS102 - Thermophysics and Electromagmetism, TEL240 - Mechatronics II: Control Engineering and Automation, 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 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 examination, approx. 45 minutes, with presentation and discussion of the project work. The project report must be submitted at least one week before the oral examination.

ZOOL300 Ecological Entomology

Ecological Entomology

Credits: 10 **Language:** English upon request
Staff/institute: Eline Benestad Hågvar/ INA
Teachers:
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 should also 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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