

Studieplan

Master i teknologi innen innovasjon og entreprenørskap
- En realfaglig master i teknologiledelse (IET)

MSc in Innovation and Entrepreneurship
(master's - 2 years)
- MSc in Technology Management (IET)

2 år/120 studiepoeng

En fellesmaster i samarbeid mellom
Senter for entreprenørskap,
Universitetet i Oslo
og
Avdeling for ingeniørutdanning,
Høgskolen i Bergen

Bergen 6. april 2011

Innholdsfortegnelse

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1. Innledning

Masterprogrammet i Innovasjon og entreprenørskap (IET) ved HiB er en fellesgrad i samarbeid mellom Universitetet i Oslo, Senter for entreprenørskap ved Det matematiske – naturvitenskapelige fakultet, og Høgskolen i Bergen, Avdeling for ingeniørutdanning. Universitetet i Oslo (UiO) har hatt det faglige ansvaret, studentene får sine vitnemål fra denne institusjonen, mens gjennomføringen av utdanningen skjer i samarbeid mellom Universitetet i Oslo og Høgskolen i Bergen (HiB). UiO sin studieplan for studiet er gjeldende også for den studievarianten som gjennomføres ved HiB. UiO sin plan for studiet er presentert under pkt. 3. Studievarianten for studiet ved HiB blir presentert under pkt. 4. HiBs undervisningstilbud har en regional forankring og tilpasning, men tett koordinert med UiO's studieplaner.

Etterspørselen etter kompetent ingeniørkompetanse på Vestlandet er i dag meget stor. Vestlandsfylkene står for en betydelig del av landets verdiskaping. Bare den maritime klyngen på Vestlandet står for 66% av landets maritime verdiskaping (Høgestøl and Ryssevik, 2010: 11). Samfunnets etterspørsel etter innovasjon er også synliggjort gjennom et omfattende virkemiddelapparat og gjennom Regjeringens innovasjonsmeldingen (Nærings- and handelsdepartementet, 2008).

HiBs IET-master på 120 studiepoeng inngår nå i den kunnskapsmessige tilbudssiden for det nye sivilingeniørstudiet ved Høgskolen i Bergen med disiplinforankring i programutvikling, undervannsteknologi, energiteknologi og kommunikasjonssystemer. IET-masteren er den flerfaglige og tverrdisiplinære mastersatsingen for ingeniører og studenter med realfaglig bakgrunn som ønsker en ytterligere profesjonalisering i teknologiretningen de har fra sin ingeniørutdanning, sammen med et kunnskapspåslag innenfor innovasjon, entreprenørskap, finansiering og markedsføring, teknologiledelse, organisasjon & ingeniørprofesjonalitet samt samfunnsansvar og etikk. I presentasjonen bruker vi *teknologifag* eller *teknologiske studieretningsemner* som fellesbegrep i den teknologiske og realfaglige del av mastertilbudet. Vi bruker *IET-fagene* som fellebetegnelse på de øvrige masteremnene.

Studieprogrammet er beskrevet i samsvar med retningslinjene i det nasjonale kvalifikasjonsrammeverket for høyere utdanning. Læringsutbyttebeskrivelsene i de enkelte emnene gjør rede for de detaljerte **kunnskaper**, **ferdigheter** og den **generelle kompetanse** som alle studentene som har fullført et emne (eller nivå) skal ha. Teksten i studieplanen er delvis på engelsk og delvis på norsk, fordi studiet gis på engelsk ved UiO mens det ved HiB fram til i dag er blitt undervist på norsk.

Lærerstabene som er tilknyttet IET-masteren kommer fra tunge fagmiljø innen ingeniørfagene ved HiB – landets største ingeniørutdanning, fra Senter for nyskaping og fra Institutt for økonomisk-administrative fag ved HiB. Høgskolen i Bergen er eneste utdanningsinstitusjon for høgre utdanning i landet som har valgt å organisere økonomi, organisasjons- og ledelsesfagene sammen med ingeniørutdanningen.

Vi har valgt å innlede beskrivelsen av studieplanen med å presentere trekk ved etterspørselssiden - regionale behov for en slik master. Dernest presenterer vi HiBs faglige tilbudsside – vår samlede fagtilbud og kompetanse for å gi et slikt undervisningstilbud på masternivå.

2. Samfunnsmessige behov for ingeniører med kompetanse i innovasjon, entreprenørskap og teknologiledelse

Vestlandet er en viktig region for verdiskaping i Norge. Sentrale næringssektorer i regionen er blant annet maritim sektor, olje og gass (inkludert subsea) og marin sektor. Tall for den maritime næringen viser at Vestlandet hadde vel 64% av landets verdiskaping i 2009, nær 60% av omsetningen og 57% av de ansatte (Høgestøl and Ryssevik, 2010: 10 og 11). Denne marine klynge hadde 57 prosent av landets omsetning og verdiskaping samme år (smst.s:18). Vestlandet er også svært dominerende innenfor olje og gass sektoren. Eksempelvis var nesten halvparten av sysselsettingen innenfor leverandørindustrien i 2007 knyttet til selskaper som enten var lokalisert i Bergens-regionen eller Stavanger/Sandnes (Vatne 2008).

Både innenfor disse og andre sektorer på Vestlandet er etterspørselen etter kompetent ingeniørkompetanse meget høy, og høgskolens satsing på å etablere mastergrader innen teknologi er et ledd i å imøtekomme regionens behov for teknologisk kompetanse. Forskere i fagmiljøet tilknyttet studien har blant annet gjennomført analyser av den marine sektor og subsea-klyngen i Hordaland som viser at bedriftene her er svært opptatt av å utvikle et godt samarbeid med FoU-institusjonene i regionen og utnytte den kompetansen som disse besitter (Jakobsen, 2009, Jakobsen and Fløysand, 2010)(se Jakobsen 2009 og Jakobsen og Fløysand 2010). Når subseabedriftene eksempelvis blir spurt om hva som er viktigst for økt konkurransekraft og vekst for subsea-klyngen i tiden som kommer trekker de fram et relevant utdanningstilbud i regionen som den aller viktigste faktoren. Også Bergens Tidende har i flere sammenhenger meldt om at mange bedrifter har ubesatte ingeniørstillinger (se eksempelvis BT 15.01.11 og 20.01.11).

Vi ser det slik at HiBs IET-mastersatsing treffer godt høgskolens samfunnsmandat slik det er skissert i Regjeringens innovasjonsmelding til Stortinget:

”Etterspørselen etter kompetent arbeidskraft vil av flere grunner fortsette å øke i årene som kommer. Globaliseringen fører til økt nyskaping og teknologiutvikling over hele verden, og dermed øker behovet for omstilling og spesialisering også i Norge. Den demografiske utviklingen og tilhørende økte krav til offentlig tjenesteproduksjon, vil medføre en kraftig økning i etterspørselen etter kompetent arbeidskraft. Også i andre europeiske land ser vi den samme utviklingen, noe som vil bidra til økt internasjonal konkurranse om arbeidskraften.” (Nærings- and handelsdepartementet, 2008, Kap 6)

Mastergradsprogrammet imøtekommer behovet i næringsliv og offentlig sektor på en helhetlig måte. Programmet har et bredt fokus som omfatter entreprenørskap, innovasjonsprosesser, innovasjonssystemer, teknologiledelse, organisering, ingeniørprofesjonalitet, økonomistyring og utfordringer knyttet til etikk og samfunnsansvar. Under vil vi gi en litt mer inngående drøfting av disse temaene og vise hvordan vårt studium bidrar til å styrke utdanningstilbudet på disse viktige temaene.

Utvikling av nye vekstbedrifter

Regjeringens handlingsplan for entreprenørskap i utdanninga vektlegger høyere utdanning og en satsing på studier innen entreprenørskap og innovasjon (Kunnskapsdepartementet, Kommunal- og regionaldepartementet og Næringsdepartementet: Entreprenørskap i utdanninga – frå grunnskole til høyre utdanning 2009 – 2014. Handlingsplan). Vi mener det ligger særlig godt til rette for at et utvidet studietilbud innen entreprenørskap ved Høgskolen i Bergen, med et fokus

på koblingen mellom teknologi, forretningsutvikling og god ledelse, kan bli et viktig bidrag til å nå sentrale utdannings- og nærings- og regionalpolitiske målsettinger uttrykt i handlingsplanen. I tillegg korresponderer disse målsettingene med regionale utviklingsplaner. Entreprenørskapstemaet belyses særlig i IET-fagene MOØ200, MOØ202 og MOØ203. I tillegg vil det at studentene også tar teknologifag som inngår i masteren bidra til en særdeles nyttig kobling mellom teknologiutvikling og forretningsutvikling.

Høgskolen i Bergen har i flere år jobbet systematisk med opplæring innen entreprenørskap og en tilrettelegging for idé- og forretningsutvikling. Dette gjelder både for ansatte og studenter. Gjennom det nasjonale nettverket InnovationNet (finansiert i flere år av FORNY programmet i NFR) deltok også ansatte på kurs på mastergradsnivå.

Innovasjon i bedrifter og systemer

Innovasjonsgraden i norsk næringsliv debatteres ofte. Nyere forskning påpeker utfordringene ved at inkrementelle kundedrevne innovasjoner ser ut til å dominere i store deler av næringslivet i vår region. I en kunnskapsintensiv og globalisert økonomi vil dette trolig representere en trussel på sikt med hensyn til konkurransekraft. Det pekes derfor på behovet for mer radikale kunnskaps-/forskningsdrevne innovasjoner. Forståelsen for innovasjonsdynamikken i ulike deler av næringslivet fremstår derfor som sentralt for å videreutvikle nasjonalt og regionalt næringsliv.

Teorier om regionale innovasjonssystem og næringsklynger har en sentral plass i innovasjonslitteraturen. Disse teoriene har også blitt retningsgivende for innovasjonspolitikken og utformingen av offentlige virkemidler. Forståelsen er at slike samhandlingssystemer påvirker graden av kunnskapsutvikling og – deling i næringslivet, og stimulerer utviklinga av en unik regional kunnskapsbase. Dette bidrar til konkurransekraft og innovasjonsevne. En slik systemisk kunnskap om innovasjonsprosesser vil i stor grad bidra til at utdannede kandidater får en helhetlig forståelse for utviklingsdynamikk både i næring og samfunn. Det er særlig faget MOØ200 som skal gi læringsutbytte til en forståelse av innovasjonsprosesser og innovasjonssystemer. Emnet MOØ204 tematiserer hvilke organisering og ledelse som fremmer og hvilke som kan hemme innovasjon og endring.

Økonomisk styring og finansiering

Det foreslåtte masterprogrammet er flerfaglig, men bygger på en realfaglig bachelorgrad. Dette gjør behovet for et visst innslag av (bedrifts)økonomiske fag særlig stort. Uten økonomisk forståelse blir det vanskelig både å fatte gode beslutninger og konkret å vurdere ulike innovasjoner. Kandidater med en kombinasjon av teknologisk og økonomisk utdanning er svært ettertraktede på arbeidsmarkedet. Utdanningen retter seg delvis inn mot entreprenørskap og nystartede bedrifter, men trolig vil mange av kandidatene før eller siden arbeide i mer etablerte organisasjoner. Mye (bedrifts)økonomisk kompetanse vil være like anvendelig her som i nystartede virksomheter, og fagområdet bidrar derfor til at kandidatene kan dekke et behov innenfor et bredere spekter av organisasjoner enn kun nystartede bedrifter. IET-faget MOØ201 vil gi studentene en grunnleggende forståelse av utfordringer knyttet til økonomisk styring og finansiering.

Teknologi-, kunnskapsledelse og organisering

Enhver bedrift og offentlig virksomhet trenger en organisasjon for å nå sine mål og fungere i sine omgivelser. Gode strukturer, gode sosiale relasjoner, politiske rammebetingelser og symbolbruk er avgjørende viktig for en virksomhet (Bolman et al., 2009). God ledelse er etterspurt, men også

kunnskap om begrensninger om hvilke mål god ledelse alene kan nå i varierende omgivelser og markeder (Strand, 2007). En leder i teknologibedrift må være forberedt på å mestre et bredt kunnskapsfelt, herunder spesifikke ferdigheter og verktøy innenfor teknologiledelse (Cetindamar, 2010).

Nyutdannede ingeniører blir i større grad enn tidligere eksponert for en global økonomi med komplekse organisasjonsformer og forventninger til arbeidet som han eller hun skal utføre. Ledelsesforskeren Torodd Strand har vist hvilke motstridende krav som ligger i forventningene som ligger i tradisjon og historie til et foretak på den ene siden og krav til endring og nyskaping på den andre siden (Strand, 2007: 320). For fagpersoner det viktig å forstå hvordan handlingsrommet endrer seg etter om vedkommende arbeider i en gruppeorganisasjon, entreprenørorganisasjon, et hierarki eller i en ekspertorganisasjon (smst.: kap 9).

Den nordiske arbeidslivsmodellen med høy grad av tillit mellom arbeidere og ledelse krever kompleks klokskap, men ingen andre ordninger for koordinering av arbeid og spesialistkunnskap er mer effektiv enn tillit (Klev and Levin, 2009, Grimen, 2008, Grimen, 2009).

Den globale kunnskapsøkonomien med stadig mer avansert og spesialisert teknologisk kunnskap bidrar til å gi velstand og reduserer fattigdom, men den gir også nye menneskeskapte risiki. Nye teknologi- og kunnskapsledere må være best mulig forberedt på å møte både de teknologiske mulighetene og begrensningene. Det er i første rekke fagene MOØ203 og MOØ204 som gir læringsutbytte i tema knyttet til ledelse, organisering og vilkår for ingeniørprofesjonalitet.

Etikk og samfunnsansvar

Norge er i dag på 10 plass på korrupsjonsindeksen til Transparency International, bare Island i Norden kommer bak oss på listen¹. Med bakgrunn i de mange sakene om mislighold og korrupsjon som er på dømt i rettsvesenet de siste årene er det grunn til å tro at ingeniører og andre nøkkelpersoner i offentlig og privat virksomhet kan bli eksponert for etiske dilemma. En spørreundersøkelse til lærerne ved Høgskolen i Bergen i 2008 indikerte at et slikt trusselbilde var begrenset, men tilstede (Skauge, 2009).

Samfunnsansvar og bærekraft er i dag viktige element sammen med økonomisk overskudd i den tredelte bunnlinjen (Crane and Matten, 2010, Carson and Kosberg, 2008). Samfunnet forventer, bl.a. gjennom reviderte rammeplaner til utdanningen, at universitet og høyskoler skolerer nye medarbeidere og ledere i samfunnsansvar. Etikk og samfunnsansvar blir særlig tematisert i faget MOØ204.

Samfunnskontakt

I undervisningsformene og pedagogikken for IET-masteren vektlegger vi stor grad av nærhet til og kontakt med samfunns-, nærings-, og arbeidsliv på Vestlandet. Høgskolen har i mange år bygget ut gode relasjoner til offentlige og private foretak, nettverk og næringsklustre i regionen.

Høgskolen i Bergen var en sentral initiativtaker til, og ledere av prosessen, som førte til opprettelsen av Norwegian Centre of Expertice Subsea. Denne næringsklyngen som er lokalisert i Bergensregionen har et av verdens sterkeste fagmiljøer innen undervannsteknologi. En vesentlig del av verdens 3000 undervannsbrønner driftes av fagmiljøet i Bergensregionen. I 2008 arbeidet mer enn 4600 mennesker i subsea-klyngen i Hordaland, og bedriftene omsatte for over 11,6 milliarder kroner. NCE Subsea jobber for at subsea-klyngen i Hordaland skal være internasjonalt anerkjent som verdens ledende undervannsteknologimiljø med hovedfokus på marked for drift,

¹ <http://www.transparency.no/article.php?id=307>

vedlikehold og modifikasjoner, og på leveranser av innovative og teknisk ledende produkter. Det er i dag i overkant av 100 virksomheter som er medlem i nettverket. Høgskolen har et betydelig samarbeid med dette miljøet og har svart på sentrale utfordringer knyttet til kompetanse og rekrutteringsbehov i næringen. Dette omfatter både etableringen av et bachelor- og et mastergradsprogram i undervannsteknologi og satsningen på et studieprogram i innovasjons- og entreprenørskap (IET-masteren).

Høgskolen tok også initiativ til å opprette et samarbeidsorgan med industrien i Osterfjordregionen. Regionen er kjennetegnet av små og mellomstore bedrifter under press for endring fra marked, teknologi og mangel på kompetent arbeidskraft. For å overleve med høye lønnskostnader satser mange foretak på avanserte CNC-maskiner og produksjonslinjer med robotteknologi. Kommunen Osterøy alene har en robottetthet som er 10 ganger større enn i landsgjennomsnittet. Samtidig er innbyggernes formelle utdanningskvalifikasjoner blant de laveste i fylket. Bedrifter i samarbeidet har vært brukt til bedriftsbesøk og FOU-arbeid. Regionalt forskningsfond for Vestlandet har gitt forskningsmidler til samarbeidet (vedlegg 3c).

IET-masteren imøtekommer behov fra arbeids-, nærings- og samfunnsliv

Regjeringens innovasjonsmelding 2008-2009 (Nærings- and handelsdepartementet, 2008) har et eget kapittel 6 om Utdanning og kompetanse. Kapitlet understreker behovet for kvalifisert personell som kan redusere barrieren for innovasjon i virksomheter. Meldingen viser til to positive effekter som relevant kunnskap og kompetanse kan ha for innovasjon:

”1 Evne til å ta kunnskap og kompetanse i bruk og kombinere den på nye måter er avgjørende i enhver innovasjonsprosess i alle typer virksomheter, både nye og eksisterende. Et velfungerende innovasjonssystem er derfor avhengig av et utdanningssystem som produserer kompetanse av høy kvalitet og som er relevant for aktørene i arbeidslivet. Det er i land som over tid satser på utdanning, forskning og kommersialisering en kan observere sterkest økonomisk vekst. Mye av forklaringen ligger i selvforsterkende effekter av å ha en høyt utdannet befolkning.

2 Gode grunnleggende ferdigheter øker evnen til å tilegne seg ny kunnskap og kompetanse. Et høyt kunnskaps- og ferdighetsnivå gjør det lettere å utvikle og ta i bruk ny teknologi og bidra til endringer i oppgaver og organisering. Helt avgjørende for verdiskaping og sterk økonomisk vekst er befolkningens evne til å omsette denne teknologien og kunnskapen til ny lønnsom virksomhet. Internasjonale studier viser at satsing på entreprenørskap i utdanningssystemet er svært viktig for at dette oppnås.” (smst.: kap 6.1).

Vi vil oppsummere vår gjennomgang av samfunnsmessige behov med at vårt mastertilbud er relevant og møter et behov for etterspørsel etter bred teknologikompetanse i arbeids-, nærings- og samfunnsliv.

3. Studieprogram og læringsutbytte

Tilbudet om IET-master ved HiB bygger på et felles studieprogram for UiO/HiB. I teksten under følger de viktigste punktene som er relevant for studenter ved HiB:

The programme's main focus is to train entrepreneurial/innovative leaders of tomorrow.

The vision of the programme is to educate business developers and managers who can integrate technological knowledge with business knowledge in an economic, social, environmental and ethical way.

Students with an engineering and natural science background are given a good foundation in the various functional aspects of technology management, allowing them to pursue a management career or work as project leaders of new technology based ventures.

The Master of Science in Innovation and Entrepreneurship addresses the vision by providing a curriculum in technology management focusing on innovation theory, business development, management strategy, finance and marketing along with two science electives. In addition to the course-work, all students are required to complete an independent, 40-60 page thesis, and two internships in a science or technology-based start-up company.

Learning outcomes

The programme's main focus is on the process of transforming new knowledge or new technology into viable products and services on commercial markets. In order to do so, participants need to develop an understanding of the various functional domains of this process. In particular, the learning outcomes of the programme are as following:

Knowledge based learning outcomes

- The candidate has acquired advanced knowledge in regard to the process of bringing new knowledge or new technology to the market.
- The candidate is able to combine and apply her/his understanding of new knowledge or new technology with her/his insights from business.
- The candidate has gained an up to date understanding of the field in regard to the process of assessing the commercial potential of new technology and markets.
- The candidate has acquired a cutting edge understanding when it comes to identifying opportunities and challenges affiliated with the organization and financing of new initiatives such as new business ventures. The candidate is also aware of challenges affiliated with the rapid growth of new business ventures.

Skill based learning outcomes

- The candidate has developed the ability of assessing the commercial viability of a new technology based idea. The candidate can use various methods and tools for this purpose.
- The candidate has developed the ability of transforming research based ideas into feasibility- and business plans. The candidate can use (tacit and explicit) methods and tools for this purpose.

- The candidate has developed an ability to present new ideas to the market.
- The candidate is able to assess the need for innovation, initiate the process and run innovations in organizations.
- The candidate is able to seize opportunities, organize and finance viable initiatives through to fruition.

General qualifications

The programme seeks to maintain and develop academic curiosity so as to promote scientific values such as openness, precision and the importance of separating between knowledge and opinions. At the end of the programme the students should be able to reflect upon central, ethical, philosophical and scientific problems in relation to individual work and the work of others.

Tuition fees

The masters degree programme offers different tracks. If you follow the regular track you do not pay a tuition fee. There is a small semester registration fee of NOK 440 (approx. 55 euro), which also gives you the benefit of the services of the Foundation for Student Life (SiO), and a copy fee of NOK 100 (approx. 12 euro). Erasmus, Nordplus, and most Bilateral Exchange students are exempt from paying the semester registration fee. You can read more about this on "How to finance your studies": http://www.uio.no/english/student_life/scholarship.html If you choose the track which includes *Gründerskolen*, you should anticipate a cost of approximately NOK 50 000. But, the amount may change every year due to changes in the exchange rate and agreements with partner universities. Please read more about "financing": <http://www.grunderskolen.no/finansiering.php>

Admission requirements

The MSc-program in Innovation and Entrepreneurship is specifically tailored for those individuals who are interested in combining their science/technology background, with that of innovation and entrepreneurial thinking. Only candidates who have completed a Bachelor's degree within mathematics, natural science or technology are considered for admission. A grade point average (GPA) of **C** or better from the specialization in your degree.

Ranking of applicants

Applicants are ranked according to their grade point average (GPA). Applicants who can not be estimated according to their grade point average, will be ranked based on individual assessment. Admission to 1-2 years' Master's programmes is subject to [Regulations governing admission to 1- to 2-year master's degree programmes at the University of Oslo](#) .

Recognition of prior education

If you have a bachelor from another University than The University of Oslo you have to read about [Academic Evaluation of External Education](#)

Structure and accomplishment

The Master's Degree programme in Innovation and Entrepreneurship gives you the opportunity to choose between different tracks. You will find the courses that are included in the Master's degree below².

² <http://www.uio.no/english/studies/programmes/inent-master/samlet.xml>

You are expected to specialize further within the field of your bachelor studies in the first and the third semester. (..) In the final part of the programme, you are expected to write a 30-credit Master's thesis. This thesis should be based on your Bachelor's Degree, and should be an independent scientific thesis with relevance to the context of innovation and entrepreneurship. (..)

Form of tuition and assessment

Like most other university studies, much of the tuition in the Master's programme will include lectures, casework, seminars and group work. However, in addition to traditional forms of tuition, the programme highlights empirical learning through two internships.

You will be assessed on the basis of written and oral exams, other forms of written reports such as individual papers, team based project reports and case analysis. Both individual and group assessment methods are employed.

It is required that you have a tuition attendance rate of at least 80% at the University of Oslo and while studying at joint venture universities abroad.

Teaching and examinations

Time and location

You will find the times and places for teaching and examinations at the semester pages for each course. (..) Time and place for lectures and examination in the courses can be found at the main page of the programme.

Teaching and learning methods

The Master's degree programme emphasizes group work, case learning as well as project work. Students will work with real cases to a large extent, and also have internships in start-ups as part of the MSc programme.

The students will utilize their knowledge from their Bachelor degree to implement a time-limited research- and/or development project with help from a supervisor. Through the programme the candidate will acquire sufficient scientific, technical and management expertise to be able to understand issues and possible solutions.

The Master's degree shall give the candidate experience in working independently as well as being a part of a research team. The teaching methods used provide the candidates training in organizing and planning their work so that the project will be carried out in accordance with the allotted resources and within clear deadlines.

The programme will equip the candidates with skills in analyzing, evaluating and disseminating information, theories, ideas, problems and solutions in their own field of study both in writing and orally.

Language: English

Location: Universitetet i Oslo / Bergen University College

Diploma

The diploma is issued when you have completed the combination of courses which fulfill the degree requirements. The diploma is issued in English. With the diploma you also receive a Diploma Supplement, providing more information about the degree and about the Norwegian system of higher education.

A semester abroad

(..) Parts of the study programme may be taken abroad. That is, at the beginning of March in the second semester, you may opt to take the internship abroad.

Quality assurance

The University of Oslo aims at offering an innovative and relevant education with the best teaching and tuition possible. It is therefore important that you as a student give us feedback and contribute to evaluations of your programme and courses.

The programme of study is regularly evaluated to ensure and develop the quality of the programme:

- Each year, the programme management conducts a review to assess whether the objectives of the programme have been met. External programme supervisors monitor examinations and assessment.
- At least every fourth year, the faculty conducts a more thorough evaluation of the programme. External representatives take part in the evaluation panel.
- Courses in the programme are evaluated regularly, according to a schedule decided by the faculty.

Read more about [the quality assurance system at the University of Oslo \(in Norwegian only\)](#).

After completion / career opportunities

The coming years we will most probably see an increase in markets regarding knowledge-based and research-based entrepreneurship, a development which will necessarily create a substantial demand for employees with cutting-edge expertise in this field. Potential employers for candidates with a Master's Degree in innovation and entrepreneurship will be companies with a high level of Research & Development activity (especially in the fields of information technology, biochemistry, pharmaceuticals, biomedicine and biotechnology); universities, science colleges, research institutions, consultancy companies, patent agencies, investment companies and public administration.

4. Faglige tyngdepunkt

IET-masteren er en flerfaglig mastergrad. Sentrale faglige tyngdepunkt for IET-masteren er:

- 1) Teknologiske studieretningsfag som korresponderer med HiBs tunge ingeniørretninger på bachelornivå. Vi tilbyr studieretningsfag for studenter fra fagretninger knyttet til instituttene for Akvakultur-, kjemi- og bioingeniørfag, Bygg- og jordskiftedag, Data- og realfag, Elektrofag og Maskin- og marinfag.
- 2) IET-fagene som gir bred tilleggskompetanse til ingeniørutdanningen innen finansiering og markedsføring, innovasjons- og entreprenørskapsfag, teknologiledelse, organisasjon og ingeniørprofesjonalitet, samfunnsansvar og etikk, forskningsdesign og metode.

Studieprogrammet for de to første kullene av masterstudenter ved HiB er organisert etter UiOs egegodkjente program. Tabell 1 viser teknologiske studieretningsfag med blå farge. IET-fagene har gul og hvit farge. HiB har ansvar for emnene som er farget blått og gult. UiO har ansvar for emnene som er farget hvitt.

De teknologiske studieretningsfagene er plassert i 1. og 3. semester. Her kan studentene velge studieretningsfag med bakgrunn i den teknologiske fordypning de har fra egen ingeniørbachelor.

For kull 2009 og kull 2010 har vi gitt undervisning i teknologifag som særlig har vært rettet inn mot studenter fra maskin- og marinretningen. Teknologifagene skal sikre at ingeniørstudentene får et læringsutbytte der de kan spesialisere sine kunnskaper, ferdigheter og sin generelle kompetanse fra bachelornivå.

| Sem | Fagemner | | |
|-----|--|-------------------------------|-----------------------------|
| 4 | Masteroppgave (UiO) 30 ECTS | | |
| 3 | Teknologiske studieretningsemner (HiB)10 ECTS | IET-emner (HiB)10 ECTS | Praksisemne (UiO)10 ECTS |
| 2 | IET-emner (HiB) (HiB)10 ECTS | Grunderskolen (UiO)20 ECTS | |
| 1 | Teknologiske studieretningsemner (HiB)10 ECTS | IET-emner (HiB)10+5+5 ECTS | |

Tabell 1: Studieprogram for IET-master ved HiB for kull 2011

Tabellen under, tabell 2a-2d viser tilbudet av teknologifag som HiB har for masterstudenter for kull 2011. Tabellen illustrerer også sammenhengen mellom IET-masterens enkelte fagemner og masterens faglige tyngdepunkt. Tabell 2a-2d viser at tilbudet av teknologiorienterte studieretningsfag (blå farge) blir betydelig utvidet fra høsten 2011. Vi forutsetter imidlertid at minimum 5 studenter blir tatt inn for at det blir gitt undervisning i fordypningsfaget. Med disse teknologiske studieretningsfagene gir vi tilbud om teknologimaster for studenter fra alle instituttene ved HiB og tilsvarende fag fra andre utdanningsinstitusjoner.

De øvrige emnene i masteren har vi gitt samlebenevnelsen *IET-emnene* (gul og hvit farge). Emnene MOØ203, MOØ200, ENT4110, ENT4210 gir læringsutbytte innen innovasjon og entreprenørskapsfag. Emnene MOØ201, MOØ202, gir læringsutbytte i finansiering, markedsføring og utvalgte emner i teknologiledelse. MOØ204 er hovedemnet for teknologiledelse, organisasjon og ingeniørprofesjonalitet. Emnet MOØ204 gir også læringsutbytte i etikk og samfunnsvar. Emnene MOØ203 og MOØ204 er masterens fag for forskningsdesign og metode.

Masteroppgaven teller 30 ECTS studiepoeng. IET-masteren åpner for tema, forskningsspørsmål, teorigrunnlag, sentrale begrep og datagrunnlag fra alle fagemnene i masteroppgaven. Normalbesvarelsen for en masteroppgave vil ha forskningsspørsmål der elementer fra et teknologisk studieretningsfag blir kombinert med ett eller flere av IET-emnene.

Eksempel på tema som våre studenter fra kull 2009 nå jobber med i sine masteroppgaver er miljøteknologi for skipsfart, integrerte operasjoner i oljeindustrien, forsøk med desentralisert ledelse ved Åsgard A-installasjonen, teknologiledelsens status i norske industribedrifter, betydningen av det som kan være et paradigmeskifte i organisering av data i IKT: Cloud Computing, teknologiske og samfunnsmessige utfordringer ved kraftutbygging i det til nå fredede Raudalsvassdraget.

1.semester:

| ECTS | Emnenavn | Faglige tyngdepunkt |
|------|--|---|
| 10 | MOM250 Materials for Energy Technology | Teknologiske fag – Maskin og marin, Byggfag |
| 10 | MOD250 Avansert programvareteknologi | Teknologiske fag – Datafag |
| 10 | MOD201 Applied Environmental research on Fish | Teknologiske fag – Akva/Bioteknologi |
| 10 | MOK200 Systems Biology I - Approaches to Research Problems | Teknologiske fag – Bioteknologi |
| 10 | MOD251 Moderne systemutviklingsmetoder | Teknologiske fag – Datafag |
| 10 | MOØ200 Innovation theory and innovation strategy | Innovasjons- og entreprenørskapsfag |
| 5 | MOØ201 Financial Management | Finansiering og markedsføring |
| 5 | MOØ202 Marketing Management | Finansiering og markedsføring |

2.semester:

| ECTS | Emnenavn | Faglige tyngdepunkt |
|------|---|---|
| 10 | MOØ203 Technology-based Entrepreneurship | Innovasjons- og entreprenørskapsfag Forskningsdesign og metode Teknologiledelse og organisasjon |
| 10 | ENT4190 Entrepreneurship Theory in an International Context | Innovasjons- og entreprenørskapsfag |
| 10 | ENT4200 Startups in practice - Entrepreneurship | Innovasjons- og entreprenørskapsfag |

3. semester:

| ECTS | Emnenavn | Faglige tyngdepunkt |
|------|--|---|
| 10 | MOB250 Structural Modelling | Teknologiske fag – Byggfag |
| 10 | MOM251 Marine Operations | Teknologiske fag – Maskin og marin |
| 10 | MOD251 Moderne systemutviklingsmetoder | Teknologiske fag - Datafag |
| 10 | MOD252 Agentteknologier | Teknologiske fag - Datafag |
| 10 | MOK201 Systems Biology II – Genomics and Proteomics in Applied Biomedical Laboratory Science | Teknologiske fag – Bioteknologi |
| 10 | MOD202 Water Quality and Environmental Treatment Technology | Teknologiske fag – Akva, Bioteknologi |
| 10 | MOØ204 Technology Management and Research Design | Teknologiledelse, organisasjon & ingeniørprofesjonalitet Forskningsdesign og metode |
| 10 | ENT4210 Practical Innovation Management | Innovasjons- og entreprenørskapsfag Teknologiledelse |

4. semester:

| ECTS | Emnenavn | Faglige tyngdepunkt |
|------|-----------------------|---|
| 30 | ENT5930 Master Thesis | Teknologiske fag Finansiering og markedsføring Innovasjons- og entreprenørskapsfag Teknologiledelse, organisasjon og ingeniørprofesjonalitet Samfunnsansvar og etikk |

Tabell 2a-2d: Oversikt over forholdet mellom IET-masterens emner og faglige tyngdepunkt.

5. Målgruppe

HiB har tre målgrupper for sitt IET-mastertilbud: Søkere med ingeniør- eller realfagsbakgrunn fra HiB er vår viktigste rekrutteringsbase. Målgruppe 2 er ingeniører eller realfagskandidater fra andre deler av Vestlandet. Målgruppe 3 er internasjonale studenter med tilsvarende fagbakgrunn.

HiB har gjort et strategisk valg om først å bygge opp en master for fulltidsstudenter rettet mot nyutdannede ingeniører og studenter med realfaglig bakgrunn, men vi ser at vi også har søkere som har vært i arbeid en tid og som ønsker å kombinere studier med for eksempel skiftordninger i Nordsjøen.

6. Tiltak for godt læringsmiljø

Sterkt fagmiljø

Vår viktigste styrke for å sikre et godt læringsmiljø er at masterprogrammet IET inngår i en helhetlig satsning på teknologifag i et stort og kompetent fagmiljø (figur 2 og 3).



Figur 3: Oversikt over masterutdanninger i teknologi ved Høgskolen i Bergen

Teknologiske kompetanse

Teknologisk kompetansen er ved HiB er meget omfattende ettersom HiB har landets største ingeniørutdanning. Flere ulike fagmiljø bidrar aktivt inn mot IET-masteren (figur 1 og tabell 6). Som vist i tabell 5 og 6 har høgskolen en stor lærerstab med førstekompetente lærere i hele stillinger på alle disse prioriterte fagfeltene. De lærerne som underviser uten førstekompetanse har en meget lang praktisk erfaring fra sine fagfelt.

Ledelses- og organisasjonsfagene

Ledelsesfagene og organisasjonsfagene inkludert finans, markedsføring, etikk og samfunnsansvar er forankret ved Institutt for økonomisk-administrative fag (ØkAdm). Instituttet har vel 400 bachelorstudenter innenfor bachelorstudiet i økonomi og administrasjon. Studiet er anerkjent og attraktivt, og opptakskvaliteten er blant høgskolens beste. I tillegg har instituttet et omfattende EVU-tilbud, bl.a. moduler i teknologiledelse og HMS. Ved instituttet er også

forskningsprogrammet FORPRO forankret som organiserer FoU-arbeid knyttet til profesjonalisering og profesjonsutdanning³. Ingeniørprofesjonen har siste året stått i særlig fokus. Instituttet har også lagt stor vekt på etikk og samfunnsansvar i sine fagplaner.

Innovasjons- og entreprenørskapsfagene

Senter for nyskaping og Institutt for økonomisk-administrative fag har over flere år bygget opp kompetanse innen innovasjon og entreprenørskap ved høgsolen, der det blant annet tilbys inkubatorløsninger både for studenter og ferdig utdannede kandidater. Høgsolen drifter en FoU-inkubator⁴ i samarbeid med de andre utdanningsinstitusjonene i Bergen. Det også vokst frem et studentengasjement der det blant annet er etablert en egen START HiB-organisasjon som driver studentsosiale og faglige arrangementer. Sammen med aktivitetene ved Senter for nyskaping vil dette støtte positivt opp om det læringsmiljøet som utvikles i tilknytning til masterprogrammet. Institutt for økonomisk-administrative fag har også i en rekke år tilbudt fordypning i entreprenørskapsfag.

Godt læringsmiljø

Læringsmiljøet styrkes videre av faglige seminarer arrangert for mastergradsstudentene i regi av høgsolen. Alle nye og gamle studenter sammen med undervisningsstaben blir invitert til oppstartseminar ved kyst- og kultursenteret på Lygra nord for Bergen ved høstsemesterets begynnelse. Vi har innledet en tradisjon med fjellseminar der Truls Erikson fra UiO gir viktige faglige bidrag og der studentene presenterer forskningsartikler. Vi arrangerer også en rekke bedriftsbesøk og gjesteforelesninger.

Høgsolen i Bergen ved avd. for ingeniøruddanning har reservert permanente arbeidsplasser for mastergradsstudenter og legger til rette for stabile og gode arbeidsvilkår. Vi viser også til tiltak nevnt under § 4-4.

7. Opptakskrav

Vi viser til opptakskravene referert i avsnitt 3. For å bli tatt opp til masterprogrammet må du ha bachelorgrad i ingeniørfag eller realfag, med minst 80 studiepoeng innen ingeniør- og realfag. Karaktersnittet må være på minimum C.

8. Arbeidsomfang

IET-masteren er beregnet på fulltidsstudenter. Hvert år regner vi at studentene må bruke vel 1680 timer. Tabell 3 viser hvordan vi fordeler undervisning/veiledningstimer, arbeide med oppgaveløsning, laboratoriarbeid og/eller hospitering og timer til selvstudium for hhv. emner som gir 5, 10 og 30 studiepoeng.

³ www.profesjon.no

⁴ Inngår i SIVA sitt inkubator program

| ECTS Studie-poeng | Ant timer Underv/Veil | Ant timer Oppg/Lab/Hospitering | Ant timer Selvstudium/ Eks.forbr | SUM Hvert emne |
|-------------------|-----------------------|--------------------------------|----------------------------------|----------------|
| 5 | 30 | 55 | 110 | 140 |
| 10 | 60 | 110 | 110 | 280 |
| 30 | 30 | 810 | (Masteroppgaven) | 840 |

Tabell 3: Forventet arbeidsinnsatsbelastning i timer for studentene i emner med 5,10 og 30 ECTS studiepoeng.

9. Lærerkompetanse

HiB har en stor lærerstab med solid undervisnings- og forskningskompetanse for IET-masteren. Tabell 4 viser en oversikt over faglige tyngdepunkt, lærerstab og kompetanse for de enkelte lærerne.

| Faglige tyngdepunkt | Lærerstab | |
|--|---|--|
| Teknologiske fag | R. Gjengedal J. Jørgensen Ø. Fyllingen K Øvsthus S. Fivelstad A. Bjørkum T.Kristensen | Førsteamanuensis Høgskolelektor Førsteamanuensis Professor Professor Førsteamanuensis Dosent |
| Finansiering og markedsføring | O.J. Bergfjord H. Bjånesø | Førsteamanuensis Høgskolelektor |
| Innovasjons- og entreprenørskapsfag | M. Morå S.E. Jacobsen J.K. Fosse Alf Slinning T.Erikson | Høgskolelektor Professor Førsteamanuensis Høgskolelektor Professor |
| Teknologiledelse, Organisasjon og ingeniørprofesjonalitet | J. Aarstad T. Skauge | Førsteamanuensis Førsteamanuensis |
| Samfunns ansvar og etikk | T. Skauge | Førsteamanuensis |
| Forskningsdesign og metode | T. Skauge J. Aarstad | Førsteamanuensis Førsteamanuensis |
| Sentrale støttefag Matematikk | T. Simonsen | Høgskolelektor |

Tabell 4: Oversikt over lærerkompetanse og IET-masterens faglige tyngdepunkt

10. Studieprogresjon og emnebeskrivelser ved HiB

Vi presenterer her oversikt over studieprogresjon og de enkelte emnebeskrivelsene for IET-masteren slik den blir undervist ved HiB. Tabell 5 gir oversikt over studieprogrammet som blir tilbudt studenter i kullet som starter høsten 2011. Tabell 6a-6d viser tilbudet av fagemner i større detalj. Emner i blå farge er våre teknologiske studieretningsfag. Emner i gult og hvitt er IET-fagene. HiB har fagansvar for fagene merket blått og Gult. UiO har fagansvar for emnene merket hvitt.

| Sem | Fagemner | | |
|-----|--|-------------------------------|-----------------------------|
| 4 | Masteroppgave (UiO) 30 ECTS | | |
| 3 | Teknologiske studieretningsemner (HiB)10 ECTS | IET-emner (HiB)10 ECTS | Praksisemne (UiO)10 ECTS |
| 2 | IET-emner (HiB) (HiB)10 ECTS | Grunderskolen (UiO)20 ECTS | |
| 1 | Teknologiske studieretningsemner (HiB)10 ECTS | IET-emner (HiB)10+5+5 ECTS | |

Tabell 5: Studieprogram for IET-master ved HiB for kull 2011.

Tabellen under, tabell 6a-6d viser emnene som studenter ved HiB får tilbud om i detalj. For de teknologiske studieretningsfagene må studentene velge ett 10 studiepoengsfag i 1. sem og ett i 3. sem. Emnene merke gult og hvitt er obligatoriske fag. Emnebeskrivelsen for hvert fag er gitt etter tabell 5.

1.semester

| ECTS | Emnenavn |
|------|--|
| 10 | MOM250 Materials for Energy Technology |
| 10 | MOD250 Avansert programvareteknologi |
| 10 | MOD201 Applied Environmental research on Fish |
| 10 | MOK200 Systems Biology I - Approaches to Research Problems |
| 10 | MOD251 Moderne systemutviklingsmetoder * |
| 10 | MOØ200 Innovation Theory and Innovation Strategy |

| | |
|---|-----------------------------|
| 5 | MOØ201 Financial Management |
| 5 | MOØ202 Marketing Management |

2. semester

| Studiepoeng | Emnenavn |
|-------------|---|
| 10 | MOØ203 Technology-based Entrepreneurship |
| 10 | ENT4190 Entrepreneurship Theory in an International Context |
| 10 | ENT4200 Startups in practice - Entrepreneurship |

3. semester

| Studiepoeng | Emnenavn |
|-------------|--|
| 10 | MOM251 Marine Operations |
| 10 | MOB250 Structural Modelling |
| 10 | MOD251 Moderne systemutviklingsmetoder* |
| 10 | MOD252 Agentteknologier |
| 10 | MOK201 Systems Biology II - – Genomics and Proteomics in Applied Biomedical Laboratory Science |
| 10 | MOD202 Water Quality and Environmental Treatment Technology |
| 10 | MOØ204 Technology Management & Research Design |
| 10 | ENT4210 Practical Innovation Management |

4. semester

| Studiepoeng | Emnenavn |
|-------------|-----------------------|
| 30 | ENT5930 Master Thesis |

Tabell 6a-6d: Studieprogram for IET-master ved HiB for kull 2011 med oversikt over de enkelte emner.

*Kan også velges som 3. sem. fag

11. Oversikt over de enkelte emnebeskrivelser

- organisert etter fagtype og studieprogresjon

1. sem – Teknologiske studieretningsfag (HiB)

| | | |
|--|--|--|
| MOM250 Materials for Energy Technology | | |
| MOD250 Avansert programvareteknologi | | |
| MOK200 Systems Biology I - Approaches to Research Problems | | |
| MOD251 Moderne systemutviklingsmetoder | | |
| MOD201 Applied Environmental research on Fish | | |

MOM 250 MATERIALS FOR ENERGY TECHNOLOGY

10 ECTS Credits

Course Content

The course aims at giving engineers a tool for understanding the principles of material selection for engineering applications. Modern society offers a wide set of materials available, and the combination of application and material is of significant importance together with the manufacturing method. Material properties consist of a wide set of parameters and to understand the various properties like sustainability and environmental impact. Engineering materials for subsea applications will be given special focus, with regard to steel.

All students will present a term paper in which material selection is essential. Material selection is not limited to the material as both manufacturing technology and combination of material and design might well be relevant. Any engineering application must fulfill a market need. The connection of understanding market need together with profitability for the supplier is essential in any (engineering) application. The understanding of innovative solutions in this context will be emphasized.

Learning Outcome

Knowledge

After finishing the course, the candidate

- Has a general understanding of material properties and principles of selection.
- Understand the sustainability impact of material selection

Skills

After finishing the course, the candidate

- Is able to write a technical report including a short market and financial review
- Is able to evaluate a material for a certain application with respect to properties
- Will be trained in studying an engineering application and to analyze and evaluate the material selection potential in the application.

Competence

After finishing the course, the candidate

- Understand the connection between a good technical solution in mechanical engineering and the influence of material selection in that.
- Evaluate the potential of a new or an alternative material solution for an existing application
- Understand the need for involvement of material specialists for material selection

Learning methods and activities

The main learning work will be done by applying the literature into the term paper. Some training excersies are given for self study. Weekly lectures and by need supervising of the term papers.

All literature will be in English. Participants might expect some lectures in English language. All written work from the student can be in Norwegian or English.

Compulsory work

The term paper must be accepted to be entitled to the exam.

Evaluation

Written exam, A-F scale, 4 hours. The term paper shall be presented after the exam for a final adjustment of the score.

Permitted items at the exam

Calculator allowed, within the standard at the college.

Literature

Main textbook will be Material Selection in mechanical design 3rd ed, Mike Ashby

Selected parts from:

Engineering materials properties and selection 9th ed Budinski and Budinski

Additional literature (articles etc.) will be provided through the course.

Recommended previous knowledge

The students must have completed 10 credits in Materials technology, Mechanics of materials, Elementary course in chemistry or equivalent.

Responsible teacher

Ragnar Gjengedal

MOD250 - Avansert programvareteknologi

10 ECTS

Innledning

Mål

I faget skal studentene tilegne seg innsikt i og gjøre praktiske erfaringer med bruk av moderne verktøyer, teknikker og plattformer innenfor programvareteknologier. Dessuten vil de få praktisk erfaring med vurdering av nye programvare- og utviklingsteknologier.

Innhold

Innholdet i faget blir endret når det kommer nye relevante teknologier. For tiden baserer faget seg på bruk av Java Enterprise Edition samt en rekke aktuelle teknologier knyttet til Java plattformen. Faget omfatter følgende hovedområder:

Applikasjonstjenere og containers, prinsipper bak enterprise applikasjoner, eksempelvis GlassFish og Google Application Engine.

- Webutviklingsarkitektur og webrammeverk, eksempelvis Servlets, JavaServerPages/Faces, Django.
- XML-teknologier, herunder JAX-B for binding mellom Java og XML.
- SOAP og REST baserte web-tjenester, herunder Web Service Description Language (WSDL), JAX-WS, JAX-RS.
- Tjenesteorientert arkitektur (SOA).
- Komponentbasert programvare og Enterprise Java Beans (EJB), Eclipse plug-ins, OSGi.
- Meldingsorientert programvarearkitektur og Java Message Service (JMS).
- Datalagring, Object-Relation Mapping (ORM) samt Java Persistence API (JPA).
- Alternative språk for Java VM, eksempelvis Scala.

Organisering og arbeidsformer

Praksis

Forkunnskaper

Studiets opptakskrav. Programmeringskompetanse tilsvarende fagene TOD063 Datastrukturer og algoritmer (HiB) eller faget INF102 Algoritmer, datastrukturer og programmering (UiB). Kjennskap til relasjonelle databaser og query språk anbefales.

Vurdering

Bokstavkarakter på grunnlag av 30 minutters muntlig eksamen samt prosjektrapporten. Prosjektet teller 50 % av den samlede karakteren.

Obligatoriske arbeidskrav

Alle 4 øvinger må være godkjent før eksamen kan avlegges. Prosjektet skal også være presentert for klassen, og prosjektrapport levert.

Eksamen

Skriftlig eksamen

Hjelpemidler ved eksamen

Ingen.

Litteratur

Blir opplyst ved semesterstart.

Muligheter for internasjonal utveksling

Emneansvarlig

Dosent Lars M. Kristensen.

MOK200 SYSTEMS BIOLOGY I

– APPROACHES TO RESEARCH PROBLEMS

10 ECTS Credits

Course Content

This course will introduce and develop skills and concepts necessary for comprehension and application of modern systems-biology approaches to research problems. The course will focus on a central research problem, selected in part by the course participants and supervisors, implemented with computational and bench techniques, and analyzed with emphasis on global applicability to other problems. Sessions of the course will focus on the application for specific systems-biology technologies in the context of the theme problem. Each student should be able to develop, as a result of this course, a *research outline that could form the core of a systems-based master project*.

- Experimental design, linking discovery and hypothesis-driven science
- Integration of bench work and computational biology
- Examples of ongoing systems biology projects
- Philosophy of systems biology
- Computational biology including relevant statistics and bioinformatics
- Use of database search tools necessary in systems biology, genomics and proteomics.

Internationalization:

There will also be possibilities to take the course both in Norway, Bergen and abroad with research collaborators Assoc. prof. Alvhild Alette Bjørkum at Bergen University College (BUC), Bergen Norway and Prof. Gabor Juhász at Eötvös Loránd University, Institute of Biology, Proteomics Laboratory, Budapest, Hungary (Erasmus agreement since 2004 and verified to 2013) or Assoc. Prof. Nirinjini Naidoo, University of Pennsylvania School of medicine, Center for Sleep and Respiratory Neurobiology, Pennsylvania, USA (Bjørkum/Naidoo research collaboration and student exchange from NO to US through J1-visa since 2009).

Also other collaborating institutions and Biomedical Laboratory Science programs there through Erasmus agreements could be possible (Savonia University of Applied Sciences and Turku University of Applied Science-BioCity, Finland, Umeå University, Sweden, Plantijn Hogeschool, Netherlands and Cape Peninsula University of Technology, South-Africa).

Learning Outcome

Knowledge

After finishing the course, the candidate

- has thorough knowledge about fundamental concepts, methods and terminology in systems biology
- has thorough knowledge of the use of computational biology and bioinformatics
- understand and have an analytical attitude towards the possibilities and limitation of systems biology and experience and thorough knowledge of cutting-edge methods in systems biology

Skills

After finishing the course, the candidate is independently however under supervision

- able to carry out systems biology databases explorations and handle related software
- able to take part in planning and carry out systems biology exploration on a given dataset analyze the results
- able to use knowledge and experience in systems biology to make a project plan for how to handle a Master's thesis high-throughput dataset

Competence

After finishing the course, the candidate is

- able to proceed to more in-depth studies of systems biology; both from a practical and theoretical perspective
- able to communicate about relevant topics in systems biology; both in discussions among specialists and to non-specialist co-workers or other users of the technology as investors.
- able to know when further expertise on systems biology is necessary, and where this can be found
- able to apply knowledge and skills after national and international ethical rules and regulations in the field
- able to contribute to innovation

Learning methods and activities

The most important is experimental experience and self study, both reading of literature and work on assigned systems biology course and exercises. This will be complemented by traditional lectures reviewing much of the literature and working through some examples, in addition to one or two guest lectures with a more practical perspective.

The course will be taught in English if required by any of the participants and or abroad, otherwise in Norwegian. Assignments and exams can be written in Norwegian or English.

Compulsory work

One assignment must be passed to take the exam.

Evaluation

Written exam, A-F scale, 4 hours.

Permitted items at the exam

Calculator allowed. Students should have a calculator with standard functions included and if necessary given databases related so systems biology.

Literature

Main textbook to be announced (there are few textbooks on the market, however literature on systems biology methodology and databases exist and will be used in addition to reviews and articles etc. mentioned below). Additional literature (compendiums, articles etc.) will be provided by the start of the course.

One textbook example: Systems Biology: A Textbook [Edda Klipp](#) ed. et al. 2009, Wiley-Blackwell

Recommended previous knowledge

No formal requirements, but previous courses in general biology, physiology, cell and molecular biology/science subject on bachelor-level will be very useful. Practical or theoretical knowledge about biology and chemistry laboratory-work or similar practice will also be an advantage. Students without any previous courses in bioengineering subjects or science subjects mentioned above should be prepared to read up on some of this during the first part of the course, and will be given a reading list.

Responsible teacher

Alvhild Alette Bjørkum

MOD251 - Moderne systemutviklingsmetoder

10 ECTS

Mål

Studentene skal tilegne seg innsikt i og gjøre praktiske erfaringer med bruk av moderne metoder innen systemutvikling.

Innhold

utvikling (MDA, MDD) og formell spesifisering, samt ulike aspekt ved kvalitetssikring av programvare. Emnet tar for seg metoder for utvikling av programvaresystemer og tar spesielt for seg bruk av smidige metoder (f.eks. Ekstermprogrammering). Dette vil så vurderes opp mot mer strukturerte metoder (f.eks. Unified Process). Videre diskuteres designprinsipper og -mønstre, kravspesifisering, arkitektur, systemmodeller, testing, samt ulike aspekt ved kvalitetssikring av programvare.

Forkunnskaper

Studiets opptakskrav. Programmeringskompetanse tilsvarende emnene TOD063 Datastrukturer og algoritmer (HiB) eller INF102 Algoritmer, datastrukturer og programmering (UiB).

Det anbefales også kompetanse i systemutvikling tilsvarende emnet TOD076 Systemutvikling og webapplikasjoner (HiB) eller INF112 Systemkonstruksjon (UiB).

Vurdering

5 timers skriftlig eksamen. Bokstavkarakter. Dersom det er få studenter oppmeldt kan det bli arrangert muntlig eksamen. Eksamensform avgjøres i rimelig tid etter kursstart.

Obligatoriske arbeidskrav

Eksamen

Hjelpemidler ved eksamen

Ingen.

Litteratur

Robert C. Martin: "Agile Software Development - Principles, Patterns and Practices" , Prentice Hall, 2003.

Ian Sommerville: "Software Engineering", 7 edition, Addison-Wesley, 2004 (8. utgave kan også brukes)

Emneansvarlig

Høgskolelektor Lars-Petter Helland

MOD201 APPLIED ENVIRONMENTAL RESEARCH ON FISH

10 ECTS Credits

Course Content

The course will cover advanced environmental research on fish. The students will learn about the main physiological systems in fish: Respiration, osmoregulation, the endocrine system, stress hormones and how to discriminate between a normal physiological status and different levels of stress. The course will also cover the rules and regulations regarding animal research, animal welfare aspects, and environmental conditions during experiments, and various sampling techniques (water, tissue and blood samples). The students will also obtain advanced knowledge about the relationship between aquaculture technology (for example oxygenation and biofiltration) and fish physiology. The students will learn to use the relationship between technology and physiology in innovation.

Learning Outcome

Knowledge

The students will obtain advanced knowledge about the relationship between aquaculture technology (such as oxygenation and biofiltration) and natural environmental conditions and the physiology of both farmed and wild fish. They will learn how to perform experimental research on environmental conditions relevant for farmed fish and for fish in the wild. The students will obtain advanced knowledge on how to measure physiological effects (both positive and negative) on the fish as a part of an innovation process and during development of new technology.

Skills

After finishing the course, the candidate

- is able to carry out experimental studies related to environmental conditions for fish
- is able to measure and evaluate the stress level of fish
- is able to use experimental studies and fish physiology in innovation of new technology, in a Master's thesis and other projects

Competence

After finishing the course, the candidate

- is able to proceed to more in-depth studies of environmental conditions from a practical or theoretical perspective
- is able to communicate about relevant topics; both in discussions among specialists and to non-specialist co-workers or other stakeholders
- knows when further expertise is necessary, and where this can be found

Learning methods and activities

The most important success factor is self study, both in acquiring and reading of literature as well as when working on assigned exercises. This will be complemented by traditional lectures reviewing much of the literature and working through some examples, in addition to one or two guest lectures.

The students will have the opportunity to participate in experimental studies, blood sampling and analyses in our environmental laboratory. The course will be taught in English if required by any of the students, otherwise in Norwegian. Assignments and exams can be written in Norwegian or English.

Compulsory work

Two compulsory reports must be approved in order to take the exam.

Evaluation

Written exam, A-F scale, 5 hours. The written exam is credited 60%. The two reports are credited 40% in the total evaluation.

Permitted items at the exam

Calculator allowed

Literature

Brattelid, T., Forsgren, E., Hansen, T., Aas-Hansen, Ø., Fivelstad, S., Bæverfjord, G., Ramstad, A., Stenevik, I. H., Espmark, Å. M. O., Ruyter, B., 2009.. Fisk i forskning – miljøkrav og velferdsindikatorar hos fisk. En utredning om forskningsbehovet(for Norges Forskningsråd), 1-103 (this report is also given in english).

Bjerknes, W.. 2007. Vannkvalitet og smoltproduksjon. Juul forlag, 1-228.

A.G.Heath. Water pollution and fish physiology. 1995 (CRC press, second edition), page 1-384.

International publications:

Fivelstad, S., Olsen, A.B., Wågbø, R., Zeitz, S, Hosfeld, A.-C.- D., Stefansson, S. 2003. A major water quality problem in smolt farms: Combined effects of carbon dioxide and reduced pH (Al) on Atlantic salmon (*Salmo salar* L.) smolts. Aquaculture, 215, 339-357.

Fivelstad, S., Olsen, A.B., Wågbø, R., Stefansson, S. , Handeland, S., Waagbø, R., Kroglund, F. and Colt, J. (2004) "Lack of long-term sublethal effects of reduced freshwater pH alone on Atlantic salmon (*Salmo salar*) smolts subsequently transferred to seawater". Can. J. Fish. Aquat. Sci. 61: 511-518.

Fivelstad, S., Wågbø, R., Olsen, A. B., Stefansson, S. 2007. Impacts of elevated water carbon dioxide partial pressure at two temperatures on Atlantic salmon (*Salmo salar* L.) parr growth and haematology. Aquaculture 269, 241-249.

Hosfeld, C.D., Engevik, A., Mollan, T., Lunde, T., Waagbø, R., Olsen, A. B., Breck, O., Stefansson, S., Fivelstad, S., 2008. Long-term separate and combined effects of environmental hypercapnia and hyperoxia in Atlantic salmon (*Salmo salar* L.) smolts. Aquaculture 280 (1-4), 146-153.

Stefansson, S. O., Bæverfjord, G., Finn, R. N., Handeland, S., Finstad, B., Fivelstad, S., Kristensen, T., Kroglund, F., Rosten, T., Rosseland, B. O., Salbu, B., Toften, T., Breck, O., Bjerkås, E., Waagbø, R., 2007. Water quality – salmonids. In: Thomassen, M., Gudding, R., Norberg, B., Jørgensen, L (Eds.), Aquaculture research: From cage to consumption. The Research Council of Norway, Oslo, pp. 101 – 119.

Recommended previous knowledge

No formal requirements, but previous courses in chemistry, mathematics and statistics will be very useful.

Responsible teacher

Professor Sveinung Fivelstad

1.sem – IET-fag (HiB)

| | | |
|--|--|--|
| | MOØ200 Innovation Theory and Innovation Strategy | |
| | MOØ201 Financial Management | |
| | MOØ202 Marketing Management | |

MOØ200 Innovation theory and innovation strategy

10 ECTS Credits

Course Content

This course is an introduction to the field of innovation theory and provides an understanding of the different aspects of innovation. Innovation and the introduction of new technology occur through processes of learning, knowledge accumulation and networking, and students will learn how and why firms and industries innovate or do not innovate. The course will emphasise the interactive nature of innovation, i.e. innovation activities of firms relay on factors outside the single firms such as collaborators, rivals, market conditions, formal and informal institutions. The course will also focus on the evolutionary nature of innovations. Innovation is a cumulative phenomenon that builds on existing knowledge and practice, including past inventions and innovations. Import topics in the study will be: knowledge creation and innovation, innovation strategy, the networks of the innovators, various models for innovation, innovation systems, and innovation and the society.

Learning Outcome

Knowledge

After finishing the course the student:

- has advanced knowledge in the field of innovation theory
- has advanced knowledge about different strategies and models for innovation and are able to identify innovation opportunities and challenges for an organisation
- has insight into the commercial potential of new products and technology
- has an advanced understanding of the interactive or systemic nature of innovation
- understands why knowledge about innovation is important for innovation

Skills

After finishing the course the student:

- is able to use theories and methods from innovation theory in a Master's thesis
- is able to conduct a research project in accordance with the norms and guidelines for research ethics
- is able to use theory and models about innovation when participating in innovation processes
- is able to manage innovation processes within an organization

Competence

After finishing the course the student:

- is able to translate findings from innovation theory into practical knowledge
- is able to communicate important findings from innovation theory
- has a critical attitude toward models and theories

Learning methods and activities

The course will be carried out through lectures reviewing and discussing the literature. There will also be working seminars emphasize the writing of an essay. In these seminars students have to present an essay outline and comment on other students work.

Compulsory work

It is compulsory for students to write and present one essay outline and one response paper in the working seminars

Evaluation

The students must submit one individual essay that will count as 60% of the final examination. A 4-hours written examination will count as 40% of the final examination. The essay and exams can be written in Norwegian or English.

Permitted items at the exam

-

Literature

The main textbook of the course will be Fagerberg, J, Mowery, D.C and Nelson, R.R. (eds.) (2005): *"The Oxford handbook of innovation"* (Oxford : Oxford University Press). Several chapters from this book will be included in the syllabus, but the whole book is course required reading. In addition there will be a compendium of articles / book chapters, including chapters from M.A. Schilling *"Strategical management of technological innovation"*.

Recommended previous knowledge

No formal requirements

Responsible teacher

Stig-Erik Jakobsen

MOØ201 FINANCIAL MANAGEMENT

5 ECTS Credits

Course Content

The first part of the course will review some fundamental economic concepts and methods. For students with a solid background, this part will mainly be repetition, and there will be no direct questions from this part on the exam. Nevertheless, a solid understanding is crucial for success in the following parts of the course.

The second part of the course will cover fundamental investment and financial theory, including cash flow analysis, NPV, IRR, RRR calculations and capital structure issues. This section will also review various financial instruments and valuation techniques.

The third part of the course discusses venture capital (VC) from a theoretical perspective. Organizational and financial considerations, different types of VC financing, typical VC processes and differences between VC financing and other types of financing are some of the issues discussed in this part of the course.

The fourth and final part of the course integrates the previous parts by using standard financial theory in a VC setting, to improve understanding of both the fundamental theory and the financial side of entrepreneurship. In particular, valuation techniques are revisited and applied to young and small firms. In this part, one or more guest lectures will be included.

Learning Outcome

Knowledge

After finishing the course, the candidate

- has knowledge about fundamental economic and financial concepts, methods and terminology
- understands the function of and the process of venture financing

Skills

After finishing the course, the candidate

- is able to carry out financial analysis and valuation, both from an investor's and an entrepreneur's point of view
- is able to take part in the financial management of start-up firms/projects
- is able to use financial theory in a Master's thesis

Competence

After finishing the course, the candidate

- is able to proceed to more in-depth studies of venture capital or financial management; either from a practical or theoretical perspective
- is able to communicate about relevant topics; both in discussions among specialists and to non-specialist co-workers or other stakeholders
- knows when further expertise is necessary, and where this can be found

Learning methods and activities

The most important success factor is self study, both reading of literature and work on assigned exercises. This will be complemented by traditional lectures reviewing much of the literature and working through some examples, in addition to one or two guest lectures with a more practical perspective.

The course will be taught in English if required by any of the participants, otherwise in Norwegian. Assignments and exams can be written in Norwegian or English.

Compulsory work

One assignment must be passed to take the exam.

Evaluation

Written exam, A-F scale, 4 hours.

Permitted items at the exam

Calculator allowed. Students should have a calculator with standard financial functions included.

Literature

Main textbook to be announced (one of the standard, MBA level corporate finance texts – the decision will be based on a review of new editions coming up).

Additional literature (compendiums, articles etc.) will be provided by the start of the course.

Recommended previous knowledge

No formal requirements, but previous courses in mathematics, statistics, economics or finance will be very useful. Practical or theoretical knowledge about entrepreneurship or venture financing will also be an advantage. Students without any previous courses in business or finance should be prepared to read up on some of this during the first part of the course, and will be given a reading list.

Responsible teacher

Ole Jakob Bergfjord

MOØ202 MARKETING MANAGEMENT

5 ECTS Credits

Course Content

This course offers a general introduction to modern marketing and how companies can gain and sustain competitive advantage in the marketplace through marketing management. The main principles and fundamental concepts and theories of marketing will be reviewed. The main focus of the course are consumer marketing and business marketing, but more specific areas as service and purchasing management and international marketing will be covered. The course provides a general introduction to strategic marketing management.

The first part of the course describes key terms and perspectives in marketing, the role of marketing in the organization and the marketing environment. The second part deals with key topics like market analysis and customers' buying behaviour. It continues by focusing on market planning and the development of market strategies through segmentation, targeting and positioning. How companies develop and apply basic marketing tools based on product, price, distribution and communication policies is also covered. The importance of marketing in innovation and business startup processes will be discussed.

Learning Outcome

Knowledge

After finishing the course, the candidate

- has a thorough understanding of central concepts in the field of marketing.
- has gained insight into the main principles of marketing by working with material drawn from current business examples.

Skills

After finishing the course, the candidate can apply this knowledge on real cases to:

- understand businesses' marketing and purchasing behaviour
- master strategic models for development of good market strategies, and
- implement these in good market plans.

Competence

After finishing the course, the candidate

- is familiar with challenges that are associated with the development and the application of market plans
- is capable of relating and integrating the skills acquired in this course to skill acquired in other courses of master's programme (e.g. technology-based entrepreneurship)

Learning methods and activities

Learning methods and activities will be a mixture of traditional "lecturing", class discussions, project work, student presentations, and supervision on written assignments.

The course will be taught in English if required by any of the participants, otherwise in Norwegian. Assignments and exams can be written in either Norwegian or English.

Compulsory work

Class attendance and -participation is compulsory. Written assignments (including a research proposal) and oral class presentations. A limited number of students can collaborate on the assignments.

Evaluation

Written exam, 3 hours. Written assignments (including a research proposal). Each candidate will receive a final grade (A-F) in which the written exam counts 60% and the written assignments count 40%.

Permitted items at the exam

None.

Literature

Kotler, P, K.L. Keller, M. Brady, M. Goodman and T. Hansen : *Marketing Management* , 2009.

Information about further literature (compendiums, articles, books or book chapters, etc.) will be provided by the start of the course.

Recommended previous knowledge

Bachelor degree or an equivalent qualification is required. Enrolment in the Innovation and Entrepreneurship Programme required.

Responsible teachers

Morten Morå

2.sem. IET-fag (HiB) og Gründerskolen (UiO)

| | | |
|--|--------|---------|
| | MOØ203 | ENT4190 |
| | | ENT4200 |

MOØ203 TECHNOLOGY-BASED ENTREPRENEURSHIP

10 ECTS Credits

Course Content

The course is divided in two major parts. One part focuses on how successful enterprises come about and gives an introduction to business development processes in start-up projects. Key topics will be the development and analysis of innovative business ideas, business models and strategies and how to write a professional business plan. This part also focuses on project management in new or established technological enterprises in relation to new product development and innovative activities. It is expected that the candidates are able to gain an analytic approach to the mentioned issues. Thus, the other part of the course introduces the candidates to a general and basic understanding of social science methodology in order to critically analyze and evaluate technology-based entrepreneurial activities and innovative value added activities at micro-level and macro-level.

Learning Outcome

Knowledge

After finishing the course, the candidate

- has acquired advanced knowledge in regard to the development of business plans for technology based enterprises
- is able to combine and apply her/his understanding of new knowledge or new technology to undertake innovative and value adding projects in new or established technology based enterprises
- has gained an up to date understanding of the field in regard to the assessment of the commercial potential of new technology and markets in new or established technology based enterprises
- has acquired a cutting edge understanding when it comes to identifying opportunities and challenges affiliated with new or established technology based enterprises. The candidate is also aware of challenges affiliated with the rapid growth of new technology based enterprises

Skills

After finishing the course, the candidate

- has developed the ability of assessing the commercial viability of a new technology based idea. The candidate can use various methods and tools for this purpose, thus the candidate has a basic understanding of social science methodology
- has developed the ability of transforming research based ideas into feasibility- and business plans. The candidate can use tacit and explicit social science methodology as tools for this purpose
- has developed an ability to present new ideas to the market for new or established technology based enterprises
- can evaluate the validity of scientific methodologies and apply the preferred methodology or methodologies to analytically study and evaluate entrepreneurial activities or innovative and value adding projects in new or established technological enterprises

Competence

After finishing the course, the candidate

- is able to reflect upon ethical, philosophical and scientific challenges that are related to the assessment of business plans for new or established technology based enterprises

- has developed academic curiosity so as to promote scientific values and competence such as openness, precision, validity, and the importance of separating between knowledge and opinion in relationship to the assessment of business plans and beyond
- can participate in and conduct social science projects that are related to the development and the assessment of business plans for new or established enterprises, and can also apply social science methodology in research projects on other topics
- is capable of relating and integrating the skills acquired in this course to skill acquired in other courses of master's programme (e.g. financial management and the master's thesis)
- can apply and relate the knowledge of social science methodology to scientific issues beyond the specifics topics of the course

Learning methods and activities

Learning methods and activities will be a mixture of traditional "lecturing", class discussions, project work, student presentations, and supervision on written assignments.

The course will be taught in English if required by any of the participants, otherwise in Norwegian. Assignments and exams can be written in either Norwegian or English.

Compulsory work

Class attendance and -participation is compulsory. Written assignments (including a research proposal) and oral class presentations. A limited number of students can collaborate on the assignments.

Evaluation

Written exam, 4 hours. Written assignments (including a research proposal). Each candidate will receive a final grade (A-F) in which the written exam counts 60% and the written assignments count 40%.

Permitted items at the exam

Calculator allowed.

Literature

Illar, D., Kubr, T. & Marchesi, H. (2003) *Starting Up*. McKinsey & Company Inc.

Weston-Smith, M. & Luebcke, P. (2006) *Starting a Technology Company: A Guidebook*. Cambirdge University Press.

Information about further literature (compendiums, articles, books or book chapters, etc.) will be provided by the start of the course.

Recommended previous knowledge

Students must have passed the courses of the first semester or equivalent courses. Basic knowledge in statistics is preferred.

Responsible teachers

Morten Morå and Jarle Aarstad

ENT4190 - Entrepreneurship Theory in an International Context

Credits: 10

Course content

This course is part of the Norwegian study programme called Gründerskolen, and takes place outside of Norway in cities like Boston, Houston, San Francisco, Shanghai and Singapore. The course explores the challenges and various options for commercializing technology in general, and by doing this through establishing a high-tech start-up and grow this into something big in particular. The course is provided by a local university, and is taught in a local, regional and international context.

Typical issues that entrepreneurs face are operating and administrative problems, financing, sales and marketing approaches, growth and sale.

Learning outcomes

The course will provide you with knowledge and tools which make you better equipped to evaluate opportunities in the marketplace and to take part in developing entrepreneurial businesses in high-tech industries. You will also be trained in presentation techniques and improve your English as a result of active class participation and discussions.

Admission

Enrolment in the Gründerskolen programme required.

Prerequisites

Formal prerequisites: ENT4000 - From idea to business or ENT4000I - From idea to business - Intensive

Language of instruction:

English

Administrated by:

Centre of Entrepreneurship

Students who are admitted to study programmes or individual courses at UiO must each semester register which courses and exams they wish to sign up for in StudentWeb.

International applicants, if you are not already enrolled as a student at UiO, please see our information about admission requirements and procedures for international applicants.

Teaching

Lectures are typically held once or twice a week during the afternoon/evening. Extensive use of guest speakers, case discussions and student presentations. The course will be slightly different between destinations, but the overall amount of teaching and course work will be approximately the same.

Exam information

Written group assignment (business plan) and a final oral examination at the end of the course. The course is assessed by pass/fail and the credits are given by the University of Oslo. You will also receive a certificate from the university abroad with a grade for the course, which you can use together with the course diploma for Gründerskolen and the transcript from the University of Oslo.

There might be exemptions where credits are given by the universities abroad, and if so this will be clearly communicated to the prospective students.

Assessment and grading

Pass/fail.

ENT4200 - Startups in practice - Entrepreneurship

Credits: 10

Course content

Through this three months internship course outside of Norway the students learn about the region, its culture, history, customs, business practices and entrepreneurial thinking, and gain first-hand start-up experience. The students will be exposed to different environments and different levels of stress to give a realistic understanding of the work involved in start-ups. The students have to go through an intensive recruiting process with company presentations and job interviews where they have to negotiate with the internship companies.

Learning outcomes

The objective is to give the students business practice and experience by working as an intern in a start-up company.

Admission

Enrolment in the MSc in Innovation and Entrepreneurship or the Gründerskolen programme required.

Students who are admitted to study programmes or individual courses at UiO must each semester register which courses and exams they wish to sign up for by registering a study plan in StudentWeb.

International applicants, if you are not already enrolled as a student at UiO, please see our information about admission requirements and procedures for international applicants.

Prerequisites

Formal prerequisites: ENT4000 - From idea to business or ENT4000I - From idea to business - Intensive

Language of instruction:

English

Administrated by:

Centre of Entrepreneurship

Teaching

Internship in a startup company outside of Norway. Full time attendance in the relevant business culture, often 40+ hour week.

Exam information

Written report and presentation on the internship company. Feedback on student performance from intern company. May be subject to change.

Language of examination

English

Assessment and grading

Students are awarded either a passing or failing grade. The pass/fail scale is applied as an independent scale with only two possible results.

3.sem – Teknologiske studieretningsfag (HiB)

| | | |
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| MOM251 Marine Operations | | |
| MOB250 Structural Modelling | | |
| MOD251 Moderne systemutviklingsmetoder | | |
| MOD252 Agentteknologier | | |
| MOK201 Systems Biology II - – Genomics and Proteomics in Applied Biomedical Laboratory Science | | |
| MOD202 Water Quality and Environmental Treatment Technology | | |

MOM251 - Marine Operations

10 ECTS Credits

Course Contents

- Basic hydrostatics and stability of floating objects and submersible vehicles
- General hydrodynamics, linear wave theory, calculation of forces in current and waves based on Morison's equation, lifting dynamics
- General introduction to field planning and development, including platform concepts, subsea production plants, submersible vehicles, marine operations, and methods of subsea intervention
- Planning of tow out and lifting operations related to subsea installations, including operational criteria, weather window, and governing rules and regulations

Learning Outcome

Knowledge

After having finished the course, the candidate

- has adequate knowledge regarding the physics behind the analyses described above
- knows the mathematical methods necessary to perform the analyses

Skill

After having finished the course, the candidate shall be able to

- calculate hydrostatics and stability of floating objects
- calculate forces on slender objects in a marine environment by means of Morison's equation
- calculate the probability of performing an operation based on operational criteria and weather window

Competence

After having finished the course, the candidate

- is capable of participating in planning, evaluation, and documentation of various marine operations, complying with relevant regulations and standards

- knows when further expertise is necessary

Learning methods and activities

Lectures covering the theory, examples and exercises covering the methods of analyses

Compulsory work

One approved project report

Evaluation

4 hours written exam, A – F scale

Permitted items at the exam

Calculator, Technical Tables

Literature

To be announced at the commencement of the term

Recommended previous knowledge

As required to commence the program

Responsible teacher

Assistant professor Johnny Jørgensen

MOB250 Structural Modelling

10 ECTS Credits

Learning Outcome

One of the most widely used methods for structural analysis is the finite element method. The method is implemented into most of the commonly used commercial codes for structural analysis. Such codes are used to design for instance buildings, ships, offshore and subsea installations, vehicles, airplanes and trains.

The aim of the course is to provide basic understanding of the structural behaviour of the finite elements for analysis of various types of structures and establish skills towards the use of the method. Emphasis is placed on proper modelling, checking and results interpretation.

A compulsory project is part of the course. Both practical and theoretical challenges are relevant to study through the project.

Course Content

The course gives the theoretical framework for the finite element method, and formulates elements for beams, plates, shells, axisymmetric and three-dimensional structures. Element properties, convergence requirements and modelling errors are discussed. The course emphasizes modelling, choice of element type, discretization, introduction of loads and boundary conditions, and results control. Further, an introduction to geometric modelling of simple two- and three-dimensional structures and typical structural details is given.

Learning methods and activities

The course is organized as lectures, five compulsory homework assignments, a compulsory project which should be presented as a written report and an oral presentation.

Compulsory work

Written report and oral presentation of the project. Five homework assignments.

Evaluation

Written exam which counts 70% of the final grade. Written report and oral presentation which counts 30% of the final grade. If there is a re-sit examination, the examination form may be changed from written to oral.

Permitted items at the exam

Calculator without the possibility of communication.

Literature

Concepts and applications of finite element analysis, Robert D. Cook.

Recommended previous knowledge

Basic course in mechanics, Mathematical analysis and vector algebra, Extensive mathematical analysis and linear algebra or similar courses.

Responsible teacher

Associate Professor Ørjan Fyllingen

MOD251 Moderne systemutviklingsmetoder

10 studiepoeng

Innledning

Mål

Studentene skal tilegne seg innsikt i og gjøre praktiske erfaringer med bruk av moderne metoder innen systemutvikling.

Innhold

utvikling (MDA, MDD) og formell spesifikasjon, samt ulike aspekt ved kvalitetssikring av programvare. Emnet tar for seg metoder for utvikling av programvaresystemer og tar spesielt for seg bruk av smidige metoder (f.eks. Ekstermprogrammering). Dette vil så vurderes opp mot mer strukturerte metoder (f.eks. Unified Process). Videre diskuteres designprinsipper og -mønstre, kravspesifikasjon, arkitektur, systemmodeller, testing, samt ulike aspekt ved kvalitetssikring av programvare.

Organisering og arbeidsformer

Praksis

Forkunnskaper

Studiets opptakskrav. Programmeringskompetanse tilsvarende emnene TOD063 Datastrukturer og algoritmer (HiB) eller INF102 Algoritmer, datastrukturer og programmering (UiB).

Det anbefales også kompetanse i systemutvikling tilsvarende emnet TOD076 Systemutvikling og webapplikasjoner (HiB) eller INF112 Systemkonstruksjon (UiB).

Vurdering

5 timers skriftlig eksamen. Bokstavkarakter. Dersom det er få studenter oppmeldt kan det bli arrangert muntlig eksamen. Eksamensform avgjøres i rimelig tid etter kursstart.

Obligatoriske arbeidskrav

Eksamen

Hjelpemidler ved eksamen

Ingen.

Litteratur

Robert C. Martin: "Agile Software Development - Principles, Patterns and Practices", Prentice Hall, 2003.

Ian Sommerville: "Software Engineering", 7 edition, Addison-Wesley, 2004 (8. utgave kan også brukes)

Muligheter for internasjonal utveksling

Emneansvarlig

Høgskolelektor Lars-Petter Helland

MOD252 - Agentteknologier

10 studiepoeng

Innledning

Mål

Kurset skal gi en introduksjon til grunnleggende prinsipper for design og konstruksjon av multiagentsystemer. Sentralt i kurset står termen "intelligente agenter". Ulike egenskaper for intelligente agenter, ulike typer av dem og mønstre for vekselvirkning mellom agenter, vil bli utforsket i kurset. Eksempler på applikasjoner av intelligente agenter vil også bli analysert og implementert i kurset.

Innhold

Kurset gir en innføring i hovedaspektene ved bygging av multiagentsystemer, som for eksempel kunnskapsdeling, ulike kommunikasjonsmodeller for multiagentsystemer, arkitektur av multiagentsystemer, mobile agenter, lærende agenter, spill teori og Nash likevekt, i tillegg til aspekter som involverer implementasjon av multiagentsystemer. Til å utvikle applikasjoner nyttes rammeverket JADE (Java Agent DEvelopment framework).

Organisering og arbeidsformer

Undervisningen vil skje i klasserom og veiledning på datalab. Det forutsettes at arbeid med programmeringsoppgaver skjer i grupper.

Forkunnskaper

Studiets opptakskrav. I tillegg gode kunnskaper i Java noen kunnskaper i deklarativ programmering.

Vurdering

Sluttvurdering på grunnlag av 4 timers skriftlig eksamen (teller 70%) og 3 øvinger (teller 30%). Bokstavkarakter.

Øvingene må være innlevert før en får gå opp til eksamen.

Dersom mindre enn 15 studenter melder seg opp til eksamen, åpnes det mulighet for at muntlig eksamen kan arrangeres. Faglærer orienterer om eksamensform innen 1. mars / 1. oktober

Obligatoriske arbeidskrav

Eksamen

Skriftlig

Hjelpemidler ved eksamen

Ingen

Litteratur

Michael Wooldridge: An introduction to Multi-Agent Systems. Wiley 2009.

Fabio Bellifemine and others: Developing Multi-agent systems with JADE. Wiley 2008.

Terje Kristensen: Forelesningsnotater tilpasset kurset.

Muligheter for internasjonal utveksling

Emneansvarlig

Dosent Terje Kristensen.

MOK 201 SYSTEMS BIOLOGY II – GENOMICS AND PROTEOMICS IN APPLIED BIOMEDICAL LABORATORY SCIENCE

10 ECTS Credits

Course Content

Principle: The lecture series intend to provide a critical overview of the rapidly developing field of genomics and mainly proteomics. The program is highly technical oriented but deeply based on molecular biology and genomics. Basically it is a theoretical program providing firm background for proteomics in practice.

Genomics

Genome and the Human Genome Program, transcription, translation, post-translational modifications, complexity of the proteome, genotype to phenotype and phenotype to genotype research strategies. Genomics, mRNA expression, small interfering RNAs (siRNA) and microRNAs (miRNA). High-throughput data acquisition techniques (gene microarray).

Proteomics

Application of proteomics and its complementary role in understanding cellular processes, protein separation technologies and limitations, detection of proteins, identification of proteins, validation of proteins on the basis of the genome, functional and screening proteomics.

Different proteomic techniques as 2D-gel electrophoresis based protein separation. Principle and limitations, sample preparation, isoelectric focusing, PAGE, staining of gels, image analysis, spot picking. Protein fingerprinting. Digestion methodology, on-gel digestion, chromatography of digest fragments on reverse-phase-HPLC, MUDPIT digest strategy. Principles of mass spectrometry: Ionization of peptides, electrospray-ionization, MALDI-Tof-MS-ionization, SELDI-Tof-MS-ionization, ion-beam-focusing, quadrupole-detectors, TOF detectors, FTRD, tandem systems with ion trap, quantitative proteomics as SRM/MRM-methodology, resolution, sensitivity, accuracy, validation, commercial aspects and reality.

Peptide mass fingerprinting. Expression proteomics, data base search, data base systems, protein modifications, mass tags and fluorescent tags. MUDPIT-strategy in fingerprinting. Protein sequencing with tandem MS/MS. Problems of de novo sequencing, data base oriented sequencing, reliability, relation to Edman sequencing.

Screening proteomics. Perspectives and problems, limitations of protein separation, difficulties in 2D electrophoresis, data bases of screening proteomics.

Epigenomics. High throughput protein detection and quantification of protein modifications (e.g. acetylation, methylation, phosphorylation) with flow cytometry, including phosphoflow.

Interactionomics in cellular signal transduction pathways. Detection of activated proteins involved in signal transduction by flow cytometry in cells as response to specific stimuli.

The Human Proteome Organization's (HUPO, <http://www.hupo.org/>) and ongoing worldwide collaboration in the Human (blood) Plasma Proteome Project (<http://www.hupo.org/research/hppp/>) will be focused on. Collaboration with and from the proteomic technology platform PROBE (<http://www.uib.no/rg/probe>) at the University of Bergen, Norway into HUPO will be displayed and 2-3 day payment crash-course can be given at PROBE on demand and or in collaboration with The Biomedical Laboratory Program at Bergen University College (BUC).

Internationalization

There will also be possibilities to take the course both in Norway, Bergen and abroad with research collaborators Assoc. prof. Alvhild Alette Bjørkum at Bergen University College (BUC), Bergen Norway and Prof. Gabor Juhász at Eötvös Loránd University, Institute of Biology, Proteomics Laboratory, Budapest, Hungary (Erasmus agreement since 2004 and verified to 2013) or Assoc. Prof. Nirinjini Naidoo, University of Pennsylvania School of medicine, Center for Sleep and Respiratory Neurobiology, Pennsylvania, USA (Bjørkum/Naidoo research collaboration and student exchange from NO to US through J1-visa since 2009). Also other collaborating institutions and Biomedical Laboratory Science programs there through Erasmus agreements could be possible (Savonia University of Applied Sciences and Turku University of Applied Science-BioCity, Finland, Umeå University, Sweden, Plantin Hogeschool, Netherlands and Cape Peninsula University of Technology, South-Africa).

Learning Outcome

Knowledge

After finishing the course, the candidate

- has thorough knowledge about fundamental concepts and different genomics and proteomic techniques as peptide mass fingerprinting, screening proteomics, epigenomics and interactionomics and the terminology in genomics and proteomics
- has thorough understanding and analytical attitude of the possibilities and limitation of genomics and proteomics and experience and knowledge of cutting-edge methods in genomics and proteomics.

Skills

After finishing the course, the candidate is independently however under supervision

- able to carry out proteomic sample preparation and carry out the most fundamental genomic as high-throughput data acquisition techniques (gene microarray).
- and proteomic methods as peptide mass fingerprinting, screening proteomics, epigenomics and interactionomics including quantitative genomics and proteomics
- able to take part in planning and carry out genomic and proteomic experiments
- able to use genomic and proteomic laboratory experience and theory in a Master's thesis project

Competence

After finishing the course, the candidate is

- able to proceed to more in-depth studies of genomic and proteomics; both from a practical and theoretical perspective
- able to communicate about relevant topics in genomic and proteomics; both in discussions among specialists and to non-specialist co-workers or other users of the technology as investors.
- able to know when further expertise on is necessary, and where this can be found
- able to apply knowledge and skills after national and international ethical rules and regulations in the field
- able to contribute to innovation

Learning methods and activities

The most important is experimental experience and self study, both reading of literature and work on assigned laboratory course and exercises. This will be complemented by traditional lectures reviewing much of the literature and working through some examples, in addition to one or two guest lectures with a more practical perspective.

The course will be taught in English if required by any of the participants and or abroad, otherwise in Norwegian. Assignments and exams can be written in Norwegian or English.

Compulsory work

One assignment must be passed to take the exam.

Evaluation

Written exam, A-F scale, 4 hours and pass a laboratory course.

Permitted items at the exam

Calculator allowed. Students should have a calculator with standard functions included.

Literature

Main textbook as an example with focus on proteomic: *Introducing Proteomics: From concepts to sample separation, mass spectrometry and data analysis* [Paperback] [Josip Lovric](#), 2011. Wiley-Blackwell.

Additional literature (compendiums, articles etc.) will be provided by the start of the course.

Recommended previous knowledge

No formal requirements, but previous courses in general biology, physiology, cell and molecular biology/science subject on bachelor-level will be very useful. Practical or theoretical knowledge about biology and chemistry laboratory-work or similar practice will also be an advantage. Students without any previous courses in bioengineering subjects or science subjects mentioned above should be prepared to read up on some of this during the first part of the course, and will be given a reading list.

Responsible teacher

Alvhild Alette Bjørkum

MOD202 WATER QUALITY AND ENVIRONMENTAL TREATMENT TECHNOLOGY

10 ECTS Credits

Course Content

The course will cover important water quality parameters regarding drinking water and land based fish farming systems, including how systems may be affected by local- and global climate conditions. The students will obtain an advanced qualitative and quantitative understanding of the main water quality parameters and their interactions in reservoirs for drinking water and land based aquaculture activity. The course will review water cleaning technologies for fish farming inlet water and effluent water, as well as water recirculation. The candidate will learn how to improve the water quality – both theoretically and practically. Competence in evaluating research results will be acquired. National and EU water legislations will also be covered.

Learning Outcome

Knowledge

The students will obtain advanced knowledge about how different water quality parameters are connected through theory and mathematical calculations. Water quality, water quality criteria and pollution from effluent water and fish farming will be covered in an international framework. The students will acquire advanced knowledge regarding neutralization, aeration, oxygenation, disinfection and mechanical, chemical, and biological cleaning, including the treatment of sludge as well as innovation processes related to water treatment.

Skills

After finishing the course, the candidate

- is able to carry out water quality calculations and evaluations
- is able to conclude on water treatment processes and the necessary water quality analyses
- is able to handle and discuss water quality research aspects at Master's thesis level, in other projects and in innovation of water treatment systems

Competence

After finishing the course, the candidate

- is able to proceed to more in-depth studies of water quality from a practical or theoretical perspective
- is able to communicate about relevant topics; both in discussions among specialists and non-specialist co-workers or other stakeholders
- will know when further expertise or information are needed, and where this can be found

Learning methods and activities

The most important learning method is active learning where the teacher presents a topic and the students continue to work with calculation exercises and international databases. The students will be able to study water quality parameters in the environmental laboratory at the college. The students will also study literature handed out by the teacher and seek available literature by using international databases. Guest lecturers of invited competence will be used. The course will be given in English if required by any of the students, otherwise in Norwegian. Assignments and exams can be written in Norwegian or English.

Compulsory work

Two compulsory reports must be approved in order to take the exam.

Evaluation

Written exam, A-F scale, 5 hours. The written exam are credited 60%. The two reports are credited 40% in the total evaluation.

Permitted items at the exam

Calculator allowed

Literature

Metcalf and Eddy. 2009. Wastewater engineering: Treatment and reuse, 4th Edition, Chapter: 1-4, Chapter 6-7 (page 475-565), Chapter 12, Chapter 13 (page1347-1374), totally 538 pages.

Aquacultural Engineering and Environment, 2007. Research Signpost (Editor: Asbjorn Bergheim),187 sider.

International publications:

Bergheim, A., Drengstig, A., Ulgenes, Y., Fivelstad, S., 2009. Production of Atlantic salmon smolts in Europe- Current characteristics and future trends. Aquacult. Eng. 41, 46-52.

Colt, J., 2006. Water quality requirements for reuse systems. Aquacult. Eng. 34, 143-156.

Colt, J., Summerfelt, S., Fivelstad, S. 2008. Energy and resource consumption of land-based Atlantic salmon smolt hatcheries in the Pacific Northwest (USA). Aquaculture 280 (1-4), 94-108.

Kristensen, T. , Åtland, Å., Rosten, T., Urke, H.A., Rosseland, B.O., 2009. Important influent- water quality parameters at freshwater production sites in two salmon producing countries. Aquacultural Engineering 41, 53-59.

Masser, M.P., Rackocy, J., and Losordo, T.M. 1999. Recirculation aquaculture tank production systems. Management of recirculation systems, SRAC Publication no. 452, 1-12.

Recommended previous knowledge

No formal requirements, but previous courses in chemistry, mathematics and statistics will be very useful.

Responsible teacher

Professor Sveinung Fivelstad

3.sem – IET-fag (HiB) og praksisfag (UiO)

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| | MOØ204 Technology Management & Research Design | ENT4110 Practical Innovation Management |
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MOØ204 Technology Management & Research Design

10 ECTS Credits

Course Content

The module has two main parts 1) Research design with method knowledge targeted for master thesis and 2) Organization, leadership and technology management. The course is organized in order to give students personal experience with main methods for data collection, -analysis and interpretation. Students are expected to participate extensively with presentations and discussions. Two compulsory written reports are to be submitted with proposals and discussions for each of the two module themes.

Learning Outcome

Knowledge

After finishing the course, the candidate has advanced knowledge

- about main principles in research design
- of relevant concepts and methods for data collection analysis and interpretation.
- in order to prepare, organize and write a master thesis equivalent to 30 ECTS points
- on main theories and principles in theories about organization, administration and innovation in private and public business
- on main theories on leadership, management and innovation in technology based organizations.
- on knowledge production and management in the engineer profession
- on principles for business ethics and corporate social responsibility (CSR).

Skills

After finishing the course, the candidate is able to

- carry out data collection with necessary skills for critical research
- carry out analysis with quantitative and qualitative research methods
- analyze a private or public organization with respect to organization structure, culture, human relations, technology, innovation capacity and management.
- analyse and suggest instruments for ethical behaviour and CSR in a given organization

Competence

After finishing the course, the candidate

- is able to read, criticize and use knowledge published in scientific literature
- can take part in bigger research projects
- can be a partner in consultant work on organization, relevant technology and management
- is able to communicate about relevant topics; both in discussions among specialists and to non-specialist co-workers or other stakeholders
- knows when further expertise is necessary, and where this can be found

- knows relevant conditions under which management are important and under which conditions other variables or explanations should be addressed.
- knows basic theories on professions and professionalization.

Learning methods and activities

The most important success factor is self study and participating in organized seminars with student presentation. Self study is important to benefit from literature and work on assigned exercises. This will be complemented by traditional lectures and working through some examples, in addition to guest lectures with a more practical perspective. The course will include presentations and visits to some relevant organizations and one lunch to lunch seminar outside HiB.

The course will be taught in English if required by any of the participants, otherwise in Norwegian. Assignments, reports and exams can be written in Norwegian or English.

Compulsory work

Two reports must be approved in order to take the exam.

Evaluation

Written exam, A-F scale, 5 hours. The written exam are credited 60%. The two reports are credited 40% in the total evaluation.

Permitted items at the exam

No items

Recommended previous knowledge

First and second semester completed. The course will be based on knowledge on scientific method from the module MOØ203.

Literature

Research design and method:

Easterby-Smith, Mark, Richard Thorpe, and Paul R. Jackson. 2008. *Management research*. 3rd ed. Los Angeles: Sage. Kap 3,5-10 (23+180 s.)

Frankfort-Nachmias, Chava, and David Nachmias. 2008. *Research methods in the social sciences*. 7th ed. New York: Worth Publishers. Kap 1-4 (96 s.)

Yin, Robert K. 2009. *Case Study Research. Design and Methods*: Newbury Park, London, New Dehli: Sage. (150 s.)

Techology management , Organisation, professionalism and CSR:

Strand, Torodd. 2007. *Ledelse, organisasjon og kultur*. 2. utg. ed. Bergen: Fagbokforl. Kap 1-11 (290 s.), Kap 17-20 (98s.)

English:

Robbins, S. P. and D. A. DeCenzo (2008). Fundamentals of management: essential concepts and applications. Upper Sadle River, New Jersey, Pearsons Prentice Hall.

Carson, Siri Granum, and Norunn Kosberg. 2008. *Etisk forretning: bedriftens samfunnsansvar*. Oslo: Cappelen akademisk forl. Kap 1-5 (150 s.)

English:

Crane, A. and D. Matten (2010). Business ethics : managing corporate citizenship and sustainability in the age of globalization. Oxford, Oxford University Press. (Ch. 1-5)

Recommended:

Cetindamar, Celik; Robert Phaal; Davod Probert. 2010. *Technology Management*: Palgrave Macmillan

Klev, Roger, and Morten Levin. 2009. *Forandring som praksis : endringsledelse gjennom læring og utvikling*. 2. utg. ed. Bergen: Fagbokforl.Kap 1-8 (170.s)

A list of articles will be presented at the start of the course.

Responsible teacher

Tom Skauge, Dr.Polit, Associate Professor

ENT4210 - Practical Innovation Management

Course content

The aim of the course is to introduce students to a practical innovation context, typically a knowledge-based and innovation oriented company, where they will be able to draw upon their skills acquired in previous courses to solve, or work on, a problem relating to a company's innovation processes. The student will do this by working as an intern in the company for four days a week during the course period. The internship is problem oriented – focusing on a task of importance and use to the company, and/or the company may serve as a case in a case writing project. A specific assignment can typically be formulated in dialogue between the student and the company, and with representatives from the Center for Entrepreneurship. This course complements ENT4220/ Gründerskolen where the students worked in a small start-up company. Now they are exposed to innovation processes in more larger companies.

Learning outcomes

The students should demonstrate proficiency in writing a business or learning case which may address one or more of the following themes:

- Development of parts of or a complete business plan for a product
 - Analysis and development of a business model
 - Development of a market analysis and marketing plan
 - Development of a competitor analysis
 - Analysis of new supply and distribution channels
 - Assessment of a firm's current position vis-à-vis competitors, including identification of core competences
 - Risk analysis of a firm's activities or a of a product/market strategy
 - Analysis and development of new product concepts
 - Analysis and development of new collaboration strategies
 - Intellectual property investigation and strategy
 - Organizational analysis and development

Admission

Enrolment in the Innovation and Entrepreneurship programme required.

Students who are admitted to study programmes or individual courses at UiO must each semester register which courses and exams they wish to sign up for in StudentWeb.

International applicants, if you are not already enrolled as a student at UiO, please see our information about admission requirements and procedures for international applicants.

Prerequisites

Formal prerequisites

Passed in course ENT 4400. Otherwise no obligatory prerequisites beyond the minimum requirements for entrance to higher education in Norway.

Recommended prior knowledge

ENT4000 - From idea to business, ENT4000I - From idea to business - Intensive, ENT4130 - Entrepreneurship theory from a Singaporean point of view, ENT4200, ENT4300 - Entrepreneurship and internationalisation, ENT4310 - Business economics and marketing, ENT4400 - Innovation strategy and management

Teaching

Project based with internship / cooperation with local technology company.

October – December

Exam information

Submission of a written paper, and participated in three mandatory dialog meetings.

Language of examination

English

Assessment and grading

Students are awarded either a passing or failing grade. The pass/fail scale is applied as an independent scale with only two possible results.

ENT5930 Master Thesis

30 ECTS

Course content

During the final semester of the Master Programme in Innovation and Entrepreneurship, the students concentrate on writing a master thesis. The thesis is an independent piece of scientific research project demonstrating the student's competence in Innovation and Entrepreneurship in relation to the aims of the programme.

Learning outcomes

The student will acquire in depth knowledge of the specific problem chosen for the thesis, and learn to use the required methods.

Admission

Only students formally admitted into the master programme in Innovation and Entrepreneurship are eligible for this course.

Formal prerequisites

Students must hold a Bachelor's degree within mathematics, natural science or technology.

Students must have completed all other courses in the programme in order to receive supervision and hand in the thesis.

Theaching

The supervisor(s) will guide the student in the work on the thesis in individual tutorials. Each student has the right to a maximum of 30 hours of supervision. This includes the supervisor's time for preparation and 10 hours of face-to-face supervision. The amount of time for supervision remains the same in case of co-supervision by several supervisors.

A supervision-contract, must be completed and signed by both supervisor(s) and student.

Exam information

Students must have completed all other courses in the programme in order to receive supervision and hand in their thesis.

The commission is comprised of two members, one of which is external. The supervisor can be included as a commission member. The two commission members will jointly agree on a grade. If there is a disagreement amongst the commission members, a new commission will be arranged and a new exam date will be set.

There is no oral examination.

Exam resources

No special exam resources are allowed.

Language of examination

The examination language is English.

Assessment and grading

The final grade is based on an overall evaluation of master thesis.

Course grades are awarded on a descending scale using alphabetic grades from A to E for passes and F for fail.

Lodging a formal complaint

A student may appeal against an awarded grade and/or file a formal complaint about exam procedures.

Possibility of make-up exams and re-takes

See Act for Studies and Exam §7.1.6 c) Special rules for 2-year master's program c1) 2-year master's program at the Faculty of Science

Postponement is only possible with medical leave and by application. If the deadline for submission of the thesis is not respected the student will normally lose student rights, and must apply again. Then the student must choose a task which is different from the task that was not submitted. Students must expect adjustment of curriculum theory, even if new task is selected from the same area as the first

LITTERATUR

som er refert i teksten for studieplanen:

- BOLMAN, L. G., DEAL, T. E. & THORBJØRNSSEN, K. M. (2009) *Nytt perspektiv på organisasjon og ledelse: Struktur, sosiale relasjoner, politikk og symboler*, Oslo, Gyldendal akademisk.
- CARSON, S. G. & KOSBERG, N. (2008) *Etisk forretning: bedriftens samfunnsansvar*, Oslo, Cappelen akademisk forl.
- CETINDAMAR, C. R. P. D. P. (2010) *Technology Management*, Palgrave Macmillan.
- CRANE, A. & MATTEN, D. (2010) *Business ethics : managing corporate citizenship and sustainability in the age of globalization*, Oxford, Oxford University Press.
- GRIMEN, H. (2008) Profesjon og tillit. IN MOLANDER, A. O. L. I. T. (Ed.) *Profesjonsstudier*. Universitetsforlaget.
- GRIMEN, H. (2009) Skjønn som resonneringsform. IN SKAUGE, T. (Ed.) *Profesjonsledelse og kunnskapsorganisering*. Bergen.
- HØGESTØL, A. & RYSSEVIK, J. (2010) Den maritime næringen på Vestlandet. *ideas2evidence rapport nr 7:2010*. Vestlandsrådet.
- JAKOBSEN, S.-E. (2009) Relasjoner mellom bedrifter i Hordaland og FoU-institusjoner. IN 39/09, S. A. (Ed.). *Samfunns og næringslivsforskning*, Bergen.
- JAKOBSEN, S.-E. & FLØYSAND, A. (2010) Subsea bedriftenes regionale forankring. Funn fra en spørreundersøkelse blant bedrifter i Hordaland. . IN 48/10, S. A. (Ed.). *Samfunns og næringslivsforskning*, Bergen.
- KLEV, R. & LEVIN, M. (2009) *Forandring som praksis : endringsledelse gjennom læring og utvikling*, Bergen, Fagbokforl.
- NÆRINGS- & HANDELSDEPARTEMENTET, O. (2008) St.meld. nr. 7, (2008-2009): Et nyskapende og bærekraftig Norge. IN HANDELSDEPARTEMENTET, N.-O. (Ed.). Regjeringen.
- SKAUGE, T. (2009) Profesjonsetikken - Er profesjonsorganisasjonene på den nye bølgen? *NEON - konferansen*. Kristiansand, Høgskolen i Bergen, Avdeling for ingeniørutdanning Institutt for økonomisk-administrative studier.
- STRAND, T. (2007) *Ledelse, organisasjon og kultur*, Bergen, Fagbokforl.